Environmental, Social and Health Impact Assessment (ESHIA) for Exploration Drilling in Block IOR-7, PETRONAS Carigali Myanmar Inc.




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EXECUTIVE SUMMARY လေ့လာချက်အနှစ်ချုပ်

မာတိကာ

ဇယားများ

ပုံများ

E1 အကျဉ်းချုပ်ဖော်ပြချက်

E1.1 နောက်ခံအချက်များ

ပက်ထရိုနှစ်ချာရီဂါလီမြန်မာကော်ပိုရေးရှင်း PETRONAS Carigali Myanmar Inc. (နောင်တွင် "PCMI" ဟု ဖော်ပြပါမည်) သည် ပုံ ပုံ Figure E-1တွင် ဖော်ပြထားသည့် မြန်မာနိုင်ငံ အလယ်ပိုင်းတွင် တည်ရှိသော လုပ်ကွက် Block IOR-7 ကို ထုတ်လုပ်မှုခွဲဝေယူရေး သဘောတူညီချက်ကန်ထရိုက်စာချုပ် Production Sharing Contract (PSC) ဖြင့် လုပ်ကိုင်ဆောင်ရွက်လျက် ရှိသည့် Operator ဖြစ်ပါသည်။

ဧရာဝတီတိုင်းဒေသကြီးအတွင်းတွင် တည်ရှိသည့် ဤလုပ်ကွက်၏ စုစုပေါင်း ဧရိယာအကျယ်အဝန်းမှာ ၉၅ စတုရန်းမိုင် သို့မဟုတ် ၂၄၆ စတုရန်းကီလိုမီတာ ဖြစ်ပါသည်။

IOR-7 လုပ်ကွက်ကို ပိုမိုကောင်းမွန်သော ရေနံပြန်လည်ထုတ်ယူမှု ကန်ထရိုက်စာချုပ် Improved Petroleum Recovery Contract (IPR) ချုပ်ဆိုလျက် လုပ်ဆောင်နေခြင်း ဖြစ်ပါသည်။ စာချုပ်တွင် သတ်မှတ်ကာလ သုံးနှစ်အတွင်း ကီလိုမီတာ ၃၀၀ မျဉ်း သုံးဖက်မြင် ကုန်းတွင်း ဆိုဒ်စမစ် အချက်အလက် ရယူရန်နှင့် အစမ်းတွင်း ၂တွင်း တူးရန် ပါဝင်ပါသည်။ သုံးဖက်မြင် ကုန်းတွင်း ဆိုဒ်စမစ် အချက်အလက် ကောက်ယူသည့် လုပ်ငန်းမှာ ပြီးစီးပြီ ဖြစ်ပါသည်။ သို့ဖြစ်၍ ဤ ESHIA တွင် အစမ်းတွင်းနှင့် ရေနံတွင်းများ တူးသည့် အစီအစဉ် စီစဉ်ထားပုံကို ဖော်ပြထားပါသည်။

လုပ်ကွက် IOR-7 တွင် ဆောင်ရွက်ရန် အဆိုပြုထားသော အစမ်းတွင်း/ရေနံတွင်းတူးဖော်ရေး စီမံချက် (နောင်တွင် "စီမံချက်" ဟု ဖော်ပြပါမည်)အတွက် သဘာဝပတ်ဝန်းကျင်၊ လူမှုရေးနှင့် ကျန်းမာရေး သက်ရောက်မှု ဆန်းစစ်အကဲဖြတ်ချက် အစီရင်ခံစာ (ESHIA) ရေးသားပြုစုရန် International Environmental Management Co. Ltd. (IEM) နှင့် ပြည်တွင်းမှ ဖက်စပ်ကုမ္ပဏီ Environmental Quality Management Co. Ltd. (EQM) တို့ကို PCMI က စာချုပ်ချုပ်ဆို လုပ်ငန်းအပ်နှံထားပါသည်။

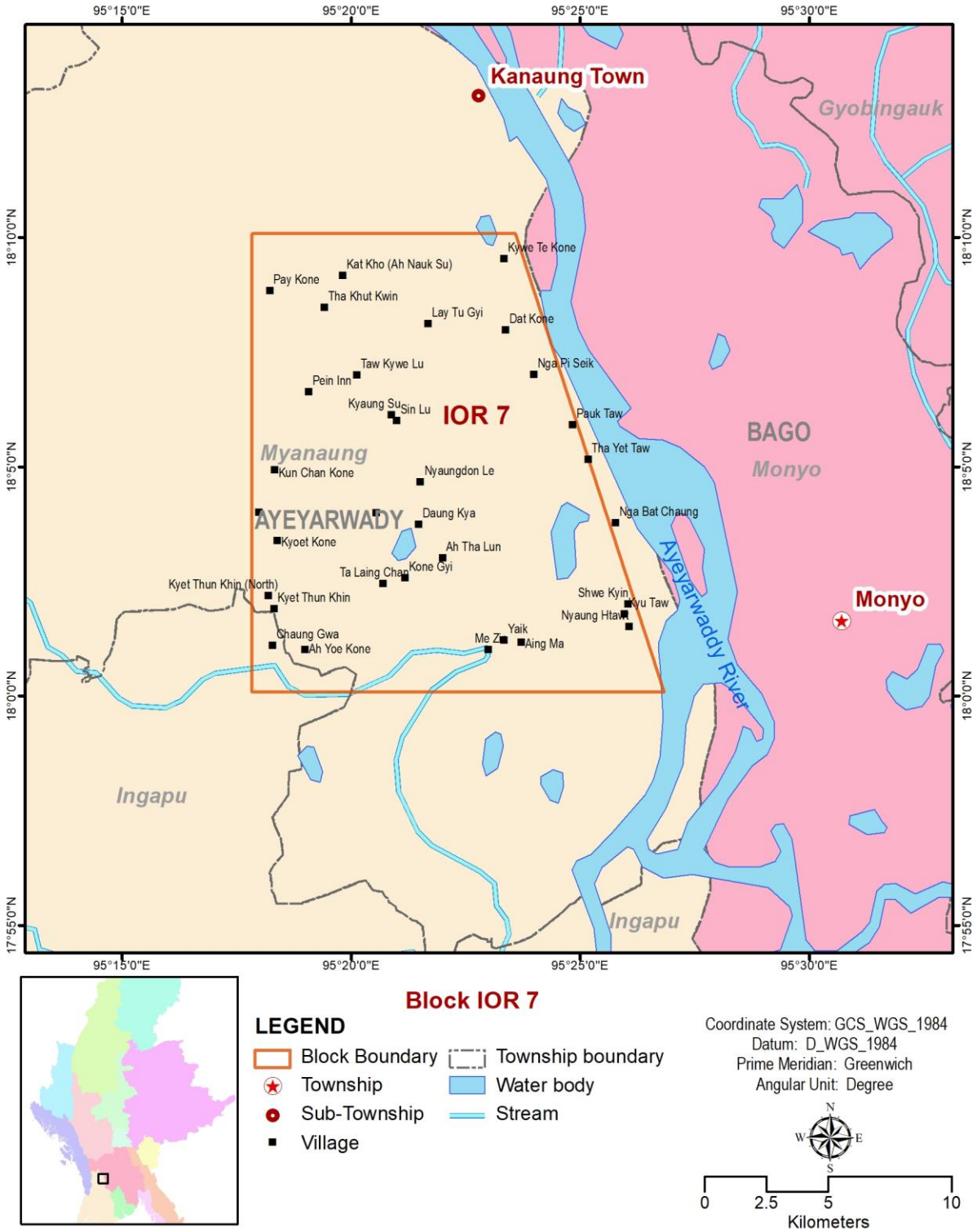
E1.2 စီမံချက်ဆောင်ရွက်မည့်အဖွဲ့အစည်း

Petroliam Nasional Berhad (ပက်ထရိုနှစ်) ကို ၁၉၇၄ခုနှစ်တွင် တည်ထောင်ခဲ့ပါသည်။ မလေးရှားနိုင်ငံ၏ နိုင်ငံအများတွင် လုပ်ငန်းဆောင်ရွက်လျက်ရှိသော ဘက်စုံ ရေနံနှင့်သဘာဝဓာတ်ငွေ့ လုပ်ငန်း ဖြစ်ပါသည်။ မဂ္ဂဇင်းက ပြုစုသော ကမ္ဘာ့အကြီးမားဆုံး ကုမ္ပဏီ ၅၀၀ (FORTUNE Global 500®) တွင် တစ်ခု အပါအဝင်ဖြစ်ပါသည်။ PETRONAS Carigali Myanmar Inc. (PCMI) သည် Petroliam Nasional Berhad၏ လက်အောက်ခံ ကုမ္ပဏီတစ်ခုဖြစ်ပြီး လုပ်ကွက် Block IOR-7၏ ထုတ်လုပ်မှုခွဲဝေယူရေး သဘော တူညီချက် ကန်ထရိုက်စာချုပ် Production Sharing Contract (PSC) ဖြင့် လုပ်ကိုင်ဆောင်ရွက်လျက် ရှိသည့် Operator ဖြစ်ပါသည်။ PCMI သည် လူ့အဖွဲ့အစည်း၏ တိုးပွားများပြားလာသော စွမ်းအင် လိုအပ်ချက်များကို ဖြည့်ဆည်းပေးရေးအတွက် ရေနံနှင့်သဘာဝဓာတ်ငွေ့ အစမ်းတွင်းများ
တူးဖော်ခြင်း၊ ထုတ်လုပ်ခြင်း၊ ပေးပို့ရောင်းချခြင်းများ လုပ်ဆောင်ပါသည်။

PCMI နည်းပညာကို ဆ နိုင်းသစ်တီထွင်သော ချဉ်းကပ်ပုံဖြင့် အသုံးပြုပါသည်။ ကမ္ဘာတစ်ဝန်း
နိုင်ငံပေါင်း ၅၀ ကျော်တွင် လုပ်ငန်းများ ဆောင်ရွက်လျက်ရှိပြီး အဖေးလံဆုံးသော
နယ်မြေဒေသများနှင့် လုပ်ငန်း ဆောင်ရွက်ရန်
အခက်ခဲဆုံးသော နယ်မြေဒေသများမှ စွမ်းအင်သယံဇာတများ ထုတ်ယူနိုင်ရန်နှင့်
ထွက်ရှိသည့်ပမာဏ အများဆုံး ရရှိနိုင်ရန် ကူညီဆောင်ရွက်ပါသည်။

ရန်ကုန်မြို့ရှိ PCMI ၏ ရုံးလိပ်စာမှာ အောက်ပါအတိုင်းဖြစ်ပါသည်။

PETRONAS Carigali Myanmar Inc.
အမှတ် ၁၆ ရွှေတောင်ကြားလမ်း
ရန်ကုန်မြို့ ၁၁၂၀၁
မြန်မာနိုင်ငံ



ပုံ Figure E-1 - လုပ်ကွက် BlockIOR-7 တည်နေရာ

E1.3 မြန်မာနိုင်ငံဥပဒေများ

သဘာဝပတ်ဝန်းကျင်အပေါ် သက်ရောက်မှု လေ့လာချက် (EIA) ပြုလုပ်ရာတွင် အနိမ့်ဆုံးအားဖြင့် ပြည့်မီရမည့် ဥပဒေပါ သတ်မှတ်ချက်များကို အောက်ဖော်ပြပါ ဥပဒေများဖြင့် ပြဋ္ဌာန်းထားပါသည်။ အခြားဥပဒေပြဋ္ဌာန်းချက်များရှိကောင်းရှိနိုင်ပါသေးသည်။

- ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော် ဖွဲ့စည်းပုံအခြေခံဥပဒေ (၂၀၀၈ခုနှစ်)
- မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှုဥပဒေ (၂၀၁၆ခုနှစ်)
- မြန်မာ သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဥပဒေ (၂၀၁၂ခုနှစ်)
- သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေး နည်းဥပဒေ (၂၀၁၄ခုနှစ်)
- သဘာဝပတ်ဝန်းကျင်အပေါ် သက်ရောက်မှု လေ့လာချက် ပြုလုပ်သည့် လုပ်ထုံးလုပ်နည်း (၂၀၁၅ခုနှစ်)
- သဘာဝပတ်ဝန်းကျင်အပေါ် သက်ရောက်မှု လေ့လာချက် ပြုလုပ်သည့် လုပ်ထုံးလုပ်နည်းဆိုင်ရာ အုပ်ချုပ်စီမံမှုပိုင်း လမ်းညွှန်ချက် မူကြမ်း (၂၀၁၅ခုနှစ်)
- ကုန်းတွင်းနှင့် ကမ်းလွန် ရေနံနှင့် သဘာဝဓာတ်ငွေ့ ရှာဖွေတူးဖော်ခြင်း လုပ်ငန်းများအတွက် သဘာဝပတ်ဝန်းကျင်အပေါ်
  သက်ရောက်မှု လေ့လာချက် ပြုလုပ်ရာတွင် လိုက်နာရန်
  လမ်းညွှန်ချက်များ(၂၀၁၅ခုနှစ် ဒီဇင်ဘာလ)
- မြန်မာနိုင်ငံတွင် သဘာဝပတ်ဝန်းကျင်အပေါ် သက်ရောက်မှု လေ့လာချက် (EIA) လုပ်ငန်းစဉ်များတွင် အများပြည်သူ ပါဝင်ဆောင်ရွက်နိုင်ရေးဆိုင်ရာ လမ်းညွှန်ချက်များ မူကြမ်း (၂၀၁၇ခုနှစ်)
- အမျိုးသား သဘာဝပတ်ဝန်းကျင် အရည်အသွေး (ဓာတ်ငွေ့များ ထုတ်လွှတ်မှု) လမ်းညွှန်ချက် (၂၀၁၅ခုနှစ်)

အခြားသက်ဆိုင်သော နိုင်ငံတော်အစိုးရ အဖွဲ့အစည်းများ/ သတ်မှတ်ပြဋ္ဌာန်းချက်များတွင် အောက်ပါတို့ ပါဝင်ပါသည်။

- ရေနံနှင့်ရေနံထွက်ပစ္စည်းဆိုင်ရာဥပဒေ ၂၀၁၇ ခုနှစ် အပိုဒ် ၈ (ခ) ၊ အပိုဒ် ၉ (က၊ ဂ ၊ ဃ)၊ အပိုဒ် ၁၉ (က၊ ခ၊ င)၊ အပိုဒ် ၁၀ (က၊ ဂ၊ ဃ၊ စ)
- ပြည်သူ့ကျန်းမာရေးဥပဒေ ၁၉၇၂ခုနှစ်
- ကူးစက်ရောဂါ တားဆီးကာကွယ် ထိန်းချုပ်ရေးဥပဒေ ၁၉၉၅ခုနှစ်
- ဆေးလိပ်သောက်ခြင်းနှင့် ဆေးရွက်ကြီးထွက် ထုတ်ကုန်များကို မှိုဝါခြင်း ထိန်းချုပ်ရေး ဥပဒေ ၂၀၀၆ခုနှစ် (အပိုဒ် ၉)
- မြန်မာနိုင်ငံ မီးသတ်တပ်ဖွဲ့ဥပဒေ ၂၀၁၅ခုနှစ် (အပိုဒ် ၂၅)
- ရေးဟောင်းပစ္စည်း ထိန်းသိမ်း ကာကွယ်စောင့်ရှောက်ရေး ဥပဒေ ၂၀၁၅ခုနှစ် (အပိုဒ် ၁၂)
- ရေးဟောင်းအဆောက်အဦ ထိန်းသိမ်း ကာကွယ်စောင့်ရှောက်ရေး ဥပဒေ
  (အပိုဒ် ၁၂၊ ၂၀ (စ)၊ (ဂ)၊ ၁၅ (ဂ))

- မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှု ဥပဒေ ၂၀၁၆ခုနှစ် (အပိုဒ် ၅၁ (က) (ခ) (ဂ) (ဃ)၊ အပိုဒ် ၆၅(ဆ) (ဈ) (ည) (ဋ) (ဌ) (ဍ) (ဎ) (တ) (ထ))
- ပန်ထမ်းများနှင့် ကျွမ်းကျင်မှု ဖွံ့ဖြိုးတိုးတက်ရေးဥပဒေ ၂၀၁၃ခုနှစ် (အပိုဒ် ၅၊ ၁၄၊ ၃၀)
- စက်ရုံအက်ဥပဒေ ၁ ၉၅၁ခုနှစ် (ဤ စီမံချက်မှာ ရေနံမြေ ကိစ္စရပ် ပါဖြစ်သည်ဟု လျှပ်စစ်နှင့် စွမ်းအင်ပန်ကြီးဌာနက ကြေညာချက် မထုတ်ပြန်မီက)
- ရေနံမြေလုပ်သားများ သာယာပြောရေး အက်ဥပဒေ ၁၉၅၁ခုနှစ် (ကြေညာချက်ထုတ်ပြန်ပြီး)
- အလုပ်သမားလျော်ကြေး အက်ဥပဒေ ၁၉၅၁ခုနှစ်
- အလုပ်သမားအဖွဲ့အစည်း ဥပဒေ ၂၀၁၁ခုနှစ်
- အလုပ်သမား အငြင်းပွားမှု ဖြေရှင်းရေး ဥပဒေ ၂၀၁၂ခုနှစ်
- အနိမ့်ဆုံးလုပ်ခ ဥပဒေ ၂၀၁၃ခုနှစ်
- လုပ်ခပေးချေင်း ဥပဒေ ၂၀၁၆ခုနှစ် - (၃၊ ၄၊ ၈၊ ၇(၂)၊ ၉၊ ၁၀ (က) မှ (ငဲ))
- လူမှုဖူလုံရေးဥပဒေ ၂၀၁၂ခုနှစ် (၁၁၊ ၁၆(က)၊ ၄၈(က)၊ ၅၁(က) (ခ)၊ ၅၄)
- ခွင့်နှင့် အားလပ်ရက် ဥပဒေ ၁၉၅၁ခုနှစ်
- ပေါက်ကွဲပစ္စည်းအက်ဥပဒေ
- ပေါက်ကွဲတတ်သောပစ္စည်းများ အက်ဥပဒေ
- ရေချိုငါးလုပ်ငန်း ဥပဒေ ၁၉၉၁ခုနှစ် (အပိုဒ် ၄၀)
- မော်တော်ယာဉ်ဥပဒေ ၂၀၁၅ခုနှစ် နည်းဥပဒေများ ၁၉၈၇ ခုနှစ်
- မြန်မာအာမခံဥပဒေ ၁၉၉၃ခုနှစ် (အပိုဒ် ၁၆)
- သစ်တောဥပဒေ ၁၉၉၂ခုနှစ် (အပိုဒ် ၁၂)
- တောရိုင်းတိရစ္ဆာန်နှင့် တောရိုင်းအပင်များ ကာကွယ်စောင့်ရှောက်ရေး နှင့် သဘာဝနယ်မြေဒေသများ ကာကွယ်ထိန်းသိမ်းရေးဥပဒေ ၁၉၉၄ခုနှစ်
- မြေအောက်ရေ အက်ဥပဒေ ၁၉၃၀ခုနှစ်
- လယ်ယာမြေဥပဒေ ၂၀၁၂ခုနှစ် (အပိုဒ် ၃၀)
- ယဉ်ကျေးမှုအမွေအနှစ်နယ်မြေများ ထိန်းသိမ်းကာကွယ်စောင့်ရှောက်ရေး ဥပဒေ (အပိုဒ် ၂၀၊ ၂၃၊ ၂၉ (ခ))
- အလုပ်အကိုင်နှင့် ကျွမ်းကျင်မှု ဖွံ့ဖြိုးတိုးတက်ရေးဥပဒေ ၂၀၁၃ခုနှစ်
- အန္တရာယ်ရှိသော ဓာတုပစ္စည်းနှင့် ဆက်စပ်ပစ္စည်းများ၏ အန္တရာယ်ကို တားဆီးကာကွယ်ရေး ဥပဒေ ၂၀၁၃ခုနှစ် (အပိုဒ် ၁၆၊ ၁၇၊ ၂၃၊ ၂၇)
- သွင်းကုန်ထုတ်ကုန်ဥပဒေ ၂၀၁၂ခုနှစ် (အပိုဒ် ၇)
- မြစ်ချောင်းများနှင့် ရေအရင်းအမြစ်များ ထိန်းသိမ်းစောင့်ရှောက်ရေး ဥပဒေ ၂၀၁၆ခုနှစ် (အပိုဒ် ၂၄ (ခ)၊ ၂၁ (က) (ခ)၊ ၁၉၊ ၁၁ (က) (ခ))
- လုပ်ငန်းခွင်ဘေးအန္တရယ်ကင်းရှင်းရေးနှင့် ကျန်းမာရေး ဥပဒေ (မူကြမ်း)

E1.4 ESHIAဦးတည်ချက်များနှင့် နယ်ပယ်

ဤ ESHIA အစီရင်ခံစာ၏ ရည်ရွယ်ချက်မှာ စီမံချက်လုပ်ဆောင်ခြင်းဖြင့် ဖြစ်ပေါ် လာနိုင်ခြေရှိသည့် သဘာဝ ပတ်ဝန်းကျင်၊ လူသားများ အသုံးပြုနိုင်သည့် တန်ဖိုးများ၊ ဘဝနေထိုင်မှု အရည်အသွေးနှင့် ကျန်းမာရေးတို့ အပေါ် အကောင်းအဆိုး သက်ရောက်မှုများကို ဖော်ထုတ်ပြီး ဖြစ်နိုင်သမျှ အတိုင်းအတာအထိ ကိန်းဂဏန်းဖြင့် တွက်ချက်ဖော်ပြရန် ဖြစ်ပါသည်။
သက်ရောက်မှုများကို ဖော်ထုတ်ပြီးနောက် ထိခိုက်မှု အနည်းပါးဆုံးဖြစ်စေရန် တားဆီးကာကွယ်ရေး၊ ထိခိုက်မှုလျော့ချရေးနှင့် စောင့်ကြည့်စစ်ဆေးရေး အစီအမံများကို အဆိုပြုပါမည်။

ဤအစီရင်ခံစာ၏ အသေးစိတ် ဦးတည်ချက်များမှာ အောက်ပါအတိုင်း ဖြစ်ပါသည်။

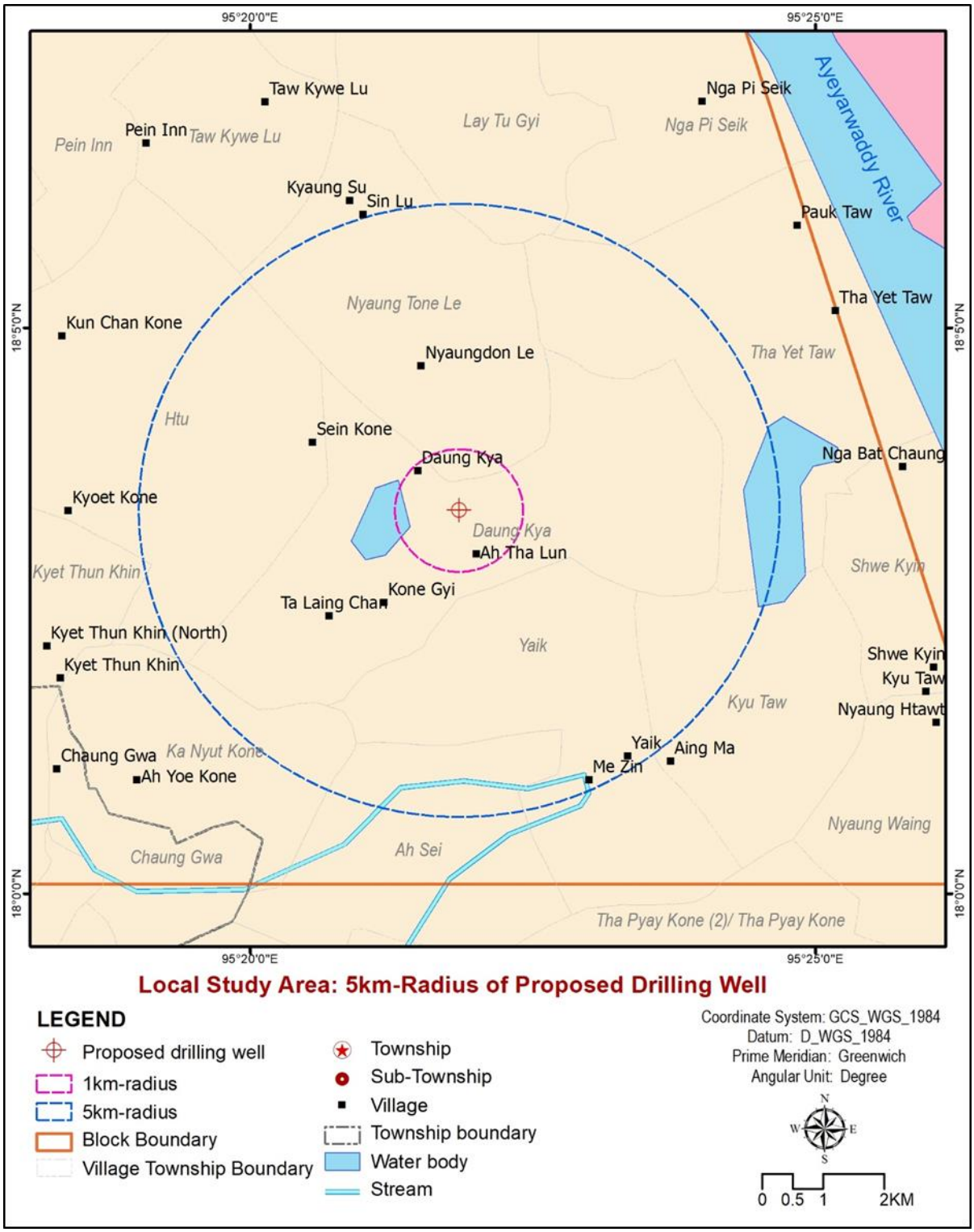
- ဆောင်ရွက်ရန် စီစဉ်ထားသည့် လုပ်ငန်းများအားလုံးနှင့် စီစဉ်မထားသော်လည်း ဖြစ်ပွားလာနိုင်သော ဖြစ်ရပ်များ အားလုံးကို ဖော်ထုတ်ခြင်း
- စီမံချက်လုပ်ဆောင်မည့် နယ်မြေဒေသအတွက် သဘာဝပတ်ဝန်းကျင်၊ လူမှုရေးနှင့် ကျန်းမာရေး မူလပကတိအခြေအနေ (baseline) ဖော်ထုတ်သတ်မှတ်ခြင်း
- လက်ရှိအခြေအနေအပေါ် အခြေခံလျက် အောက်ပါတို့တွင် ဖြစ်ပေါ်လာနိုင်ခြေရှိသည့် အရေးပါသော သက်ရောက်မှုများကို ဖော်ထုတ်အကဲဖြတ်ခြင်း
    - ရုပ်ဝတ္ထုပိုင်း အရင်းအမြစ်များ
    - ဂေဟစနစ်ပိုင်း အရင်းအမြစ်များ
    - လူသားများ အသုံးပြုနိုင်မှု တန်ဖိုးများ
    - ဘဝနေထိုင်မှု အရည်အသွေး တန်ဖိုးများ
    - ကျန်းမာရေး
- ထိခိုက်မှုဖြစ်နိုင်ခြေများကို အနည်းပါးဆုံးဖြစ်စေရန် ထိခိုက်မှုလျော့နည်းကျဆင်းစေရေး အစီအမံများကို ဖော်ထုတ် အကြံပြုခြင်း
- သဘာဝပတ်ဝန်းကျင်တွင် ဖြစ်ပေါ်လာသော အပြောင်းအလဲများ၊ လူအဖွဲ့အစည်းတွင်း ကိစ္စရပ်များနှင့် ကျန်းမာရေးတို့ကို စီမံချက်ကာလအတွင်း စောင့်ကြည့်ပြီး နိုင်ငံတော်က ပြဋ္ဌာန်းထားသည့် ဥပဒေများအတိုင်း လိုက်နာဆောင်ရွက်မှု ရှိစေရေးအတွက် စောင့်ကြည့်စစ်ဆေးရေး အစီအစဉ်တစ်ရပ်ကို အကြံပြုခြင်း

E1.5 လေ့လာမည့် နယ်မြေဒေသ

စီမံချက်အတွက် လေ့လာမည့် နယ်မြေဒေသမှာ လုပ်ကွက် Block IOR-7 အတွင်းရှိ စ မ်းသပ်တွင်း တူးဖော်ရန် အဆိုပြုထားသည့် နေရာဖြစ်ပြီး စုစုပေါင်း ၅ကီလိုမီတာ ရှိပါသည်။ (စမ်းသပ်တွင်း ၂တွင်းလုံးကို တွင်းတူးစင် တစ်ခုတည်းမှ တူးဖော်ပါမည်။) သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာနှင့် လူအဖွဲ့အစည်းပိုင်းဆိုင်ရာ မူလ ပကတိအခြေအနေ အချက်အလက်များ (baseline data) ကို

တွင်းတူးစင်မှ ၁ ကီလိုမီတာအထိ ကွာဝေးသော ကြားခံနယ်မြေ (buffer area) အတွင်း အဓိကထား ကောက်ယူခဲ့ပါသည်။

လေ့လာခဲ့သော နယ်မြေဒေသကို ပုံ Figure E-2 တွင် ဖော်ပြထားပါသည်။ ရုပ်ဂတ္တုပိုင်း အရင်းအမြစ်များ၊ ဇီဂအရင်းအမြစ်များ၊ လူသားများ အသုံးပြုနိုင်မှု တန်ဖိုးများနှင့် ဘဂနေထိုင်မှုအရည်အသွေး တန်ဖိုးများအပေါ် သက်ရောက်မှုများကို အကဲဖြတ်သုံးသပ်ရာတွင် သက်ရောက်မှု ထင်ရှားသည့် နေရာများ (sensitive receptors) ကို ဖော်ထုတ်နိုင်ရန် ယင်းနယ်မြေဒေသကို အသုံးပြုပါမ ည်။ ဥပမာ စာသင်ကျောင်းများ၊ ဘုရားစေတီများ၊ ရေအရင်းအမြစ်များ၊ လူနေထိုင်သည့် မြို့ရွာများ စသည်တို့သည် သက်ရောက်မှု ထင်ရှားသည့် နေရာများ (sensitive receptors) ဖြစ်ပါသည်။



ပုံ Figure E-2 - IOR-7 လေ့လာချက်ပြုလုပ်မည့် နယ်မြေဒေသ

E1.5.1 အချက်အလက်များ စုဆောင်းခြင်း

E1.5.1.1 အဓိကအချက်အလက် အရင်းအမြစ်များ

ဤ EIA လေ့လာချက်အတွက် ရယူစုဆောင်းခဲ့သည့် အချက်အလက်များတွင် အဆိုပြုထားသော စီမံချက်ဆိုင်ရာ အသေးစိတ်အချက်အလက်များ၊ သဘာဝပတ်ဝန်းကျင် မူလပကတိ အခြေအနေ၊ သက်ရောက်မှု ဖြစ်နိုင်ခြေရှိသည့် နယ်မြေဒေသ၏ လူမှု စီးပွားရေး အခြေအနေနှင့် ကျန်းမာရေး အခြေအနေ များ ပါဝင်ပါသည်။ အချက်အလက်များကို တိုက်ရိုက် ကွင်းဆင်း ရယူသကဲ့သို့ စာအုပ်စာတမ်း နှင့် အခြားအရင်းအမြစ်များမှ တဆင့်လည်း ရယူပါသည်။

တိုက်ရိုက် ကွင်းဆင်း ရယူသည့် အချက်အလက် အရင်းအမြစ်များတွင် အောက်ပါတို့ ပါဝင်ပါသည်။

- မြေပြင်ပေါ်ရှိရေနှင့် မြေအောက်ရေ အရည်အသွေးကို သိရှိနိုင်ရန် ၂၀၁၄ခုနှစ် နိုဝင်ဘာလ ၇ ရက်မှ ၁၃ ရက်အထိ သဘာဝပတ်ဝန်းကျင် အရည်အသွေး မူလပကတိ အခြေအနေ စစ်တမ်းကောက်ယူခြင်းနှင့် မြေလွှာစစ်တမ်း ကောက်ယူခြင်း
- အသံဆူညံမှုနှင့် လေ အရည်အသွေးကို သိရှိနိုင်ရန် ၂၀၁၄ခုနှစ် နိုဝင်ဘာလ ၇ ရက်မှ ၁၃ ရက်အထိ သဘာဝပတ်ဝန်းကျင် အရည်အသွေး မူလပကတိ အခြေအနေ စစ်တမ်းကောက်ယူခြင်း
- သမိုင်း၊ ရှေးဟောင်းသုတေသနနှင့် ယဉ်ကျေးမှု အရင်းအမြစ်များ အစည်းအဝေးကို ၂၀၁၄ခုနှစ် နိုဝင်ဘာလ ၇ ရက်မှ ၁၃ ရက်အထိ စီစဉ်ပြုလုပ်ခြင်း
- ဇီဝမျိုးစုံမျိုးကွဲခြင်းနှင့် ဂေဟစနစ် အခြေအနေ ဆိုင်ရာ ဂေဟစနစ် အညွှန်းကိန်းအချို့ကို အဓိကထားလျက် နယ်ခံ လယ်သမားများထံမှ အစဉ်အလာ ဂေဟစနစ် အသိပညာ (TEK) စစ်တမ်းများကို ၂၀၁၄ခုနှစ် နိုဝင်ဘာလ ၇ ရက်မှ ၁၃ ရက်အထိ ကောက်ယူခြင်း
- လူမှုစီးပွားရေး စစ်တမ်းများကို ၂၀၁၄ခုနှစ် နိုဝင်ဘာလ ၇ ရက်မှ ၁၃ ရက်အထိ ကောက်ယူခြင်း
- ၂၀၁၄ခုနှစ် နိုဝင်ဘာလ ၇ ရက်မှ ၁၃ ရက်အထိ ရွာသူရွာသားများနှင့် အုပ်စုငယ် (Focus Group) ဆွေးနွေးပွဲများ ပြုလုပ်ခြင်း

အခြားသော အောက်ဖော်ပြပါ နည်းလမ်းများဖြင့်လည်း တိုက်ရိုက် အချက်အလက် စုဆောင်းခြင်းများ ပြုလုပ်ခဲ့ပါသည်။

- မြေပြင်ပေါ်ရှိရေနှင့် မြေအောက်ရေ အရည်အသွေးကို သိရှိနိုင်ရန် ၂၀၁၇ခုနှစ် ဒီဇင်ဘာလ ၄ ရက်မှ ၆ ရက်အထိ သဘာဝပတ်ဝန်းကျင် အရည်အသွေး မူလပကတိ အခြေအနေ စစ်တမ်းကောက်ယူခြင်းနှင့် မြေလွှာစစ်တမ်း ကောက်ယူခြင်း
- အသံဆူညံမှုနှင့် လေ အရည်အသွေးကို သိရှိနိုင်ရန် ၂၀၁၇ခုနှစ် ဒီဇင်ဘာလ ၄ ရက်မှ ၆ ရက်အထိ သဘာဝပတ်ဝန်းကျင် အရည်အသွေး မူလပကတိ အခြေအနေ စစ်တမ်းကောက်ယူခြင်းနှင့် မြေလွှာစစ်တမ်း ကောက်ယူခြင်း
- သမိုင်း၊ ရှေးဟောင်းသုတေသနနှင့် ယဉ်ကျေးမှု အရင်းအမြစ်များ အစည်းအဝေးကို မြန်အောင်နှင့် ကြံခင်းမြို့နယ် အထွေထွေအုပ်ချုပ်ရေး ဦးစီးဌာန အာဏာပိုင်များ တက်ရောက်လျက်

၂၀၁၇ခုနှစ် ဒီဇင်ဘာလ ၅ ရက်မှ ၆ ရက်အထိ စီစဉ်ပြုလုပ်ခြင်း(ယင်းမြို့နယ်များတွင် ယဉ်ကျေးမှုအမွေအနှစ်ဌာန ရုံး မရှိပါ။)

- သဘောထားနှင့် ထင်မြင်ချက် စစ်တမ်းကောက်ယူခြင်း၊ အုပ်စုငယ် (Focus Group) များဖြင့် ဆွေးနွေးခြင်းတို့ကို ရွာသူရွာသားများ တက်ရောက်လျက် ၂၀၁၇ခုနှစ် ဒီဇင်ဘာလ ၅ ရက်မှ ၆ ရက်အထိ စီစဉ် ပြုလုပ်ခြင်း

E1.5.1.2 စာအုပ်စာတမ်းစသည့် တစ်ဆင့်ခံ အချက်အလက် အရင်းအမြစ်များ

တစ်ဆင့်ခံ အ ချက်အလက် အ ရင်းအမြစ်များကို ပညာရပ်နယ်ပယ်ဆိုင်ရာ စာအုပ်စာတမ်းများ၊ စီမံချက်နယ်မြေဒေသမှ သက်ဆိုင်ရာ အာဏာပိုင်များထံမှ ရရှိပါသည်။
ယင်းတစ်ဆင့်ခံ အချက်အလက် အရ င်းအမြစ် များကို အစီရင်ခံစာတစ်ခုလုံးတွင် ရည်ညွှန်းချက်များဖြင့် ထည့်သွင်းဖော်ပြထားပြီး အစီရင်ခံစာ နောက်ဆုံးပိုင်း ရည်ညွှန်းစာအုပ်စာတမ်းများအပိုင်းတွင် စာရင်းပြုလုပ်ဖော်ပြထားပါသည်။

E1.6 ESHIA အကောင်အထည်ဖော်ရေး စုဖွဲ့စီစဉ်ခြင်း

သက်ရောက်မှုအကဲဖြတ်သုံးသပ်ချက်ကို မြန်မာနိုင်ငံတွင် မှတ်ပုံတင်ထားသော အတိုင်ပင်ခံကုမ္ပဏီများ ဖြစ်သော International Environmental Management Co. Ltd. (IEM) နှင့် Environmental Quality Management Co. Ltd. (EQM) တို့က ပြုစုခဲ့ပါသည်။ IEM နှင့် EQM တို့၏ အတိုင်ပင်ခံ မှတ်ပုံတင် အချက်အလက်များကို **နောက်ဆက်တွဲ ၁** တွင် ဖော်ပြထားပါသည်။

International Environmental Management Co. Ltd
(နိုင်ငံတကာ သဘာဝပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု ကုမ္ပဏီလီမိတက်)
အမှတ် ၁၄၈ ဘီ ဓမ္မစေတီလမ်း၊ ဗဟန်းမြို့နယ်၊ ရန်ကုန်မြို့

Environmental Quality Management Co. Ltd
(သဘာဝပတ်ဝန်းကျင်အရည်အသွေး စီမံခန့်ခွဲမှု ကုမ္ပဏီလီမိတက်))
အမှတ် ၂၃၁၊ ၂၃ ရပ်ကွက်၊ စရည်းပင်လမ်း၊ သုဝဏ္ဏ၊ သင်္ကန်းကျွန်းမြို့နယ်၊ ရန်ကုန်မြို့၊ မြန်မာနိုင်ငံ

E1.6.1 ESHIA အဖွဲ့

သက်ရောက်မှုအကဲဖြတ်သုံးသပ်ချက်ကို မြန်မာနိုင်ငံတွင် မှတ်ပုံတင်ထားသော အတိုင်ပင်ခံကုမ္ပဏီများ ဖြစ်သော International Environmental Management Co. Ltd. (IEM) နှင့် Environmental Quality Management Co. Ltd. (EQM) တို့က ပြုစုခဲ့ပါသည်။ ESHIA အကဲဖြတ်သုံးသပ်သည့်အဖွဲ့တွင် ပါဝင်သူများကို ဇယား ၁-၁ **ဇယား Table** 1-1တွင် ဖော်ပြထားပါသည်။

ဇယား Table 1-1 - ESHIA အကဲဖြတ်သုံးသပ်သည့်အဖွဲ့

စဉ်.	အမည်	နောက်ခံအချက်များ/ကျွမ်းကျင်မှု	တာဝန်
IEM			
1	Ron Livingston	၁၉၇၉ခုနှစ် သဘာဝသယံဇာတ စီမံခန့်ခွဲရေး မဟာဘွဲ့၊ Manitoba တက္ကသိုလ်၊ Winnipeg, Manitoba, ကနေဒါနိုင်ငံ ၁၉၇၆ခုနှစ် သိပ္ပံဘွဲ့ Manitoba တက္ကသိုလ်၊ Winnipeg, Manitoba, ကနေဒါနိုင်ငံ	အကြီးတန်း သဘာဝပတ်ဝန်းကျင် လူမှုရေးနှင့် ကျန်းမာရေး EIA ကျွမ်းကျင်သူ
2	Dylan Jenkins	၂၀၀၈ခုနှစ် သိပ္ပံဘွဲ့ B.Sc. (Biosystems Engineering), Manitoba တက္ကသိုလ်၊ ကနေဒါနိုင်ငံ	သဘာဝပတ်ဝန်းကျင် ဆန်းစစ်လေ့လာသူ/ ဇီဝမျိုးစုံမျိုးကွဲ
3	Komgrit Prawatlertudom	၂၀၀၉ခုနှစ် B. Sc. (Marine Sciences), ချူလာလောင်ကွန် တက္ကသိုလ်၊ ထိုင်းနိုင်ငံ	သဘာဝပတ်ဝန်းကျင် နမူနာ ကောက်ယူခြင်း/ရေနေဇီဝဗေဒ
4	Ubonwan Sintopan	၂၀၀၇ခုနှစ် MS. (Natural Resources Management), Asian Institute of Technology, ထိုင်းနိုင်ငံ ၂၀၀၄ခုနှစ် B.S. (GEOGRAPHY), ချင်းမိုင်တက္ကသိုလ်၊ ထိုင်းနိုင်ငံ	သဘာဝပတ်ဝန်းကျင် ဆန်းစစ်လေ့လာသူ/ GIS
EQM			
1	ဒေါက်တာ ဥမ္မာမေ တင်လျိုင်	၂၀၀၄-၂၀၀၆ခုနှစ်၊ M.Sc in Environmental Engineering and Management, Asian Institute of Technology, ထိုင်းနိုင်ငံ ၁၉၈၆-၁၉၉၆ခုနှစ်၊ အမ်ဘီဘီအက်စ်၊ ဆေးတက္ကသိုလ်၊ မြန်မာနိုင်ငံ	အကြီးတန်းသဘာဝပတ်ဝန်းကျင် ကျွမ်းကျင်သူ/ ပြည်တွင်း ညှိနှိုင်းရေးမှူး
2	ဒေါ်စိုးမိုးနွယ်	၂၀၁၃ခုနှစ်၊ B.Sc. (Forestry)	လူမှုစီးပွား အစုအဖွဲ့ ခေါင်းဆောင်
3	ဦးခွန်ဆက်သာ	၂၀၁၄ခုနှစ်၊ သစ်တောတက္ကသိုလ်၊ သစ်တောဘာသာ	လူမှုစီးပွား အစုအဖွဲ့ ခေါင်းဆောင် / ဇီဝမျိုးစုံမျိုးကွဲ စစ်တမ်း
4	ဦးသီဟထွဋ်	၂၀၁၂ခုနှစ်၊ ဒဂုံတက္ကသိုလ် Microbiology	လူ့အဖွဲ့အစည်းစစ်တမ်း ကောက်ယူသူ
5	ဒေါ်နိုးနိုးလွင်	၂၀၁၄ခုနှစ်၊ ရေကြောင်းပညာတက္ကသိုလ် (Myanmar Maritime University) B.E (Naval Architecture)	လူ့အဖွဲ့အစည်းစစ်တမ်း ကောက်ယူသူ
6	ဒေါ်သွယ်သွယ်ထွန်း	B.Sc. (Chemistry)	လူ့အဖွဲ့အစည်းစစ်တမ်း ကောက်ယူသူ
7	ဒေါ်ယွန်းမိမိသော်	B.Sc. (Chemistry)	လူ့အဖွဲ့အစည်းစစ်တမ်း ကောက်ယူသူ
8	ဦးစိုးပြည့်ထွန်း	၂၀၁၂ခုနှစ်၊ ဒဂုံတက္ကသိုလ်၊ Microbiology	လေ/ဆူညံသံ
9	ဦးရဲနိုင်ထွန်း	၂၀၁၃ခုနှစ်၊ သစ်တောတက္ကသိုလ်၊ သစ်တောဘာသာ	လေ/ဆူညံသံ
10	ဦးကျော်ကိုကို	၂၀၀၉ခုနှစ်၊ ဒဂုံတက္ကသိုလ်၊ သင်္ချာ	လေ/ဆူညံသံ
11	ဦးဝင်းစည်သူ	၂၀၁၂ခုနှစ် ဒဂုံတက္ကသိုလ် (အဝေးသင်တက္ကသိုလ်)	ရေနှင့်မြေလွှာ နမူနာကောက်ယူခြင်း
12	ဦးဇေဇေကို	ဒီပလိုမာ၊ လျှပ်စစ်စွမ်းအား	ရေနှင့်မြေလွှာ နမူနာကောက်ယူခြင်း

E1.7 စီမံချက်ဖော်ပြချက်

စီမံချက်ကို ပြည့်စုံစွာ
နားလည်သဘောပေါက်ရန်နှင့် စီမံချက်လုပ်ငန်းများဆိုင်ရာ
သတင်းအချက်အလက် များကို ပြုစုရန်အတွက် စီမံချက်ကို ပြန်လည်သုံးသပ်ခဲ့ပါသည်။ **အပိုင်း ၄** တွင် စီမံချက် ဖော်ပြချက် ပါရှိပါသည်။

PETRONAS Carigali Myanmar Inc. (နောင်တွင် "PCMI" ဟု ဖော်ပြပါမည်)၊ MOGE နှင့် ပြည်တွင်း တွဲဖက် ကုမ္ပဏီ UNOG Company Limited ၊ Petroleum Brunei Myanmar တို့သည် ကုန်းတွင်း လုပ်ကွက် Block IOR-7 တွင် ပူးပေါင်း ရင်းနှီးမြှုပ်နှံကြပါသည်။

PCMI နှင့် MOGE အကြား ချုပ်ဆိုသော Petroleum Sharing Contract (PSC) (ရေနံခွဲဝေယူရေးစာချုပ်) ကို ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံ နေပြည်တော်တွင် ၂၀၁၇ခုနှစ် စက်တင်ဘာလ ၁၆ ရက်နေ့က လက်မှတ်ရေးထိုး ချုပ်ဆိုခဲ့ပါသည်။ ဤအခန်းတွင် စမ်းသပ်တွင်း ၂တွင်း တူးမည့် အစီအစဉ် အဆိုပြုချက်ကို ဆွေးနွေးတင်ပြထားပါသည်။

PCMI သည် လုပ်ကွက် Block IOR-7 တွင် စမ်းသပ်တွင်း တူးမည့် အစီအစဉ်၌ စမ်းသပ်တွင်း ၂တွင်း တူးရန် ပါဝင်ပါသည်။ စတင်တူးဖော်မည့် နေ့စွဲ (spud date) မှာ ၂၀၁၈ခုနှစ် နိုဝင်ဘာလအတွင်း ဖြစ်ရန် မျှော်မှန်းပါသည်။ စမ်းသပ်တွင်းကို
သမားရိုးကျ တွင်းပေါက်နည်းလမ်းဖြင့် အထက်အောက် ထောင်လျက် တူးဖော်မည်ဖြစ်ပါသည်။
သုံးရိုးသုံးစည် ကုန်းတွင်း ရေနံတွင်းတူးစင်ကိုပင် အသုံးပြုလျက် စမ်းသပ်တွင်းကို တူးဖော်ပါမည်။
တွင်းတူးစင် တည်နေရာ တစ်နေရာတည်းမှ စမ်းသပ်တွင်း ၂တွင်း တူးပါမည်။

ကန်ထရိုက်ရရှိမည့် ကုမ္ပဏီနှင့် ထပ်ဆင့်ကန်ထရိုက် ရရှိမည့် ကုမ္ပဏီအားလုံးသည် သတ်မှတ်သော သဘာဝပတ်ဝန်းကျင်နှင့် လူမှုရေး ကတိကဝတ်များကို လိုက်နာ ဆောင်ရွက်ပါမည်။

E1.7.1 စီမံချက်အချိန်ဇယား

စမ်းသပ်တွင်းများကို မိုးရာသီကုန်လွန်ပြီးနောက် ခြောက်သွေ့ရာသီအတွင်း တူးဖော်ပါမည်။
၂၀၁၉ခုနှစ် မေလကုန် မိုးရာသီအစတွင် စမ်းသပ်တွင်းတူးဖော်သည့် လုပ်ငန်း ပြီးစီးရန် မျှော်မှန်းပါသည်။

IOR-7 စီမံချက် အချိန်ဇယားကို ဇယား ဇယား Table E-2 တွင် ဖော်ပြထားပါသည်။

ဇယား Table E-2 - IOR-7 စီမံချက်အချိန်ဇယား

လုပ်ငန်း	တွင်း ၁	တွင်း ၂
စတင် တူးဖော်မည့် နေ့စွဲ	၂၀၁၈ခုနှစ် နိုဝင်ဘာလ ၁ ရက်	၂၀၁၈ခုနှစ် ဒီဇင်ဘာလ ၁၅ ရက်
တူးဖော်မည့် ကြာမြင့်ချိန်	ရက်ပေါင်း ၃၀ (၂၀၁၈ခုနှစ် နိုဝင်ဘာလ ၃၀ ရက်)	ရက်ပေါင်း ၃၀ (၂၀၁၉ခုနှစ် ဇန်နဝါရီလ ၁၅ ရက်)
အပြီးသတ်ရန် ကြာမြင့်ချိန်	၁၅ ရက် (၂၀၁၈ခုနှစ် ဒီဇင်ဘာလ ၁၅ ရက်)	၁၅ ရက် (၂၀၁၉ခုနှစ် ဖေဖော်ဝါရီလ ၁ ရက်)
တွင်း စမ်းသပ်မှုများ ကြာမြင့်ချိန်	(၁၅ ရက်) ၂၀၁၉ခုနှစ် ပထမ သုံးလပတ် အတွင်း အခြားတွင်းတူးစင်ဖြင့် တူးဖော်ပါမည်။	(၁၅ ရက်) ၂၀၁၉ခုနှစ် ပထမ သုံးလပတ် အတွင်း အခြားတွင်းတူးစင်ဖြင့် တူးဖော်ပါမည်။

Source: PCMI, 2018

E1.7.2 စမ်းသပ်တူးဖော်ခြင်း Exploration Drilling

E1.7.2.1 တူးဖော်မည့် နည်းလမ်းအမျိုးအစား

တွင်းများကို သမားရိုးကျ တွင်းအရွယ်အစားအတိုင်း တူးဖော်ပါမည်။ PCMI ၏ တွင်းများကို သေးငယ်သော အရွယ်အစားတွင်းများ တူးဖော်ရန် မဖြ စ်နိုင်ပါ။ တူးရမည့် အနက်၊ မြေလွှာအမျိုးအစား၊ မျှော်မှန်းဖိအားနှင့် တွင်း တ ည်ငြိမ်မှုအတွက် သ မားရိုးကျ တွင်း အရွယ်အစားဖြစ်ရန် လိုအပ်ပါသည်။ reservoir section တွင် ရှစ်လက်မခွဲ လွန်သွားဖြင့် တွင်း၏ နောက်ဆုံး အပိုင်းကို တူးဖော်ပါမည်။

PCMI ၏ တူးဖော်မည့် အစီအစဉ်တွင် ကလိုရိုက်ကင်းစင်သည့် High performance Water Based Mud (WBM) (တူးဖော်အားမြင့်မားသော ရေဖြင့်ဖျော်ထားသည့် ရွံ့ ရည်) ကိုသာ အသုံးပြုပါမည်။ ရွံ့ ဖော်စပ်ရာတွင် ကလိုရိုက်များ ထည့်သွင်းမည်မဟုတ်ပါ။

E1.7.2.2 တည်နိုင်နေထိုင်မည့် လုပ်ငန်းစဉ်နှင့် အခင်းအကျင်း

အလုပ်သမားနေအိမ်ဆိုင်ရာ IFC လမ်းညွှန်ချက် (၂၀ ၁၉ခုနှစ်) ပါ သ တ်မှတ်ချက်များအတိုင်း လုပ်ငန်းစဉ်နှင့် အတွင်း နေအိမ်အဆောက်အဦများ တည်ဆောက်ပါမည်။ တွင်းတူးဖေ
ာ်ရာ နေရာ ဆောက်လုပ်ရေး ဇုန် အနီးတွင် လုပ်ငန်းစဉ်နှင့်ကို တည်ဆောက်ပါမည်။ အနည်းဆုံး အားဖြင့် လူဆယ်ဦးလျှင် ရေချိုးခန်း ၁ခ န်း၊ လူ ၁၅ဦးလျှင် အိမ်သာတစ်လုံး လက်ဆေးဇလုံ ၁လုံး နှုန်း ပါ၀ ငါပါမည်။
စားသောက်ဆောင်မှာ အနည်းဆုံး လူ၂၀ တစ်ပြိုင်နက်တည်း စားသောက်ရန် နေရာ ရှိပါမည်။

တွင်းတူးဖော်သည့်အဆင့်တွင် တွင်းတူးစင် ကန်ထရိုက်ရရှိသည့် ကုမ္ပဏီက တွင်းတူးသည့် စခန်းနေရာ တည်ဆောက်ပေးပါမည်။ အစိမ်းရောင်ဇုန် သတ်မှတ်ထားသည့်အတွင်း တွင်းတူးစင်နှင့် ကပ်လျက် ဖြစ်ပါမည်။ နေထိုင်ရန်အတွက် လုပ်ငန်းစုအတွင်း စံသတ်မှတ်ထား သည့်အတိုင်း ကွန်တိန်နာများဖြင့် တည်ဆောက်ပေးပါမည်။ အလုပ်ဆိုက်အတွင်း ယူဆောင်လာမည်ဖြစ်ပြီး အိမ်သာနှင့် ရေချိုးခန်း တွဲလျက် တစ်ယောက်အိပ်၊ နှစ်ယောက်အိပ်၊ လေးယောက်အိပ် ယူနစ်များ ပါ၀ငါပါမည်။ ကွန်တိန်တာအခန်းများတွင် လေအေးစက် (အဲယားကွန်း) ပါရှိပါမည်။ သီးခြား စားသောက်ခန်း ထည့်သွင်းပေးမည်ဖြစ်ပြီး အနည်းဆုံး လူ၄၀ တစ်ပြိုင်တည်း စားသောက်နိုင်ပါမည်။

E1.7.2.3 သွားလမ်းများ

စက်ပစ္စည်းကိရိယာများ သ ယ်ယူပို့ဆောင်ရန် အ ဓိက လ မ်းကြောင်းအဖြစ် ပုသိမ်-မုံရွာ အဝေးပြေးလမ်း အတိုင်း ကြဲခင်းအထိ၊ ထိုမှဆ က်လက်၍ မြန်အောင်၊ ထို့နောက် မင်းကုန်းလမ်းဆုံမှ စတင်၍ MOGE က ဖောက်လုပ်ထားသော လမ်းဖြင့် တွင်းအထိ ပို့ဆောင်နိုင်ရန် PCMI အနေဖြင့် စီစဉ်ထားပါသည်။ တွင်းနေရာသို့ လုပ်သားများ
ပို့ဆောင်ခြင်းနှင့် တွင်းနေရာမှ လုပ်သားများပြန်လည်ထွက်ခွာခြင်းအတွက် PCMI သည် ရန်ကုန် ဟသ််တ မြန်အောင်လမ်းထိ၊ ထို့နောက် မင်းကုန်းလမ်းဆုံမှ MOGE က ဖောက်လုပ်ထားသောလမ်းအထိ အသုံးပြုရန် စီစ ဉ်ထားပါသည်။ အသုံးပြုမည့်လမ်းကြောင်းနှင့် MOGE က ဖောက်လုပ်ထားသောလမ်း အတွက် လမ်းကြောင်းအန္တရယ်ဆန်းစစ်လေ့လာမှုကို ၂၀၁၈ခုနှစ်

မတ်လတွင် ဆောင်ရွက်ပြီးဖြစ်ပါသည်။MOGE လမ်းမှာ တွင်းတူးစင်များ သယ်ယူနိုင်ရန် ဖောက်လုပ်ထားခြင်း ဖြစ်ပြီး PCMI က ယင်းလမ်းကို ပြုပြင်ထိန်းသိမ်းသွားပါမည်။ လိုအ ပ်ပါက လမ်းအမြင့် မြှင့်တင်ရန်လည်း လုပ်ဆောင်ပါမည်။ MOGE လမ်း တလျှောက် အ ဆင့်မြှင့်တင်ရန် လိုအ ပ်သည့် နေရာများတွင် MOGE ၏ သဘောတူညီချက်ဖြင့် အကျယ် ၆မီတာအထိ PCMI က တိုးချဲ့သွားပါမည်။ အဆင့်မြှင့်တင်ရန် လိုအပ်မည့် စုစုပေါင်း လမ်းအရှည်မှာ အများဆုံး ၂၅ ကီလိုမီတာမှ ၃၀ ကီလိုမီတာခန့် ရှိမည်ဟု မျှော်မှန်းပါသည်။

E1.8 ပတ်ဝန်းကျင်ဖော်ပြချက်

စီမံချက်အတွက် လေ့လာမည့် နယ်မြေဒေသမှာ IOR-7 ကို ဗဟိုပြုပြီး စီမံချက်ကြောင့် ဖြစ်နိုင်သည့် သက်ရောက်မှုများနှင့် စီမံချက်အပေ ါ် ဖြစ်နိုင်သည့် သက်ရောက်မှုများဆိုင်ရာ သ ဘာဝပတ်ဝန်းကျင်ပိုင်း၊ လူမှုစီးပွားရေးပိုင်းနှင့် ကျန်းမာရေးပိုင်း မူလ ပကတိအခြေအနေ (baseline) ကို ဖော်ပြရန် ရည်ရွယ်ပါသည်။ နယ်မြေဒေသ၏ ပကတိအခြေအနေကို သိရှိနိုင်ရန် သင့်တင့်လျောက်ပတ်သည့် နေရာများတွင် နယ်မြေဒေသမှ အချက်အလက်များနှင့် လေ့လာတွေ့ရှိချက်များကိုလည်း ရည်ညွှန်းဖော်ပြပါသည်။

ဤလုပ်ကွက်၏ စုစုပေါင်း နယ်မြေဧရိယာမှာ ၉၅ စ တုရ နိ်းမိုင် သို့မ ဟုတ် ၂၄၆ စတုရန်း ကီလိုမီတာ ဖြစ်ပါသည်။ လုပ်ကွက်၏ အရှေ့ဘက် နယ်နိမိတ်မှာ ဇရာဝတီမြစ်ဖြစ်ပါသည်။ လုပ်ကွက်အတွင်း တည်ရှိသည့် မြို့ကြီးများမှာ ကျွဲသည်ကုန်း၊ ရွှေကျင်၊ ညောင်ထော၊ ပေါက်တော စသည်တို့ ဖြစ်ပါသ ည်။ ဘူမိဗေဒရှုထောင့်မှ ကြည့်လျှင် လုပ်ကွက် IOR 7 သည် ပြည် Embayment ၏ တောင်ဘက်အစွန်တွင် တည်ရှိပါသည်။ MOGE ဘူမိမြေပုံတွင် ရွှေပြည်သာ နယ်မြေဒေသဟု ဖော်ပြထားပါသည်။ ရွှေပြည်သာ ရေနံမြေမှာ ယခုအခါ ရေနံထွက်ရှိနေဆဲဖြစ်ပါသည်။ တွင်းပေါင်း ၁၄တွင်းမှ ရေနံ ၁၄၃ စည် နှင့် သဘာဝဓာတ်ငွေ့ ၀.၇၈၆ MMSCF ထုတ်လုပ်လျက်ရှိပါသည်။

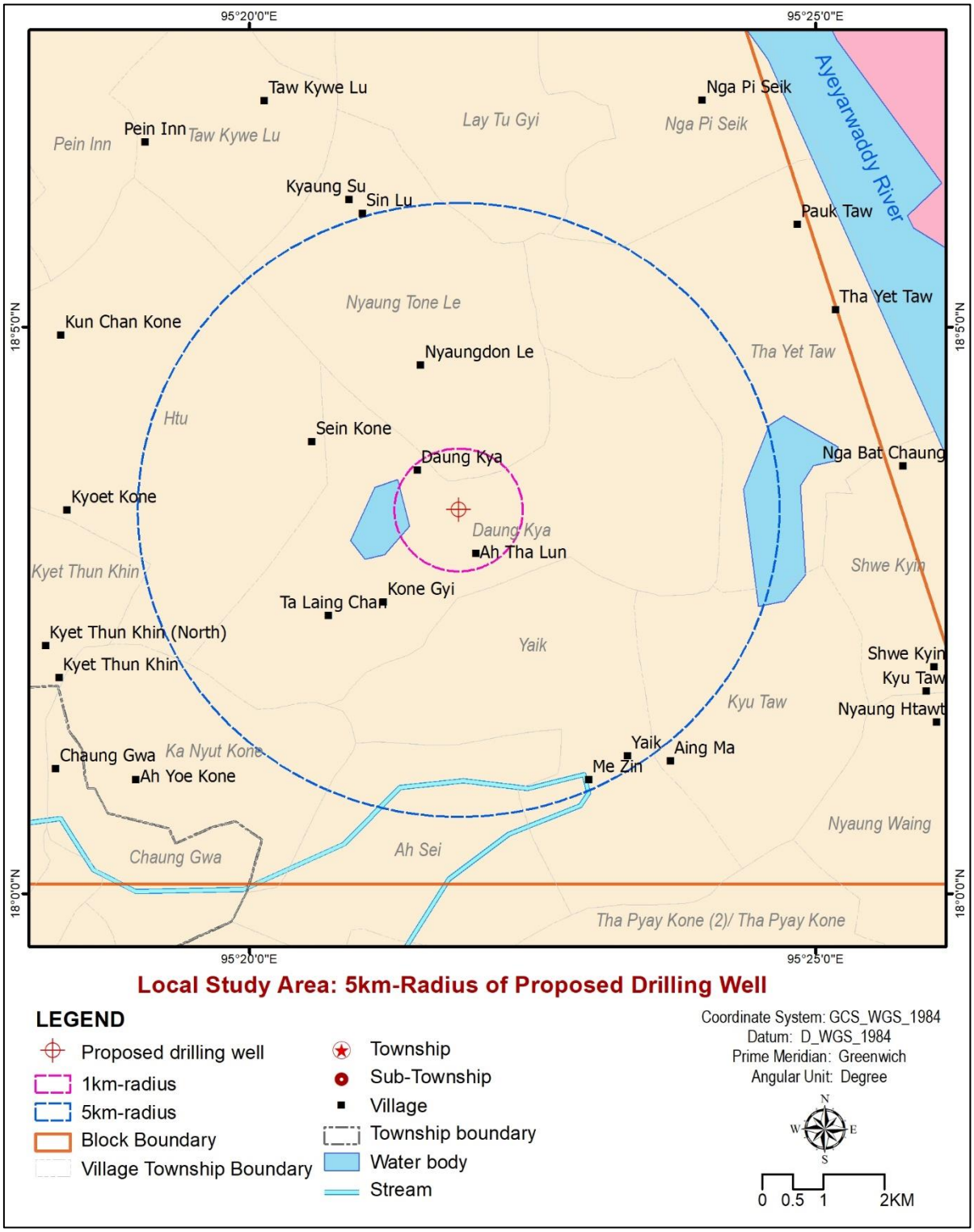
နယ်မြေဒေသလေ့လာရာတွင် အဆိုပြုထားသော တွင်းတူးဖော်မည့် နေရာကို အဓိကထားပြီး ယင်းမှ ၅ ကီလိုမီတာ ပ တ်လည်တွင် ဇီဝရုပ်ပိုင်းနှင့် မြေအသုံးပြုမှုကို လေ့လာပါမည်။ မူလပကတိအခြေအနေ နမူနာ ကောက်ယူသည့် လုပ်ငန်းကို အဆိုပြုထားသော တွင်းတူးဖော်မည့် နေရာမှ ၁ ကီလိုမီတာ ပတ်လည် အတွင်း ဖြန့်ကြက် လုပ်ဆောင်ခဲ့ပါသည်။ တွင်းတူးဖော်ရန် အဆိုပြုထားသော နေရာမှာ ဒေါင်းကျ ကျေးရွာအုပ်စုအတွင်း မြောက်လတ္တီတွဒ် 18° 3′ 23.090″ နှင့် အရှေ့လောင်ဂျီတွဒ် 95° 21′ 50.883″ တွင် တည်ရှိပါသည်။ နယ်မြေဒေသလေ့လာရာတွင် ဒေါင်းကျ၊ ညောင်တုန်းလယ်၊ သရက်တော၊ ကျွဲတော၊ ရိုက်၊ ကညွတ်ကုန်း၊ ထူး ကျေးရွာအုပ်စုများနှင့် ဟင်္သာတခ ရိုင် မြန်အောင်မြို့နယ်တို့ ပါဝင်ပါသ ည် (**ပုံ Figure** E-3)။ စီမံချက်နယ်မြေဒေသတွင် အဓိကအားဖြင့် လယ်မြေ အများဆုံးပါဝင်ပြီး စိုက်ပျိုးရေးကို အဓိကထား

လုပ်ကိုင်သော ရ ပ်ရွာများ ရှိပါသည်။ MOGE မှ ဖောက်လုပ်ထားသော သွားလမ်းလည်း ရှိပါသည်။ လယ်မြေမှာ ဆန်စပါးနှင့် ပဲမျိုးစုံ စိုက်ပျိုးကြပါသည်။

အောက်ဖော်ပြပါနယ်မြေဒေသများတွင် သဘာဝပတ်ဝန်းကျင်၊ လူမှုရေးနှင့် ကျန်းမာရေး သတင်း အချက်အလက်များကို စုဆောင်းကောက်ယူပြီး ဆန်းစစ် အကဲဖြတ်ခဲ့ပါသည်။

- **ရ ပ်ပို င်းသဘာဝပတ်ဝန်းကျင်** - ပထဝီဝင်၊ ရာသီဥတု၊ လေအရည် အသွေး၊ အ သ ံ ဆ ူ ည ံ မှ ု ၊ ဘူမိဗေဒ၊ မြေလွှာ၊ မြေပြင်ပေါ်ရှိ မြစ်ချောင်းအင်းအိုင်များဆိုင်ရာ ဇလဗေဒ၊ မြစ်ချောင်းအင်းအိုင်များအတွင်း ရေ အရည်အသွေး၊ မြေအောက်ရေ။
- **ဇီ ဝပတ်ဝန်းကျင်** - နယ် မြေဒေသတွင်း ပေါက် ရောက် သော အပင်များ၊ နယ် မြေဒေသတွင်း နေထိုင် ကျက် စား သော သတ္တဝါများ၊ ရေနေသတ္တဝါများ၊ မျိုးတုံးမည့် အန္တရာယ် ကျရောက်နေသော မျိုးစိတ်များ၊ ကာကွယ်စောင့်ရှောက်ထားသော နယ်မြေများ။
- **လ ူ သ ာ း မ ျ ာ း အ သ ံ း ြ ပ ု ဒ ိ ု င ် မ ှ ု တ ွ ဲ ဖ ိ ု း မ ျ ာ း** - မြေအသုံးပြုမှု၊ စိုက်ပျိုးရေးနှင့် စက်မှုလုပ်ငန်း၊ ရေလုပ်ငန်းနှင့် ငါးမွေးမြူရေး၊ ရေသွင်းစိုက်ပျိုးရေးနှင့် စိုက်ပျိုးရေ အရင်းအမြစ်များ၊ ရေပေးဝေမှု၊ ရေဆိုးစီမံခန့်ခွဲမှု၊ စွန့်ပစ်အမှိုက်စီမံခန့်ခွဲမှု၊ သယ်ယူပို့ဆောင်ရေး၊ လျှပ်စစ်မာတ်အားပေးဝေမှု၊ လျှပ်စစ်မာတ်အား နှင့် ဆက်သွယ်ရေး။
- **ဘဝနေထိုင်မှု အရည်အသွေး တန်ဖိုးများ** - ဒေသန္တရအုပ်ချုပ်ရေး၊ လူဦးရေဆိုင်ရာ သွင်ပြင်လက္ခဏာများ၊ လူမှုစီးပွားရေး၊ ရှေးဟောင်းသုတေသန အရင်းအမြစ်များ၊ ခရီးသွားလုပ်ငန်း
- **ကျန်းမာရေး** - ကျန်းမာရေး ဝန်ဆောင်မှုများနှင့် အများပြည်သူ ကျန်းမာရေး စာရင်းအင်းများ

သဘာဝပတ်ဝန်းကျင်အနေအထားကို **အပိုင်း ၅** တွင် ဖော်ပြထားပါသည်။



ပုံ Figure E-3 - လေ့လာခဲ့သည့် နယ်မြေဒေသ

E1.9 သက်ရောက်မှုအကဲဖြတ်ချက်

စီမံချက်လုပ်ငန်းများကို က နဦးစီစစ်အကဲဖြတ်ရာတွင် စီမံချက်လုပ်ငန်းများကို အကျဉ်းချုပ် ရေးသားပြုစုပြီး အရေးပါသော သ က်ရောက်မှုဖြစ်နိုင်ခြေ ရှိမရှိ သတ်မှတ်ဆုံးဖြတ်နိုင်ရန် သဘာဝပတ်ဝန်းကျင်၊ လူမှုရေးနှင့် ကျန်းမာရေး အကြောင်းအချက်များနှင့် တိုက်ဆိုင်စစ်ဆေးပါသည်။ အရေးပါသော ပြဿနာများ ဖြစ်နိုင်သည်ဟု ယူဆပါက ယင်းတို့ကို ထပ်မံ၍ အသေးစိတ် အကဲဖြတ်ပါသည်။ အဆိုပြုထားသော စီမံချက် လုပ်ငန်းများကြောင့် သိသာထ င်ရှားသော သဘာဝပတ်ဝန်းကျင်၊ လူမှုရေးနှင့် ကျန်းမာရေး သက်ရောက်မှုများ ဖြစ်နိုင်ခြေကို အကဲဖြတ်ရန် အရ ည်အသွေးပိုင်းနှင့် ကိန်းဂဏန်းပိုင်း ဆန်းစစ်ချက်များ လုပ်ဆောင်ပါသည်။ သက်ရောက်မှုဆန်းစစ်ချက် စံနှုန်းများကို **အပိုင်း ၆** တွင် အကျဉ်းဖော်ပြထားပါသည်။

သက်ရောက်မှု ဆ နဲ်းစစ်ရာတွင် စီစဉ်မထားဘဲ ဖြစ်ပွားလာနိုင်သည့် ဖြစ်ရပ်များကိုလည်း ထည့်သွင်း ဆန်းစစ်ပါသည်။ စီမံချက်ကြောင့် ဘေးအန္တရာယ်ဖြစ်ရပ်ကြီးများ (ဥပမာ မီးလောင်ခြင်း၊ ပေါက်ကွဲမှု ဖြစ်ပြီး ရေနံများ ယိုစီးထွက်ခြင်း) ဖြစ်နိုင်ခြေကို လေ့လာပါသည်။ စီမံချက်နှင့် စီမံချက်ပတ်ဝန်းကျင်အပေါ် ထိခိုက် နိုင်သော သဘာဝဘေးများ (ဥပမာ ငလျင်လှုပ်ခြင်း) ကိုလည်း လေ့လာပါသ ည်။ ယင်း ဘေးအန္တရာယ် ဖြစ်ရပ်ကြီးများ ဖြစ်နိုင်ခြေနှင့် ပေါ် ပေါက်လာနိုင်သည့် အကျိုးဆက်များ၊ ယင်းတို့၏ အရေးပါမှု၊ ယ င်းဖြစ်ရပ်များကြောင့် ထိခိုက်မည့် နယ်မြေဒေသများကို ထပ်မံ၍ ဖော်ထုတ်ရာတွင် အထောက်အကူ ဖြစ်စေရန် အရည်အသွေးပိုင်းနှင့် ကိန်းဂဏန်းပိုင်း ဆန်းစစ်ချက်ကိုလည်း အန္တရာယ်ဖြစ်နိုင်ခြေ အကဲဖြတ်ချက်တွင် ထ ည့်သွင်း လုပ်ဆောင်ပါသည်။ အရေးပါသော အန္တရာယ်ဖြစ်နိုင်ခြေများကို ဆက်လက်၍ စီမံခန့်ခွဲနိုင်ရန် စန စ်များကိုလည်း အဆိုပြုထားပါသည်။ စီမံခန့်ခွဲမှု အစီအမံများကို ဖော်ထုတ် သတ်မှတ်ပြီးနောက် ကြွင်းကျန်နိုင်သည့် အန္တရာယ်ဖြစ်နိုင်ခြေကိုလည်း ဖော်ထုတ်သတ်မှတ်ပါသည်။

E1.10 ထိခိုက်မှုများ တစ်စတစ်စ စုပေါင်းလျက်များပြားလာမှု အကဲဖြတ်ချက်

အချို့သော သဘာဝပတ်ဝန်းကျင်၊ လူမှုရေး သို့မဟုတ် ကျန်းမာရေးပိုင်း ထိခိုက်မှုများမှာ ၎င်းတို့ချည်း ထိခိုက်မှု မ များပြားသော်လည်း စီမံချက်နှင့် ဆက်စပ်နေသ ည့် အတိတ် ပစ္စုပ္ပန်နှင့် မျှော်မှန်းနိုင်သည့် အနာဂတ်ကာလ ထိခိုက်မှုများနှင့် စုပေါင်းလိုက်သောအခါ ပိုမိုကြီးမားပြီး အရေးပါသော ထိခိုက်မှုများ ဖြစ်ပေါ် လာနိုင်ခြင်းကြောင့် ယင်းတို့ကို ဖော်ထုတ်နိုင်ရန် ထိခိုက်မှုများ တစ်စတစ်စုပေါင်းလျက် များပြားလာမှု အကဲဖြတ်ချက်ကို လုပ်ဆောင်ပါသည်။ တစ်စတစ်စုပေါင်းလျက် များပြားလာနိုင်သော ထိခိုက်မှုများကို **အပိုင်း ၇** တွင် ဖော်ပြထားပါသည်။

E1.11 ထိခိုက်မှုနည်းပါးသက်သာစေခြင်းနှင့် စောင့်ကြည့်စစ်ဆေးခြင်း

ထိခိုက်မှုဆန်းစစ်ချက်မှ အရေးပါသော ထိခိုက်မှုအချို့ ဖြစ်နိုင်ခြေကို ဖော်ထုတ်ရရှိပါသည်။ ယင်းသို့သော စီမံချက်လုပ်ငန်းတစ်ခုစီအတွက် ထိခိုက်မှု မဖြစ် စ်ပွားစေရေး တားဆီးရန်၊ မတားဆီးနိုင်ပါက ထိခိုက်မှု ဖြစ်နိုင်ခြေ နှင့်/သို့မ ဟုတ် ပမာဏကို ကန့်သတ်လျော့ချရန် ထိခိုက်မှုနည်းပါးသက်သာစေရေး အစီအမံများကို ဖော်ထုတ်ပါသည်။ ထိခိုက်မှုနည်းပါးသက်သာစေရေး အစီအမံများ

အဆိုပြုရောတွင် သက်ဆိုင်အကျုံးဝင်သော လမ်းညွှန်ချက်များ၊ လုပ်ငန်းစုအတွင်း လုပ်နည်းလုပ်ဟန်များ၊ ကျွမ်းကျင်သူ အ ကဲဖြတ်ချက်၊ ဒီဇိုင်းပုံစံထုတ်သည့် နည်းလမ်းများနှင့် လုပ်ငန်းပိုင်း ထိန်းချုပ်မှုတို့ကို ထည့်သွင်းစဉ်းစား ပါသည်။

ထို့အပြင် သဘာဝပတ်ဝန်းကျင်နှင့် စီမံချက်လုပ်ငန်းများကို စောင့်ကြည့်စစ်ဆေးရန် သဘာဝ ပတ်ဝန်းကျင် စောင့်ကြည့်စစ်ဆေးရေး အစီအမံများ စီစဉ်ထားပါသည်။ ယင်းအစီအမံများ ထားရှိရသည့် ရည်ရွယ်ချက်မှာ ချမှတ်မည့် ထိခိုက်မှုနည်းပါးသက်သာစေရေး အစီအမံများ၏ ထိရောက်မှုကို အကဲဖြတ်သုံးသပ်ရန်၊ နိုင်ငံတော်က ထုတ်ပြန်ထားသော ဥပဒေပြဋ္ဌာန်းချက်များ၊ လမ်းညွှန်ချက်များ၊ စံချိန်စံနှုန်းများနှင့်အညီ ဆောင်ရွက်မှုကို အကဲဖြတ်ရန်နှင့် စီမံချက်ကြောင့် ဖြစ်ပေါ်လာမည့် အပြောင်းအလဲ နှင့်/သို့မဟုတ် သက်ရောက်မှုကို မှတ်တမ်းပြုစုနိုင်ရန် စီမံချက်အကောင်အထည်ဖော်ပြီးနောက် သဘာဝပတ်ဝန်းကျင် အခြေအနေများကို မူလပကတိအခြေအနေ (baseline) နှင့် နှိုင်းယှဉ်လေ့လာရန် ဖြစ်ပါသည်။ ထိခိုက်မှု နည်းပါးသက်သာစေရေးနှင့် စောင့်ကြည့်လေ့လာရေး အစီအမံများကို **အပိုင်း ၈** တွင် ဖော်ပြထားပါသည်။

E1.12 အများပြည်သူ တိုင်ပင်ဆွေးနွေးခြင်းနှင့် ထုတ်ပြန်ခြင်း

ပတ်ဝန်းကျင် အခြေခံစစ်တမ်းများကောက်ယူစဉ်အတွင်း ရရှိလာသော သတင်းအချက်အလက်မျ ားနှင့် မြေပုံများအပေါ် အခြေခံ၍ အများပြည်သူ တိုင်ပင်ဆွေးနွေးခြင်းနှင့် ထုတ်ပြန်ခြင်းလုပ်ငန်းစဉ်တွင် အောက်ဖော်ပြပါ ပတ်သက်ဆက်နွယ်သည့်အဖွဲ့များပါဝင်ပါသည်။

၁။ မြန်မာ့ရေနံနှင့်သဘာဝဓာတ်ငွေ့လုပ်ငန်းနှင့် သယံဇာတ နှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဝန်ကြီး ဌာန
၂။ စီမံကိန်းအနီးအနားရှိ ကျေးရွာအုပ်စု ခေါင်းဆောင်များနှင့် ကျေးရွာသားများ
၃။ မြို့နယ်အဆင့်တာဝန်ရှိသူများ

၂၀၁၇ခုနှစ် ဒီဇင်ဘာလတွင် IEM သည် မြန်အောင်နှင့် ကြံခင်းမြို့နယ် ဒေသန္တရ အ ရာရှိများအတွက် အကျိုးသက်ဆိုင်ပါဝင်သူများနှင့် တိုင်ပင်ဆွေးနွေးပွဲ ပြုလုပ်ခဲ့ပါသည်။ တစ်ကီလိုမီတာ ကြားခံဇုန်အတွင်း သက်ရောက်မှု ရှိနိုင်သော စစ်တမ်းကောက်ယူသည့် နယ်မြေဒေ သတွင် တည်ရှိသည့် မြန်အောင်မြို့နယ် အတွင်းမှ ကျေးရွာ ၄ရွာတွင်လည်း ရွာသူရွာသားများနှင့် အုပ်စုငယ် (focus group) ဆွေးနွေးပွဲ များ ပြုလုပ်ခဲ့ပါသည်။

- မြန်အောင် အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာန၊ သစ်တောဦးစီးဌာန၊
  စည်ပင်သာယာ အရာရှိများနှင့် တွေ့ဆုံခြင်းများ
- ကြံခင်း အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာန၊ သစ်တောဦးစီးဌာန၊ စည်ပင်သာယာ အရာရှိများနှင့်
  တွေ့ဆုံခြင်းများ
- မြန်အောင်နှင့် ကြံခင်းမြို့နယ်များရှိ စွန့်ပ စ်အမှိုက်များ
  စွန့်ပစ်မည့် နေရာများသို့ သွားရောက်ကြည့်ရှုခြင်း
- အရေးပါသော
  မြို့နယ်အဆင့် အ ရာရှိများ၊ ကျေးရွာခေါင်းဆောင်များ ပါဝင်သော အဓိက သ က်ဆိုင်သူများနှင့်
  တွေ့ဆုံမေးမြန်းခြင်း
- ပတ်သက်ဆက်နွယ်သူများနှင့် အစည်းအဝေးများ/ ဒေသခံပြည်သူများနှင့် အုပ်စုဖွဲ့ဆွေးနွေးပွဲ
  (Focus Group Discussion) များ ပြုလုပ်ခြင်း
- အိမ်ထောင်စုများ ထံမှ ထင်မြင်ချက်နှင့် သဘောထား စစ်တမ်း ကောက်ယူခြင်း

အသေးစိတ် ထင်မြင်ချက်နှင့် သဘောထား စစ်တမ်းများကို
ရွာသူရွာသား ၁၁၁ဦးခန့်ထံမှ ကောက်ယူခဲ့ ပါသည်။ အ များပြည်သူ ပါဂင်ရေး လုပ်ငန်းစဉ်အဖြစ်
အဓိက သတင်းအချက်အလက် ဖြည့်ဆည်းပေးသူ များနှင့်
တွေ့ဆုံမေးမြန်းခြင်းများကို ကျေးရွာခေါင်းဆောင်များ၊
ကျန်းမာရေး ဆေးဂါးကုသမှုပေးသူများ ပါဂင်လျက် လုပ်ဆောင်ခဲ့ပါသည်။ ထို့အပြင် လူမှုစီးပွားနှင့်
သဘာဂပတ်ဂန်းကျင် ပေါင်းစည်းလျက်
မူလပကတိအခြေအနေ ဖော်ထုတ်သတ်မှတ်ရေး စစ်တမ်းများ ကောက်ယူရာတွင် အစဉ်အလာ ဂေဟစနစ်
တွေ့ဆုံမေးမြန်းခြင်း
များနှင့် စစ်တမ်း ကောက်ယူခြင်းများကို ရွာသူရွာသားများ၊ လယ်သမားများနှင့် လုပ်ဆောင်ခဲ့ပါသ
ည်။ မြို့နယ်အတွင်း တွင် မှတ်ပုံတင်ထားသည့် အစိုးရမဟုတ်သော အဖွဲ့အစည်းများ မရှိပါ။

IEM မှ စစ်တမ်းကောက်ယူသော အဖွဲ့တွင် အကြီးတန်း လူမှုစီးပွား ကျွမ်းကျင်သူ၊ ကြီးကြပ်သူ ၃ဦးနှင့် IEM
က လေ့ကျင့် သင်တန်းပေးထားသော ပြည်တွင်းမှ မြန်မာ technician ၁၀ဦး ပါဂင်ပါသည်။

ထင်မြင်ချက်နှင့် သဘောထား မေးခွန်းလွှာများ မေးမြန်းရသ ည့် ရည်ရွယ်ချက်မှာ
အကျိုးသက်ဆိုင် ပါဂင်သူများ၏ ရှုမြင်ပုံများကို သိရှိရန်နှင့် PCMI က စီစဉ်ထားသော စ မ်းသပ်တွင်းများ
တူးဖော်သည့် အစီအစဉ်ကို နားလည်သဘောပေါက်မှုမည်မျှရှိကြောင်း သိရှိရန် ဖြစ်ပါသည်။

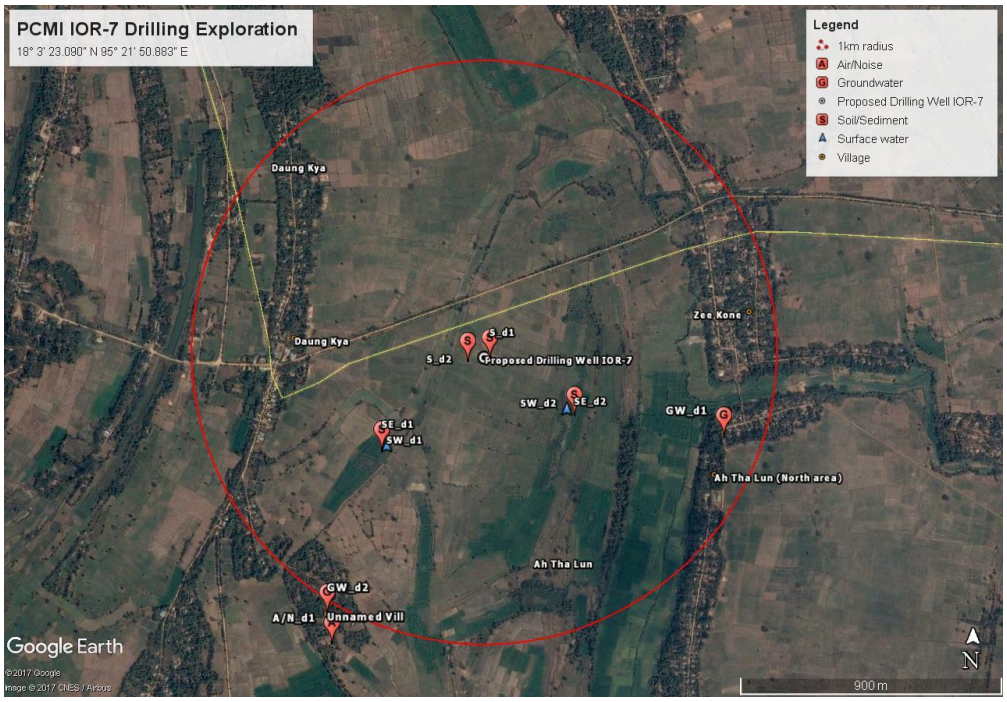
ထင်မြင်ချက်စစ်တမ်း မကောက်ယူမီ အုပ်စုငယ် (focus group) တွေ့ဆုံပွဲများ ပြုလုပ်ရာတွင်
ရွာသူရွာသား များအား PCMI အနေဖြင့် တွင်းတူးစင် တည်နေရာတစ်ခုတည်းမှ စမ်းသပ်တွင်း
၂တွင်း တူးဖော်ရန် စီစဉ်ထားကြောင်း အသိပေး ပြောကြားခဲ့ပါသည်။

E1.12.1 စစ်တမ်းကောက်ယူသည့် နေရာများ

စမ်းသပ်တွင်း တူးဖော်ခြင်းကြောင့် သက်ရောက်မှုဖြစ်နိုင်သည့် တစ်ကီလိုမီတာ ပ တ်လည် စီမံချက် နယ်မြေဒေသအတွင်းရှိ ကျေးရွာ လေးရွာတွင် စစ်တမ်းကောက်ယူရန် ဖော်ထုတ်ထားပါသည်။

ဇယား Table E-3 - IOR-7 ကျေးရွာနှင့် နမူနာ ကောက်ယူမည့်နေရာများ အကျဉ်းချုပ်

စဉ်	နေ့စွဲ	ကျေးရွာ	မြို့ရွာ	အိမ်ထောင်စု အရေအတွက်
၁	၅-၁၂-၂၀၁၇	အသလွန်	မြန်အောင်	၈၉
၂	၅-၁၂-၂၀၁၇	ဇီးကုန်း	မြန်အောင်	၁၀၈
၃	၆-၁၂-၂၀၁၇	ဒေါင်းကျ	မြန်အောင်	၁၉၈
၄	၆-၁၂-၂၀၁၇	ကြိုးကုန်း	မြန်အောင်	၄၈



ပုံ Figure E-4 - စီမံချက်နယ်မြေဒေသအတွင်းရှိ ထိခိုက်မှုဖြစ်နိုင်သော ကျေးရွာများ

E1.12.2 အုပ်စုငယ် (Focus Group) တွေ့ဆုံပွဲများ

ထင်မြင်ချက်စစ်တမ်း မကောက်ယူမီ ပြုလုပ်ခဲ့သော အုပ်စုငယ် (focus group) တွေ့ဆုံပွဲများတွင် PCMI သည် စမ်းသပ်တူးဖော်သည့် အစီအစဉ်ဖြင့် တွင်းတူးစင်နေရာ တစ်ခုမှ စမ်းသပ်တွင်းနှစ်တွင်း တူးဖော်ရန် စီစဉ်ထားကြောင်း ရွာသူရွာသားများအား ပြောကြားပါသည်။ စီမံချက်အချိန်ဇယားမှာ လူနေထိုင်အလုပ် လုပ်ကိုင်ရန် ဆောက်လုပ်ခြင်းများအတွက် ခြောက်လအထိ၊ စမ်းသပ်တွင်းတူးဖော်ရန် ဆယ်လ ပါဂင်ပါမည်။

စမ်းသပ်တွင်းတူးဖော်မည့် အစီအစဉ်မှာ ရေနံနှင့် သဘာဂဓာတ်ငွေ့ ရှိမရှိ စူးစမ်းရှာဖွေခြင်း ဖြစ်ပါသည်။ ရေနံနှင့် သဘာဂဓာတ်ငွေ့ မတွေ့ရှိရပါက တွင်းများကို ဆက်လက်တူးဖော်မည်မဟုတ်ဘဲ နယ်မြေဒေသကို မူလအနေအထား ပြန်လည်ရောက်ရှိရန် ဆောင်ရွက်ပေးပါမည်။ ရေနံနှင့် သဘာဂဓာတ်ငွေ့ တွေ့ရှိရပါက တူးဖော်ထုတ်လုပ် ရောင်းချပါမည်။

စီမံချက်ဆက်လက်ဆောင်ရွက်နိုင်ရေး ခွင့်ပြုချက်ရယူရန် သဘာဂပတ်ဂန်းကျင် လူမှုရေးနှင့် ကျန်းမာရေး သက်ရောက်မှု ဆန်းစစ်ချက် လုပ်ဆောင်ရန် လိုအပ်ပြီး ယင်းဆန်းစစ်ချက်တစ်စိတ်တစ်ဒေသအဖြစ် လည်းကောင်း၊ PCMI အနေဖြင့် ထိခိုက်မှုဖြစ်နိုင်ခြေကို လျော့ချရာတွင် လမ်းညွှန်အဖြစ် အသုံးပြုနိုင်ရန် လည်းကောင်း၊ အုပ်စုငယ် (focus group) တွေ့ဆုံပွဲများနှင့် မေးခွန်းလွှာများဖြင့် မေးမြန်းခြင်းများ ပြုလုပ်ခြင်းဖြစ်ကြောင်း ရွာသူရွာသားများအား ရှင်းလင်းပြောကြားခဲ့ပါသည်။

အများပြည်သူ ပါဂင်ဆောင်ရွက်ခြင်းနှင့် စီမံချက်အကြောင်းထုတ်ပြန်ခြင်းအတွက် ရုံးလင်းတင်ပြ/ဆွေးနွေးရာတွင် အကြောင်းအရာများ ပါဂင်ပါမည်။ အခြားအကြောင်းအရာများလည်း ပါဂင်ပါမည်။

- အများပြည်သူနှင့် တိုင်ပင်ဆွေးနွေးခြင်း ဦးတည်ချက်
- စီမံချက်ဖော်ပြချက်/သတင်းအချက်အလက်များကို ခြုံငုံဖော်ပြခြင်း
- တူးဖော်မည့် နည်းလမ်း
- လက်ရှိ သဘာဂပတ်ဂန်းကျင် အခြေအနေများ
- အဓိက သက်ရောက်မှု အပိုင်းများ
- စီမံချက်ကြောင့် ထိခိုက်မှု နည်းပါးသက်သာစေရန် အဆိုပြုထားသော အစီအမံများနှင့် စောင့်ကြည့်စစ်ဆေးမည့် အစီအစဉ်
- လျော်ကြေး

MOGE သည် မြို့နယ်နှင့် ကျေးရွာတစ်ခုစီရှိ ဒေသန္တရ အရာရှိများနှင့် ဆက်သွယ်ပေးခြင်း၊ အစုအဖွဲ့ အနေဖြင့် ဒေသန္တရ အရာရှိများနှင့် တွေ့ဆုံနိုင်ရန် စီစဉ်ပေးခြင်းအားဖြင့် IEM/PCMI ကို အကူအညီပေးခဲ့ပါသည်။ အုပ်စုငယ် (focus group) တွေ့ဆုံပွဲ တစ်ခုစီတွင်လည်း MOGE

အနေဖြင့် ပါဂင် ဆွေးနွေးပြီး
နိုင်ငံတော်အစိုးရအနေဖြင့် ဖြေကြားသင့်သော မေးခွန်းများကို ရှင်းလင်းဖြေကြားခဲ့ပါသည်။

ရပ်ရွာအစည်းအဝေးများ မပြုလုပ်မီ စီမံချက်ကို နားလည်သဘောပေါက်မှု ရှိစေရန်၊ ESHIA ဦးတည်ချက်များကို သိရှိနားလည်စေရန်နှင့် ကျေးရွာတွင်း အစည်းအဝေးများ ပြုလုပ်ရေး ခွင့်ပြုချက်နှင့် ပံ့ပိုးမှု ရရှိရေးအတွက် အ ဓိကအရေးပါသော မြို့နယ်အဆင့် အရာရှိများနှင့် အုပ်ချုပ်ရေးမှူးများထံ ရှင်းလင်းတင်ပြပွဲ ပြုလုပ်ခဲ့ပါသည်။

E1.12.3 အဓိကအရေးပါသော သတင်းအချက်အလက်ဖြည့်ဆည်းပေးသူများနှင့် တွေ့ဆုံမေးမြန်းခြင်းများ

အဓိကအရေးပါသော သ တင်းအချက်အလက်ဖြည့်ဆည်းပေးသူများအား စစ်တမ်းကောက်ယူရာတွင် မေးခွန်း ၁၉၃ ကို မေးမြန်းခဲ့ပါသည်။ စစ်တမ်းကောက်ယူရရှိသည့် ရလဒ်များကို ဆန်းစစ်ပြီး အောက်တွင် အကျဉ်းချုပ်ဖော်ပြထားပါသည်။
အများပြည်သူနှင့် တိုင်ပင်ဆွေးနွေးသည့် တွေ့ဆုံပွဲများတွင် ကျေးရွာ သုံးရွာ (ဒေါင်းကျ၊ အသလွန်နှင့် ကြိုးကုန်း) မှ အ ဓိက အရေးပါသော သတင်းအချက်အလက် ဖြည့်ဆည်းပေးသူများ တက်ရောက်ကြပါသည်။

အချက်အလက်များကို ဆက်စပ်နိုင်စေရန် လူမှုစီးပွားနှင့် သဘောထား စစ်တမ်းမှ သ က်ဆိုင်သည့် မေးခွန်း အချို့ကို အဓိက အရေးပါသော သတင်းအချက်အလက်ဖြည့်ဆည်းပေးသူများအား တွေ့ဆုံမေးမြန်းရာတွင် အခြေခံအဖြစ် အသုံးပြုခဲ့ပါသည်။

အဓိကအရေးပါသော သ တင်းအချက်အလက်ဖြည့်ဆည်းပေးသူများသည် စီမံချက်မှ အောက်ဖော်ပြပါ ကောင်းမွန်သော သက်ရောက်မှုများ ရရှိမည်ဟု မျှော်မှန်းကြပါသည်။ အလုပ်အကိုင်ရရှိမှု တိုးတက်လာခြင်း (၄၅%) ၊ ဝင်ငွေတိုးတက်ရရှိခြင်း (၁၅ %)၊ လမ်းပန်းသယ်ယူပို့ဆောင်ရေး ပိုမိုကောင်းမွန်လာခြင်း (၁၅%)၊ ဘဝနေထိုင်မှုအခြေအနေများ တိုးတက်ကောင်းမွန်လာခြင်း (၁၅%)၊ မြေအတွက်လျော်ကြေးရရှိခြင်း (၁၀%) စ သည်တို့ ဖြစ်ပါသည်။ မကောင်းသော သက်ရောက်မှုများနှင့် စပ်လျဉ်း၍ ၂၈%သည် လူမှုရေး ထိခိုက်မှုများ၊ ၂၈%သည် သဘာဝပတ်ဝန်းကျင်ညစ်ညမ်းမှု၊ ၂၈%သည် သဘာဝပတ်ဝန်းကျင် ထိခိုက် ပျက်စီးမှု ဖြစ်ပွားမည်ကို စိုးရိမ်ပူပန်မှု ရှိပါသည်။ တွေ့ဆုံမေးမြန်းခဲ့သူများအနက် ၉၀%သည် အဆိုပြုထားသော စီမံချက် လုပ်ဆောင်မှုကို သဘောတူညီကြပါသည်။

E1.12.4 ထင်မြင်ချက်နှင့် သဘောထား စစ်တမ်းများ

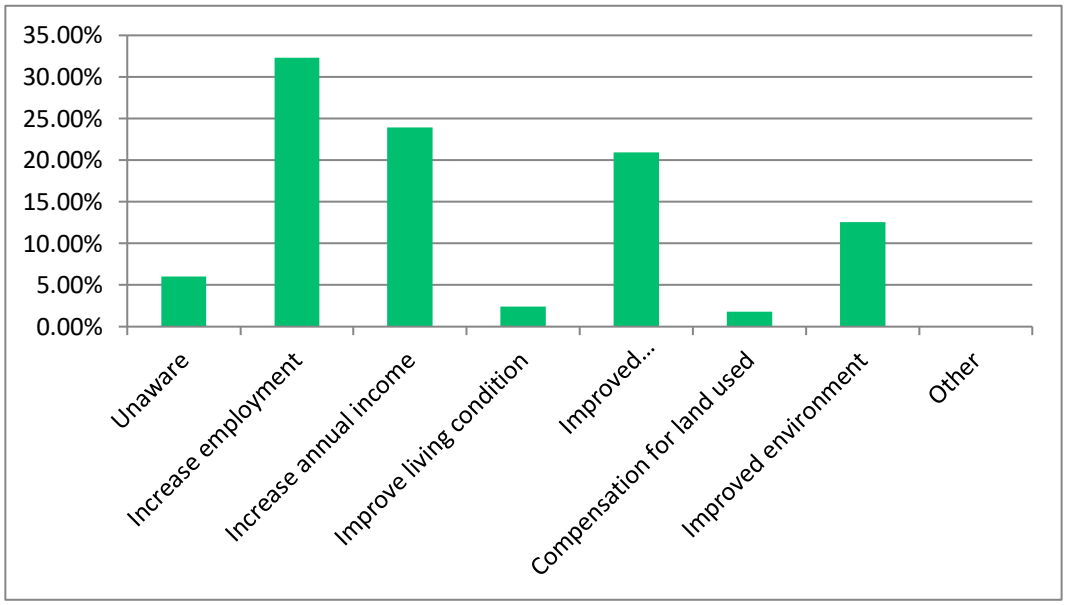
ဖြေကြားသူ ၅၉ %မှာ အမျိုးသားများဖြစ်ပြီး ၄၁% မှာ အမျိုးသမီးများ ဖြစ်ပါသည်။ စစ်တမ်းကို မြန်အောင် မြို့နယ်အတွင်း လုပ်ကွက် Block IOR-7 တွင်

ပါဂင်သော ကျေးရွာ လေးရွာတွင် ပြုလုပ်ခဲ့ပါသည်။ ဒေါင်းကျ၊ အသလွန်၊ ကြိုးကုန်းနှင့် ဇီးကုန်းတို့ ဖြစ်ပါသည်။

E1.12.4.1 စီမံချက်မှ ရရှိလာနိုင်သည့် အကျိုးကျေးဇူးများနှင့် စပ်လျဉ်းသည့် ထင်မြင်ချက်များ

ရွာသူရွာသားများအနေဖြင့် စီမံချက်မှ ရ ရှိရန် မျှော်မှန်းကြသော အကျိုးကျေးဇူးများမှာ အလုပ်အကိုင် တိုးတက်ရရှိခြင်း (၃ ၂%)၊ နှစ်စဉ်ဂင်ငွေ တိုးတ က်ရရှိခြင်း (၃၄%)နှင့် လူနေထိုင်မှု အခြေခံအဆောက်အဦ တိုးတက်ကောင်းမွန်လာခြင်း (၂၁%) ဖြစ်ပါသည်။

ဇယား Chart 1 - စီမံချက်မှ မည်သည့် ကောင်းမွန်သော သက်ရောက်မှုများ ရရှိမည်ဟု မျှော်မှန်းပါသနည်း။

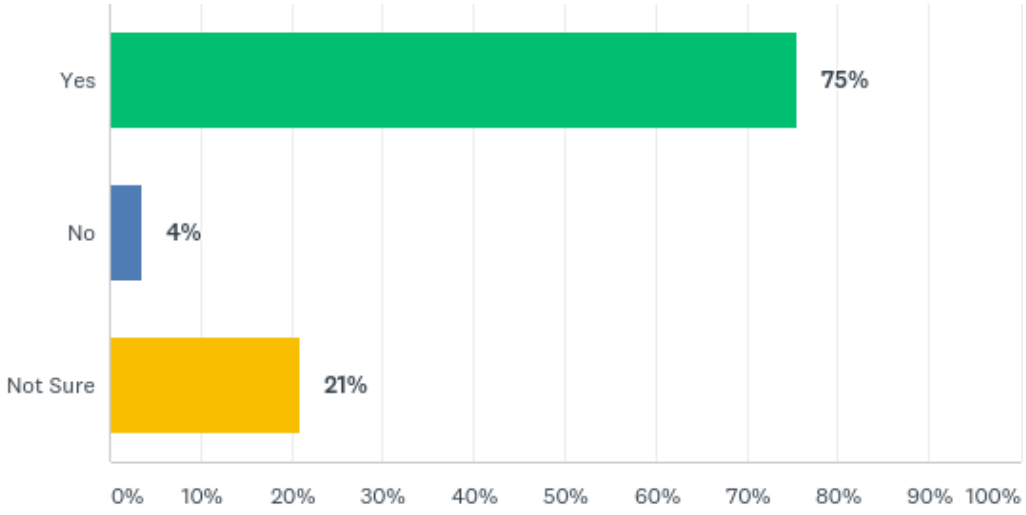


မသိ၊ အလုပ်အကိုင်တိုးရ၊ နှစ်စဉ်ဂင်ငွေတိုး၊ ဘဂနေထိုင်မှုပိုမိုကောင်းမွန်၊ ... ပိုမိုကောင်းမွန်၊ မြေလျော်ကြေးရရှိ၊ သဘာဂပတ်ဂန်းကျင်ပိုမိုကောင်းမွန်၊ အခြား

E1.12.4.2 စီမံချက်ကို အိမ်ထောင်စုများအနေဖြင့် ထောက်ခံ သဘောတူညီမှု

တွေ့ဆုံမေးမြန်းခဲ့သူများအနက် ၇၅%သည် အဆိုပြုထားသော စီမံချက် ဆောင်ရွက်ခြင်းကို သဘောတူညီ ကြပါသည်။

ဇယား Chart 2 - စီမံချက်ဆောင်ရွက်ခြင်းကို သဘောတူညီပါသလား။

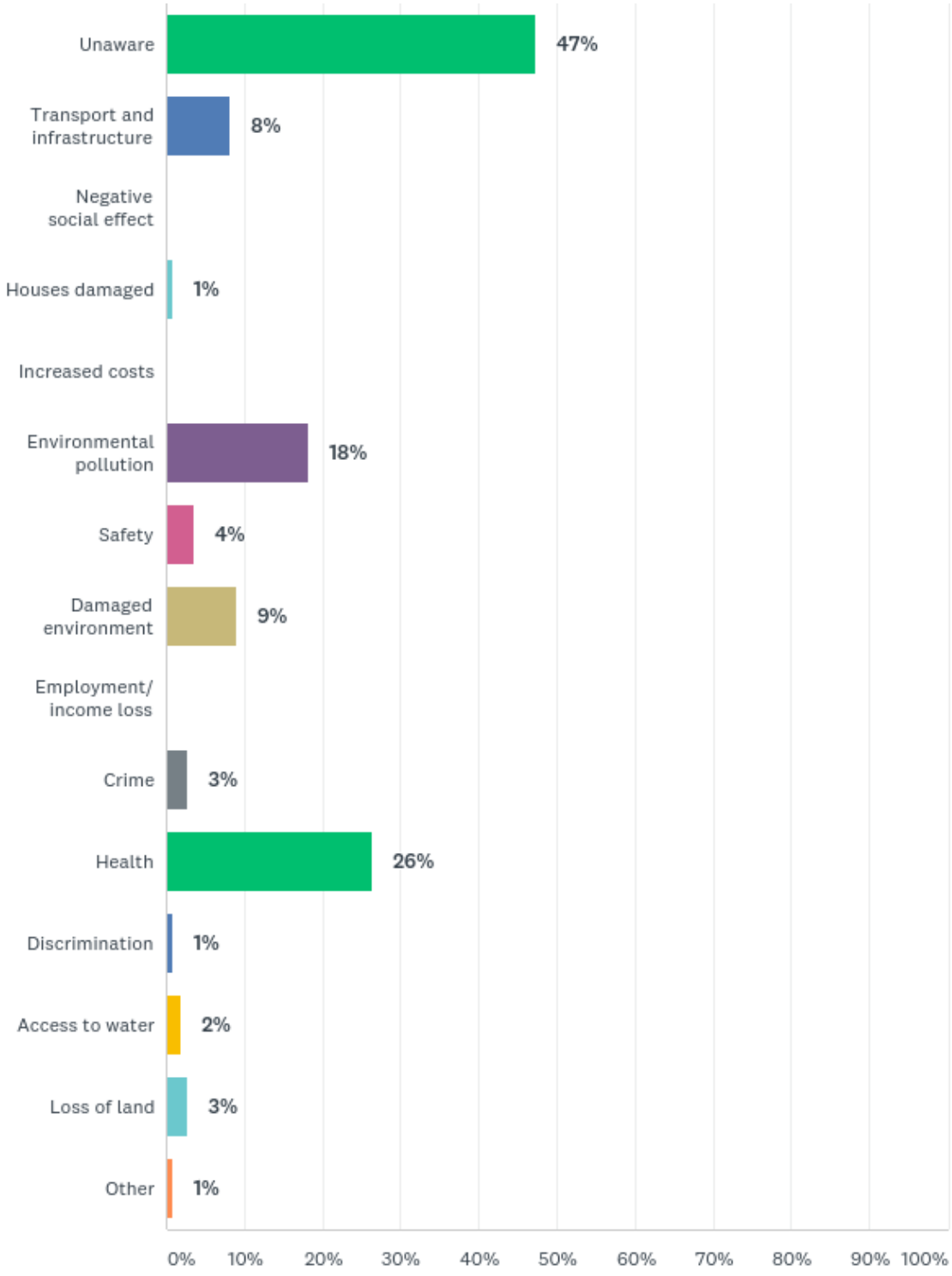


သဘောတူသည် ၇၅%၊ သဘောမတူ ၄%၊ မပြောတတ်ပါ ၂၁%

E1.12.4.3 စီမံချက်ကြောင့် ဖြစ်ပေါ်လာနိုင်သည့်သက်ရောက်မှုများနှင့် စပ်လျဉ်းသည့် ထင်မြင်ချက်များ

ရွာသူရွာသား အများစု (၄၇%) သည် မကောင်းသော သက်ရောက်မှုများ ဖြစ်ပွားနိုင်သည်ဟု မသိရှိကြပါ။ ၂၆%မှာ ကျန်းမာရေးထိခိုက်မှုများ၊ ၁၈%မှာ သဘာဝပတ်ဝန်းကျင် ညစ်ညမ်းမှု ဖြစ်ပွားမည်ကို စိုးရိမ်ပူပန် ကြပါသည်။

ဇယား Chart 3 - စီမံချက်ကြောင့် ဖြစ်ပွားလာနိုင်သည့်
မကောင်းသော သက်ရောက်မှုများ
ရှိပါက မည်သည့် သက်ရောက်မှု သုံးခုကို အဆိုးဝါးဆုံး ထိခိုက်နိုင်သည်ဟု စိုးရိမ်ပူပန်မှု ဖြစ်ပါသနည်း။



မသိရှိ ၄၇% သယ်ယူပို့ဆောင်ရေးနှင့် အခြေခံအဆောက်အဦ ၈% လူမှုရေးထိခိုက်မှု ၁% အိမ်များထိခိုက်ပျက်စီး ၁% ကုန်ကျစရိတ် မြင့်မားခြင်း ၁%

သဘာဝပတ်ဝန်းကျင်ညစ်ညမ်းခြင်း ၁၈%၊ အန္တရာယ်ကင်းရှင်းရေး ၄%၊ သဘာဝပတ်ဝန်းကျင် ထိခိုက်ခြင်း ၉%၊ အလုပ်အကိုင်/ဝင်ငွေ ဆုံးရှုံးခြင်း ၈%၊ ပြစ်မှု ၃% ၊ ကျန်းမာရေး ၂၆%၊ ခွဲခြားဆက်ဆံမှု ၁%၊ ရေရရှိမှု ၂%၊ မြေဆုံးရှုံးခြင်း ၃%၊ အခြား ၁%

E1.12.5 စီမံချက်ကို ထုတ်ပြန်ခြင်း

လူမှုစီးပွား မေးခွန်းလွှာ မဖေးမြန်းမီ အုပ်စုငယ် (focus group) တွေ့ဆုံပွဲများပြုလုပ်ရာတွင် PCMI အနေဖြင့် နယ်မြေဒေသအတွင်း စမ်းသပ်တွင်း နှစ်တွင်း တူးဖော်ရန် စီစဉ်လျက် ရှိပါကြောင်း ရွာသူရွာသားများအား ရှင်းလင်းပြောကြားပါသည်။

EIA ပြုလုပ်လျက် အ ကျိုးသက်ဆိုင် ပါဝင်သူများနှင့် တိုင်ပင်ဆွေးနွေးလျက် ဆွေးနွေးချက်များကို ရယူပြီး စီမံချက် ဒီဇိုင်းပုံစံတွင်လည်းကောင်း၊ EMP တွင် ထည့်သွင်းဖော်ပြမည့် ထိခိုက်မှု နည်းပါးသက်သာစေရေး အစီအမံများတွင်လည်းကောင်း ပေါင်းစည်းထည့်သွင်း အသုံးပြုပါမည်

PCMI သည် သက်ဆိုင်ရာ [illegible] မိုနယ်အဆင့် အုပ်ချုပ်ရေးမှူးများထံ သွားရောက်တွေ့ဆုံပြီး အများပြည်သူနှင့် တိုင်ပင်ဆွေးနွေးရေး အစီအစဉ်ကိုလည်းကောင်း၊
ပံ့ပိုးမှုရရှိရန် လိုအပ်ချက်များကိုလည်းကောင်း ဆွေးနွေးပါမည်။

စီမံချက်အကြောင်း ထုတ်ပြန်ရာတွင် EIA လုပ်ထုံးလုပ်နည်းနှင့်အညီ ဆောင်ရွက်ပါသည်။ PCMI Myanmar သည် စီမံချက်သတင်းအချက်အလက်များကို နိုင်ငံတော်အစိုးရပိုင် သတင်းစာများတွင် ကြေညာချက် ထည့်သွင်းလျက် သတင်းနှင့် မီဒီယာသို့ ထုတ်ပြန်ခဲ့ပါသည်။
စီမံချက် အစီအစဉ်များကို PCMI ဖက်ဘ်ဆိုက် (http://www.petronas.com.my/investor-relations/Pages/OtherReports.aspx) တွင် လွှင့်တင်ထားရှိ မည်ဖြစ်ပြီး PCMI Myanmar ရန်ကုန်ရုံးတွင်လည်း ရယူနိုင်ပါမည်။

EIA မူကြမ်းနှင့် အပြီးသတ် EIA စာတမ်းတို့ကို မြန်အောင်မြို့နယ်အုပ်ချုပ်ရေးမှူးရုံး၊ အထွေထွေ အုပ်ချုပ်ရေး ဦးစီးဌာနရုံးနှင့် စီမံချက်နယ်မြေအတွင်းရှိ ကျေးရွာများ၏ ကျေးရွာအုပ်ချုပ်ရေးမှူးရုံးများသို့ တင်သွင်းပေးပို့သွားပါမည်။

E1.13 သက်ရောက်မှုများကို အကျဉ်းဖော်ပြချက်

ဖြစ်နိုင်ချေရှိသည့် ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုများကို သတ်မှတ်ပြီးသည့်နောက်တွင် ၄င်းတို့၏ သိသာထင်ရှားမှုနှင့် လျော့ချရေးနည်းလမ်းများကို စီမံကိန်း၏ ဒီဇိုင်းအဆင့်တွင် ထည့်သွင်းစဉ်းစားသွားပါမည်။ ထို့အပြင် နောက်ထပ်လျော့ချရေးနည်းလမ်းများကို ထိန်းညှိ ဆောင်ရွက်သွားပါမည်။ လျော့ချရေးနည်းလမ်းများဖြင့် ဖြစ်နိုင်ချေရှိသည့် သက်ရောက်မှုများကို ကြာချိန်နှင့် ပ မာဏကို လက်ခံနိုင်သည့်အဆင့်ထိရောက်အောင် လျော့ချသွားပါမည်။ ကျန်ရှိနေသည့် သက်ရောက်မှုများကို ကြွင်းကျန်သက်ရောက်မှုများအဖြစ် သတ်မှတ်နိုင်ပါသည်။

စမ်းသပ်တွင်းများ တူးဖော်ရာတွင် ကြိုတင်စီစဉ်ရန် မဖြစ်နိုင်သော ဖြစ်ရပ်များကြောင့် သဘာဝပတ်ဝန်းကျင် လူမှုရေးကျန်းမာရေးနှင့် ကြိုတင်စီစဉ်နိုင်ခြင်းမရှိသည့် အပိုင်းများတွင် ပေါ်ပေါက်လာနိုင်သည့် ကြွင်းကျန်အန္တရာယ်များကို အောက်ဖော်ပြပါ ဇယား **ဇယား Table** E-4 မှ **ဇယား Table** E-7 အထိတွင် အကျဉ်းချုပ် ဖော်ပြထားပါသည်။

ဇယား Table E-4 - သဘာဝပတ်ဝန်းကျင်ပိုင်း ကြွင်းကျန်အန္တရာယ်အဆင့်များ

အပိုင်းကဏ္ဍ	လုပ်ငန်း	သက်ရောက်မှုဖြစ်နိုင်ခြေ	ကြွင်းကျန်အရေးပါမှု				
			Pos	No	L	M	H
မြေနှင့် နေထိုင်ကျက်စားရာ ဒေသ ပျက်ယွင်းခြင်း	အခြေခံ အဆောက်အဦ ဆောက်လုပ်ခြင်း လမ်းဖောက်ခြင်း	ဒေသန္တရ မြေပြင် အနေထား ပျက်ယွင်းခြင်း					
	စခန်းနေရာ ဆောက်လုပ်ခြင်း တွင်းတူးဖော်မည့်နေရာ ဆောက်လုပ်ခြင်း တွင်းကို အသုံးပြုမှု ရပ်ဆိုင်းခြင်း နှင့် နေရာကို မူလပကတိ ဖြစ်စေရန် ပြန်လည် ဆောင်ရွက် ပေးခြင်း	မြေလွှာပျက်ယွင်းခြင်းနှင့် တိုက်စားခြင်း					
		ဒေသန္တရ အပင်များ ပေါက်ရောက်မှု ပျက်ယွင်းခြင်း					
		ဒေသန္တရ တိရစ္ဆာန်များ နေထိုင် ကျက်စားမှု ပျက်ယွင်းခြင်း					
		ရေတားခြင်း၊ အငွေ့ပြန်ခြင်း/ ရေငွေ့ဖြစ်ခြင်းနှင့် မြေအတွင်း စိမ့်ဝင်ခြင်းတို့ လျော့နည်း ကျဆင်းမှုကြောင့် မြစ်ချောင်းအင်း အိုင် ဇလဗေဒ ပြောင်းလဲခြင်း					

အပိုင်းကဏ္ဍ	လုပ်ငန်း	သက်ရောက်မှုဖြစ်နိုင်ခြေ	ကြွင်းကျန်အရေးပါမှု				
			Pos	No	L	M	H
		နေရာအလိုက် ရေအရည်အသွေးနှင့် ရေနေသတ္တဝါများ နေထိုင်ကျက်စားသည့် နေရာ အပြောင်းအလဲဖြစ်ခြင်း					
ယာဉ်နှင့် တွင်းတူးစင် သယ်ယူ ရွှေ့ပြောင်းခြင်းများ	ယာဉ်နှင့် တွင်းတူးစင် သယ်ယူရေ့ပြောင်းခြင်းများ	ယာဉ်နှင့် တွင်းတူးစင် သယ်ယူရွှေ့ပြောင်းခြင်းများကြောင့် ဒေသန္တရ တိရစ္ဆာန်များ နေထိုင် ကျက်စားမှုကို ထိခိုက်ခြင်း					
လေထုတွင်း ဓာတ်ငွေ့ ထုတ်လွှတ်ခြင်း များ	အခြေခံ အဆောက်အဦ တည်ဆောက်ခြင်း	ဖုံကြောင့် လေအရည်အသွေး ကျဆင်းခြင်း					
	တွင်းတူးဖော်ခြင်း တွင်း စမ်းသပ်ခြင်း ထွက်ရှိလာသော ဓာတ်ငွေ့ကို မီးရှို့ခြင်း	ဟိုက်ဒရိုကျဉ်ဆာလဖိုဒ်များ ထွက်ခြင်း					
	တွင်းတူးဖော်ရန်နှင့် မီးရှို့ရန် လျှပ်စစ်ဓာတ်အား ထုတ်ခြင်း တွင်း စမ်းသပ်ခြင်းနှင့် ထွက်ရှိလာသော ဓာတ်ငွေ့ကို မီးရှို့ခြင်း	ဒေသန္တရနှင့် နယ်မြေဒေသအတွင်း NOx SOx နှင့် CO ကဲ့သို့သော ဓာတ်ငွေ့များ ထုတ်လွှတ်မှုကြောင့် လေအရည်အသွေး အနည်းငယ် ကျဆင်းခြင်း					
	သယ်ယူပို့ဆောင်ခြင်း လမ်းဖောက်လုပ်ခြင်း တွင်းတူးဖော်မည့်နေရာ ပြန်လည်ထူထောင်ခြင်း နှင့် စခန်းနေရာ ဆောက်လုပ်ခြင်း တွင်း တူးဖော်ရန် လျှပ်စစ်ဓာတ်အား ထုတ်လုပ်ခြင်း ထွက်ရှိလာသော ဓာတ်ငွေ့ကို မီးရှို့ခြင်း ညစ်ညမ်းဓာတ်ငွေ့များ ထွက်ခြင်း	GHG ထုတ်လွှတ်ခြင်းကြောင့် ရာသီဥတု အပြောင်းအလဲကို ဆိုးဝါးစေခြင်း					
အသံဆူညံမှု	အခြေခံအဆောက်အဦ တည်ဆောက်ခြင်း တွင်းတူးဖော်ခြင်းနှင့် ရေနံမြေအတွင်း လုပ်ငန်းများ ဆောင်ရွက်ခြင်း တွင်း စမ်းသပ်ခြင်းနှင့် ထွက်ရှိလာသော ဓာတ်ငွေ့ကို မီးရှို့ခြင်း	နယ်မြေဒေသတွင်း နေထိုင်ကျက်စား သော သတ္တဝါများ အပြုအမူ ပျက်ယွင်းခြင်း					

အပိုင်းကဏ္ဍ	လုပ်ငန်း	သက်ရောက်မှုဖြစ်နိုင်ခြေ	ကြိုင်းကျန်အရေးပါမှု				
			Pos	No	L	M	H
လျှပ်စစ်မီး	ယာဉ်များ၊ တွင်းတူးစင်၊ စခန်းနေရာနှင့် တွင်းတူးဖော်သည့် နေရာတို့တွင် လုပ်ငန်း ဆောင်ရွက်ရန် မီးထွန်းခြင်း ထွက်ရှိလာသော ဓာတ်ငွေ့ကို မီးရှို့ခြင်း	နယ်မြေဒေသတွင်း နေထိုင်ကျက်စား သော သတ္တဝါများ အပေါ် သက်ရောက်မှု ဖြစ်နိုင်ခြင်း					
		နယ်မြေဒေသတွင်း နေထိုင်ကျက်စား သော သတ္တဝါများ အပေါ် သက်ရောက်မှု ဖြစ်နိုင်ခြင်း					
အပူဓာတ်	ထွက်ရှိလာသော ဓာတ်ငွေ့ကို မီးရှို့ခြင်း	နယ်မြေဒေသတွင်း နေထိုင်ကျက်စား သော သတ္တဝါများ အပေါ် သက်ရောက်မှု ဖြစ်နိုင်ခြင်း					
စွန့်ပစ်အရည်များ	တွင်းတူးဖော်သည့် နေရာ ရေသွယ်ထုတ်မှု	နေရာကွက်၍ ရေအရည်အသွေး ပြောင်းလဲခြင်း သို့မဟုတ် ရေနုံနှင့် ဆီချေး တို့ကြောင့် ပြ မလွှာညစ်ညမ်းခြင်း					
	မိလ္လာနှင့် ညစ်ညမ်းအရည်များ	နေရာကွက်၍ ရေအတွင်း မလိုလားအပ် သော သက်ရှိများ ပေါက်ပွားနိုင်သည့် အာဟာရဓာတ်များ တိုးပွားခြင်း၊ ပတ်ဝန်းကျင် မြေလွှာ မြစ်ချောင်း အင်းအိုင်များနှင့် မြေအောက်ရေ ညစ်ညမ်းခြင်း					
	စိမ့်ဝင်ခြင်း	လွန်သွားဖြင့် တူးဖော်ရာမှ ထွက်ပေါ်လာသော အရာများနှင့် စွန့်ပစ် ရေဆိုးတွင်းမှ ရေဆိုးများ စိမ့်ဝင်ခြင်းကြောင့် မြေအောက်ရေ အရည်အသွေး ကျဆင်းခြင်း					
စွန့်ပစ်အမှိုက်များ	တွင်း တူးဖော်ရေး လုပ်ငန်းများမှ ဘေးအန္တရာယ် မရှိသော စွန့်ပစ်ပစ္စည်းများ စွန့်ထုတ်ခြင်း	ရေနှင့် မြေလွှာ ညစ်ညမ်းခြင်း နှင့် နယ်မြေဒေသတွင်း နေထိုင်ကျက်စား သော သတ္တဝါများ ထိခိုက်ဒဏ်ရာရရှိခြင်း					
	ဘေးအန္တရာယ် ဖြစ်စေနိုင် သော စွန့်ပစ်ပစ္စည်း/ အမှိုက်များ စွန့်ထုတ်ခြင်း	ရေနှင့် မြေလွှာ ညစ်ညမ်းခြင်း နှင့် နယ်မြေဒေသတွင်း နေထိုင်ကျက်စား သော သတ္တဝါများ ထိခိုက်ဒဏ်ရာရရှိခြင်း					

အပိုင်းကဏ္ဍ	လုပ်ငန်း	သက်ရောက်မှုဖြစ်နိုင်ခြေ	ကြွင်းကျန်အရေးပါမှု				
			Pos	No	L	M	H
လွန်သွားဖြင့် တူးဖော်ရာမှ ထွက်ပေါ်လာသော အရာများနှင့် အရည်များ	လွန်သွားဖြင့် တူးဖော်ရာမှ ထွက်ပေါ်လာသော အရာများနှင့် ညစ်ညမ်း ရှုံ့နှစ်များ	တွင်းတူးဖော်ရာတွင် အသုံးပြုသော အရည်များတွင် ထည့်သွင်းဖော်စပ် ထားသော ဓာတုဗေဒပစ္စည်းများကြောင့် နေရာကွက်၍ ရေနှင့် မြေလွှာ အရည်အသွေး ပြောင်းလဲခြင်း					
	ရေလည်ပတ်စီးဆင်းမှု ဆုံးရှုံးခြင်း	မြေအောက်အတိမ်ပိုင်း နှင့် အနက်ပိုင်း မြေအောက်ရေ ယိုယွင်းခြင်း					

ဇယား Table E-5 - လူအဖွဲ့အစည်းပိုင်း ကြွင်းကျန်အန္တရာယ်အဆင့်များ

အပိုင်းကဏ္ဍ	လုပ်ငန်း	သက်ရောက်မှု ဖြစ်နိုင်ခြေ	ကြွင်းကျန်အရေးပါမှု				
			Pos	No	L	M	H
မြေအသုံးပြုမှု ေ ပျောင်းလဲခြင်း	သွားလမ်းဖောက်လုပ်ရန်၊ တူးဖော်ရန်နေရာ နှင့် စခန်း နေရာ အတွက် မြေ ပယ်ယူခြင်း	စိုက်ပျိုးနိုင်သော မြေများ ဆုံးရှုံးမည့် ဖြစ်နိုင်ခြေ စီမံချက် ဆောင်ရွက်ခြင်းကြောင့် အနီးအနားရှိ မြေများ စိုက်ပျိုး ထွက်ရှိမှုအပေါ် သက်ရောက်မှု ရှိခြင်း မြေမပိုင်ဆိုင်သော လယ်ယာ လုပ်သားများ အလုပ်အကိုင် ဆုံးရှုံးပြီး မြေယာမှ စွန့်ခွာရခြင်း					
ယာဉ်အသွားအလာ	ပစ္စည်းကိရိယာများ၊ လူများနှင့် ပန်ဆောင်မှုများ သယ်ယူပို့ဆောင်ခြင်း	နယ်မြေဒေသတွင်း ယာဉ်အသွားအလာ များပြားလာခြင်းနှင့် မသွားနိုင် မလာနိုင်ဖြစ်ခြင်း					
ရေအသုံးပြုမှု	ဆောက်လုပ်ခြင်း စမ်းသပ်တွင်း တူးဖော်ခြင်းနှင့် အိမ်သုံးအတွက် ရေ	နယ်ခံ ရပ်ရွာအတွက် ရေရရှိနိုင်မှု လျော့နည်းကျဆင်းခြင်း					
လျှပ်စစ်ဓာတ်အား အသုံးပြုမှု	တွင်းတူးဖော်ရေးလုပ်ငန်းနှင့် လုပ်ငန်းစခန်းအတွက် လျှပ်စစ် ဓာတ်အား	နယ်ခံ ရပ်ရွာအတွက် လျှပ်စစ်ဓာတ်အား ရရှိနိုင်မှု တိုးတက်မြင့်မားလာခြင်း သို့ မဟုတ် လျော့နည်းကျဆင်းခြင်း					
မြောင်းများဖြ င့် ရေသွယ်ထုတ်ခြင်း	လမ်းများနှင့် စခန်းနေရာမှ မိုးရေများ သွယ်ထုတ်ခြင်း	ရေသွယ်ထုတ်မှု ပိုမို များပြားလာ ခြင်းေ ကာင့် လမ်းများနှင့် အခြေခံ အဆောက်အဦများကို ထိခိုက်ခြင်း					
စွန့်ပစ်ရေဆိုး	စီမံချက်လုပ်ငန်းဆောင်ရွက်မှု ကြောင့် ရေအရည်အသွေး အပေါ် သက်ရောက်မှုများ	စိုက်ပျိုးရေး၊ ငါးမွေးမြူရေးနှင့် ရေလုပ်ငန်းအပေါ် သက်ရောက်မှု ဖြစ်နိုင်ခြေ					
အမှိုက် စွန့်ပစ်ခြင်း	စီမံချက်နယ်မြေဒေသအတွင်း စွန့်ပစ်ပစ္စည်း စွန့်ထုတ်ခြင်း	စွန့်ပစ်ပစ္စည်း စွန့်ထုတ်မှု တိုးမြင့်လာခြင်းကြောင့် နယ်မြေဒေသတွင်း အခြေခံအဆောက်အဦအပေါ် ပန်းခြင်း					
ခရီးသွားလုပ်ငန်းနှင့် ဖျော်ဖြေရေး	စီမံချက်ပါ ဆောက်လုပ်ရေး လုပ်ငန်းများနှင့် စီမံချက် လုပ်ဆောင်ခြင်း တို့ကြောင့် ခရီးသွားလုပ်ငန်းနှင့် ဖျော်ဖြေရေးအပေါ် သက်ရောက်မှု ရှိခြင်း	ခရီးသွားလုပ်ငန်းနှင့် ဖျော်ဖြေရေး ရရှိခံစားနိုင်မှု ယိုယွင်းခြင်းနှင့် လျော့နည်းကျဆင်းခြင်း					
အလုပ်အကိုင် ရရှိမှုနှင့် ပင်ငွေ	အနီးအနား ရပ်ရွာများ အတွက် အလုပ်အကိုင် ရရှိမှုနှင့် ပင်ငွေ	နယ်မြေခံ ရပ်ရွာများအတွက် အလုပ်အကိုင်နှင့် ပင်ငွေ တိုးတက် ရရှိရန် ဖြစ်နိုင်ခြေ					

အပိုင်းကဏ္ဍ	လုပ်ငန်း	သက်ရောက်မှု ဖြစ်နိုင်ခြေ	ကြွင်းကျန်အရေးပါမှု				
			Pos	No	L	M	H
အလုပ်သမားများ ရေ ့ေပြာင်း ပင်ရောက်လာခြင်း	အလုပ်သမားများ ရွှေ့ပြောင်း ပင်ရောက်လာခြင်းနှင့် လူအ ဖွဲ့အစည်း အတွင်း ထိတွေ့ဆက်ဆံခြင်း	အခြားဒေသများမှ အလုပ်သမားများ နှင့် နယ်ခံ ရပ်ရွာများအကြား ပဋိပက္ခ ဖြစ်နိုင်ခြေ					
သမိုင်းဆိုင်ရာ ရှေးေ ဟာင်း သုတေသန ဆိုင်ရာ နှင့် ယဉ်ကျေး မှုဆိုင်ရာ အရင်းအမြစ်များ	စီမံချက်ပါ ဆောက်လုပ်ရေး လုပ်ငန်းများ လုပ်ဆောင်ခြ ငး် ကြောင့် သမိုင်းဆိုင် ရာ နှင့် ရှေးဟောင်း သုတေသန နေရာများ ပျက်စီးခြင်း	သမိုင်းဆိုင်ရာ နှင့် ရှေးဟောင်း သုတေသန နေရာများ ဆုံးရှုံးခြင်း သို့မဟုတ် ထိခိုက် ပျက်စီးခြင်း					

ဇယား Table E-6 - ကျန်းမာရေးပိုင်း သက်ရောက်မှုအကျဉ်းချုပ်

အပိုင်းကဏ္ဍ	လုပ်ငန်း	သက်ရောက်မှုဖြစ်နိုင်ခြေ	ကြွင်းကျန်အရေးပါမှု				
			Pos	No	L	M	H
ဖုံ	လမ်းဖောက်ခြင်း/အဆင့်မြှင့်တင် ခြင်း၊ ဆို က်ဆောက်လုပ်ခြင်း၊ တွင်းဖြည့်ကျောက်စေ့များ ၊ အလုပ်သမားများနှင့် ပစ္စည်း ကိရိယာများ သယ်ယူပို့ဆောင်ခြင်း	အသက်ရှူလမ်းကြောင်း ယားယံ အနှောင့်အယှက်ဖြစ်ခြင်း ပန်းနာရင်ကြပ်ပိုမို ဖြစ်ပွား ခြင်း					
အသံဆူညံမှု	ဂျင်နရေတာ၊ သယ်ယူပို့ဆောင်ရေး၊ ဆောက်လုပ်ရေး၊ တွင်းတူးခြင်း	အလုပ်သမားများ နားလေးခြင်း၊ အများပြ ည်သူ စိတ်အနှောင့်အယှက် ဖြစ်ခြင်း					
ဘေးအန္တရာယ်မဖြ စ်သော စွန့်ပစ်ပစ စ္စည်းများ	စွန့်ပစ်ပစ္စည်း စွန့်ထုတ်ခြင်း၊ ယိုစိမ့်ခြင်း/ မတော်တဆ စီးထွက်ခြင်း၊ မစီးဆင်းသောရေ	စားနပ်ရိက္ခာ အန္တရာယ်ကင်းရှင်းရေး၊ အစာအိမ်နှင့်အူ ရောင်ရမ ်းခြင်း၊ ခြင်နှင့်ပိုးမ ွှားကြောင့် ဖြစ်သော ငှက်ဖျား၊ တိုက်ဖိုက်၊ ဦးနှောက် အမြှေးေ ရာင်နှင့် အခြား ရောဂါများ ပိုမိုဖြစ်ပွားလာခြင်း					
ရှဲ့ ဓာတုပစ္စည်းများ နှင့် လွန်သွားဖြင့်	တွင်းတူးရာတွင် အသုံးပြုသည့် ဓာတုပစ္စည်းများရောနှော ဖော်စပ်ခြင်း	အများအပြား ထိတွေ့မိခြင်းကြောင့်					

အပိုင်းကဏ္ဍ	လုပ်ငန်း	သက်ရောက်မှုဖြစ်နိုင်ခြေ	ကြိုင်းကျန်အရေးပါမှု				
			Pos	No	L	M	H
တူးဖော်ရာမှ ထွက်ရှိသော စွန့်ပစ် ပစ္စည်းများ	ဓာတုပစ္စည်း ယိုစိမ့်ခြင်း/ ရှုံ့ရည် အတွင်း ထည့်သွင်းဖော်စပ်သည့် ဓာတုပစ္စည်းများ မတော်တဆ စီးထွက်ခြင်း	အရေပြား ယားယံခြင်း စသည်တို့ ဖြစ်ပွားခြင်း၊ ရှူသွင်းမိခြင်း စသည်					
ဘေးအန္တရာယ် ြ ဖစ်သော ဓာတုပစ စ္စည်းများနှင့် စွန့်ပစ် ပစ္စည်းများ	ရေနုံ သို့မဟုတ် ဓာတုပစ္စည်း များ ကြောင့် ညစ်ညမ်းနေသော ပစ္စည်းများ၊ ချောဆီ၊ ဟိုက်ဒရောလစ်ဆီ၊ ဓာတုပစ္စည်း သယ်ယူပို့ဆောင်ခြင်း သို့လှောင် ခြင်းအတွက် အသုံးပြုသော စည်ပိုင်းနှင့် ပုံးများ	အများအပြား ထိတွေ့မိခြင်းကြောင့် အရေပြားနှင့် မျက်စိ ယားယံခြင်း စသည်တို့ ဖြစ်ပွားခြင်း၊ ရှူသွင်းမိခြင်း စသည်					
ကူးစက်ရောဂါများ	ပြင်ပမှ အလုပ်သမား အများအပြား ရွှေ့ပြောင်း/ ဝင်ရောက်လာခြင်း	HIV/AIDS, အသည်းရောင် အသားဝါ စီ အမျိုးအစား၊ ဆစ်ဖလစ် စသည်တို့ အများအပြား ပိုမို ဖြစ်ပွားလာခြင်း					
အလင်းရောင်နှင့် အပူဓာတ်	ထွက်ရှိလာသော ဓာတ်ငွေ့ကို မီးရှို့ခြင်း	အပူဒဏ်ခံရခြင်း အလင်းရောင်ကြောင့် အနှောင့်အယှက်ဖြစ်ခြင်း					
မီးရှို့ရာမှ ဓာတ်ငွေ့ထွက်ခြင်း	ထွက်ရှိလာသော ဓာတ်ငွေ့ကို မီးရှို့ခြင်း	အသက်ရှူလမ်းကြော ငးဆိုင်ရာ ပြဿနာများ /ရောဂါများ ပိုမိုဖြစ်ပွားခြင ်း၊ ပန်းနာရင်ကြပ်ပိုမိုဆိုး ဝါးခြင်း စိတ်ပိုင်းဆိုင်ရာ သာယာဝပြောမှု ယိုယွင်း ကျဆင်းခြင်း H2S (ဟိုက်ဒရိုဂျင်ဆာလဖိုဒ်) ကြောင့် အသက်ဆုံးရှုံးခြင်းများ					

ဇယား Table E-7 - ကြိုတင်စီစဉ်ခြင်း မပြုနိုင်သော ဖြစ်ရပ်များအပိုင်း ကြွင်းကျန်အန္တရာယ်အဆင့်များ

အပိုင်းကဏ္ဍ	လုပ်ငန်း	သက်ရောက်မှုဖြစ်နိုင်ခြေ	ကြွင်းကျန်အရေးပါမှု				
			Pos	Neg	L	M	H
ပေါက်ထွက်ခြင်း	တူးဖော်ခြင်း	ဟိုက်ဒရိုကာဗွန်များ ထိန်းချုပ်မှု မရှိဘဲ ပန်းထွက်ခြင်း မီးလောင်ခြင်း ပေါက်ကွဲခြင်း					
မီးလောင်ခြင်း သို့မဟုတ် ပေါက်ကွဲခြင်း (ပေါက်ထွက်ခြင်းနှင့် မသက်ဆိုင်)	လောင်စာ သိုလှောင်ခြင်း မီးရှို့စမ်းသပ်ခြင်း	တွင်းတူးစင် သို့မဟုတ် စခန်းနေရာ သို့မဟုတ် စက်သုံးဆီသိုလှောင်သည့် နေရာတွင် ပေါက်ကွဲနိုင်ခြင်း သို့မဟုတ် မီးလောင်နိုင်ခြင်း					
ဟိုက်ဒရိုကာဗွန် ဓာတုပစ္စည်း သို့မဟုတ် အန္တရာယ်ရှိသော အမှိုက် သို့မဟုတ် စွန့်ပစ်ပစ္စည်းများ မတော်တဆ ထုတ်လွှတ်ခြင်း	ဓာတုပစ္စည်းများ၊ အန္တရာယ် ဖြစ်သော ပစ္စည်းများ သို့မဟုတ် စွန့်ပစ်ပစ္စည်းများ သိုလှောင်ခြင်း	မတော်တဆ စီးထွက်ခြင်းကြောင့် လေအရည်အသွေး၊ မြေလွှာ အရည်အသွေး၊ မြစ်ချောင်းအင်းအိုင်များ အတွင်းရှိရေ၊ မြေအောက်ရေ၊ ဒေသတစ်ခု အတွင်း ပေါက်ရောက်ကျက်စားသော အပင်နှင့် သတ္တဝါ အစုနှင့်လူသားများကို ထိခိုက်ပြီး သဘာဝပတ်ဝန်းကျင်ကို အန္တရာယ်ဖြစ်နိုင်ခြေ ရှိခြင်း					
သယ်ယူပို့ဆောင်စဉ် မတော်တဆဖြစ်ခြင်း များ	ပစ္စည်းကိရိယာများ၊ ဝန်ထမ်းများ၊ တွင်းဖြည့် ကျောက်စေ့များ၊ ရှုံ့နှင့် လွန်တူးစများ၊ စွန့်ပစ်ပစ္စည်းများ သယ်ယူပို့ဆောင်ခြင်း	ဝန်ထမ်းများ ထိခိုက်ဒဏ်ရာ ရရှိခြင်း သို့မဟုတ် အသက်ဆုံးရှုံးခြင်း ဖြစ်နိုင်ခြေ၊ နေရာကွက်၍ သဘာဝပတ်ဝန်းကျင် ညစ်ညမ်းမှုဖြစ်ခြင်း					
ငလျင်လှုပ်ခြင်း	မြေမျက်နှာပြင် ပြောင်းလဲသွားခြင်း	ရုပ်ပိုင်းအနေအထား ပျက်ယွင်းသွားခြင်း ကြောင့် အဆောက်အဦများ ပြိုကျခြင်း၊ တွင်းမှ ရေနံပန်းထွက်ခြင်း၊ မီးလောင်ခြင်း၊ မတော်တဆ စီးထွက်ခြင်းတို့ ဖြစ်နိုင်ခြေ					

မှတ်ချက်- S - အရေးပါမှု - 1 ဖြစ်နိုင် 2 လျစ်လျူရှုနိုင် 3 သက်ရောက်မှုနိမ့်ကျ 4 သက်ရောက်မှုအလယ်အလတ် 5 သက်ရောက်မှုမြင့်မား
P - ဖြစ်နိုင်ခြေ - A – မဖြစ်နိုင်သလောက် B – မဖြစ်တန်ရာ C – ဖြစ်နိုင် D – ဖြစ်နိုင်ခြေများ E – ဖြစ်နိုင်ခြေအလွန်များ

E1.14 နိဂုံး

သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ ကိစ္စရပ်အားလုံးမှာ ထိခိုက်မှုနည်းပါးမှ ထိခိုက်မှု မဆိုစလောက်သာ ရှိမည်ဟု အဆုံးသတ်မှတ်ပါသည်။ ထိခိုက်မှုဖြစ်နိုင်ခြေများကိုလည်း အနည်းဆုံးဖြစ်စေရန် စီမံခန့်ခွဲထိန်းချုပ်သွားနိုင်မည် ဖြစ်ပါသည်။ လူအဖွဲ့အစည်းဆိုင်ရာ ကိစ္စရပ်နှစ်ခုမှာ အကျိုးကျေးဇူးဖြစ်နိုင်သည်ဟု ဖော်ထုတ်ရရှိပါသည်။ မြေအသုံးပြုမှု အပြောင်းအလဲပြုလုပ်နိုင်ခြင်းနှင့် အလုပ်အကိုင်/ဝင်ငွေရရှိမှုတို့ ဖြစ်ပါသည်။ အခြားသော လူအဖွဲ့အစည်းပိုင်းဆိုင်ရာ ကိစ္စရပ်များမှာ အနည်းငယ်မျှ သက်ရောက်မှု ရှိနိုင်ပြီး ထိခိုက်မှု မဆိုစလောက်မှ နည်းပါးဟု အဆုံးသတ်မှတ်ပါသည်။ တွင်းများ တူးဖော်ရာတွင် ရေအသုံးပြုမှုကြောင့် ရပ်ရွာရှိရေအရင်းအမြစ် ရရှိနိုင်မှုအပေါ် သက်ရောက်နိုင်ခြေ ရှိပါသည်။PCMI အနေဖြင့် ရေလိုအပ်ချက် အတွက် သီးခြားရေတွင်းများ တူးဖော်ရန် စီစဉ်ထားသော်လည်း အရင်းအမြစ်တူညီနေပါက အနီးအနားရှိ ရပ်ရွာရေတွင်း ရေကန်များတွင် ရေရရှိနိုင်မှုအပေါ် သက်ရောက်မှု ရှိလာနိုင်ပါသည်။ စီမံချက်အတွက် ရေအရင်းအမြစ် အလုံအလောက် ရရှိပြီး နယ်မြေခံ ရပ်ရွာအသိုက်အဝန်းအပေါ်လည်း ထိခိုက်မှု မဖြစ်စေရေးအတွက် ဤကိစ္စရပ် ဖြစ်ပွားလာနိုင်ခြေကို ဂရုတစိုက် စီစဉ်ဆောင်ရွက်ရန် လိုအပ်ပါသည်။

ကျန်းမာရေးဆိုင်ရာ ကိစ္စရပ် နှစ်ခုမှာ အလယ်အလတ် အဆင့် အရေးပါပါသည်။ အန္တရာယ်ရှိသော ဓာတုပစ္စည်းများနှင့် ရေနံတွင်းတူးရာမှ ထွက်ပေါ်လာသည့် စွန့်ပစ်ပစ္စည်းများ၊ မီးရှို့ရာမှ ဓာတ်ငွေ့ထွက်ခြင်းများ ဖြစ်ပါသည်။ စွန့်ပစ်ပစ္စည်းအားလုံးကို နိုင်ငံတကာစံနှုန်းနှင့်အညီ စွန့်ပစ်နိုင်ရန် သီးသန့် စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲရေးအစီအမံတစ်ရပ် ပြုစုထားရှိရန် လိုအပ်ပါသည်။

အစီအစဉ်တွင် မပါဝင်ဘဲ အန္တရာယ်ဖြစ်ပွားလာနိုင်သည့် ဖြစ်ရပ်များကြောင့် ကြွင်းကျန်အန္တရာယ်မှာ နည်းပါးသည်ဟု အဆုံးသတ်မှတ်ပါသည်။ ယင်းသို့ နည်းပါးစေရန် စီမံခန့်ခွဲမှု လုပ်ထုံးလုပ်နည်းများ ချမှတ်ကျင့်သုံးပြီး လေ့ကျင့်သင်တန်းပေးရန်လည်း လိုအပ်ပါသည်။ ဒေသအတွင်း ပြဿနာရှိနိုင်သည့်အတွက် Drug testing ပြုလုပ်ရန်လည်း အကြံပြုပါသည်။

ရေနံများ ပန်းထွက်မှုဖြစ်နိုင်ခြေ လျော့ချရန် BOP တပ်ဆင်ပြီး စမ်းသပ်စစ်ဆေးရပါမည်။ တွင်းတူးဖော်သည့် လုပ်ထုံးလုပ်နည်းများကိုလည်း ဂရုတစိုက် လုပ်ဆောင်ရန် လိုအပ်ပါသည်။ မီးအန္တရာယ်၊ ယင်းနှင့် ဆက်စပ်လျက် ပေါက်ကွဲမှု ဖြစ်ပွားနိုင်သည့် အန္တရာယ်များ မဖြစ်စေရန် ပုံမှန် စောင့်ကြည့်ရေးနှင့် စစ်ဆေးရေး အစီအမံများ ချမှတ်ထားရှိရပါမည်။ မီးလောင်ပါက ထိခိုက်မှု အနည်းဆုံးဖြစ်စေရန် မီးသတ်ဗူး များကိုလည်း စနစ်တကျ နေရာချွေးချယ်လျက် ထားရှိပေးရပါမည်။

ဤနယ်မြေဒေသတွင် ယခင်က လျင်များ လှုပ်ခဲ့ပြီး ဒီဇိုင်းပုံစံထုတ်ရာတွင် လျင်လှုပ်ခြင်းကြောင့် ဖြစ်နိုင်သည့် သက်ရောက်မှုကို အနည်းပါးဆုံးဖြစ်စေရေး ထည့်သွင်းစဉ်းစားရပါမည်။ ကြိုတင် စီစဉ်၍ မဖြစ်နိုင်သော ဖြစ်ရပ်များ ဖြစ်ပွားလာပါက တုံ့ပြန်ဆောင်ရွက်နိုင်ရန် လုပ်ငန်းနေရာအလိုက် အရေးပေါ်အခြေအနေတုံ့ပြန်ရေး လုပ်ထုံးလုပ်နည်းများ ချမှတ်ထားရပါမည်။ စမ်းသပ်တွင်းများ တူးဖော် သည့်

အစီအစဉ် မစတင်မီ ဂန်ထမ်းများအားလုံးကို သင့်တင့်လျောက်ပတ်သော လေ့ကျင့်သင်တန်းပေးမှု ပြုလုပ်ပေးရပါမည်။

အကြံပြုချက်များ

အောက်ဖော်ပြပါအတိုင်း အကြံပြုပါသည်။

- ဆောက်လုပ်မှု လုပ်ငန်းများ မစ တင်မီ အန ညီးဆုံး တစ်လကြိုတင်၍ အကြံပြုထားသည့် သက်ဆိုင်သူများနှင့် ထိတွေ့ဆောင်ရွက်မှု အစီအစဉ်ကို အကောင်အထည်ဖော်ခြင်း
- စီမံချက်လုပ်ဆောင်မည့်နေရာအတွက် သီးသန့် အရေးပေါ်တုံ့ပြန်မှု အစီအစဉ် ရေးဆွဲပြုစုခြင်း
- စီမံချက်မစတင်မီ အကြံပြုထားသည့် လေ့ကျင့်သင်တန်းပေးမှု အစီအစဉ်ကို ဆောင်ရွက်ခြင်း
- နယ်မြေခံရပ်ရွာအသိုက်အဂန်းကို မထိခိုက်စေရန် ရေအရင်းအမြစ် အခြေအနေ ကို လေ့လာ သုံးသပ်ခြင်း
- လုပ်ကွက်အတွင်းရှိ တွင်းပေါင်းနေရာများကို ဖော်ထုတ်ပြီး သန့်စင်လျှက် မူလအတိုင်း ပြန်လည်တည်ဆောက်ခြင်း
- **အခန်း ၈** တွင် ဖော်ပြထားသည့် EMP ကို အတည်ပြုလျက် အကောင်အထည်ဖော်ခြင်း

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Responses & Addendum items for Initial Findings and Recommendations for Environmental Impact Assessment Report concerned with Operation of Oil & Gas Exploration Drilling at Onshore Block IOR-7 submitted by Petronas Carigali Myanmar Co., Ltd. (Received September 14, 2017)

Sr.	Initial findings	Recommendations	Action Plan / Responses
1	***Pact***		
(a)	In the proposed EIA report, according to Environmental Impact Assessment Procedures, Section 62, it was not found to be included endorsement letter by project proponent which will comply and conduct the facts of report.	The commitment of the project proponent which states that the facts of the project will be complied must be described in the report.	A signed Key Commitment letter by PCMI is included in the ESHIA addendum.
2	***Executive Summary & Introduction***		
(a)	In page 1-29, EIA report, the executive summary was found to be reported in English and it was not found to be submitted in Myanmar language.	The executive summary in both English and Myanmar versions must be added to the report.	The Myanmar Language Executive Summary is included in the ESHIA Addendum.
(b)	In EIA report, the information about third party organizations which prepared this EIA report: International Environmental Management Co., Ltd and Environmental Quality management Co., Ltd, list of consultants who prepared EIA and expertise field and working experiences of the third party etc. was not mentioned.	Name, professional field of responsibility, experiences and address of each specialist in third-party that will conduct Environmental Impact Assessment (EIA) must be described in EIA report.	The information about third party organizations, which prepared the EIA/SIA report are included in Chapter 2, Section 2.7 (page 2-7).
3	***Policy, Legal and institutional framework***		
(a)	From page 1-11 to 1-18, in policy, legal and institutional framework, although project related laws such as Myanmar socio economic laws, policy, rules and regulations, regional and international agreements, protocols and convention which are ratified by Myanmar government were completely described, it was found to describe exactly Myanmar existing policy and laws.	▪ To describe precisely the existing laws and regulations of Myanmar ▪ To add Environmental Conservation Regulations (2014), Environmental Impact Assessment Procedure (2015) and Settlement of Labor Dispute Law (2012) to the report ▪ To exclude the repealed laws from the report ▪ To ensure the updated name	Chapter 3: Policy, Legal and Institutional framework has been updated to include relevant and applicable laws.

		and year of laws ▪ To add legal commitments referring the sections of the applicable laws and to describe the relevant laws after consideration to the project	
(b)	In section 6, page (6-10), in describing the international standards and guidelines which are related to the project, only HSE legislation, international convention and protocol were described.	▪ International standards and guidelines, environmental and social standards, health standards for project operations that may cause negative health impacts and National Environmental Quality (Emission) Guidelines (2015) must be added to the report.	The National Environmental Quality (Emission) Guidelines (2015) applicable to the project are included in Chapter 3, Section 3.5 (page 3-44).
4	***Project description and Alternatives***		
(a)	In EIA report, page (E-4), E1.4 study Area of Figure E-2, area information of proposed seismic area was not found to be matched with area information of Block IOR-7.	▪ To describe an explanation of the project owner.	The wellsite is located within Block IOR-7. The updated study area is shown in Figure E-2 (page E-5).
(b)	In page (E-5) E1.5 of EIA report: project description, the proposed seismic grid will be designed based on available geological information and PCMI is in the process of selecting the seismic contractor for the seismic survey.	▪ To describe the clear map that covers the whole project including the seismic area, the nearby residential area, and villages and the description of the map. ▪ All of contractors and sub-contractors must be in compliance with environmental and social commitments established by PCMI. ▪ To state which contractor is selected to conduct seismic survey.	Seismic Acquisition has been completed already. The ESHIA Addendum report will focus on the proposed exploration drilling only as agreed upon in ECD Review Meeting on September 14, 2017. The wellsite is located within Block IOR-7. The updated study area is shown in Figure E-2 (page E-5) The drilling contractor is still being selected as per PCMI requirements. All of contractors and sub-contractors will be in compliance with environmental and social commitments established by PCMI.
(c)	In page 2-17, section 2.7.1, regarding the seismic location Figure 2-10, proposed survey lines were beyond the boundary of Block IOR-7 and it was found to	▪ To explain the reason why seismic survey has been performed out of the boundaries of Block IOR-7. ▪ To state whether there is an agreement about the operation	Seismic Acquisition has been completed already. The ESHIA Addendum report will focus on the proposed exploration drilling only as agreed upon in ECD

	be intended to conduct beyond the EIA study area. In terms of seismic location, numbers of seismic lines, location of seismic lines (coordinates of starting point & endpoint) and distances were not described.	of project with MOGE and nearby oil and gas companies as seismic survey area was extended to blocks of others.	Review Meeting on September 14, 2017.
(d)	In page E-7 and E-8, E1.5.2 of EIA report, it was described that one or two office camp/base camp will be built for about 60 office staffs, hotels may be rented for base camps and temporary accommodation camps can be built near to the working area. Moreover, E 1.5.2.4, it was described that 800 labors shall be required during seismic operations.	▪ To describe precisely how 60 staff and 800 labors will be allocated. ▪ To describe where and how many office camps/ base camps and temporary accommodation camps will be built. ▪ The description of primary environment prior to the erection of office camps/ base camps and temporary accommodation camps must be added. ▪ To describe how accommodation for 800 staff will be managed.	Seismic Acquisition has been completed already. The ESHIA Addendum report will focus on the proposed exploration drilling only as agreed upon in ECD Review Meeting on September 14, 2017. The well pad and camp site will be built on acquired agricultural land. The construction and drilling camp will be located next to the drill pad area as detailed in Section 4.8.1, Layout and Facilities in Well Site Area (page 4-19 to 4-21)
(e)	It is needed to add the map which covers existing roads, potential construction road, labor camps, and workshops, location of office and chemical storages.	▪ To describe the map which will cover labor camps, office camps, workshops, existing roads and the proposed roads.	The well pad and camp site will be built on acquired agricultural land. The labor camps, office camps, workshops are detailed in Section 4.8.1, Layout and Facilities in Well Site Area (page 4-19 to 4-21)
(f)	In page E-13, E1.9 of EIA report, group discussion, public consultation, socio-economic interview surveys and site inspection were found to be conducted only in 8 villages which are not included in project area and it was found that public consultations were not held in the villages which are within the project area.	▪ To describe public consultation meeting, field study and socio-economic interview surveys made in other villages within the project area or relating to the project.	In December 2017, IEM and EQM conducted stakeholder engagement with local officials for Myanaung & Kyangin Townships and focus group meetings with villagers in 4 villages within the Myanaung Township as detailed in Section 9.4 (page 9-2). PCMI will conduct ongoing public consultation and engagement during before and during project implementation.
(g)	In page 2-21, section 2.7.4.2, although it was described that the location for storing of explosive substances will be within 10 km of the field office, the location was	▪ To add location of storage area of explosive substances. ▪ To describe the distance between storage area and villages and to state whether	Seismic Acquisition has been completed already. The ESHIA Addendum report will focus on the proposed exploration drilling only as agreed upon in ECD

	not described in detail.	this area is close to the populated areas.	Review Meeting on September 14, 2017
(i)	In page 2-39, section 2.7.7.1, general wastes disposal procedures, it was described that hazardous wastes and medical wastes which are discharged from seismic survey operations will be disposed to the qualified hospital/organization/ local government.	To ensure a contract with waste management companies in order to conduct management of wastes from seismic survey and exploration drilling activities and hazardous waste and medical waste.	PCMI will use DOWA ECO-SYSTEM Co., Ltd. as a waste management contractor as described in Waste Management Plan, Section 8.1 (page 8-34).
(j)	In 2.8.2.2.1.1, section 2.8.2.2.1, under the title of cutting and dirty (waste) pit, it was described that all hazardous wastes collected within the waste pit will be transported and disposed to approved government sites.	To ensure a contract with waste management companies in order to conduct management of wastes from seismic survey and exploration drilling activities and hazardous waste and medical waste.	PCMI will use DOWA ECO-SYSTEM Co., Ltd. as a waste management contractor as described in Waste Management Plan, Section 8.1 (page 8-34).
(k)	In page 2-44, section 2.8.2.2.1.4, it was described that although fuel storage tank are stored on a concrete base with tarpaulin covers, it was not included the mitigation procedures of oil spills.	To describe an explanation of the project owner.	PCMI Oil Spill Response Plan is included in Appendix 3.
(l)	In page 2-44, section 2.8.2.2.13, it was described that chemicals are stored on a concrete base with tarpaulin covers or roof. It was not described that Bunding or spill kits will be installed.	▪ To utilize bunding or spill kits.	Mud chemicals shall be stored in a covered and concreted warehouse before transportation to the drilling site. The warehouse shall be in YANGON. Once transported to site, the chemicals shall be stored on an impermeable geo-membrane based area with in a bunded area. Most of the chemicals are dry powdered chemicals, hence the chemicals shall be covered with tarpoline at site to protect from rainwater. The geomembrane lined chemical storage area will be 10 m by 10 m. The site will have spill kits available to be used if any accidental spill happens during operations. The mud chemicals are all dry powder so spill or leakage is low, spill kits will be used for any oil or liquid spills

(m)	In page 2-44, section 2.8.2.2.1.5, it was described that the flare stack will be horizontal burner directed to an earth bermed flare pits concerning with flare stack.	▪ To describe mitigation measures on the risk of soil contamination for dumping of waste fluids in the flare pit.	No waste fluids will be discharged to the flare pit. The reservoir fluids will be burned. The produced water will be separated and directed into the wastewater pit. The flare pit is only used for the emergency burning of high-pressure hydrocarbons. The flare pit soil will tested and if contaminated will be disposed as per the WMP. PCMI will use DOWA ECO-SYSTEM Co., Ltd. as a waste management contractor as described in Waste Management Plan (Appendix 4)
(n)	In page 2-45, section 2.8.2.2.1.6, it was described that waste water will be disposed into the flare pit.	▪ To describe how to minimize soil pollution as possibly as resulting from disposal of waste fluids into flare pit.	Waste water will be disposed of in the waste pit, not the flare pit. All wastewater will be treated as per the WMP. PCMI will use DOWA ECO-SYSTEM Co., Ltd. as a waste management contractor to treat waste water on site as described in Waste Management Plan (Appendix 4)
(o)	In page 2-45, section 2.8.2.2.2, it was described that temporary camp for 130 laborers will be built near the petroleum pits in accordance with industry-standard.	▪ To perform construction of accommodation work camp in compliance with Requirements of the IFC Guidance on Workers' Accommodation (August 2009).	PCMI drilling contractor will provide industry standard container type accommodations next to the well site location in compliance with Requirements of the IFC Guidance on Workers' Accommodation (August 2009). detailed in Employment and Accommodation, Section 4.8.4 (page 4-60)
(p)	In page 2-56, table 2.19, chemical lists that will be used in drilling mud were described and we have found out that those chemicals contain hazardous chemicals if those chemicals drain into the runnel, ditch and gutter etc. In page 2-44, section 2.8.2.2.13, it is described that chemicals will be stored on a concrete base with	▪ To describe systematic plan in detail for chemical storage. ▪ To ensure intensely that there is no discharge and drain into the ditches, drainages and sewage pipelines. ▪ To keep bunding or spill kits.	The site will have spill kits available to be used if any accidental spill happens during operations. The mud chemicals are all dry powder so spill or leakage is low, spill kits will be used for any oil or liquid spills PCMI will handle chemical

	tarpaulin covers or roof		storage for exploration drilling as per the PCSB HSEM 2.1 – SUPERVISORY SAFETY PROCEDURES MANUAL (Appendix 2)
(q)	In page 2-68, section 2.8.3.3.2.2, concerning with Blowout prevention measures, although PCMI was described that they have Blowout contingency plan (BOCP) for operations in Myanmar, PCMI was not described Blowout contingency plan (BOCP) yet.	▪ To add Blowout Contingency Plan of PCMI (BOCP) to the report.	The Blowout Contingency Plan is covered in the PCMI MYANMAR OPERATION EMERGENCY MANAGEMENT PLAN (which included a Blow Out Incident) included in Appendix 5
(r)	In page 2-90, section 2-10, in terms of land acquisition, it was described little information such as location of well sites and location of access road are owned by private owner, agreement with land owner will be proceeded and grievance mechanism will be installed etc. But, it was found out that the land acquisition plan and compensation plan were not mentioned in the report.	▪ To include agreements/contracts with land owners for permission of conducting surveys in their lands/farms during seismic surveys ▪ To include land acquisition plan and compensation plans discussing land owners for their lands being located in the proposed well sites and access roads	Seismic Acquisition has been completed already. The ESHIA Addendum report will focus on the proposed exploration drilling only as agreed upon in ECD Review Meeting on September 14, 2017. PCMI completed the land acquisition plan and compensation for the drilling well site as detailed in Land Acquisition Procedure, Section 8.17 (page 8-96)
5	***Description of the surrounding environment***		
(a)	In page 3-8, 3.2.2.1, table 3-2, it was found out that the average monthly rainfall data of Magway region from 1988 to 2007 was described.	The data collected from the meteorological data of the regions within the project area should be used.	Updated meteorological data was included in Climate and Air quality, Section 5.2.2 (page 5-7 and 5-8).
(b)	Meteorological data that were described in the report are the rainfall data between 1988 and 2007. So, it should describe the updated data which are matched with the time of report preparation periods because the current situation of rainfall may differ with the old situation.	To describe the meteorological data updated	Updated meteorological data was included in Climate and Air quality, Section 5.2.2 (page 5-7 and 5-8).
(c)	In terms of the cultural heritage and religious infrastructures, it is needed to conduct assessment.	▪ To conduct an assessment for cultural heritage and religious edifices in the project area or nearby.	A cultural heritage assessment was completed in the proposed drilling areas. The drilling area is a disturbed agricultural area and

			there are no archaeological or historic areas near the project area as confirmed by Myanaung Township GAD. A Cultural Heritage Management Plan is included in Section 8.13 (page 8-69).
(d)	In page 3-31, noise monitoring was found to be compared with WHO standards, Thai standards and world bank guidelines as there was no noise standard during operation phase of project.	▪ To describe the comparison with EQ (E) Gas EQ (E) G was established in Myanmar on December 2015.	Ambient noise level in this report were compared to: ▪ Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012, and ▪ WHO Guideline for community noise (1999).
(c)	Among noise monitoring data which are described in page 3-31, table3.21, and nigh-time noise data was found to be higher than the standards.	▪ To explain the reason why night-time noise data was higher than the standards.	Updated noise monitoring has been undertaken in included in Noise, Section 5.2.3 (page 5-15). Increased night time noise was due to motorbike traffic and the use diesel generators for electricity in the evening near the sampling stations.
6	***Environmental Management plan***		
(a)	In chapter 6, it was found out that the expenses for Environmental management plan was not described.	▪ To include budget for environmental management plan	The budgets for each environmental management sub-plan is included in Chapter 8, Environmental Management Plan.
(b)	In chapter 6, page 6-4, although summary of the impacts and mitigation measures were described, the budget was not reported.	▪ To describe the budget allocation for mitigation measures implementation.	The budgets for each environmental management sub-plan is included in Chapter 8, Environmental Management Plan
(c)	In page 6-34, changes in land use, it was described that restoration of land to its original state within 6 months of project completion.	▪ To provide Land Restoration Plan	If abandoned, the area will be restored back to natural state and returned to MOGE as described in Commercial Failure, Well Abandoned, Section 4.8.3.4.2 (page 4-58)
(d)	Regarding grievance mechanism, it was not found to be described in the report.	▪ To describe the organizational structure of Grievance Mechanism, the authorized person and organization in	The PCMI Grievance Mechanism with the authorized person and organization in charge, and the

		charge, and the responsibilities.	responsibilities is included in the Community Consultation & Grievance Mechanism in Section 8.14 (Page 8-73)
(e)	In the construction of new dual lane which is 10km length, it is needed to describe the environmental management plan (EMP) to mitigate the potential impacts of new road construction.	▪ To provide Sub Environmental Management Plan for construction of new dual lane road with 10 kilometres	The project will use an existing MOGE road. This road is designed for rig move and PCMI will maintain this road including increasing the road level if required. In areas that require upgrade, PCMI will widen the MOGE road up to six (6) meters upon MOGE agreement. The maximum total road upgrading is expected to be 25-30 km along the MOGE road. The mitigation measures are included in Soil Management Plan in Section 8.9 (Page 8-52)
(f)	It was found out that the following mitigation plans were not described in the EIA report even though it was described that the sub-mitigation plans will be implemented. • HSE integrated Management system of PCMI • Emergency response plan of PCMI • Blowout Contingency Plan (BOCP) of PCMI • Waste Management plan of PCMI • Oil spill Contingency Plan of PCMI	To attach the following plans in the EIA report- ▪ Training Plan about Biodiversity ▪ HSE Integrated Management System of PCMI ▪ Emergency Response Plan of PCMI ▪ Blowout Contingency Plan of PCMI ▪ Waste Management Plan of PCMI ▪ Oil Spill Contingency Plan of PCMI	The following documents are included in the Appendix: ▪ PCSB HSEM 2.1 – SUPERVISORY SAFETY PROCEDURES MANUAL (Appendix 2) ▪ PCMI Oil Spill Response Plan (Appendix 3) ▪ PCMI Waste Management Plan (Appendix 4) ▪ MYANMAR OPERATION EMERGENCY MANAGEMENT PLAN (which included a Blow Out Incident) (Appendix 5) The area is outside any biodiversity area; therefore, no Biodiversity Plan is required.
7	***Public consultation and Disclosure***		
(a)	It was found out that information of the public consultation on proposed project are not released in the news and media	▪ To release the information of the public consultation on the proposed project in the news and media	The ESHIA has been disclosed as follows: ▪ Disclosure Statement via Government Newspaper after submission of EIA addendum ▪ On PETRONAS' website as follows: http://www.petronas.com.my/investor-

			relations/Pages/OtherReports.aspx ▪ PCMI's office in Yangon: 16 Shwe Taung Kyar Street, Yangon 11201, Myanmar ▪ Hinthada District General Administrative Department Office, Ayeyarwady Region ▪ Myanaung Township General Administrative Department Office, Hinthada District
(b)	It is needed to include the plans and procedures to distribute the related information of the project to the township administrative office, general administrative office and village administrative office which are situated within Block IOR-7.	▪ To undertake information disclosure on the proposed project to township administration office, general administration office and village administration offices in Block IOR-7.	In December 2017, IEM and EQM conducted stakeholder engagement with local officials for Myanaung & Kyangin Townships and focus group meetings with villagers in 4 villages within the Myanaung Township as detailed in Section 9.4 (page 9-2).
(c)	Implementation plan of CSR and CSR were not found to be described in the report.	▪ To include CSR program considering local community needs and the budget plan	The planned PCMI CSR Program and estimated budget has been included in Section 9.6 (page 9-22)
8	***General***		
(a)	To upload the report of the project on the website of the company and To mention the web link in the initial environmental examination report		In accordance with Myanmar Environmental Impact Assessment Procedure (Section (65): Submission of EIA Report), the report was disclosed via government newspaper and is publically viewable at the following locations: ▪ On PETRONAS' website as follows: http://www.petronas.com.my/investor-relations/Pages/OtherReports.aspx ▪ PCMI's office in Yangon: 16 Shwe Taung Kyar Street, Yangon 11201, Myanmar ▪ Hinthada District General Administrative Department Office, Ayeyarwady Region ▪ Myanaung Township General Administrative Department Office, Hinthada District

(b)	To provide separately the commitment lists to be complied during the project	A signed Commitment List letter by PCMI is included in the ESHIA addendum.
(c)	To meet and discuss local community and stakeholders in order to focus, collaborate and carry out the tasks related to their comments and suggestions	In December 2017, IEM and EQM conducted stakeholder engagement with local officials for Myanaung & Kyangin Townships and focus group meetings with villagers in 4 villages within the Myanaung Township as detailed in Section 9.4 (page 9-2). PCMI will conduct ongoing public consultation and engagement during before and during project implementation.

E1 EXECUTIVE SUMMARY

E1.1 Background

PETRONAS Carigali Myanmar Inc. (hereafter called "PCMI") is an Operator of Production Sharing Contract (PSC) of Block IOR-7, which is located in the Central Myanmar, shown in **Figure E-1**.

IOR-7 lies within the Ayeyarwady Region. The total area of this block is 95 sq. mile or 246 sq. km.

The IOR-7 Block is under an Improved Petroleum Recovery Contract (IPR) that consists of acquiring 300 km line 3D Land seismic data acquisition and drilling of 2 exploration wells within the stipulated 3 years period. The 3D seismic survey operations have been completed. Therefore, this ESHIA covers the planned exploration-drilling program.

International Environmental Management Co. Ltd. (IEM) and local partner Environmental Quality Management Co. Ltd. (EQM) have been contracted by PCMI to prepare an environmental, social, and health impact assessment report (ESHIA) for the proposed Block IOR-7 exploration drilling project ("the Project").

E1.2 Project Proponent

Petroliam Nasional Berhad established in 1974, is Malaysia's fully integrated oil and gas multinational ranked among the largest corporations on FORTUNE Global 500®. PETRONAS Carigali Myanmar Inc. (PCMI) a subsidiary of Petroliam Nasional Berhad is the operator of the Production Sharing Contract (PSC) of Block IOR-7. PCMI explores, produces and delivers energy to meet society's growing needs.

PCMI applies innovative approaches to technology, which help unlock and maximise energy sources from even the most remote and difficult environments with operations in over 50 countries around the world.

The PCMI office in Yangon is:

PETRONAS Carigali Myanmar Inc.
16, Shwe Taung Kyar Street,
Yangon 11201,
Republic of the Union of Myanmar

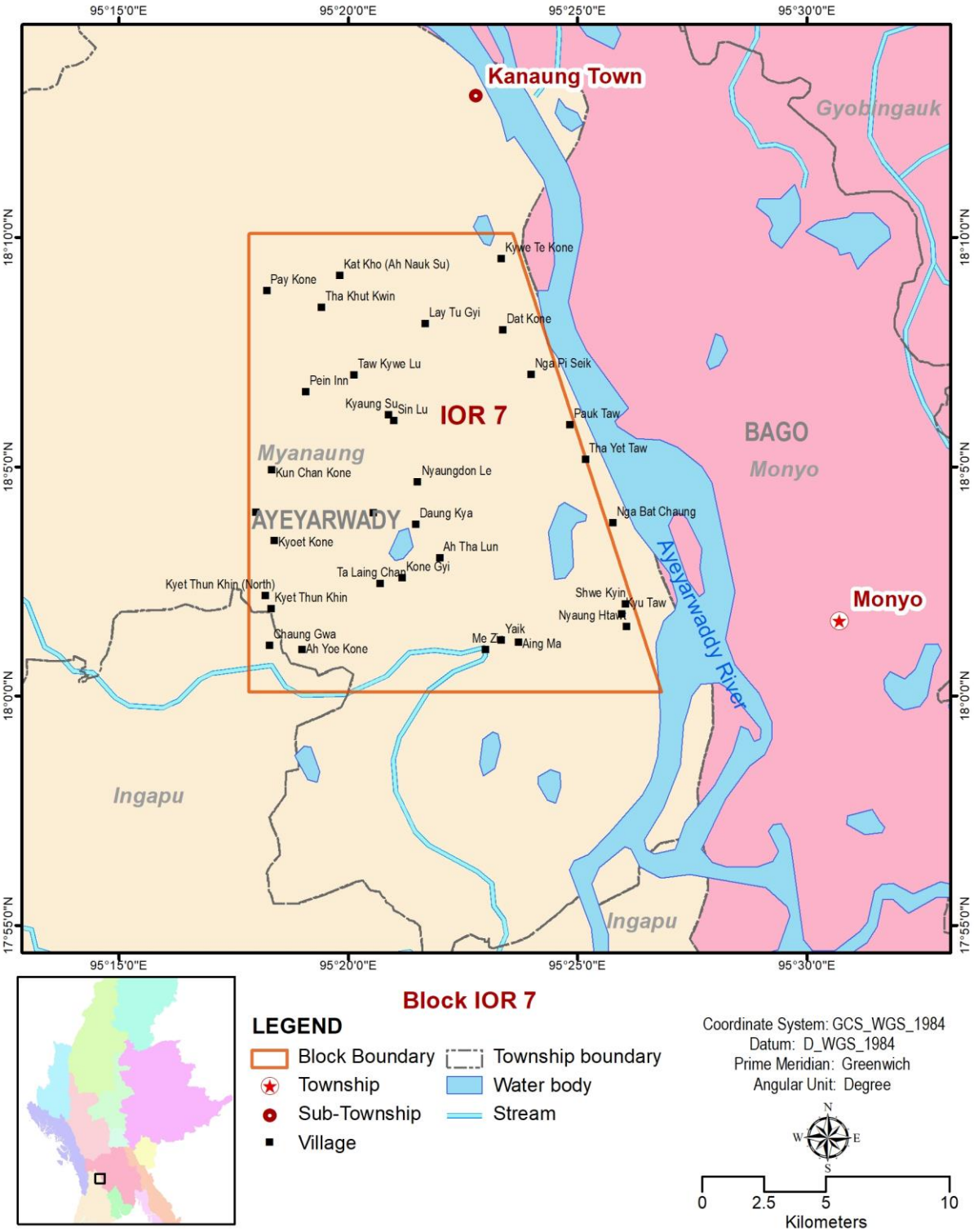


Figure E-1: Block IOR-7 Location

E1.3 Myanmar Legislation

All legislative requirements, which shall be adhered to as a minimum for the EIA study, include but not limited to:

- The Constitution of the Republic of the Union of Myanmar (2008);
- The Myanmar Investment Law (2016);
- Myanmar Environmental Conservation Laws (2012);
- Environmental Conservation Rules (2014);
- Environmental Impact Assessment Procedure (2015);
- Draft Administrative Instruction of Environmental Impact Assessment Procedure (2015);
- Draft Environmental Impact Assessment Guidelines for Onshore and Offshore Oil and Gas Developments (December 2015);
- Draft Guideline on Public Participation in Myanmar's EIA Processes (2017);
- National Environmental Quality (Emission) Guideline (2015).

Other relevant government agencies/ requirements including:

- The Petroleum and Petroleum Products Law, 2017, Section 8 (m), Section 9 (a, c, d), Section 19(a,b,e), Section 10 (a,c,d,f)
- Public Health Law, 1972
- The Prevention and Control of Communicable Disease Law, 1995
- The Control of Smoking and Consumption of Tobacco Product Law, 2006 (Section 9)
- The Myanmar Fire Force Law, 2015 (Section 25)
- The Protection and Prevention of Antique Objective Law, 2015 (Section 12)
- The Protection and Prevention of Ancient Monument Law, 2015 (Section 12, 20(f) (c), 15(c))
- Myanmar Investment Law, 2016 (Section 51(a) (b) (c) (d), 65 (g) (i) (j) (k) (l) (m) (n) (o) (p) (q))
- The Development of Employees and Expertise (Skill), 2013(Section 5, 14, 30)
- The Factories Act, 1951 (Before notification that this project is oilfield issued by MOEE)
- The Welfare of Labors of Oilfield Act, 1951(After notification)
- The Workmen Compensation Act, 1951
- Labor Organization Law, 2012
- Settlement of Labor Dispute Law, 2012
- Minimums Wages Law, 2013
- Payment of Wages Law, 2016- (3,4,8,7(ii),9,10(a) to e
- Social Security Law, 2012 - 11, 16(a), 48(a), 51(a) (b), 54
- Leaves and Holidays Act, 1951
- The Explosive Act
- The Explosive Substances Act
- Fresh Water Fisheries Law, 1991 (Section 40)
- The Motor Vehicles Law, 2015 and Rules, 1987
- Myanmar Insurance Law, 1993 (Section 16)
- Forest Law, 1992 (Section 12)
- Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law 1994
- The Underground Water Act, 1930

- The Farmland Law, 2012 (Section 30)
- The Protection and Prevention of Cultural Heritage Area, 2015 (Section 20, 23, 29(b))
- Employment and Skill Development Law, 2013
- The Prevention of Danger of Hazardous Chemical and related Substances Law, 2013 (Section 16,17,23,27)
- Import and Export Law, 2012 (Section 7)
- Conservation of Rivers, Creeks and Water Resources Law, 2006 (Section 24 (b), 21(a)(b), 19, 11(a) (b))
- Occupational Safety and Health Law (Draft)

E1.4 ESHIA Objectives & Scope

The purpose of this ESHIA Report is to identify and, to the extent possible, quantify the potential negative impacts and positive benefits of the project with respect to the environment, human use values, quality of life and health. Once these impacts have been identified, prevention, mitigation, and monitoring measures will be proposed to minimize impacts.

The specific objectives of this report are to:

- Identify all planned activities and potential unplanned events;
- Establish an environmental, social and health baseline of the project area;
- Identify and assess potentially significant impacts based on existing conditions to:
    - Physical Resources;
    - Ecological Resources;
    - Human-Use Values;
    - Quality-of-Life Values;
    - Health.
- Identify and recommend mitigation measures to minimise potential impacts;
- Recommend a monitoring plan that can track changes in the environment, social issues and health over time and to ensure compliance with Myanmar legislation.

E1.5 Study Area

The overall study area of the project will cover a 5-km area of the proposed exploration well site area (both wells will be drilled from a single well pad) in Block IOR-7. The environmental and social baseline data was focused within a 1-km buffer area of the well pad.

The outline of the study area is shown in **Figure E-2**. The study area will be used to identify sensitive receptors in the assessment of impacts on physical resources, biological resources, human use values, and quality of life values. Examples of sensitive receptors are schools, temples, water resources, residential areas, etc.

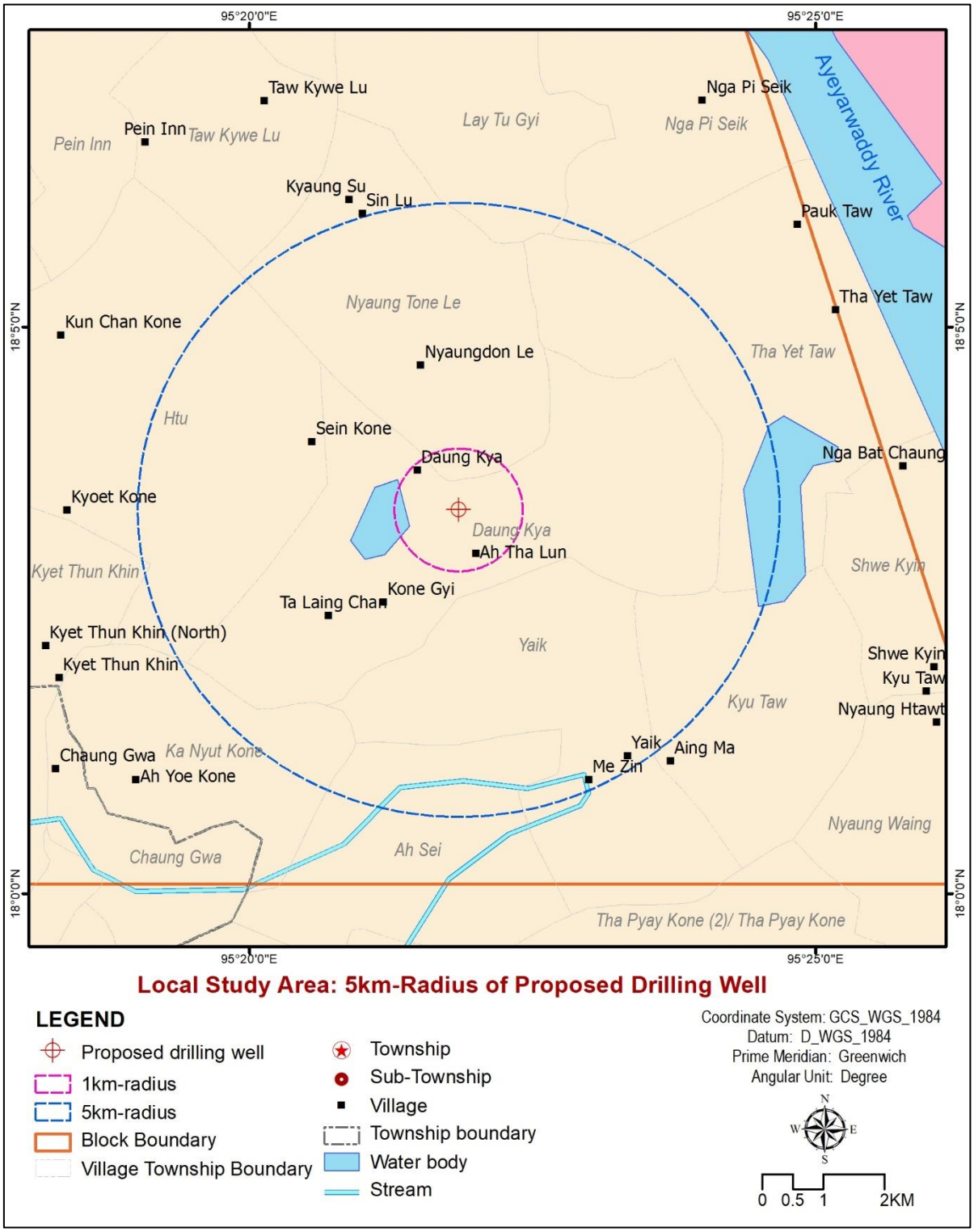


Figure E-2: IOR-7 Study Area

E1.5.1 Data Collection

E1.5.1.1 Primary Data Sources

Data collected for this EIA include details of the proposed project, environmental baseline, socio-economic setting and health conditions of the potentially affected areas. Data were obtained from primary and secondary sources.

Primary data sources include:

- Environmental quality baseline survey for surface water, groundwater quality, and soil survey conducted on 7 - 13 November 2014;
- Environmental quality baseline survey for noise and air quality survey conducted on 7 - 13 November 2014;
- A historical, archaeological and cultural resources meeting conducted on 7 - 13 November 2014;
- Traditional Ecological Knowledge (TEK) surveys with local farmers which focused on a number of ecological indicators regarding biodiversity and ecological status was conducted on 7 - 13 November 2014;
- Socio-economic surveys conducted on 7 - 13 November 2014; and
- Focus Group meetings with villagers on 7 - 13 November 2014.

Additional primary data collection:

- Environmental quality baseline survey for surface water, groundwater quality, and soil survey conducted on 4 – 6 December, 2017;
- Environmental quality baseline survey for noise and air quality survey conducted on 4 - 6 December, 2017
- A historical, archaeological and cultural resources meeting with Myanaung and Kyangin Township General Administrative Department Authorities conducted on 5 – 6 December, 2017 (No cultural or heritage departmental office is located in the region;) and
- Attitude & Opinion surveys & Focus Group Meetings with villagers conducted on 5 – 6 December 2017.

E1.5.1.2 Secondary Data Sources

Secondary data sources came from literature, relevant authorities in the project area. The secondary data sources are cited throughout this report, and listed in the references section.

E1.6 Organization of ESHIA Implementation

The impact assessment was completed by the Myanmar registered consultant companies; International Environmental Management Co. Ltd. (IEM) and Environmental Quality Management Co. Ltd. (EQM). The IEM & EQM consultant registrations are included in **Appendix 1**.

International Environmental Management Co. Ltd
No. 148/B, Dhamma Zedi Road, Bahan Township Yangon

Environmental Quality Management Co. Ltd
No. (233), Block 23, Sayeepin Lane
Thuwunna, Thingungyun Township, Yangon, Myanmar

E1.6.1 ESHIA team

The impact assessment was conducted by Myanmar registered consultant companies International Environmental Management Co. Ltd. (IEM) and Environmental Quality Management Co. Ltd. (EQM) The ESHIA assessment team consisted of the individuals described in **Table E-1.**

Table E-1: ESHIA Assessment Team

No.	Name	Background / Expertise	Responsibility
IEM			
1	Ron Livingston	1979, Master's Degree in Natural Resources Management, University of Manitoba, Winnipeg, Manitoba, Canada. 1976, B.Sc., University of Manitoba, Winnipeg, Manitoba, Canada.	Senior Environmental, Social, and Health EIA Expert
2	Dylan Jenkins	2008, B.Sc. (Biosystems Engineering), University of Manitoba, Canada	Environmental Analyst / Biodiversity
3	Komgrit Prawatlertudom	2009, B. Sc. (Marine Sciences), Chulalongkorn University, Thailand	Environmental Sampling / Aquatic Biology
4	Ubonwan Sintopan	2007, MS. (Natural Resources Management), Asian Institute of Technology, Thailand 2004, B.S. (GEOGRAPHY), Chiang Mai University, Thailand	Environmental Analyst / GIS
EQM			
1	Dr. Ohnmar May Tin Hlaing	2004 -2006, M.Sc in Environmental Engineering and Management, Asian Institute of Technology, Thailand 1986-1996, Bachelor of Medicine and Bachelor of Surgery, Institute of Medicine, Myanmar	Senior Environmental Expert / Local Coordinator
2	Daw Soe Moe Nwe	2013, B.Sc. (Forestry)	Socio-economic Team Leader
3	U Khun Set Thar	2014, University of Forestry, Forestry	Socio-economic Team Leader / Biodiversity Survey
4	U Thiha Htut	2012, Dagon University, Microbiology	Social surveyor
5	Daw Noe Noe Lwin	2014, Myanmar Maritime University, B.E (Naval Architecture)	Social surveyor
6	Daw Thwe Thwe Htun	B.Sc. (Chemistry)	Social surveyor
7	Daw Yoon Mi Mi Thaw	B.Sc. (Chemistry)	Social surveyor
8	U Soe Pyae Htun	2012, Dagon University, Microbiology	Air / Noise
9	U Ye Naung Htun	2013, University of Forestry, Forestry	Air / Noise
10	U Kyaw Ko Ko	2009, Dagon University, Maths	Air / Noise
11	U Win Sithu	2012, Dagon University, (UDE)	Water and Soil Sampling
12	U Zay Zay Ko	Diploma of Electrical Power	Water and Soil Sampling

E1.7 Project Description

The Project was reviewed in order to gain a full understanding of the project and to compile information on project activities. The Project is described in **Section 4**.

PETRONAS Carigali Myanmar Inc. (hereafter called "PCMI"), MOGE with local partner UNOG Company Limited and Petroleum Brunei Myanmar have jointly invested in on-shore block IOR-7.

The Petroleum Sharing Contract (PSC), between PCMI and MOGE was signed and effective on 16th Sept 2014 in Naypyidaw, in the Republic of the Union of Myanmar. This chapter discusses the proposed two well exploration drilling campaign.

PCMI's exploration drilling program in Block IOR-7 includes drilling 2 exploration wells. The expected spud date in November 2018. The exploration well will be drilled as a vertical well with conventional hole technique. The exploration drilling will be conducted with a typical land-drilling rig. The two exploration wells will be drilled from the same well-pad location.

All of the contractors and sub-contractors will be in compliance with the environmental and social commitments established by PCMI.

E1.7.1 Project Schedule

The exploration drilling wells would be drilled during the dry season after the monsoon season. The drilling campaign aims to finish before the 2019 monsoon season arrives at the end of May 2019.

The IOR-7 project timeline is shown in **Table E-2**.

Table E-2: IOR-7 Project Schedule

Activity	Well 1	Well 2
Spud Date	1st November 2018	15th December 2018
Drilling duration	30 days (30 November ,2018)	30 days (15 January 2019)
Completion duration	15 days (15th December 2018)	15 days (1 February 2019)
Well testing duration	(15 days) Perform with different rig in Q1 2019	(15 days) Perform with different rig in Q1 2019

Source: PCMI, 2018

E1.7.2 Exploration Drilling

E1.7.2.1 Type of Drilling Method

The wells will be drilled with a conventional hole size. Slim hole drilling is not an alternative or possible for the PCMI wells. A conventional hole size hole is required because of the depths being drilled, the type of formations being drilled, the kinds of pressures expected, and for hole stability. The final section of the well will be drilled using an 8-1/2-inch drill bit in the reservoir section.

The PCMI drilling program will only use Chloride free High performance Water Based Mud (WBM) for the drilling campaign. There shall not be any chloride additives in the mud system.

E1.7.2.2 Accommodation Work Camp Layout

The construction of accommodation in the work camp will be in compliance with requirements of the IFC Guidance on Workers' Accommodation (August 2009). The civil works campsite will be built near the well site construction zone. The camp will include a minimum one (1) Shower per ten men, one toilet per fifteen men and one washbasin per fifteen men. The construction dining Unit shall have minimum seating capacity for 20 men at any time.

Drilling rig contractor will provide the drilling campsite during the drilling phase; it will be located next to the well pad area in the designated green zone. The accommodations will be container type accommodations as per industry standard, they will be moved onto site and contain a minimum of 1 Man Sleeper, 2 Man Sleeper, 4 Man Sleeper per unit with a bath room attached. The containers will all have air conditioning. A separate dining unit will be provided and have a minimum seating capacity for 40 persons at any time.

E1.7.2.3 Access Roads

PCMI plans to use the Pathein – Monywa Highway road to Kyangin and then to Myanaung with well site access via the MOGE road starting from Mingone Junction as the main equipment transportation route. Mobilization and demobilization of crew to and from well site , PCMI plans to use Yangon – Hinthada – Myanaung road and then from Mingone junction to the MOGE road. Route Hazard Assessment for the access road and MOGE road has been conducted in March 2018.

The MOGE road is designed for rig move and PCMI will maintain this road including increasing the road level if required. In areas that require upgrade, PCMI will widen the MOGE road up to six (6) meters upon MOGE agreement. The maximum total road upgrading is expected to be 25-30 km along the MOGE road.

E1.8 Description of the Environment

The project Study Area is centred on IOR-7 for the purpose of describing baseline environmental, socio-economic and health conditions potentially affected by the project and affecting the project. Where appropriate for the purpose of establishing context, data and observations from the region are also referenced.

The total area of this block is 95 sq. mile or 246. The Ayeyarwady River is flowing at the eastern boundary of the block. Major towns situated inside the block include Kywedegon, Shwegyin, Nyaunghtaw, Pauktaw etc. Geologically IOR 7 block is situated near the southern edge of Pyay Embayment. In the MOGE geological map it is named as Shwepyitha area. Shwepyitha field is still currently on production. It is producing 143 BBL of Oil and 0.786 MMSCF of Gas from 14 producing wells.

The Local Study Area's focus is on the proposed drilling well and adjacent biophysical, and land use within its 5 km radius. The baseline sampling program was conducted throughout the area of a 1km-radius of the proposed drilling well. The proposed drilling well is located at Lat 18° 3' 23.090" N Long 95° 21' 50.883" E in Daung Kya village township (VT) and local study area cover VT Daung Kya, VT Nyaung Tone Le, VT Tha Yet Taw, VT Kyu Taw, VT Yaik, VT Ka Nyut Kone, and VT Htu, in DT Hinthada, TS Myan Aung (**Figure E-3**). The project area mainly consists of paddy land between the agriculturally dominated communities and MOGE access road. The agriculture areas are used to grow rice and beans/pulses.

Environmental, social and health information was collected and evaluated in the following areas:

- **Physical Environment**: geography, climate, air quality, noise, geology, soil, surface water hydrology, surface water quality, groundwater;
- **Biological Environment**: flora, fauna, aquatic biota, threatened/endangered species, protected areas;
- **Human Use Values:** land use, agriculture and industry, fishery and aquaculture, irrigation and agricultural water sources, water supply, wastewater management, solid waste management, transportation, power supply, electricity and communications;
- **Quality-of-Life Values**: local administration, demographics, socio-economy, archaeological resources, tourism;
- **Health**: health services and public health statistics.

The Environmental Setting is described in **Section 5.**

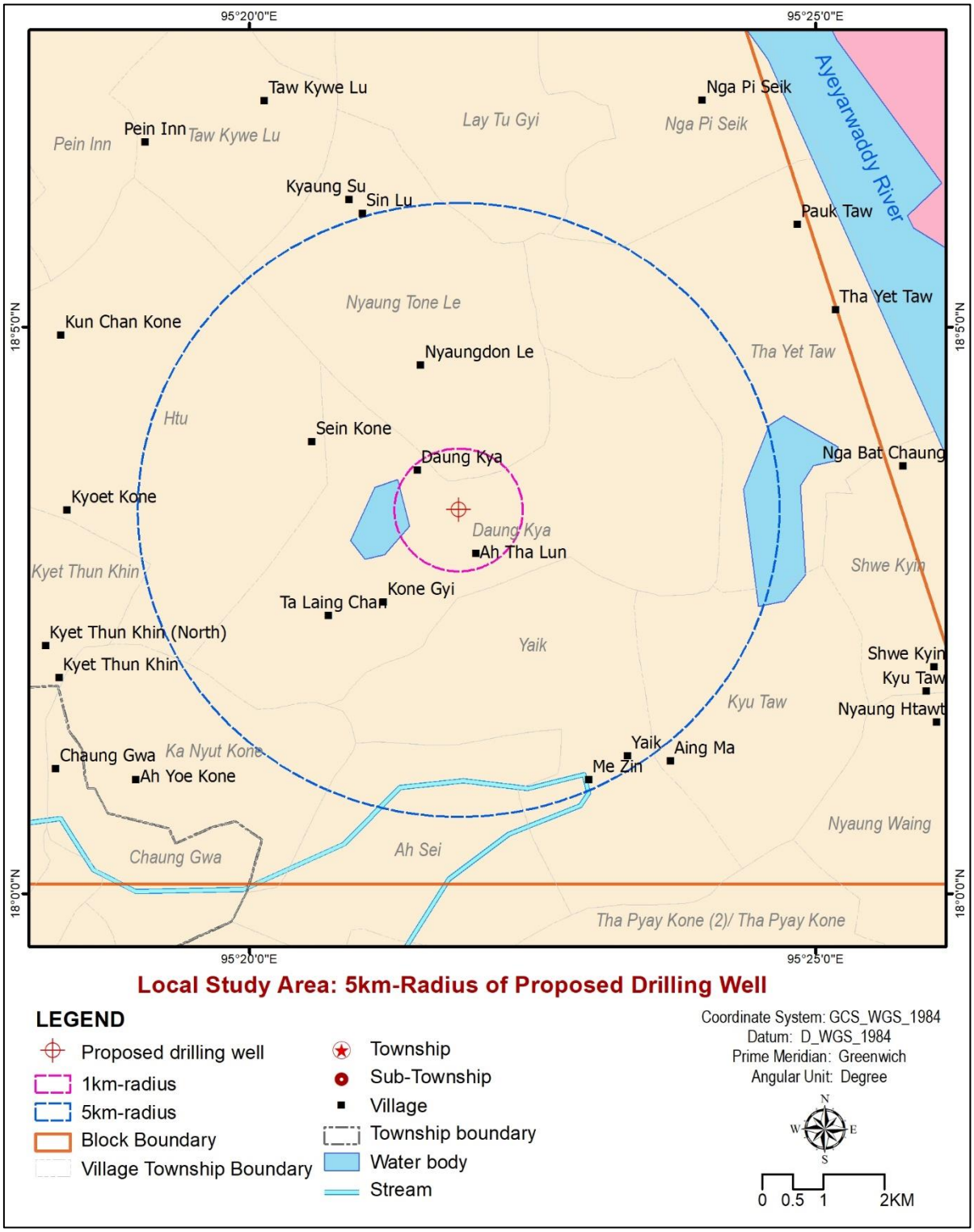


Figure E-3: Local Study Area

E1.9 Impact Assessment

An initial screening assessment of project activities consisted of developing a summary matrix of project activities against environmental, social and health parameters to determine if potential impacts were considered significant or not. If any issues were considered significant, then these were assessed in more detail. Qualitative and quantitative analyses were conducted to assess potential impacts on environmental, social or health receptors that may be caused by the proposed project activities. The impact analysis criteria are summarized in **Section 6**.

The impact assessment also included an assessment of unplanned events. The assessment examines the potential of the project to result in major hazardous events (such as a fire or oil spill from a blow-out) or environmental hazards to impact the project and the environment (such as earthquakes). The risk assessment includes a qualitative and a quantitative evaluation of risks to help further define the probability and potential consequences of these major hazardous events, and to evaluate the significance and the areas that might be impacted by these events. Specific systems for the further management of the significant risks are then proposed. Residual risk was determined after management measures were defined.

E1.10 Cumulative Impact Assessment

A cumulative impact assessment was completed to identify those environmental, social or health aspects that may not on their own constitute a significant impact but when combined with impacts from past, present or reasonably foreseeable future activities associated with this and/or other projects, result in a larger and more significant impact(s). The cumulative impact is described in **Section 7**.

E1.11 Mitigation and Monitoring

In the impact assessment, a number of potentially significant impacts were identified. For each of these project activities, mitigation measures were defined to prevent and/or reduce the likelihood or magnitude of impacts and/or to limit the extent of an impact if one does occur. The proposed mitigation measures take into account applicable guidelines, industry practices, expert judgement, design techniques, and operational control.

In addition, environmental monitoring measures were designed to monitor the environment and project activities. The purpose of these monitoring measures is: to evaluate the effectiveness of the mitigation measures that will be put in place; to assess compliance with Myanmar legislation, guidelines and standards; and to compare environmental conditions after implementation of the project to environmental baseline conditions to document possible change and/or impact. The mitigation and monitoring measures are described in **Section 8**.

E1.12 Public Consultation & Disclosure

Based on stakeholder mapping and information collected during EHS baseline surveys, the public consultation and disclosure included the following stakeholder groups:

1. MOGE & MONREC;
2. Village heads and villagers near the project location;
3. Authorities at the Township Level.

In December 2017, IEM conducted stakeholder engagement with local officials for Myanaung & Kyangin Townships and focus group meetings with villagers in 4 villages within the Myanaung Township, which are located in the potentially affected area of the survey footprint with a 1km buffer zone.

- Meetings with Myanaung General Administrative Department (GAD), Forestry Department and City Development Committee (CDC) officials
- Meetings with GAD, Forestry Department and CDC officials
- Site Visit of Myanaung & Kyangin Townships waste disposal areas
- Key Informant Interview with key Township officials and community leaders;
- Stakeholders Meeting/Focus Group Discussions with communities
- Opinion & Attitude Survey of households

Detailed opinion & attitude surveys were completed for approximately 111 villagers. As part of the public involvement process, Key Informant Interviews were also conducted with village leaders and health providers. Further, Traditional Ecological interviews and surveys were conducted with villagers and farmers during the combined socio-economic and environmental baseline surveys. No registered NGOs are present in the Township.

IEM's survey team consisted of the Senior Socio-economic Expert, three supervisors, and ten Myanmar local technicians who were trained by IEM.

The purpose of the opinion & attitude questionnaire was to obtain the stakeholder perceptions and understanding of PCMI's planned exploration drilling program.

At the focus group meetings prior to conducting the opinion surveys, the villagers were informed that PCMI was planning to conduct exploratory drilling for two wells on the same well pad location.

E1.12.1 Survey Locations

Within the 1km project area, 4 villages were identified for participation in the survey within the potentially affected by the exploration drilling well site.

Table E-3: Summary of IOR-7 Village and Sample Locations

No.	Date	Village	Township	Households
1	05/12/2017	Ah Tha Lun	Myanaung	89
2	05/12/2017	Zee Kone	Myanaung	108
3	06/12/2017	Daung Kya	Myanaung	198
4	06/12/2017	Kyoe Gone	Myanaung	48

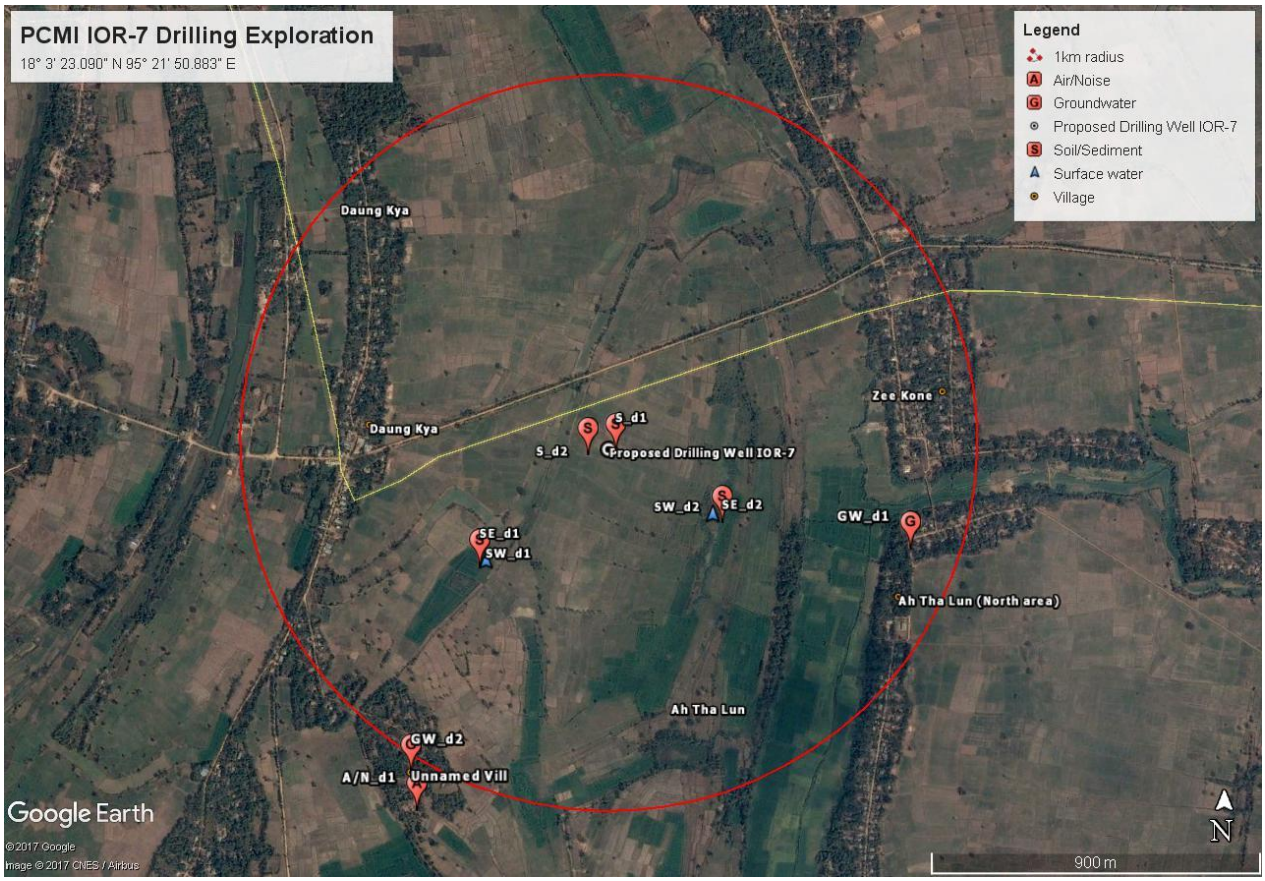


Figure E-4: Potentially Affected Villages in Project Area

E1.12.2 Focus Group Meetings

At the focus group meetings prior to conducting the opinion surveys, the villagers were informed that PCMI was planning to conduct an exploration drilling program including drilling two exploration wells from one well pad area. The project schedule will include 6 month for civil works and up to 10 months for exploration drilling.

The exploration drilling program is to determine if any oil or gas is present. If no oil or gas is found the wells will be abandoned and the area returned to its original state. If oil and gas is found, then the oil and gas will be produced for sale.

The villagers were informed that the focus group meetings and questionnaires were being conducted as part of an environmental, social and health impact assessment that is required to obtain approval for the project to proceed and to help guide PCMI to reduce any potential impacts.

The presentation/discussion topics for public involvement and disclosure included, but not limited to:

- Objective of Public Consultation
- Overview of project description/information
- Methodology of drilling activities
- Existing environmental conditions.
- Key impact aspects
- Proposed project mitigation measures and monitoring program
- Compensation

MOGE assisted IEM/PCMI by contacting local officials in each Township and village and made arrangements for our team to meet with them. MOGE too, participated in each focus group meeting and addressed those questions appropriate for the government to answer.

Prior to initiating community meetings, a presentation was provided to the Key Township Officials and Administrator to obtain understanding of the project, ESHIA objectives and support and approval for village meetings.

E1.12.3 Key Informant Interviews

The key informant survey consisted of 19 questions. The results of the surveys have been analyzed and the following summary of the results is provided below/ Key informants from 3 villages (Daung Kya, Ah Tha Lun and Kyoe Gone) were present during the public consultation meetings.

To ensure the ability to correlate data, a targeted subset of the socio economic and attitude survey was used as a basis for Key Informant Interviews.

Key Informants anticipated positive impacts from the project to include: increased employment (45%), as increased annual income (15%), improved road transport (15%), improved living conditions (15%) and land compensation (10%). Regarding possible negative impacts of the project: 28% are concerned about negative social effect, 28% are concerned about environmental pollution, and 28% damaged environment. Of those interviewed, 90% of the key informants agree with the proposed project development.

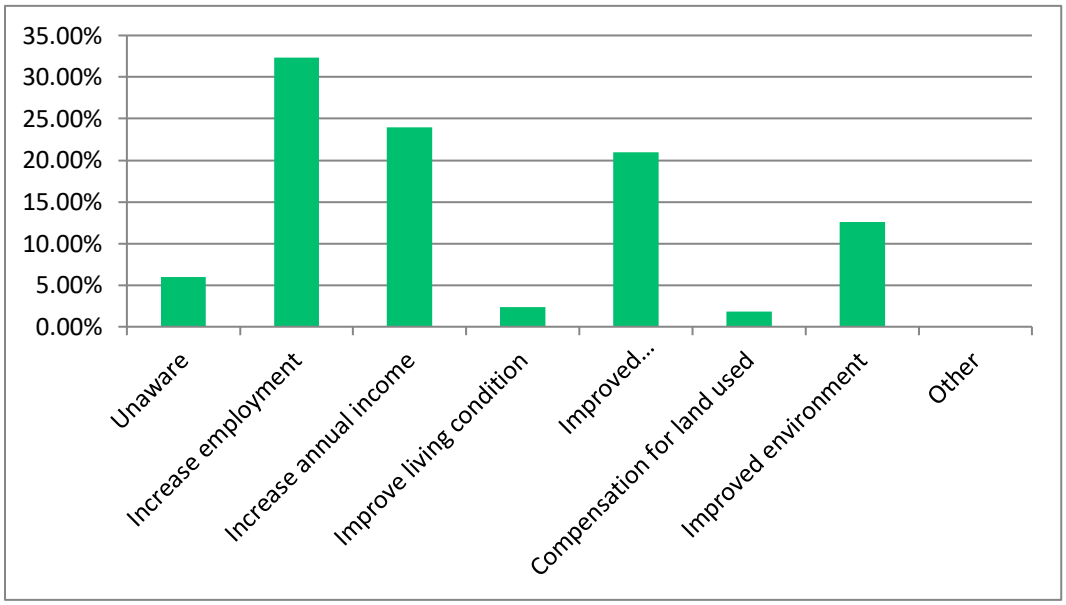
E1.12.4 Opinion & Attitude Surveys

Of the responses 59% were Male, and 41% were female. The survey was conducted in 4 villages in Myanaung Township within Block IOR-7. Villages included Daung Kya, Ah Tha Lun, Kyoe Gone and Zee Kone.

E1.12.4.1 Opinions of Possible Project Benefits

Villagers anticipated increased employment (32%), increased annual income (34%), and improved living infrastucture (21%).

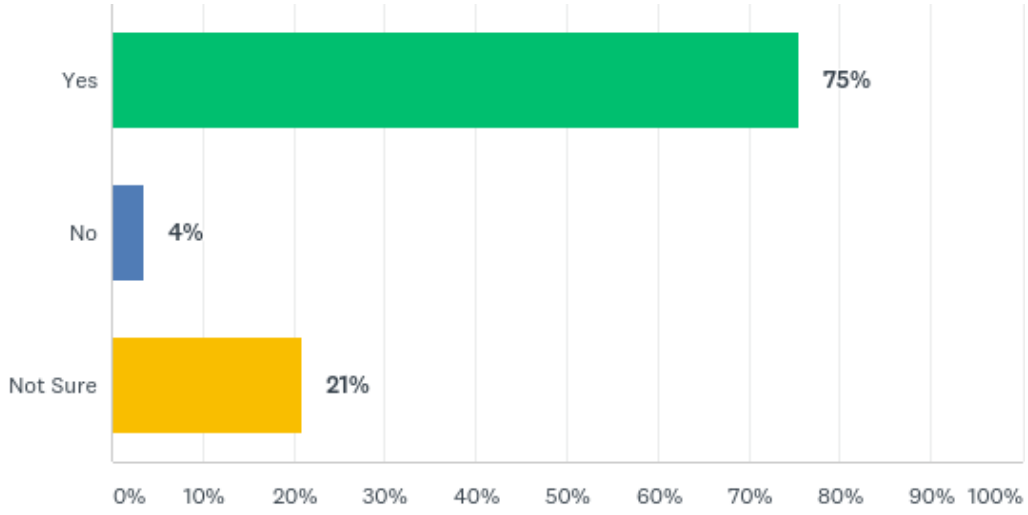
Chart E-1: What positive impacts of the project do you anticipate?



E1.12.4.2 Household Support for Project

Of those interviewed, 75% agree with the proposed project development.

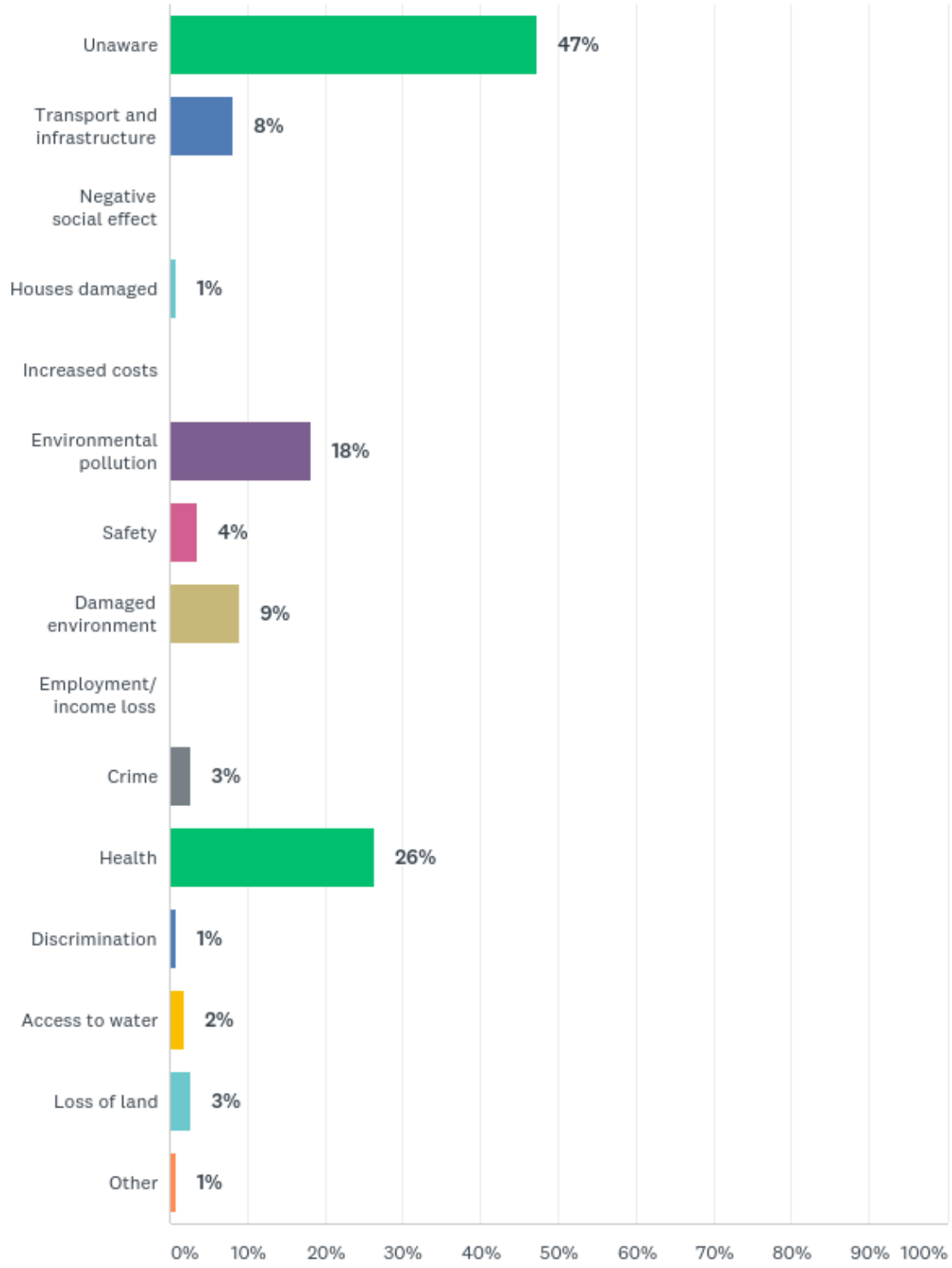
Chart E-2: Do you agree with the project development?



E1.12.4.3 Opinions of Possible Project Impacts

Most of the villagers (47%) were unaware of negative impacts, while 26% are concerned about health, and 18% are concerned about possible environmental pollution.

Chart E-3: What are the three most negative impact of the project that you are concerned about?



E1.12.5 Project Disclosure

At the focus group meetings prior to conducting the socio-economic questionnaires, the villagers were informed that PCMI was planning to conduct exploratory drilling for two wells in the area.

Input from stakeholders consulted during this EIA will be considered and incorporated into the project design and mitigation measures to be presented in the EMP.

PCMI will engage with relevant Township Administrative Officers to discuss the public consultation plan and support needs. The project disclosure was conducted in compliance with EIA Procedure. PCMI Myanmar disclosed the project information to the news and media with an announcement in the Myanmar government owned newspapers. PCMI will disclose the planned project via PCMI website (http://www.petronas.com.my/investor-relations/Pages/OtherReports.aspx) and at PCMI Myanmar Yangon Office.

In addition copies of the submitted draft EIA and Final EIA will be submitted to the Myanaung Township Administrative Office, the General Administrative Office and the Village Administrative Offices situated within the project area.

E1.13 Impact Summary

Following the identification of potential environmental and social impacts, their significance is assessed, taking into account those proposed mitigation measures already incorporated into the design of the project and, where appropriate, any further mitigation measures that are considered feasible and justified. Mitigation measures are applied to eliminate or reduce the extent, duration and or magnitude of a potential impact to an acceptable level. These remaining impacts are described as residual impacts.

The residual risk rankings of the impact assessment of the Exploration Drilling unplanned events on environmental, social, health and unplanned aspects are summarized below in **Table E-4** to **Table E-7**.

Table E-4: Environmental Aspects Residual Risk Rankings

Aspect	Activity	Potential Impact	Residual Significance				
			Pos	No	L	M	H
Land & Habitat Disturbance	Installation of Infrastructure Road construction Camp site construction Well site Construction Well abandonment and site restoration	Disturbance to local topography					
		Soil Disturbance and Erosion					
		Disturbance to local Terrestrial Flora					
		Disturbance to local terrestrial fauna					
		Alteration of surface water hydrology by reducing interception, evaporation/ transpiration and infiltration					
		Localized change in water quality and aquatic habitat					
Vehicle and Rig Movements	Vehicle and Rig Movements	Impacts to terrestrial fauna from vehicle and drilling movement					
Air Emissions	Installation of infrastructure	Deterioration of Air Quality due to dust					
	Drilling Well Testing Flaring	Hydrogen sulphide released					
	Power Generation for Drilling and Flaring Well Testing and Flaring	Minor deterioration of local and regional air quality due to emission of pollutants such as NOx and SOx and CO.					
	Transportation Road Construction and rehabilitation of Drill Site and Camp Site Construction Power Generation for Drilling Flaring	GHG Release contributing to climate change					

Aspect	Activity	Potential Impact	Residual Significance				
			Pos	No	L	M	H
	Fugitive emissions						
Noise	Installation of infrastructure Drilling and infield operations Well Testing and Flaring	Behavioral disturbance to fauna					
Artificial Light	Functional lighting on vehicles and drill rig, camp site and well site Flaring	Potential impact on terrestrial fauna					
		Potential impact on terrestrial flora					
Heat	Flaring	Potential impact on local fauna					
Liquid Waste	Drill site drainage	Localized change in water quality or contaminated soils from oil and grease					
	Sewage and sulllage	Localized nutrient enrichment and pollution of surrounding soil, surface water and ground water					
	Infiltration	Infiltration from the cuttings and dirty water waste pit may deteriorate groundwater quality					
Solid Waste	Disposal of non-hazardous wastes from drilling activities	Contamination of water and soils and injury to fauna					
	Disposal of Hazardous Solid Wastes	Contamination of water and soils and injury to fauna					
Drill Cuttings and Fluids	Disposal of drill cuttings and sludge	Localized change in water quality and soil quality from chemical composition of drill fluids					
	Loss of circulation	Deterioration of shallow and deep groundwater					

Table E-5: Social Aspects Residual Risk Rankings

Aspect	Activity	Potential Impact	Residual Significance				
			Pos	No	L	M	H
Change in Land Use	Purchase of land for access roads, drill and camp site	Loss of agriculture potential Project operation effects on nearby land productivity Loss of employment for displaced workers that do not own land					
Traffic	Transportation of equipment, people and services	Increase in and disruption of local traffic					
Water Use	Water for construction exploration drilling and domestic use	Reduction of local community water supply					
Power Use	Power for drilling operations and work camp	Increase or decrease of available power for local community					
Water Drainage	Surface runoff from roads and camp site	Increased drainage potentially affecting roads and infrastructure					
Wastewater	Project operation effects on water quality	Potential impact to agriculture, aquaculture and fisheries					
Waste Disposal	Disposal of waste in project area	Increased waste disposal overloading local infrastructure					
Tourism and Recreational experience	Project construction and operation effects on tourism and recreation	Disturbance and reduction of tourism and recreational experience					
Employment & Income	Employment & income for nearby communities	Potential increase in jobs and related income for local communities					
Labour In-migration	In-migration of labour and social interaction	Potential conflict between workers from other regions and local communities					
Historical, Archeological & Cultural Resources	Project construction potentially destroying historical and archaeological sites	Loss or damage to historical and archeological sites					

Table E-6: Health Impact Summary

Aspect	Activity	Potential Impact	Residual Significance				
			Pos	No	L	M	H
Dust	Access/upgrade roads, Site construction, Transportation of granular fill, workers, equipment	Respiratory irritation Exacerbation of asthma					
Noise	Generator, Transportation, Construction Drilling	Hearing impairment for workers and Annoyance for public					
Non-hazardous waste	Waste disposal, Leaks/spills, Standing water	Food safety, gastroenteritis Increase in vector-borne diseases: malaria, typhus and dengue and others.					
Mud Chemicals and drilling waste	Mixing of drilling chemicals, Leak/spill of mud chemicals	Acute exposure such as skin irritation, inhalation exposure etc.					
Hazardous Chemicals and waste	Material contaminated with oil or chemicals, Lubricating and hydraulic oil, Drum and containers used for chemical transportation and storage	Acute exposure such as skin and eye irritation, inhalation exposure etc.					
Communicable diseases	Migration/influx of outside workers	Increased incidence and prevalence of HIV/AIDS, hepatitis Band C, syphilis, etc.					
Light and heat	Flaring	Heat exposure Nuisance light					
Flare emissions	Flaring	Increase in respiratory illnesses/diseases Exacerbation of asthma Disturbance psychological wellbeing H2S Fatalities					

Table E-7: Unplanned Events Residual Risk Rankings

Aspect	Activity	Potential Impact	Residual Risk				
			Pos	Neg	L	M	H
Blowout	Drilling	Release of uncontrolled volumes of hydrocarbons Fire Explosion					
Fire or Explosion (not associated with Blowout)	Fuel Storage Flare Testing	Possible explosion or fire of drilling rig or at campsite, or fuel storage area					
Hydrocarbon Chemical or Hazardous Waste/Materials Spill	Storage of chemicals, hazardous materials or waste	Potential risk of spills to the environment affecting air quality, soil quality, surface water, groundwater, biota and people					
Transportation Accidents	Transportation of equipment, personnel, granular fill, mud and cuttings, and waste	Possible injury or death to personnel; and localized contamination of environment					
Earthquakes	Physical shifting of earths surface	Potential physical disruption cause building collapse, blowouts, fires or spills					

Note: S - Significance: 1 Positive, 2 Negligible, 3 Low Impact, 4 Medium Impact, 5 High Impact
P - Probability: A – Remote, B – Unlikely, C – Possible, D – Likely, E – Very Likely

E1.14 Conclusion

All environmental issues are ranked as negligible or low and can be managed to minimize potential impacts. There are two social issues that are ranked as positive, including Change in Land Use and Employment and Income. The residual significance of other social issues are ranked as negligible or low. Water use for the drilling program could potentially impact community water resource supplies. PCMI plans to drill separate water wells for its needs, this could impact nearby community water supplies, if it is from the same source. This potential issue needs to be carefully planned to ensure adequate water resources are available for the project that does not impact the local community.

Two health issues have a medium residual significance ranking including Hazardous Chemicals and Drilling Waste as well as Flare Emissions. A specific waste management plan needs to be prepared to ensure that all wastes are managed to international standards.

Unplanned Events are all ranked as having a low residual risk. To achieve this specific management procedures and training need to be implemented. Drug testing too is recommended, as this is a known issue in the region.

To mitigate the potential for a blowout, a BOP needs to be installed and tested. Drilling procedures need to be carefully implemented. The risk of fire and related explosions requires that regular monitoring and inspection measures are in place, as well as fire extinguishers strategically placed to minimize any damage should a fire occur.

This region has had earthquakes in the past and design considerations need to be taken to minimize the impact of an earthquake should it occur. Site-specific emergency response procedures for all unplanned events need to be in place and training conducted for all staff as appropriate prior to the start of the exploration drilling program.

Recommendations:

The following recommendations are provided:

- Implement recommended stakeholder engagement program at least one month before site construction.
- Prepare a site specific emergency response plan.
- Conduct recommended training program prior to project initiation.
- Evaluate water resource potential to ensure it does not impact local community.
- Identify, cleanup and restore any legacy well sites located within the block.
- Adopt and implement the EMP provided in **Chapter 8**.

2. INTRODUCTION

2.1 Background

PETRONAS Carigali Myanmar Inc. (hereafter called "PCMI") is an Operator of Production Sharing Contract (PSC) of Block IOR-7, which is located in the Central Myanmar, shown in **Figure 2-1**.

IOR-7 lies within the Ayeyarwady Region. The total area of this block is 95 sq. mile or 246 sq. km.

The IOR-7 Block is under an Improved Petroleum Recovery Contract (IPR) that consists of acquiring 300 km line 3D Land seismic data acquisition and drilling of 2 exploration wells within the stipulated 3 years period. The 3D seismic survey operations have been completed. Therefore, this ESHIA covers the planned exploration-drilling program.

International Environmental Management Co. Ltd. (IEM) and local partner Environmental Quality Management Co. Ltd. (EQM) have been contracted by PCMI to prepare an environmental, social, and health impact assessment report (ESHIA) for the proposed Block IOR-7 exploration drilling project ("the Project").

2.2 Project Proponent

Petroliam Nasional Berhad established in 1974, is Malaysia's fully integrated oil and gas multinational ranked among the largest corporations on FORTUNE Global 500®. PETRONAS Carigali Myanmar Inc. (PCMI) a subsidiary of Petroliam Nasional Berhad is the operator of the Production Sharing Contract (PSC) of Block IOR-7. PCMI explores, produces and delivers energy to meet society's growing needs.

PCMI applies innovative approaches to technology, which help unlock and maximise energy sources from even the most remote and difficult environments with operations in over 50 countries around the world.

The PCMI office in Yangon is:

PETRONAS Carigali Myanmar Inc
16, Shwe Taung Kyar Street,
Yangon 11201,
Republic of the Union of Myanmar

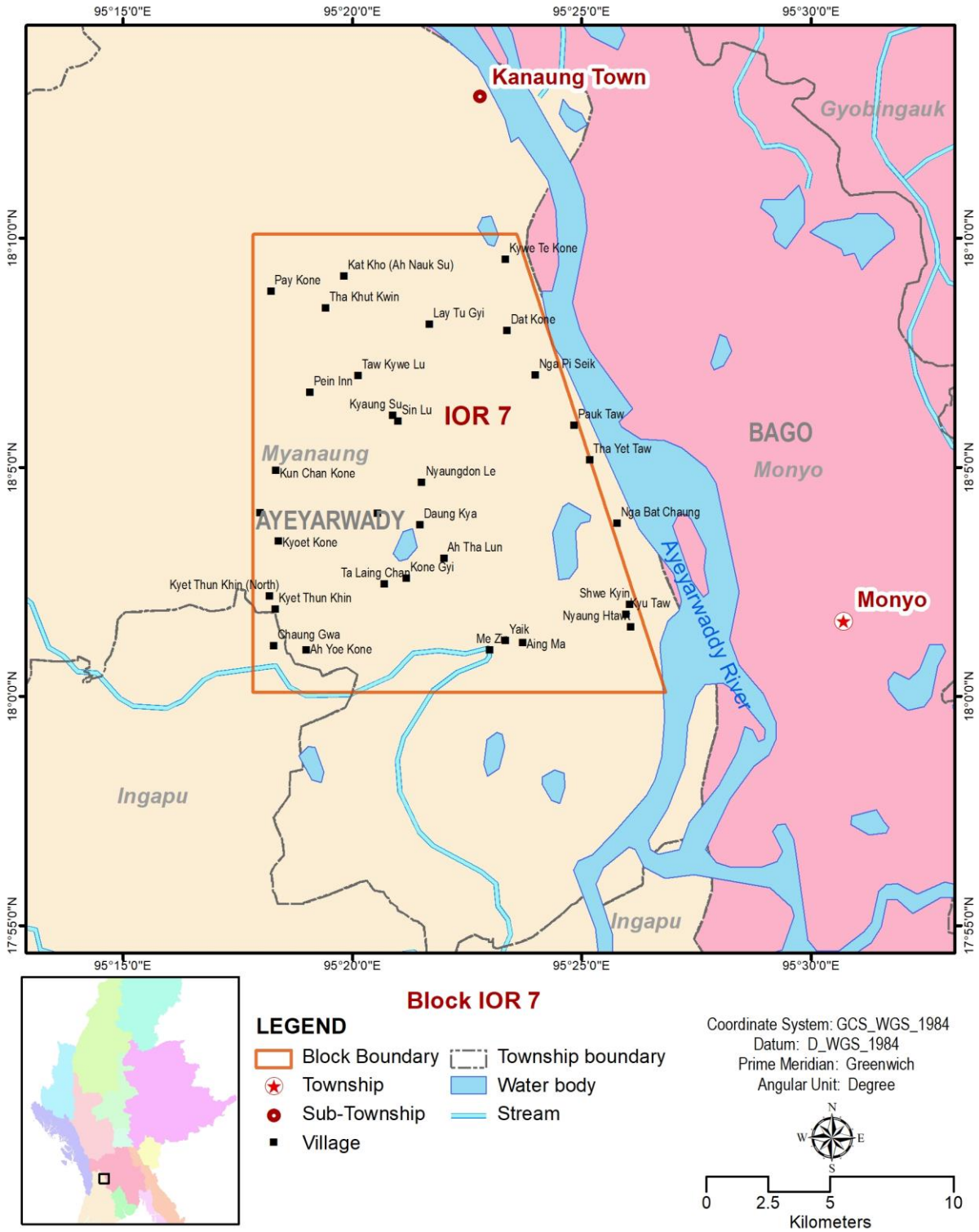


Figure 2-1: Block IOR-7 Location

2.3 ESHIA Objectives

The purpose of this ESHIA Report is to identify and, to the extent possible, quantify the potential negative impacts and positive benefits of the project with respect to the environment, human use values, quality of life and health. Once these impacts have been identified, prevention, mitigation, and monitoring measures will be proposed to minimize impacts.

The specific objectives of this report are to:

- Identify all planned activities and potential unplanned events;
- Establish an environmental, social and health baseline of the project area;
- Identify and assess potentially significant impacts based on existing conditions to:
    - Physical Resources;
    - Ecological Resources;
    - Human-Use Values;
    - Quality-of-Life Values;
    - Health.
- Identify and recommend mitigation measures to minimise potential impacts;
- Recommend a monitoring plan that can track changes in the environment, social issues and health over time and to ensure compliance with Myanmar legislation.

2.4 ESHIA Scope

The environmental, social and health impact assessment report for the Project includes:

- a review of applicable legislation;
- a detailed project description of the proposed exploration drilling program;
- an evaluation of the existing environmental, social and health conditions;
- an environmental, social and health impact assessment, including both the positive and negative impacts during the construction, the operation and the abandonment period;
- proposed mitigation measures to reduce the potential harmful impacts to the nearby environment, social issues, and health; and
- proposed monitoring program to monitor the environmental, social and health quality that may be affected by the Project.

2.5 Study Area

The overall study area of the project will cover a 5-km area of the proposed exploration well site area (both wells will be drilled from a single well pad) in Block IOR-7. The environmental and social baseline data was focused within a 1-km buffer area of the well pad.

The outline of the study area is shown in **Figure 2-2**. The study area will be used to identify sensitive receptors in the assessment of impacts on physical resources, biological resources, human use values, and quality of life values. Examples of sensitive receptors are schools, temples, water resources, residential areas, etc.

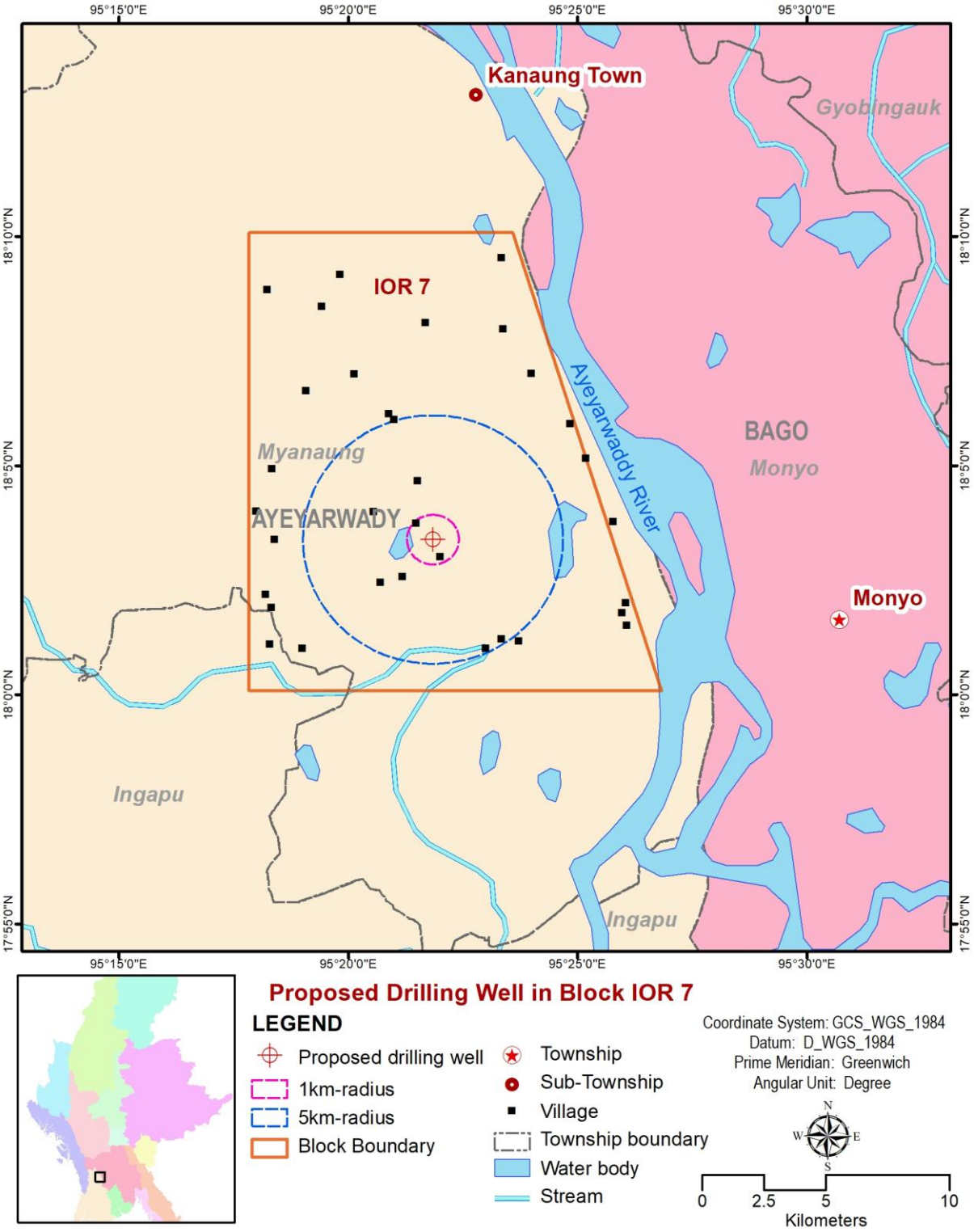


Figure 2-2: IOR-7 Study Area

2.6 ESHIA Methodology

The ESHIA was prepared following the scope outlined in **Section 2.3**. and the methodology provided in **Section 6: Impact Assessment.**

2.6.1 Data Collection

2.6.1.1 Primary Data Sources

Data collected for this EIA include details of the proposed project, environmental baseline, socio-economic setting and health conditions of the potentially affected areas. Data were obtained from primary and secondary sources.

Primary data sources include:

- Environmental quality baseline survey for surface water, groundwater quality, and soil survey conducted on 7 - 13 November 2014;
- Environmental quality baseline survey for noise and air quality survey conducted on 7 - 13 November 2014;
- A historical, archaeological and cultural resources meeting conducted on 7 - 13 November 2014;
- Traditional Ecological Knowledge (TEK) surveys with local farmers which focused on a number of ecological indicators regarding biodiversity and ecological status was conducted on 7 - 13 November 2014;
- Socio-economic surveys conducted on 7 - 13 November 2014; and
- Focus Group meetings with villagers on 7 - 13 November 2014.

Additional primary data collection:

- Environmental quality baseline survey for surface water, groundwater quality, and soil survey conducted on 4 – 6 December, 2017;
- Environmental quality baseline survey for noise and air quality survey conducted on 4 - 6 December, 2017
- A historical, archaeological and cultural resources meeting with Myanaung and Kyangin Township General Administrative Department Authorities conducted on 5 – 6 December, 2017 (No cultural or heritage departmental office is located in the region;) and
- Attitude & Opinion surveys & Focus Group Meetings with villagers conducted on 5 – 6 December 2017.

2.6.1.2 Secondary Data Sources

Secondary data sources came from literature, relevant authorities in the project area. The secondary data sources are cited throughout this report, and listed in the references section.

2.6.2 Policy, Legal and Institutional Framework

A review of all legislation relevant to the undertaking of industrial projects in Myanmar was undertaken during the ESHIA process. The details are presented in **Section 3**.

2.6.3 Project Description

The Project was reviewed in order to gain a full understanding of the project and to compile information on project activities. The Project is described in **Section 4**.

2.6.4 Description of the Environment

Environmental, social and health information was collected and evaluated in the following areas:

- **Physical Environment**: geography, climate, air quality, noise, geology, soil, surface water hydrology, surface water quality, groundwater;
- **Biological Environment**: flora, fauna, aquatic biota, threatened/endangered species, protected areas;
- **Human Use Values:** land use, agriculture and industry, fishery and aquaculture, irrigation and agricultural water sources, water supply, wastewater management, solid waste management, transportation, power supply, electricity and communications;
- **Quality-of-Life Values**: local administration, demographics, socio-economy, archaeological resources, tourism;
- **Health**: health services and public health statistics.

The Environmental Setting is described in **Section 5.**

2.6.5 Impact Assessment

An initial screening assessment of project activities consisted of developing a summary matrix of project activities against environmental, social and health parameters to determine if potential impacts were considered significant or not. If any issues were considered significant, then these were assessed in more detail. Qualitative and quantitative analyses were conducted to assess potential impacts on environmental, social or health receptors that may be caused by the proposed project activities. The impact analysis criteria are summarized in **Section 6**.

The impact assessment also included an assessment of unplanned events. The assessment examines the potential of the project to result in major hazardous events (such as a fire or oil spill from a blow-out) or environmental hazards to impact the project and the environment (such as earthquakes). The risk assessment includes a qualitative and a quantitative evaluation of risks to help further define the probability and potential consequences of these major hazardous events, and to evaluate the significance and the areas that might be impacted by these events. Specific systems for the further management of the significant risks are then proposed. Residual risk was determined after management measures were defined.

2.6.6 Cumulative Impact Assessment

A cumulative impact assessment was completed to identify those environmental, social or health aspects that may not on their own constitute a significant impact but when combined with impacts from past, present or reasonably foreseeable future activities associated with this and/or other projects, result in a larger and more significant impact(s). The cumulative impact is described in **Section 7**.

2.6.7 Mitigation and Monitoring

In the impact assessment, a number of potentially significant impacts were identified. For each of these project activities, mitigation measures were defined to prevent and/or reduce the likelihood or magnitude of impacts and/or to limit the extent of an impact if one does occur. The proposed mitigation measures take into account applicable guidelines, industry practices, expert judgement, design techniques, and operational control.

In addition, environmental monitoring measures were designed to monitor the environment and project activities. The purpose of these monitoring measures is: to evaluate the effectiveness of the mitigation measures that will be put in place; to assess compliance with Myanmar legislation, guidelines and standards; and to compare environmental conditions after implementation of the

project to environmental baseline conditions to document possible change and/or impact. The mitigation and monitoring measures are described in **Section 8**.

2.6.8 Public Consultation & Disclosure

The proposed project includes drilling and testing petroleum hydrocarbons for 2 exploration wells from a single well pad site. The public involvement for this EIA consisted of four parts: meeting with local authorities, focus group meetings, key informant interviews, opinion & attitude surveys with household representatives.

A public involvement was conducted during 5 – 6 December covering 5 villages in Block IOR-7.

MOGE assisted IEM/ PCMI by contacting local officials in each village and making arrangements for our team to meet with them. MOGE too, participated in each focus group meeting and addressed those questions appropriate for the government to answer. The public involvement & disclosure is described in **Section 9**.

2.7 Organization of ESHIA Implementation

The impact assessment was completed by the Myanmar registered consultant companies; International Environmental Management Co. Ltd. (IEM) and Environmental Quality Management Co. Ltd. (EQM). The IEM & EQM consultant registrations are included in **Appendix 1**.

International Environmental Management Co. Ltd
No. 148/B, Dhamma Zedi Road, Bahan Township Yangon

Environmental Quality Management Co. Ltd
No. (233), Block 23, Sayeepin Lane
Thuwunna, Thingungyun Township, Yangon, Myanmar

2.7.1 ESHIA team

The impact assessment was conducted by Myanmar registered consultant companies International Environmental Management Co. Ltd. (IEM) and Environmental Quality Management Co. Ltd. (EQM) The ESHIA assessment team consisted of the individuals described in **Table 2-1.**

Table 2-1: ESHIA Assessment Team

No.	Name	Background / Expertise	Responsibility
IEM			
1	Ron Livingston	1979, Master's Degree in Natural Resources Management, University of Manitoba, Winnipeg, Manitoba, Canada. 1976, B.Sc., University of Manitoba, Winnipeg, Manitoba, Canada.	Senior Environmental Expert
2	Dylan Jenkins	2008, B.Sc. (Biosystems Engineering), University of Manitoba, Canada	Environmental Analyst / Biodiversity
3	Komgrit Prawatlertudom	2009, B. Sc. (Marine Sciences), Chulalongkorn University, Thailand	Environmental Sampling / Aquatic Biology
4	Ubonwan Sintopan	2007, MS. (Natural Resources Management), Asian Institute of Technology, Thailand 2004, B.S. (GEOGRAPHY), Chiang Mai University, Thailand	Environmental Analyst / GIS
EQM			
1	Dr. Ohnmar May Tin Hlaing	2004 -2006, M.Sc in Environmental Engineering and Management, Asian Institute of Technology, Thailand 1986-1996, Bachelor of Medicine and Bachelor of Surgery, Institute of Medicine, Myanmar	Senior Environmental Expert / Local Coordinator
2	Daw Soe Moe Nwe	2013, B.Sc. (Forestry)	Socio-economic Team Leader
3	U Khun Set Thar	2014, University of Forestry, Forestry	Socio-economic Team Leader / Biodiversity Survey
4	U Thiha Htut	2012, Dagon University, Microbiology	Social surveyor
5	Daw Noe Noe Lwin	2014, Myanmar Maritime University, B.E (Naval Architecture)	Social surveyor
6	Daw Thwe Thwe Htun	B.Sc. (Chemistry)	Social surveyor
7	Daw Yoon Mi Mi Thaw	B.Sc. (Chemistry)	Social surveyor
8	U Soe Pyae Htun	2012, Dagon University, Microbiology	Air / Noise
9	U Ye Naung Htun	2013, University of Forestry, Forestry	Air / Noise
10	U Kyaw Ko Ko	2009, Dagon University, Maths	Air / Noise
11	U Win Sithu	2012, Dagon University, (UDE)	Water and Soil Sampling
12	U Zay Zay Ko	Diploma of Electrical Power	Water and Soil Sampling

3. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

This section lists all legislation relevant to the undertaking of industrial projects in Myanmar. The legislation can be divided into two categories as follows:

- PCMI Corporate HSSE Policy (summarized in **Section 3.1**)
- Policy & Legal Framework (**Section 3.2**)
- Contractual and other Commitments (**Section 3.3**)
- Institutional Framework (**Section 3.4**)
- Project's Environmental and Social Standards (**Section 3.5**)

3.1 PCMI Corporate HSSE Policy

PCMI aims to achieve sustainable Health, Safety, Security and Environment (HSSE) performance and ensure everyone goes home safely. The PETRONAS HSE Policy sets out the company commitments in upholding the safety of people, assets and the environment.

The PETRONAS HSE Policy, applicable wherever PCMI operates, ensures every person at his or her vicinity does the right thing, every time. The HSE Mandatory Control Framework and relevant control mechanisms as per the technical standards and Zero Tolerance Rules (ZeTo) translate the PETRONAS HSE Policy into action. Timely due-diligence and risks assessment findings, including intervention plans, are deliberated at the Board Audit Committee for continuous improvements.

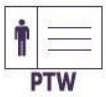
Safety is a shared accountability, where PCMI focus to ensure the reliability of operations and business activities. Alongside robust governance mechanisms, PCMI leverage on the leadership of top management personnel to inculcate stronger HSE discipline and mindset.

PCMI engages closely with stakeholders such as host governments, staff and contractors on relevant HSE matters.

As a responsible employer and operator, the safety of personnel is of utmost importance. The PETRONAS Zero Tolerance Rules, or "ZeTo Rules," are among the many safe systems of work PCMI has in place. ZeTo Rules prescribe 10 mandatory principles which must be adhered to by everyone including third-party personnel at all PETRONAS facilities.

PETRONAS

ZeTa Rules



Work with a valid work permit (PTW) required by the job
Bekerja menggunakan permit kerja (PTW) sah yang diperlukan

Verify energy isolation before starting work
Sahkan pengasingan tenaga sebelum memulakan kerja

Obtain authorisation before overriding or disabling safety critical equipment
Dapatkan kebenaran sebelum memintas atau menghentikan peralatan keselamatan kritikal

Obtain authorisation before entering a confined space
Dapatkan kebenaran sebelum memasuki ruang terkurung

Protect yourself against a fall when working at height
Lindungi diri daripada terjatuh ketika bekerja di tempat tinggi

Use the correct personal protective equipment (PPE) when handling hazardous chemicals
Gunakan peralatan perlindungan diri (PPE) yang betul ketika mengendalikan bahan kimia merbahaya

Obtain authorisation before excavation or entering a trench
Dapatkan kebenaran sebelum melakukan kerja penggalian atau memasuki parit

Do not position yourself under a suspended load
Jangan berada di bawah muatan tergantung

Do not smoke outside designated areas or bring potential ignition sources into process areas without authorisation
Jangan merokok di luar kawasan yang dibenarkan atau membawa masuk sebarang sumber penyalaan (ignition source) ke dalam kawasan pemprosesan tanpa kebenaran

Do not use your mobile phone/walkie-talkie while driving, follow the speed limit and use your seat belt
Jangan gunakan telefon bimbit/walkie-talkie ketika memandu, patuhi had laju dan pakai tali pinggang keledar

3.2 Policy and Legal Framework

3.2.1 Environmental Policy & Framework

Environmental legislation and arrangements for environmental conservation in Myanmar are developing rapidly. As part of Myanmar's reform process that involves the updating and enforcing environmental policy and legislation. The Framework for Economic and Social Reform (FESR 2013) and the National Comprehensive Development Plan (NCDP 2011-2030) continue Myanmar's goal of environmental conservation.

At present, all laws relating to the environment are being formulated and administered by the sectoral ministries and departments concerned. **Section 3.2.2** provides a list of environmental legislation relevant to the Project activities

3.2.2 National Environmental Legislation

The national legislation applicable to the Project comprises the following sources of law, listed hierarchically in accordance with the Constitution and other laws of Myanmar:

- The Constitution of the Republic of the Union of Myanmar (2008);
- The Myanmar Investment Law (2016);
- Myanmar Environmental Conservation Laws (2012);
- Environmental Conservation Rules (2014);
- Environmental Impact Assessment Procedure (2015);
- Draft Administrative Instruction of Environmental Impact Assessment Procedure (2015);
- Draft Environmental Impact Assessment Guidelines for Onshore and Offshore Oil and Gas Developments (December 2015);
- Draft Guideline on Public Participation in Myanmar's EIA Processes (2017);
- National Environmental Quality (Emission) Guideline (2015).

3.2.2.1 The Constitution of the Republic of the Union of Myanmar (2008)

The latest enacted Constitution of the Republic of the Union of Myanmar (May 2008) provides the most up to date information on governing laws and regulations in Myanmar. The Constitution prevails over any other national legislation or international agreements.

It guarantees every citizen equal rights before the law, and requires enactment of necessary laws that recognize citizens' freedom, equality, rights to liberty and justice, benefits, responsibilities, and restrictions (Article 347, and 21 (a) and (d)).

Article (45) states that The Union shall protect and conserve natural environment. Article 390, calls on the duty of its citizens to assist the Union on the following issues:

- preservation and safeguarding of cultural heritage;
- environmental conservation;
- striving for development of human resources;
- protection and preservation of public property.

3.2.2.2 Myanmar Investment Law (2016)

The Myanmar Investment Law, enacted in 2016, vastly simplified the process for investment applications and offers a number of tax breaks, incentives, guarantees, rights and protections for

business ventures. The Myanmar Investment Commission (MIC) is a government-appointed body formed under the Myanmar Investment Law.

The law includes provisions to restrict or prohibit investment activities which affect public health, the environment and ecosystems, which produce toxic waste or which engage with toxic chemicals; duties of investors to conduct business in such a way as to avoid environmental damage, air and water pollution, in accordance with existing laws as per the following sections

Chapter (12) Rights to Use Land, Section 50.

(a) An Investor who obtains a Permit or an Endorsement under this Law has the right to obtain a long-term lease of land or building from the private owned or from the relevant government departments, governmental organizations managed by the Government, or owned by the State in accordance with the stipulations in order to do investment. Citizen investors may invest in their own land or building in accordance with relevant laws.

(d) The investor shall register the land lease contract at the Office of Registry of Deeds in accordance with the Registration Act.

Chapter (13), Section 51

(c) shall appoint only citizens for works which does not require skill;

(d) shall appoint skilled citizen and foreign workers, technicians, and staff by signing an employment contract between employer and employee in accordance with the labor laws and rules;

(e) shall ensure to obtain the entitlements and rights in the labor laws and rules, including minimum wages and salaries, leave, holidays, overtime fees, damages, compensation of the workman, social welfare, and other insurance related to workers in stipulating the rights and duties of employers and employees and occupational terms and conditions in the employment contract;

(f) shall settle disputes arising among employers, among workers, between employers and workers, and technicians or staff in the investment in accordance with the applicable laws.

Chapter (16) Responsibilities of Investors, Section 65. The Investor -

(e) shall immediately inform the Commission if it is found that natural mineral resources or antique objects and treasure trove not related to the investment permitted above and under the land on which the investor is entitled to lease or use and not included in the original contracts. If the Commission allows, the investor shall continue to carry out the investment in such land, and if not allowed, the investor shall transfer and carry out, by obtaining the permission, at the substituted place which is selected and submitted by him;

(g) shall abide by the applicable laws, rules, procedures and best standards practiced internationally for this investment so as not to cause damage, pollution, and loss to the natural and social environment and not to cause damage to cultural heritage;

(i) shall close and discontinue the investment only after payment of compensation to employees in accordance with applicable laws for any breach of employment contracts, closure of investment, sale and transfer of investment, discontinuation of investment, or reduction of workforce;

(j) shall pay wages and salaries to employees in accordance with applicable laws, rules, procedures, directives and so forth during the period of suspension of investment for a credible reason;

(k) shall pay compensation and indemnification in accordance with applicable laws to the relevant employee or his successor for injury, disability, disease and death due to the work;

(l) shall supervise foreign experts, supervisors and their families, who employ in its investment, to abide by the applicable laws, rules, orders and directives, and the culture and traditions of Myanmar;

(m) shall respect and comply with the labor laws;

(n) shall have the right to sue and to be sued in accordance with the laws;

(o) shall pay effective compensation for loss incurred to the victim, if there is damage to the natural environment and socioeconomic losses caused by logging or extraction of natural resources which are not related to the scope of the permissible investment, except from carrying out the activities required to conduct investment in a Permit or an Endorsement.

(p) shall allow the Commission to inspect in any places, when the Commission informs the prior notice to inspect the investment;

(q) shall take in advance a Permit or an Endorsement of the Commission for the investments which need to obtain prior approval under the Environmental Conservation Law and the procedures of environmental impact assessment, before undertaking the assessment. Such investments shall be submitted the situation of environmental and social impact assessment to the Commission during the permitted investment period.

Section 71. In conducting their investment activities, the investor shall carry out health assessments, cultural heritage impact assessments, environmental impact assessments and social impact assessments according to the type of investment activities in accordance with the relevant laws, rules, regulations and procedures.

3.2.2.3 The Environment Conservation Law (2012)

The Environmental Conservation Law (Pyidaungsu Hluttaw Law No. 9 / 2012) has the following objectives:

a) to enable to implement the Myanmar National Environmental Policy;
b) to enable to lay down the basic principles and give guidance for systematic integration of the matters of environmental conservation in the sustainable development process;
c) to enable to emerge a healthy and clean environment and to enable to conserve natural and cultural heritage for the benefit of present and future generations;
d) to reclaim ecosystems as may be possible which are starting to degenerate and disappear;
e) to enable to manage and implement for decrease and loss of natural resources and for enabling the sustainable use beneficially;
f) to enable to implement for promoting public awareness and cooperation in educational programmes for dissemination of environmental perception;
g) to enable to promote international, regional and bilateral cooperation in the matters of environmental conservation;
h) to enable to cooperate with Government departments, Government organizations, international organizations, non-government organizations and individuals in matters of environmental conservation.

The following sections are related to pollution control and penalties:

Section 7 of the law, The rights of the Committee are as follows:

(o) managing to cause the polluter to compensate for environmental impact, cause to contribute fund by the organizations which obtain benefit from the natural environmental service system, cause to contribute a part of the benefit from the businesses which explore, trade and use the natural resources in environmental conservation works;

Section 14. A person causing a point source of pollution shall treat, emit, discharge and deposit the substances which cause pollution in the environment in accord with stipulated environmental quality standards.

Section 15. The owner or occupier of any business, material or place which causes a point source of pollution shall install or use an on-site facility or controlling equipment in order to monitor, control,

manage, reduce or eliminate environmental pollution. If it is impracticable, it shall be arranged to dispose the wastes in accord with environmentally sound methods.

Section 29. No one shall violate any prohibition contained in the rules, notifications, orders, directives and procedures issued under this Law.

3.2.2.4 Environmental Conservation Rules (June 2014)

The Environmental Conservation Rules relating to the Environmental Conservation Law, were enacted in 2014 which contain specific items relating to IEE, EIA and pollution prevention which fall under the powers of the Ministry Natural Resources and Environmental Conservation.

Section 54. The business, department, organization or person who would carry out categories of plan, business or activity stipulated under rule 52:

(a) shall carry out environmental impact assessment for his plan, business or activity;

(b) submit to the Ministry in advance by which organization or person, the environmental impact assessment is intended to be carried out;

(c) submit the environmental impact assessment report to the Ministry.

Section 55. The plan, business or activity which is established before the issue of these rules and responsible to carry out the environmental impact assessment or initial environmental examination shall prepare the environmental management plan in accord with the environmental impact assessment procedure to be issued under the Law and submit to the Ministry. The Ministry shall scrutinize the environmental management plan for approving it. The person who carries out the project, business or activity shall implement the environmental management plan approved by the Ministry and matters stipulated by the Ministry within the time stipulated by the Ministry.

Section 56. The person who carries out any project, business or activity shall arrange and carry out for conducting the environmental impact assessment for any project, business or activity by a qualified third person or organization accepted by the Ministry.

Section 69.

(a) Any person shall not emit, cause to emit, dispose, cause to dispose, pile and cause to pile, by any means, the pollutants and the hazardous waste or hazardous material stipulated by notification under the Law and any of these rules at any place which may affect the public directly or indirectly.

(b) Any person shall not carry out to damage the ecosystem and the natural environment which is changing due to such system, except for carrying out with the permission of the Ministry for the interest of the people.

3.2.2.5 Environmental Impact Assessment Procedure (2015)

Environmental Impact Assessment Procedures have been prepared by MONREC under the Environmental Conservation Law, 2012. It requires that the Project proponent shall include in its evaluation environmental, social and health aspects of the environment, and shall identify and assess all adverse impacts and risks for environment, social issues and, if relevant, health that potentially could arise from the Project. Therefore this law shall be effectively considered an ESHIA procedure framework.

CHAPTER VIII. Environmental Compliance Certificate, Conditions and Revisions to Conditions

Section 87. Upon receipt of the written approval from the relevant authority, the Project Proponent shall commence implementation of the Project strictly in accordance with the conditions attached to the ECC and including the EMP, within such time as may be prescribed by the Ministry.

Responsibility for all Adverse Impacts

Section 102. The Project Proponent shall bear full legal and financial responsibility for:

a) all of the Project Proponent's actions and omissions and those of its contractors, subcontractors, officers, employees, agents, representatives, and consultants employed, hired, or authorized by the Project acting for or on behalf of the Project, in carrying out work on the Project; and

b) PAPs until they have achieved socio-economic stability at a level not lower than that in effect prior to the commencement of the Project, and shall support programs for livelihood restoration and resettlement in consultation with the PAPs, related government agencies, and organizations and other concerned persons for all Adverse Impacts.

Section 103. The Project Proponent shall fully implement the EMP, all Project commitments, and conditions, and is liable to ensure that all contractors and subcontractors of the Project comply fully with all applicable Laws, the Rules, this Procedure, the EMP, Project commitments and conditions when providing services to the Project.

Section 104. The Project Proponent shall be responsible for, and shall fully and effectively implement, all requirements set forth in the ECC, applicable Laws, the Rules, this Procedure and standards.

Section 105. The Project Proponent shall timely notify and identify in writing to the Ministry, providing detailed information as to the proposed Project's potential Adverse Impacts.

Section 106. The Project Proponent shall, during all phases of the Project (pre-construction, construction, operation, decommissioning, closure and post-closure), engage in continuous, proactive and comprehensive self-monitoring of the Project and activities related thereto, all Adverse Impacts, and compliance with applicable laws, the Rules, this Procedure, standards, the ECC, and the EMP.

Section 107. The Project Proponent shall notify and identify in writing to the Ministry any breaches of its obligations or other performance failures or violations of the ECC and the EMP as soon as reasonably possible and in any event, in respect of any breach which would have a serious impact or where the urgent attention of the Ministry is or may be required, within not later than twenty-four (24) hours, and in all other cases within seven (7) days of the Project Proponent becoming aware of such incident.

Section 108. The Project Proponent shall submit monitoring reports to the Ministry not less frequently than every six (6) months, as provided in a schedule in the EMP, or periodically as prescribed by the Ministry.

Section 109. The monitoring reports shall include:

a) documentation of compliance with all conditions;

b) progress made to date on implementation of the EMP against the submitted implementation schedule;

c) difficulties encountered in implementing the EMP and recommendations for remedying those difficulties and steps proposed to prevent or avoid similar future difficulties;

d) number and type of non-compliance with the EMP and proposed remedial measures and timelines for completion of remediation;

e) accidents or incidents relating to the occupational and community health and safety, and the environment; and

f) monitoring data of environmental parameters and conditions as committed in the EMP or otherwise required.

Section 110. Within ten (10) days of completing a monitoring report as contemplated in Article 108 and Article 109 in accordance with the EMP schedule, the Project Proponent shall make such report (except as may relate to National Security concerns) publicly available on the Project's website, at public meeting places (e.g. libraries, community halls) and at the Project offices. Any organization or person may request a digital copy of a monitoring report and the Project shall, within ten (10) days of receiving such request, submit a digital copy via email or as may otherwise be agreed upon with the requestor.

Section 113. For purposes of monitoring and inspection, the Project Proponent:

a) shall grant to the Ministry and/or its representatives, at any time during normal working hours, access to the Project's offices and to the Project site and any other location at which the Project activities or activities related to the Project are performed; and

b) from time to time as and when the Ministry may reasonably require, shall grant the Ministry access to the Project's offices and to the Project site and any other location at which the Project activities or activities related to the Project are performed.

Section 115. In the event of an emergency, or where, in the opinion of the Ministry, there is or may exist a violation or risk of violation of the compliance by the Project with all applicable environmental and social requirements, the Project shall grant full and immediate access to the Ministry at any time as may be required by the Ministry.

3.2.2.6 National Environmental Quality (Emission) Guideline (2015)

MONREC has established environmental quality standards, the National Environmental Quality Standard [Legal Reference: ECL 2012 (Article 2c) and EQS 2016].

Section 1

These national Environmental Quality (Emission) Guidelines (hereafter referred to as Guidelines) provide the basis for regulation and control of noise and vibration, air emissions, and liquid discharges from various sources in order to prevent pollution for purposes of protection of human and ecosystem health.

Section 4

Unless otherwise indicated, these Guidelines refer to emission sources, and are intended to prevent or minimize adverse impacts to environmental quality or human health by ensuring that pollutant concentrations do not reach or exceed ambient guidelines and standards. The Guidelines apply to projects that generate noise or air emissions, and / or that have either direct or indirect discharge of process water, wastewater from utility operations or storm water to the environment.

Section 5

General and industry-specific Guidelines as set out in Annex 1 – Emissions Guidelines shall apply to any project subject to EIA Procedure, as adopted by the Ministry, in order to protect the environment and to control pollution in the Republic of the Union of Myanmar. These Guidelines specifically apply to all project types listed in the EIA Procedure under 'Categorization of Economic Activities for Assessment Purposes' which sets out projects that are subject to EIA or initial environmental examination.

Section 6

Provisions of the general and applicable industry-specific Guidelines shall be reflected in project environmental management plan (EMP) and environmental compliance certificate (ECC) and together constitute a project's commitment to take necessary measures to avoid, minimize and control adverse impacts to human health and safety, and the environment through reducing the total amount of emissions generation; to adopting process modifications, including waste minimization to lower the

load of pollutants requiring treatment; and as necessary, to apply treatment techniques to further reduce the load of contaminants prior to release or discharge.

Section 7

Recognizing that these Guidelines are intended to prevent pollution through reducing the mass of pollutants emitted to the environment, dilution of air emissions and effluents to achieve maximum permitted values is not acceptable. Specified guideline values should be achieved, without dilution, at least 95 percent of the time that a project is operating, to be calculated as a proportion of annual operating hours.

Section 9

As specified in the EIA Procedure, all projects are obliged to use, comply with and refer to applicable national guidelines or standards or international standards adopted by the Ministry. These Guidelines will henceforth be applied by the Ministry in satisfying this requirement until otherwise modified or succeeded by other guidelines or standards.

As specified in the EIA Procedure, following project approval a project shall commence implementation strictly in accordance with the project EMP and any additional requirements set out in the project ECC, which will encompass conditions relating to emissions. In this regard, the Ministry will require that projects adhere to general and applicable industry guidelines as set out in Annex 1.

Section 11

As specified in the EIA Procedure, projects shall engage in continuous, proactive and comprehensive self monitoring of the project and comply with applicable guidelines and standards. For purposes of these Guidelines, projects shall be responsible for the monitoring of their compliance with general and applicable industry-specific Guidelines as specified in the project EMP and ECC.

Section 12

Air emissions, noise, odor, and liquid / effluent discharges will be sampled and measured at points of compliance as specified in the project EMP and ECC.

3.2.2.7 Draft Administrative Instruction of Environmental Impact Assessment Procedure (2015)

In exercise of the power conferred under Section 42 b)of Myanmar Environmental Conservation Law (Law No. 9,2012), the following Administrative Instruction of Environmental Impact Assessment Procedure:

The objectives of the Instruction are to provide a common framework and formats to project proponent/practitioners of relevant study for IEE/EIA type project should be considered as to ensure a minimum quality level of the report sand/or documents to be submitted to the Ministry (i.e. Project Proposal, Scoping Report and TOR, IEE Report, EIA Report and EMP) for Project Proponents and their Study Team.

Section 4. IEE/EIA studies should:

(a) Present the characteristics of a project and its justification;

(b) Describe the environmental and social baseline data of the study area as well as the changes that will occur during and after project implementation;

(c) Analyze project alternatives and define measures that will minimize negative impacts on environmental, social, health and cultural components, and maximize benefits to affected communities; and

(d) Propose environmental, social, health and cultural management and monitoring plans to ensure

that the requests from the government and the commitments of the Project Proponent are implemented.

Section 11. The Project Proposal, IEE Report, Scoping Report and ToR, EIA Report, EMP report and the other documents determined in the EIA Procedure shall be written in Myanmar language or in English language. In case where the reports/documents are written in English language, at least the executive summary of the reports/documents shall be translated into Myanmar language.

Section 12. The every material to be distributed to local stakeholders in Public Consultations Meetings shall be in Myanmar language.

Section 15. Prior to commencement of the IEE investigation, the Project Proponent shall carefully select the consultants from the list of registered consultants published by the Ministry and organize the study team, and inform to the Ministry along with the filled Official Application Form A3 of Annex 6 of this Instruction as to identify the study team, in accordance with Article 32 of the EIA Procedure and Article 32 of the Consultant Registration Scheme for the Concerning Organizations or Persons Undertaking Environmental Impact Assessment and Initial Environmental Examination.

Section 16. Prior to commencement of the EIA investigation, the Project Proponent shall carefully select the consultants from the list of registered consultants published by the Ministry and organize the study team, and inform to the Ministry along with the filled Official Application Form A5 of Annex 6 of this Instruction as to identify the study team, in accordance with Article 45 of the EIA Procedure and Article 32 of the Consultant Registration Scheme for the Concerning Organizations or Persons Undertaking Environmental Impact Assessment and Initial Environmental Examination.

3.2.2.8 Draft Guideline on Public Participation in Myanmar's EIA Processes (2017)

Section 1.2. Objectives and application

a) This Guideline provides an indication of the type, level and approach to public participation expected to give effect to the requirements for meaningful public participation in the EIA Procedure.

b) For the purposes of this Guideline, the term public participation is used to encompass the minimum requirements in the EIA Procedure, and recommendations on good practice that go beyond these minimum requirements, relating to:

(i) information disclosure;

(ii) consultation, including through meetings; and

(iii) the consideration of public views, concerns and inputs at all stages of the EIA process, including the decision-making steps.

c) In accordance with the EIA Procedure, this Guideline applies to the preparation, review, implementation and monitoring of the EIA process, which comprises:

(i) Initial Environmental Examinations (IEEs)

(ii) Environmental Impact Assessments (EIAs) and

(iii) Stand-alone Environmental Management Plans (EMPs)

d) The Guideline has been structured in line with the EIA Procedure and in the following way to enable users to focus on the parts of the EIA process relevant to a particular Project Proposal:

(i) Chapter 1 provides general provisions about the Guideline and its application

(ii) Chapter 2 provides information about planning public participation that should apply to all types of Project Proposals under the EIA Procedure

(iii) Chapter 3 applies to IEE Type Projects

(iv) Chapter 4 applies to EIA Type Projects

(v) Chapter 5 applies to Project Proposals requiring a stand-alone EMP

(vi) Chapter 6 applies to the implementation of all projects that are approved following the EIA process.

e) This Guideline promotes public participation as early as possible in the development of project proposals and undertaking of EIA processes possible in order to maximise the benefits of relationship-building between Project Proponents and local communities.

(i) In this context, while the EIA Procedure does not mandate public participation at the screening step, Project Proponents are encouraged to undertake public participation before and during screening in accordance with the principles and approaches in this Guideline.

(ii) Public participation is also important at this step because the screening decision may result in no further formal EIA process and therefore this may be the only opportunity for communities to contribute to a government decision in the EIA process.

f) This Guideline is to be adapted by Project Proponents, EIA Consultants and government agencies to the particular circumstances when implementing the public participation requirements under the EIA Procedure.

g) The Guideline is also intended to provide all stakeholders, including project affected people (PAP), with an understanding of the type of public participation that can be expected, subject to adaptation to fit the particular circumstances.

h) The Guideline may also be used to guide public participation processes in circumstances where public participation is not legally required, but is recognised to be beneficial to the development of the project proposal and relationships with PAP and other stakeholders.

i) Throughout this Guideline, a reference to a task or responsibility of the EIA Consultant should be understood as applying ultimately to the Project Proponent as the responsible and accountable party.

3.2.3 Project-Relevant Laws

The Myanmar Environmental Conservation Law, Environmental Conservation Rules, Environmental Quality (Emission) Standards are the first step to address all the complex environmental and social management issues faced by Myanmar. A number of other laws exists which, either directly or indirectly, relate to environmental and social management of the project. The other relevant Myanmar government agencies/ requirements applicable to the Project are summarized below:

- The Petroleum and Petroleum Products Law, 2017, Section 8 (m), Section 9 (a, c, d), Section 19(a,b,e), Section 10 (a,c,d,f)
- Public Health Law, 1972
- The Prevention and Control of Communicable Disease Law, 1995
- The Control of Smoking and Consumption of Tobacco Product Law, 2006 (Section 9)
- The Myanmar Fire Force Law, 2015 (Section 25)
- The Protection and Prevention of Antique Objective Law, 2015 (Section 12)
- The Protection and Prevention of Ancient Monument Law, 2015 (Section 12, 20(f) (c), 15(c))
- Employment and Skill Development Law, 2013 (Section 5, 14, 30)
- The Factories Act, 1951 (Before notification that this project is oilfield issued by MOEE)

- The Oilfields Act, 1918
- The Welfare of Labors of Oilfield Act, 1951(After notification)
- The Workmen Compensation Act, 1951
- Labor Organization Law, 2012
- Settlement of Labor Dispute Law, 2012
- Minimums Wages Law, 2013
- Payment of Wages Law, 2016- (3,4,8,7(ii),9,10(a) to e
- Social Security Law, 2012 - 11, 16(a), 48(a), 51(a) (b), 54
- Leaves and Holidays Act, 1951
- The Explosive Act (1887)
- The Explosive Substances Act (1908)
- Fresh Water Fisheries Law, 1991 (Section 40)
- The Motor Vehicles Law, 2015 and Rules, 1987
- Myanmar Insurance Law, 1993 (Section 16)
- Forest Law, 1992 (Section 12)
- Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law 1994
- The Underground Water Act, 1930
- The Farmland Law, 2012 (Section 30)
- The Protection and Prevention of Cultural Heritage Area, 2015 (Section 20, 23, 29(b))
- The Prevention of Danger of Hazardous Chemical and related Substances Law, 2013 (Section 16,17,23,27)
- Import and Export Law, 2012 (Section 7)
- Conservation of Rivers, Creeks and Water Resources Law, 2006 (Section 24 (b), 21(a)(b), 19, 11(a) (b))
- Occupational Safety and Health Law (Draft)

3.2.3.1 Petroleum and Petroleum Products Law, 2017

The Petroleum and Petroleum Products Law (the "PPPL") 2017 was enacted by Pyaydaungsu Htuttaw as Pyaydaungsu Htuttaw Law No. 20/2017 on 1st August 2017 to repeal the Petroleum Act 1934. The PPPL contains the provisions on import and export, transportation, storage, refinery, distribution, inspection and testing of petroleum and petroleum products and issuance of relevant licenses.

Licenses for exportation, importation, transportation, transit, storage, refinery, distribution, testing of petroleum and any petroleum products must be obtained from the MOEE, other relevant Ministries and Any business related with the petroleum products cannot be operated without a relevant license.

3.2.3.2 Public Health Law, 1972

Section 3 of the Public Health Law empowers the Government of the Union of Myanmar to carry out measures relating to environmental health, such as garbage disposal, use of water for drinking and other purposes, radioactivity, protection of air from pollution, sanitation works and food and drug safety.

Provisions to promote and safeguard public health including measures and prohibitions regarding environmental health

Section 9 of this law empowers the Government to carry out measures relating to environmental health, such as garbage disposal, use of water for drinking and other purposes, radioactivity, protection of air from pollution, sanitation works and food and drug safety. However, detailed provisions do not exist to ensure more effective and comprehensive regulation of these areas.

3.2.3.3 The Prevention and Control of Communicable Disease Law, 1995

The Prevention and Control for Communicable Diseases Law (No. 01/1995) (Revised in No. 16/2011) includes Provisions to prevent the outbreak of communicable diseases; regulate environmental sanitation; and measures in the event of a disease epidemic

Section 8

Aim: For the prevention and control of Communicable Disease.

Under the supervision and guidance of the Health Officer of the relevant area, undertake the responsibility of carrying out the following environmental sanitation measures:-

(a) in-door, out-door sanitation or inside the fence outside the fence sanitation;

(b) well, ponds and drainage sanitation;

(c) proper disposal of refuse and destruction thereof by fire;

(d) construction and use of san1tary latrines; and

(e) other necessary environmental sanitation measures.

3.2.3.4 The Control of Smoking and Consumption of Tobacco Product Law, 2006 (Section 9)

The Control of Smoking and Consumption of Tobacco Product Law (No. 05/2006)

Chapter IV - Non-Smoking Areas

Section 6. The following compounds, buildings, rooms and places are non-smoking areas:

(a) hospital buildings, offices, compounds and other buildings in the compound except staff houses and apartments in the hospital compound;

(b) medical treatment centres and clinics;

(c) stadium and indoor playing fields;

(d) children drill sheds and playgrounds;

(e) teaching buildings, classrooms, offices, compounds and other buildings in the compound except staff houses and apartments in the school compound;

(f) teaching buildings of universities, degree colleges, colleges and institutes, classrooms and offices;

(g) opera houses, cinema halls, video halls and other buildings of entertainment;

(h) marts, department stores, stores and market sheds;

(i) museums, archives, public libraries and reading rooms;

(j) elevators and escalators;

(k) motor vehicles and aircrafts for passenger transport;

(l) air-conditioned public rooms;

(m) public auditoriums;

(n) teaching buildings and classrooms of private tuition classes and training schools;

(o) other public compounds, buildings and places prescribed through notification by the Ministry of Health.

Section 7. Places to which the public have access in the following buildings, vehicles and crafts are non- smoking areas except the private offices and rooms. However, specific places where smoking is

allowed, shall be arranged in such areas:

(a) buildings of offices and departments;

(b) buildings of factories and workshops;

(c) buildings of hotels, motels, guest houses and lodging houses;

(d) buildings of railway stations, airports, ports and highway bus terminals;

(e) restaurants;

(f) trains and vessels for passenger transport:

(g) other public buildings, rooms and places prescribed through notification by the Ministry of Health.

3.2.3.5 The Myanmar Fire Force Law, 2015 (Section 25)

The Myanmar fire force law, 2015 covers requirements for fire fighting and fire protection as follows:

Chapter (2)	Section (3-a,b,c,d)	It is covered all the issue of man-made disaster to the nations.
Chapter (8)	Section (15-a,b,c,d), Section (17-a,b,c,d,e,f)	It is covered all the steps how to protect the fire issues
Chapter (11)	Section (24) Section (25-a,b) Section (26) (27), (28), (29), (30), (31), (32), (33)	Issue of Prohibitions and plan how to manage for firefighting
Chapter (12)	Section (34), (35), (36), (37), (38), (39)	Penalties
Chapter (13)	Section (40), (41), (42), (43), (44), (45), (46), (47)	General Information to protect laws regulations and penalties

3.2.3.6 The Protection and Prevention of Antique Objective Law, 2015 (Section 12)

The Protection and Preservation of Antique Objects Law (No. 43/2015) covers requirements for the finding of antique objects.

Section 12. The person who finds any object which has no owner or custodian, he shall promptly inform the relevant Ward or Village-Tract Administrator if he knows or it seems reasonable to assume that the said object is an antique object.

Section 13.

(a) If the information is received under section 12, the Ward or Village- Tract Administrator shall keep the said object as may be necessary and shall forward the information to the relevant Township Administrative Office within 14 days. The Township Administrator shall promptly carry out the necessities and inform the Department within 7 days from the date on which the information is received;

(b) The Department shall inspect whether it is a real antique object or not and keep or cause to keep as may be necessary in accord with the stipulations when the information is received under sub-section (a).

3.2.3.7 The Protection and Prevention of Ancient Monument Law, 2015 (Section 12, 20(f) (c), 15(c))

The Protection and Preservation of Ancient Monuments Law (No. 51/2015)

Section 12. If a person who finds an ancient monument of over one hundred years old and above or under the ground or above or under the water which has no owner or custodian knows or it seems reasonable to assume that the said monument is an ancient monument, he shall promptly inform the relevant Ward or Village-Tract Administrative Office.

Section 13.

(a) If the information is received under Section 12, the Ward or Village- Tract Administrator shall keep the said monument as may be necessary and shall forward the information to the relevant Township Administrative Office within 14 days. The Township Administrator shall promptly carry out the necessities and inform the Department within 7 days from the date on which the information is received.

(b) The Department shall inspect whether it is a real ancient monument or not and keep or cause to protect as may be necessary in accord with the stipulations when the information is received under sub-section (a).

Chapter VII. Applying for prior Permission, Scrutiny and Issue

Section 14. Any Department, any organization or any person desirous of any of the followings shall abide by the provisions of other existing laws and apply for the prior permission under this Law to the Department in accord with the stipulations:

(a) repairing and maintaining the whole or a part of an ancient monument without altering its original form or its original workmanship or altering the boundary of its enclosure;

(e) surveying, digging and researching places where an ancient monument is situated;

Section 15. A person aiming at realizing any of the followings within the specified area of an ancient monument shall apply to get prior permission to the Department:

(b) constructing or extending or repairing new buildings including hotels, factories and residential buildings or fencing or extending a fence;

(c) digging to search petroleum, natural gas, gem or mineral, piping petroleum and natural gas, constructing factories, connecting national grid, constructing communication tower, constructing or extending infrastructures such as road, bridge, airfield, irrigation and embankment;

(d) connecting underground electric cable, communication cable and other underground works;

(f) gold sieving, digging, burning bricks, digging well, lake, creek, ditch, gully, pit digging, refilling, levelling, mining, quarry, gravel digging and unearth sand, removing the mounds and hills which can damage the physical feature of the land;

Chapter VIII Prohibitions

Section 19. No one shall carry out any of the following acts within the specified campus of an ancient monument without the written permission of the Department:

(a) destroying or damaging an ancient monument;

(b) carrying out to alter the original form or the original workmanship of an ancient monument;

(c) digging to search for remains;

(d) looting and removing original elements and artefacts from an ancient monument.

Section 20. No one shall carry out any of the following acts which are assumed to cause damage to an

ancient monument within the specified area of an ancient monument or of a listed ancient monument without a written prior permission:

(b) using machines which causes vibration within the specified place of an ancient monument and running various types of vehicles;

(c) cultivating, gardening, breeding, fencing by blocking nearby an ancient monument or doing any other act which can affect an ancient monument;

(d) emission of gas such as hot-air balloon which can affect an ancient monument;

(e) landing and taking off and, flying aeroplane and helicopter which can directly or indirectly affect an ancient monument;

(f) discarding chemical substance and rubbish which can affect an ancient monument and the environment.

3.2.3.8 The Development of Employees and Expertise (Skill), 2013 (Section 5, 14, 30)

Employment and Skill Development Law (No 29/2013)

Section 5.

(a) (1) If the employer has appointed the employee to work for an employment, the employment agreement shall be made within 30 days. But it shall not be related with government department and organization for a permanent employment.

(2) If pre training period and probation period are stipulated before the appointment the said trainee shall not be related with the stipulation of sub-section (1).

(b) The following particulars shall be included in the employment agreement:

(1) the type of employment;

(2) the probation period;

(3) wage, salary;

(4) location of the employment; (5) the term of the agreement; (6) working hour;

(7) day off, holiday and leave; (8) overtime;

(9) meal arrangement during the work hour;

(10) accommodation;

(11) medical treatment;

(12) ferry arrangement to worksite and travelling;

(13) regulations to be followed by the employees;

(14) if the employee is sent to attend the training, the limited time agreed by the employee to continue to work after attending the training;

(15) resigning and termination of service;

(16) termination of agreement;

(17) the obligations in accord with the stipulation of the agreement;

(18) the cancellation of employment agreement mutually made between employer and employee;

(19) other matters;

(20) specifying the regulation of the agreement, amending and supplementing;

(21) miscellaneous.

(c) The worksite regulations contained in the employment agreement shall be in compliance with any existing law and the benefits of the employee shall not be less than those of the any existing law.

(d) According to the employment agreement, the Ministry shall issue the notification for paying the stipulated compensation to the employee by the employer, if the work is completed earlier than the stipulated period or the whole work or any part of it have to be terminated due to unexpected condition or the work has to be terminated due to various conditions.

(e) The employment agreement made under sub-section (a) shall be related with daily wage workers, piece rate workers who are appointed temporarily in the government department and organization.

(f) The worksite regulations and benefits contained in the employment agreement mutually made between the employer and employee or among the employees shall be amended as necessary, in accord with the existing law.

(g) The employer shall send a copy of the employment agreement made between the employer and employee, to the relevant employment and labour exchange office within the stipulated period and shall get the approval of it.

(h) The employment agreement made before the enforcement of this law shall be confirmed up to the end of the term of the original agreement.

Section 14. The employer shall carry out the training program in accord with the work requirement in line with the policy of the skill development team to develop the skill relating to the employment for the workers who are proposed to appoint and working at present.

Section 30.

(a) The employer of the industry and service business shall put in to the fund monthly as put in fees without fail for the total wages of the subordinates and the supervisors' salary for not less than 0.5%;

(b) Put in money paid under sub-section (a) shall not be deducted from the wage and salary of the employees.

3.2.3.9 The Factories Act, 1951 (Before notification that this project is oilfield issued by MOEE)

The Factories Act, 1951 and Law Amending the 1951 Factories Act -Pyidaungsu Hluttaw Law No. 12/2016 contains provisions for the proper disposal of waste and effluents in factories; treatment of waste water; regulations for health and cleanliness in factories, and the prevention of hazards

Section 23: Fencing of Machinery

(1) In every factory the following shall be securely fenced by safe-guards of substantial construction which shall be constantly maintained and kept in position while the machinery is in operation:-

Section 30: Hoists and Lifts

(1) Every hoist or lift shall be of good mechanical construction, sound material and strength and shall be properly maintained.

(2) Every hoist or lift shall be thoroughly examined by an authorised examiner at least once in every period of six months and a register shall be kept containing the prescribed particulars for every such examination.

(3) Every hoistway or liftway shall be sufficiently protected by an enclosure fitted with gates. The hoist or lift and every such enclosure shall be so constructed as to prevent any person or thing from being trapped between any part of the hoist or lift and any fixed structure or moving part.

(4) The maximum safe working load shall be clearly marked on every hoist or lift and no load greater than that shall be carried thereon.

(5) The cage of every hoist and lift used for carrying persons shall be fitted with a gate on each side which provides access to a landing.

Section 32: Revolving Machinery

(1) In every factory in which the process of grinding and abrading is carried on there shall be permanently affixed to or placed near each machine in use a notice indicating the maximum safe working peripheral speed of every grinding of abrading wheel. The speed of the shaft or spindle upon which the wheel is mounted, and the diameter of the pulley necessary to secure such safe working peripheral speed.

(2) The speeds indicated in notice under sub section (1) shall not be exceeded.

(3) Effective measures shall be taken in the factory to ensure that the safe working peripheral speed of every revolving vessel, cage, basket fly wheel, pulley, discs or similar appliance driven by power is not exceeded.

Section 33 (1): Pressure Plant

(1) If in any factory, any part of the machinery or plant used in a manufacturing process is operated at a pressure above atmospheric pressure, effective

measures shall be taken to ensure that safe working pressure of such parts is not exceeded.

(2) The President may make rules providing for the examination and testing of any plant or machinery refer to in sub section (1) and prescribing such other safety measures in relation thereto as may in his opinion be necessary in any factory or class of factories.

Section 35: Heavy Lifting

(1) No woman adolescent or child shall be employed in any factory to lid or carry or move any load so heavy as to be likely to cause injury.

(2) The President may make rules prescribing the maximum weights that may be lifted, carried or moved ordinarily by persons employed in factories or in any class or description of factories or in carrying on specified process.

Section 37: Protection of Eyes

In respect of any such manufacturing process carried on in any factory as may be prescribed, being a process which involves-

(a) risks of injury to the eyes from particles or fragments thrown off in the course

(b) of the process; or

(c) risk to the eyes of exposure to excessive light, the President may make rules that require that effective screens or suitable goggles shall provide for the protection of persons employed on, or in the immediate vicinity of the process.

Section 37: Protection from Fumes

(1) In any factory no person shall enter or be permitted to enter any chamber, tank, vat, pit, pipe, flue or other confined space in which dangerous fumes are liable to be present to such an extent as to asphyxiate persons, unless it is provided with a man-hole of adequate size, or other effective means of egress.

(2) No portable electric light of voltage exceeding 24 volts shall be permitted in any factory for use inside any confined space referred to in sub-section (1), and where the dangerous fumes present are likely to be inflammable, no lamp or light other than that of flame-proof construction shall be

permitted to be used in such confined space.

(3) No person in any factory shall enter or be permitted to enter any such confined space referred to in sub-section (1) unless all possible measures have been taken to remove any fumes which may be present and to prevent any ingress of fumes and unless either,

(a) a certificate in writing has been given by an authorised examiner, based on a test carried out by himself, that the space is free from dangerous fumes and fit for persons to enter; or

(b) the person entering is wearing a suitable breathing apparatus and a belt securely attached to a rope the free end of which is held by a person standing outside the confined space.

(4) In every factory suitable breathing apparatus, reviving apparatus and belts and ropes shall be kept ready for immediate use in the vicinity of any such confined space which any person has entered. All such apparatus shall be examined at regular intervals and certified by an authorised examiner to be fit for use; and a sufficient number of the persons from amongst the employed in every factory shall be trained in the use of all such apparatus and in artificial respiration.

(5) In any factory no person shall be permitted to enter any boiler, boiler furnace, boiler flue, chamber, tank, vat, pipe, or other confined space for the purpose of working or making any of examination therein until it has been sufficiently cooled by ventilation or otherwise so as to be safe for persons to enter.

(6) The President may make rules prescribing the minimum dimensions of the manholes referred to in sub-section (1), and may by order in writing exempt or subject to such conditions as he may think fit, any factory or class or description of factories from compliance with any of the provisions of this section.

Section 39: Explosive or Inflammable Dust, Fume, Etc.

(1) Where in any factory any manufacturing process produces dust, fume or vapour of such nature and to such an extent as to be liable to explode on ignition. All possible measures shall be taken to prevent any such explosion by -

(a) effective enclosure of the plant or machinery used in the manufacturing process;

(b) removal or prevention of accumulation of dust, fume or vapour;

(c) isolation or effective enclosure of all possible sources of ignition

(2) Where in any factory the plant or machinery used in a process referred to in sub-section (1) is not so constructed as to withstand the force of such an explosion, all possible measures shall be taken to prevent the spread of the explosion and to minimize the damage caused thereby, by providing chokes,

baffles, vents or other effective appliances in the plant or machine.

(3) Where in any factory any part of a plant or machinery that contains any explosive or inflammable fumes and vapour under pressure greater than

atmospheric pressure, such part shall not be opened except in accordance with the following provisions, namely:-

a) before the fastening of any joint of any pipe connected with such part is loosened, any flow of gas or vapour into the part or into any such pipe

shall be effectively stopped by a stop-valve or other means;

b) before any such fastening of any joint or any pipe or the firmly fastened cover is removed, all measures shall be taken to reduce the pressure of

the fume or vapour in the part or pipe to atmospheric pressure;

c) where any such fastening has been loosened or removed effective measures shall be taken to

prevent any explosive or inflammable fume or vapour from escaping from the pipe plant or parts of machinery until such cover or joint has been firmly re-fastened or firmly refixed.

(4) No plant, tank or vessel which contains, or has contained any explosive or inflammable substance, shall be subjected in any factory to any welding, brazing, soldering or cutting operation involving the application of heat, unless adequate measures have been taken to remove such substance and fumes arising therefrom, or to render such substance and fumes non- explosive or non-flammable, and unless a certificate in writing has been given by a competent examiner after a test carried out by himself that the plant, tank, or vessel is free from explosive or flammable vapour. No such substance shall be allowed to enter such plant, tank or vessel after any such operation, until the metal has cooled sufficiently to prevent any risk of igniting the substance.

Section 40: Arrangements to be Made in Case of Fire

(1) Every factory shall be provided with such means of escape in case of fire as may be prescribed, and if it appears to the Inspector that any factory is not so provided, he may serve on the manager of the factory an order in writing specifying the arrangements which, in his opinion, should be carried out to bring the factory into conformity with the provisions of this section and any rules made thereunder, and requiring them to be carried out before a date specified in the order.(2) In every factory the doors affording egress from any room shall not be locked or fastened so that they cannot be easily and immediately opened

from the inside while any person is within the room, and all such doors, unless they are of the sliding type, shall be constructed to open outwards.

(3) In every factory, every window, door or other exit affording a means of escape in case of fire, other than the means of exit in ordinary use, shall be distinctively marked in a language understood by the majority of workers and in red letters or by some other effective and clearly understood sign.

(4) In every factory there shall be installed apparatus to give warning in case of fire clearly audible to every person employed in the factory.

(5) A passage - way giving access to such means of escape in case of fire shall be kept clear for the use of all workers in every room of the factory.

(6) Effective measures shall be taken to ensure that in every factory-

(a) where more than twenty workers are ordinarily employed in any place on the lowest floor, or

(b) where explosive or highly flammable materials are stored or used, all the workers are familiar with the means of escape in case of fire and have been adequately trained in the procedure to be followed in such casee

3.2.3.10 The Oilfields Act, 1918

The Oilfields Act, 1918 and The Law Amending Oilfields Act (34/2010), provides clarification on activities within the oil and gas industry, and provides the Government with the power to define and alter limits of any notified oilfield. In addition, the Government may make rules for regulating all matters connected with many operations related to the extraction of oil and/or gas. The Act also provides guidance and issues such as preventing oil and gas wastes, reporting of fires, accidents and other occurrences and regulating the collection and disposal of both oil and gas.

Section 4.

(1) the Minister for the Ministry of Energy may, by notification, define the jurisdiction of the Managing Director of the Myanmar Oil and Gas Enterprise."

(2) It shall be the duty of a Managing Director of the Myanmar Oil and Gas Enterprise to regulate within his jurisdiction all operations for the winning of oil and gas with a view to preventing waste of

oil and gas and damage to accumulations of oil and gas by the infiltration of water or other causes.

(3) The Minister for the Ministry of Energy may, by notification, appoint General Manager assigned for the relevant notified oilfield to assist the Managing Director of the Myanmar Oil and Gas Enterprise in performing his duties and exercising his power within his jurisdiction.

Section 13.

(1)The President of the Union may make rules for regulating all matters connected with or subsidiary to any operations for the winning of oil 1 or gas or both.

(2) In particular, and without prejudice to the generality of the foregoing power, such rules may-

(a) define the powers and duties of a Managing Director of the Myanma Oil and Gas Enterprise;

(b) direct that any of the powers or duties assigned by this Act or any rule thereunder to the President of the Union shall be exercised or performed, subject to such conditions as may be imposed, by the the Minister, the Ministry of Energy or the Managing Director of the Myanma Oil and Gas Enterprise;

(c) provide for the appointment by operators of responsible local representatives and officers and for the duties to be carried out by such representatives and officers ;

(d) provide for the maintenance by operators of records of all matters relating to the drilling, re-drilling, deepening, shutting down, plugging or abandoning of all wells and for the inspection of such records, and for the supply of copies or abstracts of such records to the Managing Director of the Myanma Oil and Gas Enterprise;

(e) prescribe the maintenance by operators of records relating to the production of oil, gas or water from all wells and for the inspection of such records or the supply of copies or abstracts of such records to the Managing Director of the Myanma Oil and Gas Enterprise;

(f) prescribe the submission by operators of records, reports and statistics relating to any other technical matter connected with or subsidiary to any operations for the winning of oil or gas or both, or the provision of facilities for the inspection of such records by the Managing Director of the Myanma Oil and Gas Enterprise or his representative at the offices of operators;

(g) provide for the prevention of waste of oil or gas and also the prevention of environmental pollution by petroleum operations;"

(h) provide for the detection of the presence of water in wells and for the prevention of the influx of water into oil and gas sands;

(i) for the purpose of preventing waste of oil or gas or damage to oil or gas sands by water or other causes, provide for the regulation of the drilling, re-drilling, deepening, shutting down, plugging and abandoning of wells and for the limitation or prohibition of such operations and for the taking of remedial measures;

(j) for the purposes of preventing waste of oil or gas or damage to oil and gas sands by water or other causes, provide for the regulation of the methods of producing oil or gas and for the limitation or prohibition of such methods and for the taking of remedial measures;

(k) provide for measurement of oil and gas for the assessment of royalty or of any tax:

(l) provide for the conveyance of oil and gas to the place of measurement:

(m) provide for the prevention of the removal of oil or gas without measurement;

(n) provide for the recovery of any royalty or tax ;

(o) regulate the rights of ingress or egress to and from any well- sites, and the right to transport materials, tools or machinery or to lay pipes or wires above or below ground across any well-sites ;

(p) regulate or prohibit all access to any area in which operations for the winning or subsidiary to the

winning of oil or gas or both , are carried on ;

(q) provide that no article or no specified class of article shall be removed from any area in which operations for the winning of oil or gas or both or subsidiary thereto are carried on without a pass in the prescribed form;

(r) provide for the issue, production and surrender of such passes ;

(s) prescribe the manner in which the operator operating the contract area shall demarcate such area and provide for the preservation of the demarcation marks prescribed;"

(t) prescribe the manner in which hand-dug wells shall be protected;

(u) provide for the reporting of fires, accidents and other occurrences ;

(v) prescribe the precautions which operators and their employees shall take so as not to interfere with neighboring operators or their employees or with lines of communication ;

(w) regulate or prohibit the use of naked lights and of lamps other than those of a prescribed description or pattern;

(x) regulate or prohibit smoking and the use or possession of matches;

(y) regulate or prohibit the use of forges and open fires;

(z) regulate or prohibit all or any kind of work by night;

(aa) regulate or prohibit the use of steam-boilers;

(bb) provide for the institution and regulation of fire-brigades, voluntary or otherwise;

(cc) prescribe and regulate the use of lightning conductors;

(dd) prescribe the use of fire-extinguishing apparatus

(ee) prescribe the procedure to be adopted when a fire breaks out;

(ff) provide for the compulsory cessation or limitation of operations of any kind in order to prevent or limit the spread of fires;

(gg) provide for the construction of gate-valves or stop-cocks on flowing wells and their closure on an alarm of fire being given;

(hh) provide for the maintenance of fire-lines ;

(ii) regulate the collection and disposal of oil and gas ;

(jj) regulate or prohibit the use of oil-tanks;

(kk) regulate the position of pipes for the conveyance of oil and provide for the laying of such pipes underground where necessary;

(ll) prescribe the method of dealing with flowing wells;

(mm) provide for the prohibition within or removal from any area of any construction which might in the opinion of the Managing Director of the Myanma Oil and Gas Enterprise cause danger or inconvenience;

(nn) regulate the construction of any rig, derrick, engine- house or similar construction;

(oo) regulate the use of engines and machinery;

(pp) prescribe the use of guards on machinery;

(qq) prescribe the provision and use of safety belts or appliances;

(rr) prescribe the provision and use of safety appliances in connection with the descent of

persons in hand-dug wells;

(ss) prescribe the cases in which, the authorities to whom, and the limitations as to time and other conditions subject to which, an appeal shall lie from an order passed by the Managing Director of the Myanma Oil and Gas Enterprise or by an General Manager assigned for the relevant notified oilfield under this Act

3.2.3.11 The Welfare of Labors of Oilfield Act, 1951 (After notification)

The 1951 Oilfields (Labour & Welfare) Act prescribes a wide range of protection measures for O&G workers, covering health, safety and worker welfare issues. It also covers working hours, holidays and extensive prescriptions on employing children as well as setting up an inspection service, complemented by a range of penalties but it is unclear whether there has been inspection and enforcement of these basic provisions.

3.2.3.12 The Workmen Compensation Act, 1951

Workman's Compensation Act (1923) Amended by Law No 4/2005

Section 10 (A): Power to Require From Employers, Statements Regarding Fatal Accidents

(1) Where a commissioner receives information from any source that a workman has died as a result of an accident arising out of, and in the course of, his employment, he may send by registered post a notice to the workman's employer requiring him to submit, within thirty days of the service of the notice, a statement, in the prescribed form, giving the circumstances of the death.

(2) If the employer is of opinion that he is liable to deposit compensation, he shall make the deposit within thirty days of the service of the notice.

(3) If the employer is of the opinion that he is not liable to deposit compensation, he shall in his statement indicate the grounds on which he disclaims liability.

(4) Where the employer has so disclaimed liability, the Commissioner after such inquiry as he may think fit, may inform any of the dependents of the deceased workman that it is open to the dependents to prefer a claim for compensation, and may give them such other further information as he may think fit.

Section 10 (B): Reports of Fatal Accidents

(1) Where, by any law for the time being in force, notice is required to be given to any authority, by or on behalf of an employer of any accident occurring on his premises which results in death, the person required to give the notice shall, within seven days of the death, send a report to the Commissioner, giving the circumstances attending the death;

(2) Provided that, where the President of the Union has so prescribed, the person required to give the notice may, instead of sending such report to the Commissioner. Send it to the authority to whom he is required to give the notice.

(3) The President of the Union, may by notification in the Gazette, extend the provisions of sub-section (1) to any class of premises other than those coming within the scope of that sub-section, and may by such notification, specify the persons who shall send the report to the Commissioner.

Section 11: Medical Examination

(a) Where a workman has given notice of an accident, he shall, if the employer, before the expiry of three days from the time at which service of the notice has been effected, offers to have him examined free of charge by a qualified medical practitioner, submit himself for such examination; and any workman who is in receipt of a half-monthly payment under this Act shall, if so required, submit himself for such examination from time to time:

(b) If the commissioner considers it necessary for the settlement of any question arising in any proceedings under this Act, he may require a workman who has given notice of an accident to submit himself for examination by a medical practitioner, and the cost of such medical

examination, if any, shall be payable by the employer; Provided that a workman shall not be required to submit himself for examination by a medical practitioner otherwise than in accordance with rules made under this Act or at more frequent intervals than may be prescribed.

(1) If a workman, on being required to do so by the employer under sub-section (I) or by the Commissioner at any time refuses to submit himself for examination by a qualified medical practitioner or in any way obstructs the same, his right to compensation shall be suspended during the continuance of such refusal or obstruction unless, in the case of refusal he was prevented by sufficient cause from so submitting himself.

(2) If a workman, before the expiry of the period within which he is liable under subsection

(1) to be required to submit himself for medical examination voluntarily leaves without having been so examined, his right to compensation shall be suspended until he returns and offers himself for such examination.

(3) Where a workman, whose right to compensation has been suspended under sub-section (2) or sub-section (3), dies without having submitted himself for medical examination as required by either of those sub-sections, the Commissioner may, if he thinks fit direct the payment of compensation to the dependants of the deceased workman.

(4) Where under sub-section (2) or sub-section (3) a right to compensation is suspended, no compensation shall be payable in respect of the period of suspension.

(5) Where an injured workman has refused to be attended by a qualified medical practitioner whose services have been offered to him by the employer free of charge, or having accepted such offer has deliberately disregarded the instructions of such medical practitioner then if it is thereafter proved that the workman has not been regularly attended by a qualified medical practitioner and that such refusal, failure or disregard was unreasonable in the circumstances of the case, and that the injury has been aggravated thereby, the injury and resulting disablement shall be deemed to be of the same nature and duration as they might reasonably have been expected to be if the workman had been regularly attended by a qualified medical practitioner, and compensation, if any, shall be payable accordingly.

3.2.3.13 Labor Organization Law, 2012

The Labour Organization Law, (No. 07/2011) and The Labour Organization Rules, 2012 were enacted to protect the rights of the workers, to have good relations among the workers or between the employer and the worker, and to enable to form and carry out the labour organizations systematically and independently.

Section 3. Every worker, who has attained the age prescribed in respective existing law to work in any trade or activity shall have the right to:

(a) join as a member in a labour organization and to resign from a labour organization according to their own desire;

(b) join as a member only in a labour organization formed according to the category of trade or activity relating to them.

Section 29. The employer shall recognize the labour organizations of his trade as the organizations representing the workers.

Section 30. The employer shall allow the worker who is assigned any duty on the recommendation of the relevant executive committee to perform such duty not exceeding two days per month unless they

have agreed otherwise. Such period shall be deemed as if he is performing the original duty of his work.

Section 31. The employer shall assist as much as possible if the labour organizations request for help for the interest of his workers. However, the employer shall not exercise any acts designed to promote the establishment or functioning of labour organizations under his domination or control by financial or other means.

Section 49. No person shall coerce, threaten, use undue influence or seduce by illegal means any worker to participate or not to participate in a labour organization.

Section 50. No person shall:

(a) interfere or obstruct the executive committees in performing duties and powers contained in this Law;

(b) in respect of labour affairs, carry out demonstrations within 500 yards from hospitals, schools, religious buildings, airports, railways, bus terminals, ports or diplomatic missions and military or police installations.

3.2.3.14 Settlement of Labor Dispute Law, 2012

Settlement of Labour Dispute Law (No. 05/2012) Amended by Law No. 40/2014 was enacted for the settlement of labour disputes:

Section 23. A party, employer or worker, may complain individual dispute relating to his grievance to the Conciliation Body and if he is not satisfied with the conciliation of such body in accord with stipulated manners, may apply to the competent court in person or by the legal representative.

Section 38. No employer shall fail to negotiate and coordinate in respect of the complaint within the prescribed period without sufficient cause.

Section 39. No employer shall alter the conditions of service relating to workers concerned in such dispute at the consecutive period before commencing the dispute within the period under investigation of the dispute before the Arbitration Body or Tribunal, to affect the interest of such workers immediately.

Section 40. No party shall proceed to lock-out or strike without accepting negotiation, conciliation and arbitration by Arbitration Body in accord with this law in respect of a dispute.

Section 41. No person shall carry out lock-out or strike to amend such decision or agreement within the effective period of the decision of the Arbitration Body or the Arbitration Council or any collective agreement.

Section 42. No person shall prohibit the right to work independently of the workers who are not desirous to participate in the strike nor impede the right of a worker to strike.

Section 43. No person shall fail to abide by or carry out any condition contained in agreement concluded before the Conciliation Body in respect of individual dispute or collective dispute.

Section 44. No person, after having informed in advance by the Arbitration Body or Tribunal for settling the dispute, shall fail to arrange to enable to examine the trade under dispute or to produce the documents which is considered by the Arbitration Body or Tribunal that it concerns with the dispute or to appear as a witness when he is so summoned.

Section 45. No person, if he is sent notice for examination before the Arbitration Body or Tribunal, shall fail without sufficient cause to appear in person or to send legal representative within the stipulated period.

3.2.3.15 Minimums *Wages Law, 2013*

The Minimum Wages Law, No. 07/2013 was enacted on 22nd March 2013 (The Minimum Wages Rules, 2013). Section 12 (d) of the law provides that the employer shall pay the minimum wage to the workers working in the commercial, production business and service in cash.

Section 12. The employer:

(a) shall not pay wage to the worker less than the minimum wage stipulated under this Law;

(b) may pay more than the minimum wage stipulated under this Law;

(c) shall not have the right to deduct any other wage except the wage for which it has the right to deduct as stipulated in the notification issued under this Law;

(d) shall pay the minimum wage to the workers working in the commercial, production and service business in cash. Moreover, if the specific benefits, interests or opportunities are to be paid, it may be paid in cash or partly in cash and partly in property, with prevailing regional price, jointly according to the desire of the worker;

(e) in paying minimum wage to the workers working in the agricultural and livestock business, some cash and some property at prevailing regional price may be paid jointly according to local custom or desire of the majority of workers or collective agreement. Such payment shall be for any personal use and benefit of the worker and his family and the value shall also be considerable and fair.

Section 13.

The employer:

(a) shall inform the workers the rates of minimum wage relating to the business among the rates of minimum wage stipulated under this Law and advertise it at the workplace to enable to be seen by the relevant workers;

(b) shall prepare and maintain the lists, schedules, documents and wages of the workers correctly;

(c) shall report the lists, schedules and documents prepared and maintained under sub- section(b) to the relevant department in accord with the stipulations;

(d) shall accept the inspection when summoned by the inspection officer. Moreover, he shall produce the said lists and documents upon asking to submit;

(e) shall allow the entry and inspection of the inspection officer to the commercial, production and service businesses, agricultural and livestock breeding workplaces and give necessary assistances;

(f) if the workers cannot work due to sickness, shall give them holiday for medical treatment in accord with the stipulations;

(g) if the funeral matter of the member of the family of worker or his parent occurs, shall give holiday without deducting from the minimum wage, in accord with the stipulations.

Section 22. Any employer:

(a) shall not fail to pay the workers the minimum wage stipulated under this Law;

(b) shall not pay to the workers less than the minimum wages and other benefits which is entitled by the worker under section 14;

(c) relating to the accounts, schedules, documents and lists of wage of the workers:

(i) shall not make false entry, deceitful recording or false and deceitful reporting;

(ii) shall not fail to report to the relevant department in accord with the stipulations;

(iii) shall not fail to produce when required by the inspection officer;

(d) shall not fail to go and accept inspection when summoned by the inspection officer;

(e) shall not obstruct or interfere with the inspection officer who comes and inspects on duty.

Section 24. Any employer:

(a) shall not violate any term and condition contained in the minimum wage notification;

(b) shall not fail to inform the workers relating to the rates of minimum wage concerning to his workers among the rates of minimum wage stipulated under this Law and announce at the place where the workers are able to see it in the work centre and workplace;

The Minimum Wages Rules, 2013 include:

Chapter 9 - The power and obligations of the employers

Section 43.

The employer:

(a) shall increase the remuneration depending on the skill, to promote the productivity and the

employment skill of the employees;

(b) shall perform in accord with the factory act 1951, leave and holiday act 1951 under section 13 (b) at the law for the list, schedule and document, remunerations;

(c) when the employees are not able to work due to ill health, injury at work site:

(i) if they are under premium paid insurance to the health and social care fund, the insurance under health and social security care 2012, or

(ii) if they are not entitled to enjoy social security law 2012, they must be arranged to enjoy the leave and holiday act 1951.

(d) in the event of family or parents funeral affairs, his entitled remuneration should not be deducted and shall be arranged to enjoy according to leave and holiday act 1951;

(e) before fixing of the minimum wage by the National Committee under this rule, if his remuneration is less than the prescribed amount, he should be paid up to the full amount;

(f) part time, hourly job employees shall be paid the prescribed minimum wage for the working hours;

(g) for the salary employees one day day-off shall be allowed in a week. If he has to work on the off day, overtime wage shall be paid in accord with the existing law;

(h) if the employee has to work less than the prescribed working hour and if it is not due to his will or he has to stop the work due to the shortage of work from the employer, he shall be entitled to enjoy the remuneration as if he has to work full time;

(i) the prescribed minimum wage shall be paid without discrimination of the male or female;

(j) although he has the obligation to pay the minimum wage in cash, separate entitlement, benefit in accord with the stipulation shall be given due to the employee's will, majority of the employees' will, collective consent, in cash or partial in cash or prevailing regional rate or

regional tradition;

(k) overtime work shall be allowed according to the law after negotiation with the employees;

(l) the employee who is not capable to fulfill the standard norm or production norm prescribed

in accord with the factory, workshop, department, shall be trained to be skillful in the probation period. If necessary, the relevant factory, workshop, departments under this law shall be paid for not

less than 50% of the remuneration within three months. In the probation period 75% of the remuneration shall be paid.

3.2.3.16 Payment of Wages Law, 2016- (3,4,8,7(ii), 9, 10 (a) to e

Payment of Wages Law (No 17/2016) covers the following requirements:

Chapter (2)	Section (3-a), Section (4-a,b,Cc-i,c-ii,d, e, f, g) Section (5), (6)	It is covered all the issue of strategies for payment and timeline between Employer and Employee
Chapter (3)	Section (7-a,b,c,d) Section (8) Section (9), Section (10-a,b,c,d,e,f,g,h,i,j,), Section (11-a,b), Section (12-a,b) Section (13)	It is covered all the issue of deducted salary based on different categories.
Chapter (4)	Section (14)	Wages issue related with Overtime
Chapter (6)	Section (19-a,b,c), Section (20-a,b,c), Section (21-a,b,c)	Prosecutions policy issue based on salary and wages
Chapter (7)	Section (22), Section (23)	Prohibitions
Chapter (8)	Section (24), (25),(26), (27), (28), (29), (30)	General Information to protect laws regulations and penalties

3.2.3.17 Social Security Law, 2012 - 11, 16(a), 48(a), 51(a) (b), 54

The objectives of the Social Welfare Law (2012) and accompanying Social Welfare Rules (2014) include providing workers with the right to draw back some of the contributions paid by employers and workers as savings in accordance with the stipulations, and to obtain the right to continue medical treatment, family assistance benefit, superannuation benefit, survivors' benefit, unemployment benefit, the right to residency and ownership of housing after retirement in addition to health care and pecuniary benefit for sickness, maternity, death, employment injury of the workers.

Section 11 of the Social Welfare Law (2012) requires the following establishments to comply with the provisions for compulsory registration with the social security system and benefits (indicated in the Social Welfare Law) if they employ a minimum number of workers as determined by the Ministry of Labour in co-ordination with the Social Security Board: Industries which carry out business whether or not they utilize mechanical power or a certain kind of power; businesses of manufacturing, repairing and servicing; or engineering businesses, factories, warehouses and establishments.

Section 16. (a) The following employers shall effect insurance for the workers working at their establishments by compulsorily registering at the relevant township social security office and contribute to the social security fund contained in clauses (1),(3),(4), and (5) of sub-section (a) of section 15 in accord with the stipulations to enable to enjoy social security benefits:

(i) employers of establishments;

(ii) employers of establishments employing the number of workers, including the relatives of the employers except at least one worker and their wife, husband, children and parents depending upon them, under sub-section(a) of section 11;

(iii) employers of unpaid apprentices and trainees.

Section 48 (a) The employer shall effect insurance by registering for employment injury benefit insurance system contained in section 45 at the relevant township social security office and pay contribution to employment injury benefit fund in accord with stipulations in order that workers applied to provisions of compulsory registration may obtain the employment injury benefits

Section 51. The employer:

(a) shall pay contribution monthly to Employment Injury Benefit Fund at the rates stipulated under section 50. Moreover, he shall also bear the expenses for paying as such;

(b) shall pay defaulting fee stipulated under section 88, in addition to the contribution if fails to contribute after effecting insurance for employment injury benefit.

Section 54

(a) The employer shall report to the relevant township social security office immediately if a serious employment accident occurs to his insured worker. There shall not be any delay without sufficient cause to report as such.

(b) A team of officers and other staff who inspect the establishments, if it is found out the employment injury, death, and contracting disease, shall report to the relevant township social security office in accord with the stipulations.

3.2.3.18 Leaves and Holidays Act, 1951

The Leave and Public Holiday Act, 1951 Amended by Law No. 06/2006 and No. 30/2014 include:

Section 3 (1) Every employee shall be granted by his employer the following public holidays with full wages or pay (as the case may be); namely:

- Independence day – one day
- Full Moon of Tabuang – one day
- Thingyan – three days
- Burmese New Year – one day
- May Day – one day
- Full Moon of Kason – one day
- Resistance Day – one day
- Beginning of Buddhist lent – one day
- Full Moon of Tansaungnom – one day
- National Day – one day

Section 4 (1) Every employee who has completed a period of twelve months continuous service shall be granted earned leave with average wages or average pay for a period of ten consecutive days by his employer during the subsequent period of twelve months.

3.2.3.19 The Explosive Act (1887)

Section 5 (1)

The President of the Union may make rules consistent with this Act to regulate or prohibit, except under and in accordance with the conditions of a licence granted as provided by those rules, the manufacture, possession, use, sale, transport and importation of explosives, or any specified class of explosives.

Section 6

(1) Notwithstanding anything in the rules under the last foregoing section the President of the Union may, from time to time, by notification in the Gazette, prohibit, either absolutely or subject to conditions, the manufacture, possession or importation of any explosive which is of so dangerous a character that, in the opinion of the President of the Union, it is expedient for the public safety to issue the notification.

(2) The officers of sea customs at every port shall have the same power in respect of any explosive with regard to the importation of which a notification has been issued under this section and the vessel

containing the explosive as they have for the time being in respect of any article the importation of which is prohibited or regulated by the law relating to sea customs* and the vessel containing the same; and the enactments for the time being in force relating to sea customs or any such article or vessel shall apply accordingly.

(3) Any person manufacturing, possessing or importing an explosive in contravention of a notification issued under this section shall be punished with fine which may extend to three thousand rupees, and, in the case of importation by water, the owner and master of the vessel in which the explosive is imported shall, in the absence of reasonable excuse, each be punished with fine which may extend to three thousand rupees-

Section 8

Whenever there occurs in or about, or in connection with, any place Notice of in which an explosive is manufactured, possessed or used, or any carriage or accidents. vessel either conveying an explosive or on or from which an explosive is being loaded or unloaded, any accident by explosion or by fire attended with loss of human life or serious injury to person or property, or of a description usually attended with such loss or injury, the occupier of the place, or the master of the vessel or the person in charge of the carriage, as the case may be, shall forthwith give notice thereof to the officer in charge of the nearest police-station.

Section 10

When a person is convicted of an offence punishable under this Act or the rules made under this Act, the Court before which he is convicted may direct that the explosive, or ingredient of the explosive, or the substance (if any) in respect of which the offence has been committed, or any part of that explosive, ingredient or substance, shall, with the receptacles containing the same, be forfeited.11

Section 13

Whoever is found committing any act for which he is punishable under this Act or the rules under this Act. and which tends to cause explosion or fire in or about any place where an explosive is manufactured or stored, or any railway or port, or any carriage, ship or boat, may be apprehended without a warrant by a police officer, or by the occupier of. or the agent or offences. servant of. or other person authorized by the occupier of. that place, or by any agent or servant of, or other person authorized by, the railway administration or conservator of the port, and be removed from the place where he is arrested and conveyed a soon s conveniently may be before a Magistrate.

3.2.3.20 The Explosive Substances Act (1908)

Section 2

In this Act, the expression “explosive substance” shall be deemed to include any materials for making any explosive substance; also any apparatus, machine, implement or material used, on intended to be used, or adapted for causing, or aiding in causing, any explosion in or with any explosive substance; also any part of any such apparatus, machine or implement.

Section 3

Any person who unlawfully and maliciously causes by any explosive substance an explosion of a nature likely to endanger life or to cause serious injury to property shall, whether any injury to person or property has been actually caused or not, be punished with transportation for life or any shorter term, to which fine may be added, or with imprisonment for a term which may extend to ten years, to which fine may be added

3.2.3.21 Fresh Water Fisheries Law, 1991 (Section 40)

Section 3. Freshwater fishery shall be carried out in accordance with the following objectives:

a. to further develop the fisheries;
b. to prevent the extinction of fish;
c. to safeguard and prevent the destruction of freshwater fisheries waters;
d. to obtain duties and fees payable to the State;
e. to manage the fisheries and to take action in accordance with the Law

Section 40. No one shall cause harassment of fish and other aquatic organisms or pollution of the water in a freshwater fisheries waters.

3.2.3.22 The Motor Vehicles Law, 2015 and Rule 1987

The Motor Vehicle Law No. 55/15. The Union Parliament has enacted this law.

Section 49. No one shall do the following in public places:

(a) Driving above the speed limit or below the minimum speed.

(b) Driving a dangerous motor vehicle.

(c) Driving a motor vehicle under the influence of of drugs and intoxicants or alcohol.

Section 54. No one shall do the following:

(c) Driving a motor vehicle loaded above the loading capacity.

(f) Driving a motor vehicle in violation of any provisions of the by-laws related to the pedestrian crossing.

(g) Changing, without legal permission or reasons backed up by evidence, a vehicle to lose its original type and physical appearance, altering parts of machinery equipment, or changing the conditions stated in the motor vehicle inspection certificate.

Section 65. If anyone is found guilty of breaching any provisions stated in the by-laws issued in accordance with this law, he/she shall bare a punishment of a fine worth not more than thirty thousand kyats.

Section 75. The ministry shall include one or all of the following in releasing the by-laws.

(c) Issues relating to the buidling of a motor vehicle, building of a carriage, installation of parts and equipment, and maintenance.

(d) Specifying the type of motor vehicle, the weight and the maximum load.

(f) Private industry of motor vehicle inspection

(h)Matters to be carried out by the responsible person for the driver and motor vehicle in the event of an accident caused by the motor vehicle.

(j) Matters related to the reduction of the enviornmental inpact caused by the motor vehicle.

3.2.3.23 Myanmar Insurance Law, 1993 (Section 16)

Requires any business which may pollute the environment to effect compulsory general liability insurance

Section 16

An entrepreneur or an organization operating an enterprise which may cause loss to State-owned property or which may cause damage to the life and property of the public or which may cause pollution to the environment shall effect compulsory general liability insurance with Myanmar government.

3.2.3.24 Forest Law, 1992

The Burma Forest Act 1902, with amendment made from time to time, had been in use up till the new forest legislation, Forest law 1992, was promulgated by the State Law and Order Restoration Council in November 1992. The new forest law, in line with the Myanmar Forest Policy, focuses on the balanced approach towards conservation and development issues implicit in the concept of sustainable forestry. It decentralizes the management and opens up opportunities for increased private sector involvement in timber trade. Highlighting environmental and biodiversity conservation, the law encourages community forestry and people's participation in forest management to meet the basic needs of the rural people, but prescribes severe punishments for forest offences. In addition, the MOF has promulgated the Forest Rules in 1995.

Provisions to conserve water, soil, biological diversity and the environment; sustain forest produce yields; protect forest cover; establish forest and village firewood plantations; sustainably extract and transport forest products

Section 3. This Law shall be implemented in accordance with the following basic principles: -
(a) to implement the forestry policy of the Government;

(b) to implement the environmental conservation policy of the Government;

(c) to promote the sector of public co-operation in implementing the forestry policy and the environmental conservation policy of the Government;

(d) to develop the economy of the State, to contribute towards the food, clothing and shelter needs of the public and for perpetual enjoyment of benefits by conservation and protection of forests;

(e) to carry out in accordance with international agreements relating to conservation of forests and conservation of environment;

(f) to prevent the dangers of destruction of forest and bio-diversity, outbreak of fires, infestation of insects and occurrence of plant disease;

(g) to carry out simultaneously conservation of natural forests and establishment of forest plantations;

(h) to contribute towards the fuel requirement of the country.

3.2.3.25 Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law 1994

Under the Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law, 1994, hunting without licence, breeding protected animals without permission, causing water and air pollution, poisoning water, possessing, selling, transporting or transferring wildlife or any part thereof without permission are treated as actionable crimes. The punishments are more severe for those offences committed against protected wildlife. The Law exempts the possessing of any part of a normally protected or seasonally protected wildlife as a souvenir or wearing as a traditional custom, the possessing or wearing of any part of a completely protected animal with a certificate or registration, possessing, use, sale, transport or transfer of a drug prepared from a part of a protected wildlife species.

A total of 45 protected areas have been established in Myanmar. The natural areas for protection are categorized as follows:

- Scientific Nature Reserve;
- National Park;
- Marine National Park;
- Nature Reserve;
- Wildlife Sanctuary;

- Geo-physically Significant Reserve; and
- Other Nature Reserve as determined by the Minister.

The Protection of Wild Life and Wild Plants and Conservation of Natural Areas Law, No. 6/1994 and Rules on Protection of Wildlife and Protected Area Conservation Law (2002)

Provisions on the protection of fauna and flora and their habitat (including living and non-living organisms, migratory and endangered species); the conservation of natural areas; guidelines for scientific research; and the establishment of zoological and botanical gardens

Section 3

The objectives of this Law are as follows:

- To implement the policy of the Government of protecting wild life and wild plants;
- To implement the policy of the Government of conserving natural areas;
- To carry out, in accordance with International Conventions adopted by the State, in respect of the preservation of wild life and wild plants, living and non-living organisms and migratory birds;
- To protect wild life and wild plants in danger of extinction and the habitats thereof;
- To contribute towards works of natural scientific research; and
- To protect wild life and wild plants by the establishment of Zoological gardens and botanical gardens.

The Protection of Wildlife and Protected Areas Rule 2002 provide provide the sustainability of ecosystems, habitats and biodiversity

3.2.3.26 The Underground Water Act, 1930

The Underground Water Act, 1930 provides measures for systematic and sustainable use of underground water and prohibitions on accessing and using underground water without a license

Whereas it is expedient to conserve and protect underground sources of water supply in the Union of Burma; it is hereby enacted as follows:

Section 1. This Act extends to such areas as the President of the Union may, by notification,1 direct and shall apply only to tubes exceeding a depth to be prescribed by the President of the Union: Provided that the President of the Union may prescribe different depths for different local areas.

Section 3. No person shall sink a tube for the purpose of obtaining underground water except under and in accordance with the terms of a licence granted by the water officer.

Every person owning a tube which was in existence before the extension of this Act to the local area concerned shall apply to the water officer for a licence for the said tube, and such licence shall be granted free of charge.

Section 4.

(1) Any Magistrate taking cognizance of an offence under section 3 may at any time order the tube in respect of which the offence has been or is alleged to have been committed to be forthwith closed until such time as a licence for the same has been taken out in accordance with the provisions of the said section.

(2) If the order for the closure of a tube under sub-section (1) is not complied with, the Deputy Commissioner, Subdivisional Officer or Township Officer exercising jurisdiction over the local area concerned may cause the said tube to be closed, and the expense of such closure shall be recoverable from the owner of the tube as if it were an arrear of land-revenue.

Section 5. Every person obtaining or attempting to obtain underground water shall supply the water officer with such information as the President of the Union may by rule prescribe.

3.2.3.27 The Farmland Law, 2012 (Section 30)

Section 9. The following rights shall be enjoyed in connection with the right for farming:

(a) right to have such land in hand, right for farming and gain benefit of such farm;

(b) right to sell, pawn, lease, exchange, or donate, in whole or in part of the right for farming in accord with prescribed disciplines;

(c) disputes arising out of inheritance of farmland shall be decided upon by the law respective court in accord with existing law;

(d) the duration of the right for farming shall continue so long as the stipulated conditions are not breached;

(e) land development operation are to be carried out by doing joint-venture with the investment of rural cooperative association or private investors;

Section 14. A person who has the permission of right for farming should not be sold, pawned, leased, exchanged or donated to any foreigner or organization containing foreigner without the permission of State Government.

Section 30. In respect of the application to utilize the farmland for other purposes in the interest of the public:-

(a) The Central Farmland Management Body shall give permission to utilize the paddy land for other purposes, with the recommendation of the Region or State Farmland Management Body;

(b) The respective Region or State Government shall give permission to utilize the farmland for other purposes except paddy land, with the recommendation of the Region or State Farmland Management Body

3.2.3.28 The Protection and Prevention of Cultural Heritage Area, 2015 (Section 20, 23, 29(b))

The Protection and Preservation of Cultural Heritage Region Law, 1998 *Amended by Law. No.1/2009*

Provisions to protect ancient sites and regions and cultural heritage areas from any adverse impacts due to industrialization, tourism and urbanization

Section 20. No person shall carry out any of the following in the cultural heritage region:-

(a) destroying an ancient monument;

(b) willfully altering the original ancient form and structure or original ancient workmanship of an ancient monument;

(c) excavating to search for antiquities;

(d) exploring for petroleum, natural gas, precious stones or minerals.

Section 23. No person shall plough and cultivate or carry out any activity which may cause damage to the cultural heritage within the boundary notified by the Department in the cultural heritage region.

Section 29.

(a) The provision of sub-section (d) of section 20 shall not apply to the drilling of petroleum or natural gas and mining of precious stones or minerals for the benefit of the State in the cultural heritage region.

(b) If any circumstance arises for the drilling of petroleum or natural gas and mining of precious stones or minerals in the cultural heritage region for the benefit of the State, it shall be submitted to the Government and permission shall be requested.

3.2.3.29 The Prevention of Danger of Hazardous Chemical and related Substances Law, 2013 (Section 16,17,23,27)

The Prevention of Hazard from Chemicals and Related Substances Law was enacted on 26th August 2013. The objectives of this Law include: protecting natural resources from decrease and loss, and safeguarding living things from endangerment caused by chemical and chemical related substances; and systematically controlling safety in carrying out approved chemical and associated materials businesses. The Law requires continuous development of worksite safety, health and environmental conservation.

The Prevention of Hazard from Chemicals and Related Substances Law (2013) defines Chemical as: imposing danger to the health or life of man or animal or chemical element, chemical compound and chemical mixture which cause bad consequences to the environment naturally or appearing after created by man. This definition includes the vapour, liquid, waste materials of oily and solid which act chemically and technically.

Section 16. A person who has obtained a licence:-

(a) shall abide the licence regulations;

(b) shall perform to abide strictly the instructions for being safety in using the chemical and related substances by himself and also the persons who serve the work;

(c) shall keep the required safety equipment enough in the chemical and related substances businesses, furthermore shall grant the personal protection equipment and dresses free of charge to the working persons;

(d) shall make the course of training and study and instruction if necessary to the working persons for using the occupational safety equipment, the personal protection equipment and the dresses

systematically in the chemical and related substances business;

(e) shall be inspected by the respective Supervisory Board and Boards of Inspection in respect of whether or not the hazard may impact on the Human Being and Animals' health and the environment;

(f) shall make medical check up the working persons who will work in the chemical and related substances business and shall permit to serve in that work after obtaining the recommendation that his health is suitable for that work. This medical check up records shall be kept systematically;

(g) shall send the copy of informative letter of the permission to the respective Department of Township Administration, if the hazardous chemical or related substances are permitted to store;

(h) shall acquire in advance the guidance and agreement of the respective Department of Fire Brigade, if the business that is worried to fire hazard is operated by using the fire hazard substances or the explosive substances;

(i) shall transport only the permitted amount of the chemical and related substances in accordance with the prescriptive stipulations, if they are transported in local;

(j) shall take the permission from the Central Supervisory Board if the chemical and related substance is altered and transferred from one place to any other place which contained in the license;

(k) shall abide and perform in accordance with the related environmental laws not to impact and damage to the environment in operating the chemical and related substances business.

Section 17. A person who has obtained a licence, shall put the insurance in accordance with the prescriptive stipulations to be able to pay the compensation, if the impact and damage is occurred on

the Human Being and Animals or the environment in respect of the chemical and related substances businesses.

Section 23. A person who has obtained the registration certificate:-

(a) shall apply to register again, to the Central Supervisory Board if the chemical and related substances, which are not contained in the registered list, are used;

(b) shall inform and submit the unused chemical and related substances list to the Central Supervisory Board, although which are contained in the registered list.

Section 27. A person who has obtained the licence to be complied the following matters to control and decrease the hazard of the chemical and related substances:-

(a) classifying the hazard level to protect in advance the hazard according to the properties of the chemical and related substances;

(b) expressing the Material Safety Data Sheet and Pictogram;

(c) providing the safety equipments, the personal protection equipments to protect and decrease the accident and attending to the training to be used systematically;

(d) performing in accordance with the stipulations in respect of transporting, possessing, storing, using, discharging the chemical and related substances;

(e) not being imported or exported the chemical and related substances banned by the Central Supervisory Board and the machinery and equipments which are used them.

3.2.3.30 Import and Export Law, 2012 (Section 7)

Chapter IV Prohibitions

Section 5. No person shall export or import restricted, prohibited and banned goods.

Section 6. Without obtaining license, no person shall export or import the specified goods which is to obtain permission.

Section 7. A person who obtained any license shall not violate the conditions contained in the license.

3.2.3.31 Conservation of Rivers, Creeks and Water Resources Law, 2006 (Section 24 (b), 21(a)(b), 19, 11(a) (b))

The Conservation of Water Resources and Rivers Law (2006) was promulgated on 2nd October 2006. The aims of this Law are as follows:

- To conserve and protect the water resources and rivers system for beneficial utilisation by the public;
- To ensure smooth and safe waterways navigation along rivers and creeks;
- To contribute to State economic development through improving water resources and river systems; and
- To protect environmental impact.

Section 11. No person shall:

(a) dispose of engine oil, chemical, poisonous material and other materials which may cause environmental damage, or dispose of explosives from the bank or from a vessel which is plying, vessel which has berthed, anchored, stranded or sunk.

(b) catch aquatic creatures within river-creek boundary, bank boundary or waterfront boundary with poisonous materials or explosives.

Section 19. No one shall dispose of any substance into the river-creek that may cause damage to

waterway or change of watercourse from the bank or vessel which is plying, vessel which has berthed, anchored, stranded or sunk.

Section 21. No one shall:

(a) build lavatories unsuitable to the urban and rural community lifestyle in the bank area and watercourse area.

(b) drill well or pond or dig earth without the permission of the Directorate.

Section 24. No one shall:

(a) violate the conditions relating to navigation of vessels in rivers and creeks prescribed by the Directorate for conservation of water resources, rivers and creeks.

(b) violate the conditions prescribed by the Directorate so as not to cause water pollution and change of watercourse in rivers and creeks.

3.2.3.32 The Vacant, Fallow and Virgin Lands Management Law (2012) and Fallow and Virgin Lands Management Rules (2013)

This bill sets out who the Central Committee is, and what their role is - to coordinate with MONREC, and other concerned Ministries for the prevention of damage and destruction to the forest land, including Reserved Forest, and Protected Public Forest; and for conservation of natural regions, watershed area and natural fisheries. The Central Committee shall permit the right to do, (and) right to utilize land of vacant, fallow and virgin land in the country, for the following purposes:

(a) Agriculture;

(b) Livestock Poultry Farming and Aquaculture;

(c) Mining;

(d) Government allowable other purposes in line with law.

The term "Virgin land" means "land which may be new land or other wood land in which cultivation was never done before. It may have forest, bamboo or bushes, and includes the land which has been cancelled legally from Reserved Forest, grazing ground, and fishery pond land respectively for Agriculture, Livestock Poultry Farming and Aquaculture, Mining, and Government allowable other purposes in line with law".

3.2.3.33 Notification No. 37/2014 for usage and handling of substances that deplete the ozone layer

Order relating to the usage and handling of substances that deplete the ozone layer.

Paragraph 3 of this Order indicates that any individual or organization who intends to import or export ozone-depleting substances or products and/or which are used by ozone-depleting substances must apply to MONREC.

3.2.3.34 Land acquisition (1894)

The very important and, still, frequently applied Land Acquisition Act (1894) empowers the state to acquire land where it is needed for any public purpose. The Act provides for the relevant procedures for land take, including

(i) the amount of notice to be given to the occupiers of the land to be acquired;

(ii) procedures for handling objections to acquisition;

(iii) the method to be used to establish land valuations;

(iv) the process for taking possession of land;

(v) court processes and appeals to resolve disputes;

(vi) procedures for the temporary occupation of land; and

(vii) procedures for acquiring land for private entities.

PART VII - ACQUISITION OF LAND FOR COMPANIES

Section 38. (1) The President of the Union may authorize any officer of any company desiring to acquire land for its purposes to exercise the powers conferred by section 4.

(2) In every such case section 4 shall be construed as if for the words "for such purpose" the words "for the purposes of the company" were substituted; and section 5 shall be construed as if after the words "the officer" the words "of the company" were inserted.

Section 38A. An industrial concern, ordinarily employing not less than one hundred workmen owned by an individual or by an association of individuals and not being a company, desiring to acquire land for the erection of dwelling houses for workmen employed by the concern or for the provision of amenities directly connected therewith shall, so far as concerns the acquisition of such land, be deemed to be a company for the purposes of this Part, and the references to company in sections 5A, 6, 7, 17 and 50 shall be interpreted as references also to such concern.

Section 39. The provisions of sections 6 to 37 (both inclusive) shall not be put in force in order to acquire land for any company unless with the previous consent of the President of the Union, nor unless the company shall have executed the agreement hereinafter mentioned.

Section 40. (1) Such consent shall not be given unless the President of the Union be satisfied, either on the report of the Collector under section 5A, sub-section (2), or by an enquiry held as hereinafter provided:

(a) that the purpose of the acquisition is to obtain land for the erection of dwelling houses for workmen employed by the company or for the provision of amenities directly connected therewith, or

(b) that such acquisition is needed for the construction of some work, and that such work is likely to prove useful to the public.

(2) Such enquiry shall be held by such officer and at such time and place as the President of the Union shall appoint.

(3) Such officer may summon and enforce the attendance of witnesses and compel the production of documents by the same means and, as far as possible, in the same manner as is provided by the Code of Civil Procedure in the case of a civil Court.

Section 41. If the President of the Union is satisfied, after considering the report, if any, of the Collector under section 5A, sub-section (2), or on the report of the officer making an enquiry under section 40, that the purpose of the proposed acquisition is to obtain land for the erection of dwelling houses for workmen employed by the company or for the provision of amenities directly connected therewith, or that the proposed acquisition is needed for the construction of a work and that such work is likely to prove useful to the public, he shall require the company to enter into an agreement with the Government, providing to the satisfaction of the President of the Union for the following matters, namely:-

(1) the payment to Government of the cost of the acquisition; (2) the transfer, on such payment, of the land to the company; (3) the terms on which the land shall be held by the company;

(4) where the acquisition is for the purpose of erecting dwelling houses or the provision of amenities connected therewith, the time within which, the conditions on which and the manner in which the dwelling houses or amenities shall be erected or provided; and

(5) where the acquisition is for the construction of any other work, the time within which and the conditions on which the work shall be executed and maintained, and the terms on which the public shall be entitled to use the work.

Section 42. Every such agreement shall, as soon as may be after its execution, be published in the Gazette, and shall thereupon (so far as regards the terms on which the public shall be entitled to use the work) have the same effect as if it had formed part of this Act:

3.2.4 International Environmental Conventions, Protocols and Agreements

Myanmar has ratified several international and regional conventions. Those relevant to the project are provided in **Table 3-1**.

Table 3-1: International and Regional Agreements and Conventions

No.	Conventions	Year (Ratified/ Acceded/Accepted)
Environment		
1	Plant Protection Agreement for the Southeast Asia and Pacific Region, Rome 1956	1959 (Ratified)
2	ICAO: ANNEX 16 to the Convention on International Civil Aviation Environmental Protection Vol. I and II, Aircraft Noise and Aircraft Engine Emission	Accession
3	Agreement on the Networks of Aquaculture Centres in Asia and the Pacific, Bangkok 1988	1990 (Accession)
4	Vienna Convention for the Protection of the Ozone Layer, Vienna 1985	1993 (Ratification)
5	Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal 1987	1993 (Ratification)
6	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London 1990	1993 (Ratification)
7	United Nations Framework Convention on Climate Change (UNFCCC), New York 1992	1994 (Ratification)
8	Convention on Biological Diversity, Rio de Janeiro 1992	1994 (Ratification)
9	The Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris 1972	1994 (Acceptance)
10	International Tropical Timber Agreement (ITTA), Geneva 1994	1996 (Ratification)
11	United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought, Paris 1994	1997 (Accession)
12	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Washington DC 1973; and as amended in Bonn, Germany 1979	1997 (Accession)
13	ASEAN Agreement on Conservation of Nature and Nature Resources, Kuala Lumpur, 1985	1997 (Signatory)
14	Kyoto Protocol to the Convention on Climate Change, Kyoto 1997	2003 (Accession)
15	ASEAN Agreement on Trans-boundary Haze Pollution	2003 (Ratification)
16	Stockholm Convention on Persistent Organic Pollutants (POPs), 2001	2004 (Accession)
17	Ramsar Convention on Wetlands of International Importance	2005 (Accession)
18	Establishment of ASEAN Regional Centre for Biodiversity	2005 (Signatory)
19	Declaration on ASEAN Heritage Parks	2003 (Signatory)
20	International Treaty on Plant Genetic Resources for Food and Agriculture, 2001	2004 (Ratification)
21	Catagena Protocol on Biosafety, Cartagena, 2000	2001 (Signatory)
Social, Labour and Health		
22	Universal Declaration of Human Rights (UNDHR)	signed
23	Convention on the Rights of the Child	1991 (acceded)
24	Convention on Elimination of All Forms of Discrimination against Women (CEDAW)	1997 (acceded)

No.	Conventions	Year (Ratified/ Acceded/Accepted)
25	Relevant ILO Conventions in force in Myanmar: • C1 Hours of Work (Industry) • C14 Weekly Rest (Industry) • C2 Unemployment Convention, 1919 (No. 2) • C6 Night Work of Young Persons (Industry) Convention, 1919 (No. 6) • C11 Right of Association (Agriculture) Convention, 1921 (No. 11) • C14 - Weekly Rest (Industry) Convention, 1921 (No. 14) • C17 Workmen's Compensation (Accidents) • C18 - Workmen's Compensation (Occupational Diseases) Convention, 1925 (No. 18) • C19 Equality of Treatment (Accident Compensation) • C21 - Inspection of Emigrants Convention, 1926 (No. 21) • C26 - Minimum Wage-Fixing Machinery Convention, 1928 (No. 26) • C29 Forced Labour Convention • C42 Workmen's Compensation (Occupational Diseases) Revised 1934 • C52 Holidays with Pay • C63 Convention concerning Statistics of Wages and Hours of Work, 1938 (No. 63)Excluding Parts III and IV • C87 Freedom of Association and Protection of the Right to Organize • C182 - Worst Forms of Child Labour	

3.2.5 International Standards & Guidelines

The Project will also follow International Environmental guidelines and standards including World Bank /IFC (International Finance Corporation) Guidelines & Industry Standards as detailed in **Table 3-2**.

Table 3-2: International Guidelines

Applicable International Standards & Guidelines	
1	Equator Principles (2013)
2	International Financial Cooperation/ World Bank (IFC/WB) General Environmental Health and Safety (EHS) Guidelines (April 30, 2007) including sub-sections: •Environmental •Occupational Health and Safety •Community Health and Safety •Construction and Decommissioning
3	IFC Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development (2017).
4	IFC Performance Standards on Environmental and Social Sustainability (2012);
5	IFC/EBRD Guidance on Workers' Accommodation (2009)

3.3 Contractual and other Commitments

The Project will comply with the Myanmar Environmental Conservation Law, Environmental Conservation Rules, Environmental Quality (Emission) Standards and all necessary international standards. PCMI makes the following commitments:

- The project will comply with commitments, mitigation measures and management plans stated in the EIA report.

- The company is responsible for its actions and omissions and those of its contractors, subcontractors, officers, employees, agents, representatives, and consultants employed, hired, or authorized by the company acting for or on behalf of the Project.
- Support programs for livelihood restoration and resettlement in consultation with the PAPs, related government agencies, and organizations and other concerned persons for all Adverse Impacts.
- Fully implement the EMP, all Project commitments, and conditions, and is liable to ensure that all contractors and subcontractors of the Project comply fully with all applicable Laws, the Rules, this Procedure, the EMP, Project commitments and conditions when providing services to the Project.
- Be responsible for, and shall fully and effectively implement, all requirements set forth in the ECC, applicable Laws, the Rules, this Procedure and standards.
- Timely notify and identify in writing to the Ministry, providing detailed information as to the proposed Project's potential Adverse Impacts.
- Respect and comply with the customs, traditions and traditional culture of the ethnic groups in the Union;
- Abide by the terms and conditions, stipulations of special licenses, permits, and business operation certificates issued to them, including the rules, notifications, orders, and directives and procedures issued by the MIC and the applicable laws, terms and conditions of contract and tax obligations;
- Carry out in accordance with the stipulations of the relevant department if it is, by the nature of business or by other need, required to obtain any license or permit from the relevant Union Ministries government departments and governmental organizations, or to carry out registration;
- Immediately inform the Commission if it is found that natural mineral resources or antique objects and treasure trove not related to the investment permitted above and under the land on which the investor is entitled to lease or use and not included in the original contracts.
- To inform the village administrative office and the Department of Historical Research if any historical thing is found during the project operations.
- Abide by the applicable laws, rules, procedures and best standards practiced internationally for this investment so as not to cause damage, pollution, and loss to the natural and social environment and not to cause damage to cultural heritage;
- Close and discontinue the investment only after payment of compensation to employees in accordance with applicable laws for any breach of employment contracts, closure of investment, sale and transfer of investment, discontinuation of investment, or reduction of workforce;
- Pay wages and salaries to employees in accordance with applicable laws, rules, procedures, directives and so forth during the period of suspension of investment for a credible reason;
- Pay compensation and indemnification in accordance with applicable laws to the relevant employee or his successor for injury, disability, disease and death due to the work;
- Supervise foreign experts, supervisors and their families, who employ in its investment, to abide by the applicable laws, rules, orders and directives, and the culture and traditions of Myanmar;
- Respect and comply with the labor laws;
- Have the right to sue and to be sued in accordance with the laws;

- Pay effective compensation for loss incurred to the victim, if there is damage to the natural environment and socioeconomic losses caused by logging or extraction of natural resources which are not related to the scope of the permissible investment, except from carrying out the activities required to conduct investment in a Permit or an Endorsement.
- Ensure equal rights for local workers and avoid salary bias, i.e. ensure that local and foreign workers have the same salary at the same level.
- Ensure that all foreign employees apply for the proper work permit and visa through the Myanmar Investment Commission (MIC).
- Provide rights and benefits including but not limited to, leave, holidays, overtime pay, compensation and social security. Most of the relevant particulars are in the Myanmar Companies Act.
- Settle disputes, within the law, between workers, employers, consulting experts or any other personnel involved in the business operation.

3.4 Institutional Framework

The aim of this Chapter is to describe the Administrative and political divisions of Myanmar.

3.4.1 Administrative Divisions

Myanmar is a multi-ethnic country composed of over 130 ethnic groups, and viewing macroscopically, in the central part of the country from north to south along Ayeyarwady River resides the largest group covering 70% of the total population, Bamar, and in mountainous area in east and west reside most of the minorities.

Myanmar has a three levels administrative structure, as described below.

The first level subdivision includes:

- Seven states;
- Seven regions (regions were previously referred to as "divisions", prior to August 2010);
- Five self-administered zones;
- One self-administered division;
- One union territory.

States and regions are divided into districts. Districts consist of townships, which are composed of towns, wards and village-tracts, that are groups of adjacent villages. The administrative structure of the states, regions and self-administering bodies is defined in the Constitution.

Each region and state has a Regional/State Government, consisting of a Chief Minister, Ministers and an Advocate General. Legislative authority resides with the State/Regional "Hluttaw" (a parliament or legislative body), which are made up of elected civilian members and representatives of the military.

The Constitution states that Naypyidaw is a Union Territory under the direct administration of the President. The Naypyidaw Council, led by a Chairperson, carries out general functions on behalf of the President. The Chairpersons of the Naypyidaw Council are appointed by the President, and include civilians and representatives of the military.

Self-Administered Zones and Self-Administered Divisions are administered by a Leading Body, which is headed by a Chairperson, and has executive and legislative powers. The Leading Body consists of elected State/Regional Hlutttaw members and military personnel.

Block IOR-7 is located in Myanaung and Ingapu Townships in Hinthada District in the Ayeyarwady Region of Myanmar. The Hinthada District has the following Townships:

- Hinthada Township
- Zalun Township
- Lemyethna Township (Laymyethna)
- Myanaung Township
- Kyangin Township
- Ingapu Township

3.5 Project's Environmental and Social Standards

MONREC has established environmental quality standards, the National Environmental Quality Standard [Legal Reference: ECL 2012 (Article 2c) and EQS 2016]. ECD / MONREC have indicated that the discharge standards shown in **Table 3-3** are applicable for Onshore Oil and Gas activities. These are in accordance with international standards.

Table 3-3: Myanmar Discharge Standards Applicable to Onshore Oil and Gas activities

Guideline	Standard
Drilling fluids and cuttings	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines
Produced sand	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines
Produced water	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines for discharge to surface waters or to land: – Total hydrocarbon content 10 mg/L – pH 6-9 – Biochemical oxygen demand 25 mg/L – Chemical oxygen demand 125 mg/L – Total suspended solids 35 mg/L – Phenols 0.5 mg/L – Sulfides 1 mg/L – Heavy metals (total)a 5 mg/L – Chlorides 600 mg/L (average), 1,200 mg/L maximum
Hydrotest water	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines for discharge to surface waters or to land, apply standards specified for Produced Water
Completion and well work- over fluids	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines For discharge to surface waters or to land: – Total hydrocarbon content 10 mg/L – pH 6-9
Storm water drainage	Storm water runoff should be treated through an oil / water separation system able to achieve oil and grease concentration of 10 mg/L
Cooling water	The effluent should result in a temperature increase of no more than 3°C at edge of the zone where initial mixing and dilution take place; where the zone is not defined, use 100 m from point of discharge
Sewage	Treatment as per General EHS Guidelines, including discharge requirements
Air emissions	Treatment as per General EHS Guidelines Emission concentrations as per General EHS Guidelines, and: – Hydrogen sulfide 5 mg/Nm^3

a Heavy metals include: Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, Vanadium and Zinc

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). They are designed to provide relevant industry background and technical information. This information supports actions aimed at avoiding, minimizing, and controlling EHS impacts during the construction, operation, and decommissioning phase of a project or facility.

The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs (Environmental Health and Social Guidelines, IFC 2007).

Table 3-4: Applicable IFC EHS Guidelines

Environmental topic	Applicable EHS Guidelines
Air quality	Section 1.1 provides guideline applies for facilities or projects that generate emissions to air at any stage of the project life-cycle. It presents information about common techniques for emissions management. This guideline provides an approach to the management of significant sources of emissions, including specific guidance for assessment and monitoring of impacts. Additional information on approaches to emissions management in projects located in areas of poor air quality, where it may be necessary to establish project-specific emissions standards are included. These Guidelines include the following key recommendations: • facilities and projects should avoid, minimize, and control adverse impacts to human health, safety, and the environment from emissions to air; • impacts should be estimated through qualitative or quantitative assessments by the use of baseline air quality assessments and atmospheric dispersion models to assess potential ground level concentrations; • the dispersion model applied should be internationally recognized, or comparable (examples of acceptable emission estimation and dispersion modelling approaches for point and fugitive sources are reported in these guidelines); • emissions from point sources should be avoided and controlled according to good international industry practice (GIIP) applicable to the relevant industry sector, depending on ambient conditions, through the combined application of process modifications and emissions controls (examples are provided in these guidelines); • a monitoring system should be implemented. For ambient air quality IFC refers to WHO Guidelines (Air Quality Guidelines Global Update, 2005.)
Noise and vibration emissions	Section 1.7 provides standards for daytime and night time noise emissions (for residential and industrial environments, WHO 1999) and recommends that noise prevention and mitigation measures are implemented with regard to predicted noise levels at sensitive receptors. Noise monitoring may be carried out for the purpose of establishing the existing ambient noise levels in the area of the proposed facility or for verifying operational phase noise levels. A key priority should be the implementation of noise control measures at source; the selected methods will depend on the source type and the proximity of sensitive receptors, and can include: equipment selection, acoustic enclosures, vibration isolation, traffic route selection, other.
Wastewater and Liquid effluent quality	Section 1.3 provides guidelines applied for projects that have either direct or indirect discharge of process wastewater or wastewater from utility operations. Section 1.3 provides guidelines for treatment approaches of process wastewater and wastewater from utility operations. These Guidelines include the following key recommendations: • points of discharge, rate of discharge, chemical use, dispersion and environmental risk should be considered in a disposal plan; • discharges should be planned away from environmentally sensitive areas, with specific attention to high water tables, vulnerable aquifers, wetlands, and community receptors, including water wells and intakes.
Waste management	Section 1.6 provides guidelines for projects/facilities that generate, store, or handle any quantity of industrial hazardous or not hazardous waste. Section 1.6 provides appropriate guidelines for hazardous waste storage, transport, treatment and disposal, in order to prevent harm to health, safety and environment. These Guidelines include the following key recommendations: • waste management should be addressed through a Waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring; • in addition to the implementation of waste prevention strategies, the total amount of waste may be significantly reduced through the implementation of recycling plans; • if waste materials are still generated after the implementation of feasible waste prevention, reduction, reuse, recovery and recycling measures, waste materials should be treated and disposed and all measures should be taken to avoid potential impacts to human health and the environment.

4. PROJECT DESCRIPTION

4.1 Introduction

PETRONAS Carigali Myanmar Inc. (hereafter called "PCMI"), MOGE with local partner UNOG Company Limited and Petroleum Brunei Myanmar have jointly invested in on-shore block IOR-7.

The Petroleum Sharing Contract (PSC), between PCMI and MOGE was signed and effective on 16th Sept 2014 in Naypyidaw, in the Republic of the Union of Myanmar. This chapter discusses the proposed two well exploration drilling campaign.

PCMI's exploration drilling program in Block IOR-7 includes drilling 2 exploration wells. The expected spud date in November 2018. The exploration well will be drilled as a vertical well with conventional hole technique. The exploration drilling will be conducted with a typical land-drilling rig. The two exploration wells will be drilled from the same well-pad location.

All of the contractors and sub-contractors will be in compliance with the environmental and social commitments established by PCMI.

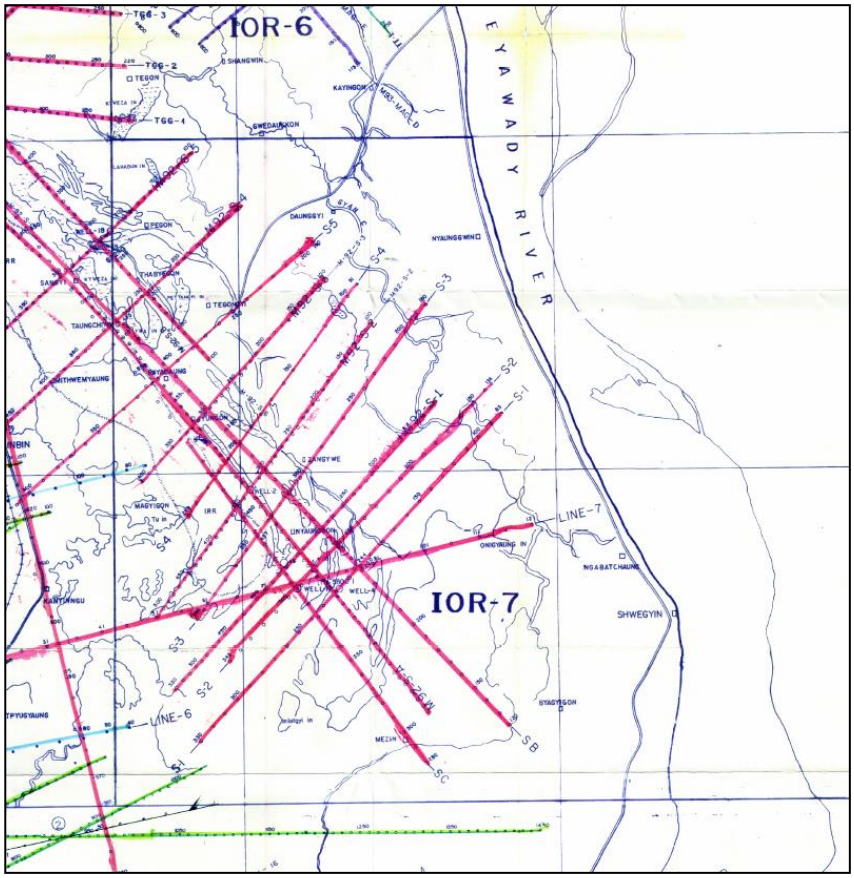
4.2 Purpose and Objectives of Project

PETRONAS Carigali Myanmar Inc. (PCMI) plans to drill two exploration wells in Block IOR-7. The primary objective of the onshore exploration-drilling project in Block IOR-7 is to acquire information on stratification and to explore potential reserves. If reservoirs are discovered, further studies on chemical and physical properties of petroleum, age of reservoirs, rock characteristics, porosity, permeability in the formation and others will be conducted. Oil/Gas are the types of petroleum product anticipated from this exploration drilling. If a sustained commercial flow rate of the potential reservoirs is established, PCMI will prepare and submit a separate ESHIA report for the production drilling campaign to MONREC for their consensus under the requirements of the Myanmar Environmental Conservation Law.

4.3 History and Petroleum Activity within Block IOR-7

4.3.1 Seismic Acquisition History

The existing historic data seismic data consists of Gravity data (1963) and an unknown amount of 2D Seismic (1963-92) acquired between by MOGE in the block. The existing seismic locations are shown in **Figure 4-1**.



Source: PCMI, 2018

Figure 4-1 Existing 2D Seismic Lines in Block IOR-7

4.3.2 Exploration Drilling History

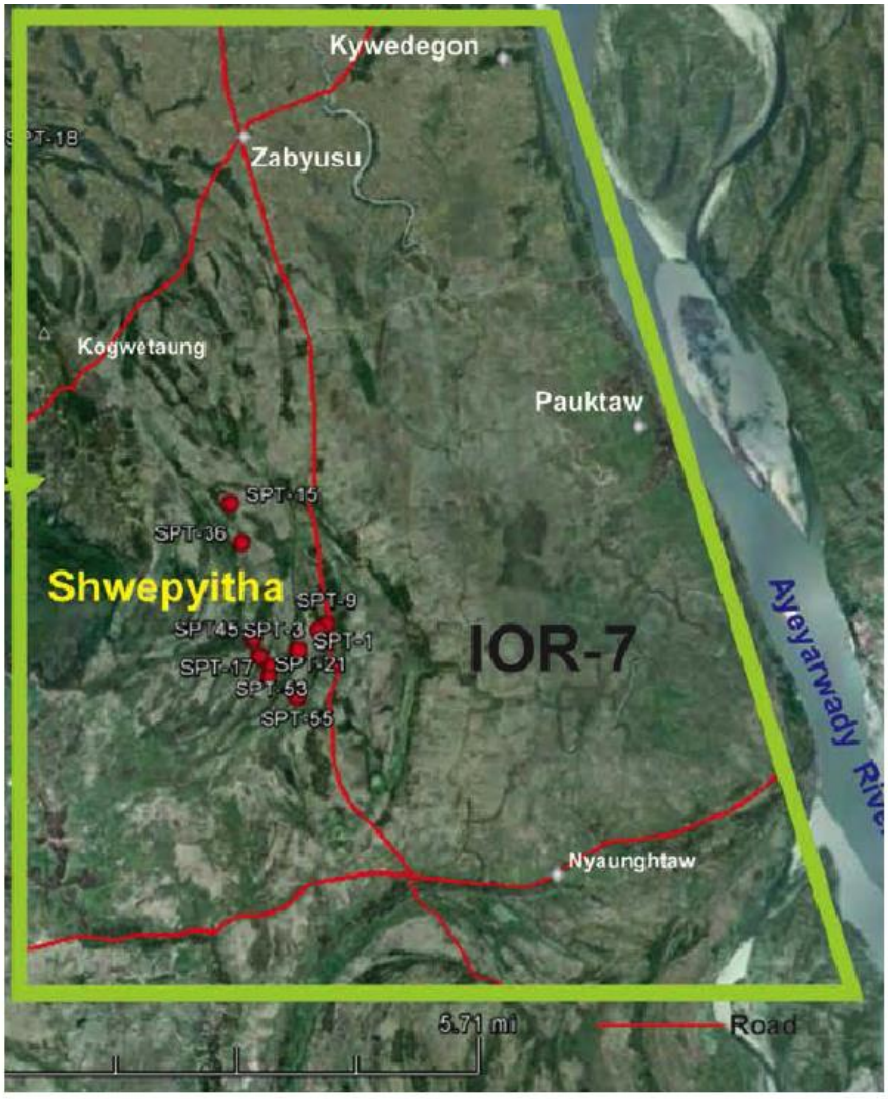
The Shwepyitha Field was discovered in 1976. It is known to be a Thrusted anticline (Shwepyitha), with x-faults play. There are some 59 wells drilled in the block.

The details of the historic drilling are shown in **Table 4-1** and **Figure 4-2**.

Table 4-1: Drilling History in Block IOR-7

Operator	MOGE
HC Discovery, Drilled wells	• 1976 (well No.1) • 59 wells • 42.1-61.2 deg. API (Condensate)
Drilling Problem	Presence of high pressure sands
Structure	Thrusted anticline (Shwepyitha), with x-faults

Source: PCMI, 2018



Source: PCMI, 2018

Figure 4-2: Historic Exploration Areas in IOR-7

4.3.3 Production History

Shwepyitha Oil & Gas field was discovered in 1967. There are some 70 wells drilled, 93.5 KM line of Gravity data and 255 KM line of 2D seismic data existing in the block. It is known to be a Middle Miocene Sandstone Oil play. The deepest well drilled is SPT#1 which was TD at 11540 ft. The field achieved its peak production of 1250 BOPD in 1991.

Shwepyitha field is still currently in production. It is producing 120 BBL of Oil and 0.786 MMSCF of Gas from 14 producing wells.

Shwepyitha Field has the following:

- Oil & Gas produced from supra-thrust & sub-thrust sands (22 payzones) of Mid Miocene Kyaukkok Fm.
- OIIP : 13.6 MMST
- GIIP: 181,850 BCF
- Cum.Prod: 3.8 MMBO, 91.8 MMSCF (2010)
- Peak Production: 1250 BOPD (1991)

Current Production: 100 BOPD (from 9 wells)

4.3.4 PCMI Seismic Acquisition

A 3D onshore seismic survey was carried out in onshore Block IOR-7, Myanmar under a geophysical contract between PCMI and Sinopec Services Myanmar Office. Under the Agreement, Sinopec Services Myanmar Office acquired data on a turnkey basis, directly controlling recording, drilling, survey/positioning and all subcontractor services. The acquisition started on 17th December 2015 and finished on 5th May 2016.

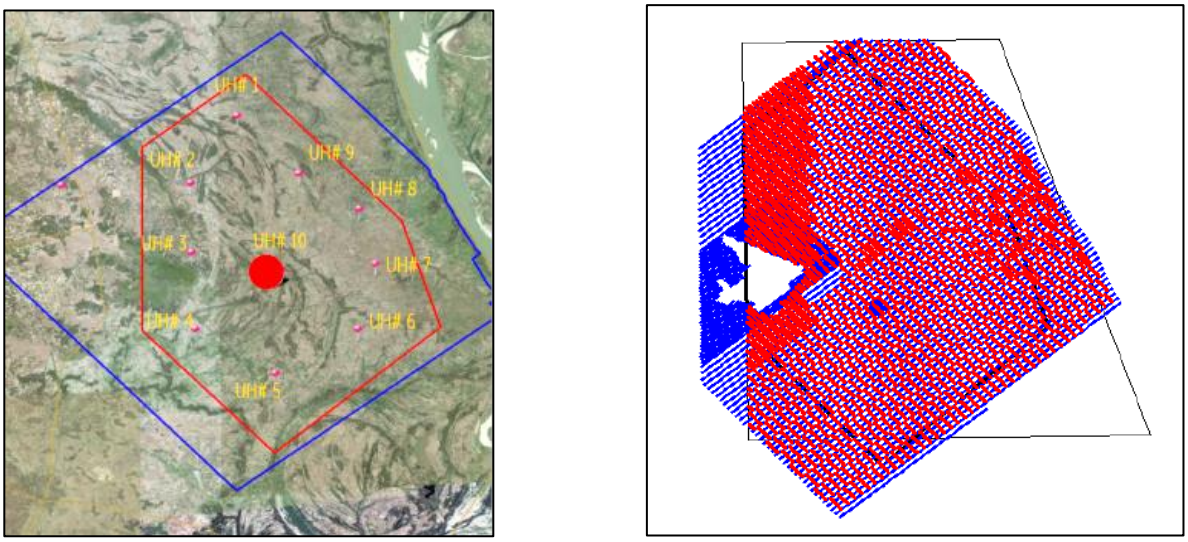
A total of 146 sq km of 3D full-fold were surveyed with 11261 shots being completed as shown in **Figure 4-3**. The prospect area mainly consisted of swampy area / oil field with some residential and paddy field. The network of plantation and main roads allowed operations to be completed smoothly in most areas.

The survey group used mostly RTK survey technique and total station. However, some conventional survey methods were used for the palm oil plantation areas with thick ground coverage where it was not possible to receive strong signals from RTK. Dynamite was used as the only energy source for the survey. All swathes were recorded using single hole charged with 4 kg of Emulex loaded at 20 depth.

One recorded unit equipped with Sercel 428XL was mobilized. All data dynamite sources were recorded using this unit. The unite system was adopted for the recording operations in Swath 23.

The Promax processing systems was used to facilitate the QC/QA of the recorded data. The purpose of the field 3D processing was mainly to confirm the source and received positioning and to ensure the data obtained in the field were to international standards. The data was processed daily and at each completion of a swath, a field brute stack was produced to display the data quality.

HSE measures were implemented throughout the project. The main hazard of the project was the traffic on the main road and the swampy area operation. The project achieved one million man-hours with zero LTI.



Source: PCMI, 2018

Figure 4-3: Location Map of Upholes for Seismic Acquisition & Final Design Map for IOR7

Table 4-2: Seismic Acquisition Summary

Area of seismic	146.06 sq. km
Number of receiver points	35,621
Number of Source Stations	11,252
Seismic Contractor	SINOPEC
3D Seismic Operation date	Start: 17th December 2015 Finish: 5th May 2016

Source: PCMI, 2018

4.3.5 Previous Environmental Impact Assessments in Block IOR-7

A seismic ESHIA was completed by IEM / EQM and submitted to MOGE before the start of the seismic operations.

The planned exploration drilling campaign is covered in this ESHIA report for Block IOR-7.

4.4 Project Need and Justification

The remaining potential in IOR-7 is located next to the deep trough of Pyay Sub-Basin - kitchen for oil and gas found in IOR-4, IOR-5, IOR-6 and IOR-7 and unexplored Lower Miocene Pyawbwe Fm.

Myanmar has proven natural gas reserves of 7.8 trillion cubic feet.[1] Gas production in 2014 was over 2 billion cubic feet per day and oil production onshore reached 8,300 barrels per day in 2014, in addition to offshore gas fields that produced 8,000 barrels per day of condensate. As of 2014, the country operated three refineries with a combined capacity of 55,000 barrels per day of petroleum products, the

[1] BP, "BP Statistical Review of World Energy" (June 2011).

vast majority of natural gas production, about 95 percent, came from the two offshore fields at Yadana and Yetagun in the Andaman Sea. There is some domestic offtake, but the majority of this gas is exported via pipeline to Thailand.[2] Since then, the Shwe field in the Bay of Bengal and the Zawtika field in the Andaman Sea have been commissioned and put into production (2013 and 2014 respectively). The majority of the gas from the Shwe field is exported to China via a newly built pipeline and the Zawtika gas is mainly exported to Thailand also vhoia pipeline.

As of 1 December 2014[3] oil and gas production in Myanmar was as follows:

Production	Onshore	Offshore
Gas mmcfd	70	2,000
Oil and condensate bpd	8,300	8,000

Gas sales were as follows:

Sales	Thailand	China	Domestic
Gas mmcfd	1,400	400	300

Myanmar faces energy access and security challenges. The International Energy Agency has calculated that Myanmar has the poorest level of energy access in all of the Asia-Pacific, and Myanmar is the least developed economy in Southeast Asia. Only 13 percent of the country's population have access to the national electricity grid, approx. 26 per cent have access to electricity, and almost 95 percent of its people depend on solid fuels such as wood and rice husks for cooking and heating.[4]

Secure energy supplies will be important to Myanmar's future development. The Ministry of Energy (MoE) has set the basis of Myanmar's energy policy framework —

(i) fulfilling domestic energy requirement
(ii) implementing sustainable energy development;
(iii) promoting the wider use of new and renewable sources of energy;
(iv) promoting energy efficiency and conservation;
(v) promoting use of alternative fuels;
(vi) implementing effective utilization of discovered crude oil and natural gas resources in the interest of the entire nation; and (vii) promoting more private participation.[5]

PCMI, as the operator of the Myanmar onshore petroleum PSC, is striving to develop and produce oil from potential reservoirs located within Block IOR-7.

[2] Asian Development Bank, Interim Country Partnership Strategy: Myanmar, 2012–2014 (Manila: October, 2012).
[3] MOGE 1 December 2014
[4] UNDP, "Accelerating Energy Access for All in Myanmar" (2013), Executive Summary.
[5] Myanmar Ministry of Energy, "Regional Energy Cooperation" (accessed 15 July 2014).

4.5 Project Alternatives

4.5.1 No Project

If the proposed exploration project is not implemented, economic benefits generated by the project would not occur (**Section 4.4**). Benefits lost would include the following:

- Employment generation and project expenditures during exploration drilling;
- Potential loss/delay of petroleum production from the site;
- Loss of revenue for the Myanmar and local governments through Production Sharing Contracts (PSC);
- The future contribution of crude oil from this area would need to be replaced with an equivalent amount sourced from overseas. Importing crude oil from outside Myanmar has associated impacts from transportation (emissions, potentials for spills) as well as cost implications;

4.5.2 Project

4.5.2.1 Drill Site Selection Process

The location of well sites in Block IOR-7 was selected based on the data from 3D seismic acquisition, general site criteria, engineering criteria, economic criteria, and environmental, social and health criteria as summarized in **Table 4-3**.

4.5.2.1.1 General Criteria

The general criteria include an evaluation of Geology, Location, Topography, Land Use and Significant sensitive areas and Infrastructure for the project. The exploration drilling project will explore the location, extent and characteristics of petroleum reservoirs. This project selected the location to drill the exploration wells based on the geological data and seismic interpretation data in the area. The most promising location to find petroleum reservoirs based on geological and seismic information will be defined as the ideal location, most suitable for understanding the target petroleum reservoir and most likely to find promising petroleum reservoirs. The ideal location is then evaluated for other constraints, such as steep terrain, land use, sensitive areas and distance from roads.

4.5.2.1.2 Engineering Criteria

Engineering criteria for well site selection regard the following factors: Minimize difficult terrain (such as drilling in steep topography, rocky areas, etc.), Minimize waterway crossings, Maximize use of existing ROW access, Minimize logistical issues (including engineering safety concerns), Minimize drilling distance to reservoir (preferably conventional straight hole) and Minimize overall length of access road construction.

4.5.2.1.3 Economic Criteria

The site selection process incorporates the assessment of the economic value of a potential petroleum hydrocarbon reservoir and its commercial worth against the cost of the investment (including Land Cost Compensation for land, Renting Rig, Construction, Operation and Maintenance costs) for alternate well locations.

4.5.2.1.4 Environment, Social and Health Criteria

Environmental, social and health criteria evaluated to select well site locations are: location as far away as possible from environmental and social sensitive areas. An "ideal" well site location should be located at least 1 km from any large village and near a transportation network or access route that can accommodate transport of the drilling rig. The shortest distance for access road construction must be considered and well site must not be located within reserved area such as national park, wildlife sanctuary, watershed area, reserved forest, historical park and etc. In case it is necessary to use such an area, the project proponent must operate strictly in accordance with applicable laws and regulations of the relevant government agencies.

Table 4-3: Well Site Selection Criteria

Environmental, Social and Health Considerations	**Physical Resources**
	Minimize use of sensitive terrain/soil (e.g. wetland/erosive soil)
	Maximize use of existing highways and access roads
	Minimize number of river, waterway, and canal crossings
	Minimize use of existing river, waterway and canal crossings
	Ecological Resources
	Minimize impact on natural sensitive terrestrial environment
	Minimize impact on natural sensitive aquatic environment
	Minimize impact on national parks, forest reserves, wildlife sanctuaries
	Human Use Values
	Minimize impact on transportation
	Minimize impact on water resources structure (river, waterway and canal crossing)
	Minimize impact on water resources structure
	Minimize impact on low level row crops (e.g., vegetable, sesame, beans and pulses)
	Minimize impact on paddy fields
	Minimize impact on orchards and forest plantations (e.g., mango, coconut, mixed orchard)
	Minimize impact on aquaculture
	Minimize impact on livestock operations (e.g., swine)
	Quality-of-Life Values
	Minimize impact on population centres, settlements
	Minimize impact on individual buildings and residences in ROW
	Minimize visual impacts
	Minimize impact on cultural/religious resources
	Health
	Minimize potential for construction accidents
	Minimize potential for operation accidents (settlements)
	Minimize anxiety of local people
	Minimize impact on water resources structure (river, waterway and canal crossing)
Engineering Design Considerations	Minimize waterway crossings
	Minimize difficult terrain (steep, rocky, etc.)
	Maximize use of existing ROW access
	Minimize logistical issues
	Engineering design (minimize drilling distance to reservoir)
	Minimize overall length of access road construction
Economic Factors	Land compensation cost
	Construction cost
	Operation and Maintenance cost

4.5.2.2 Drilling Phase Alternatives

4.5.2.2.1 Type of Rig

Rig types are still under evaluation. PCMI intends to use a land drilling rig for this drilling campaign. The rig's Drawworks will have a power rating of 1,800 – 2000 HP and a mast height ~43-1/2m. The rig will be powered by four diesel driven generator sets and each rated 600 KVA to supply the rig site with power.

The selection criteria for drilling rigs are:

- Availability
- Cost
- Rig Capability
    - Rig criteria are mostly related to the well depth requirements which consider:
        - Derrick
        - Drawworks
        - Mud Pumps
        - Drillstring
        - Mud System
        - Surface Equipment Limitation (BOP, Wellhead etc)
        - HSEMS
        - Track records
        - Experience

4.5.2.2.2 Type of Drilling Method

The wells will be drilled with a conventional hole size. Slim hole drilling is not an alternative or possible for the PCMI wells. A conventional hole size hole is required because of the depths being drilled, the type of formations being drilled, the kinds of pressures expected, and for hole stability. The final section of the well will be drilled using an 8-1/2-inch drill bit in the reservoir section.

4.5.2.2.3 Type of Mud

Many types of drilling fluids are used on a day-to-day basis world wide. Some wells require that different types be used at different parts in the hole, or that some types be used in combination with others. The various types of fluid generally fall into a few broad categories:

- Air: Compressed air is pumped either down the bore hole's annular space or down the drill string itself. Drilling depth with this fluid is limited.
- Air/water: The same as above, with water added to increase viscosity, flush the hole, provide more cooling, and/or to control dust. Drilling depth with this fluid is limited.
- Air/polymer: A specially formulated chemical, most often referred to as a type of polymer, is added to the water & air mixture to create specific conditions. A foaming agent is a good example of a polymer. Drilling depth with this fluid is limited.
- Water: Water by itself is sometimes used.
- Water-based mud (WBM): A most basic water-based mud system begins with water, and then clays and other chemicals are incorporated into the water to create a homogenous blend resembling something between chocolate milk and a malt (depending on viscosity). The clay (called "shale" in its rock form) is usually a combination of native clays that are suspended in

the fluid while drilling, or specific types of clay that are processed and sold as additives for the WBM system. The most common of these is bentonite, frequently referred to in the oilfield as "gel". Gel likely makes reference to the fact that while the fluid is being pumped, it can be very thin and free-flowing (like chocolate milk), though when pumping is stopped, the static fluid builds a "gel" structure that resists flow. When an adequate pumping force is applied to "break the gel", flow resumes and the fluid returns to its previously free-flowing state. Many other chemicals (e.g. potassium formate) are added to a WBM system to achieve various effects, including: viscosity control, shale stability, enhance drilling rate of penetration, cooling and lubricating of equipment.

- Oil-based mud (OBM): Oil-based mud can be a mud where the base fluid is a petroleum product such as diesel fuel. Oil-based muds are used for many reasons, some being increased lubricity, enhanced shale inhibition, and greater cleaning abilities with less viscosity. Oil-based muds also withstand greater heat without breaking down. The use of oil-based muds has special considerations. These include cost and environmental considerations.

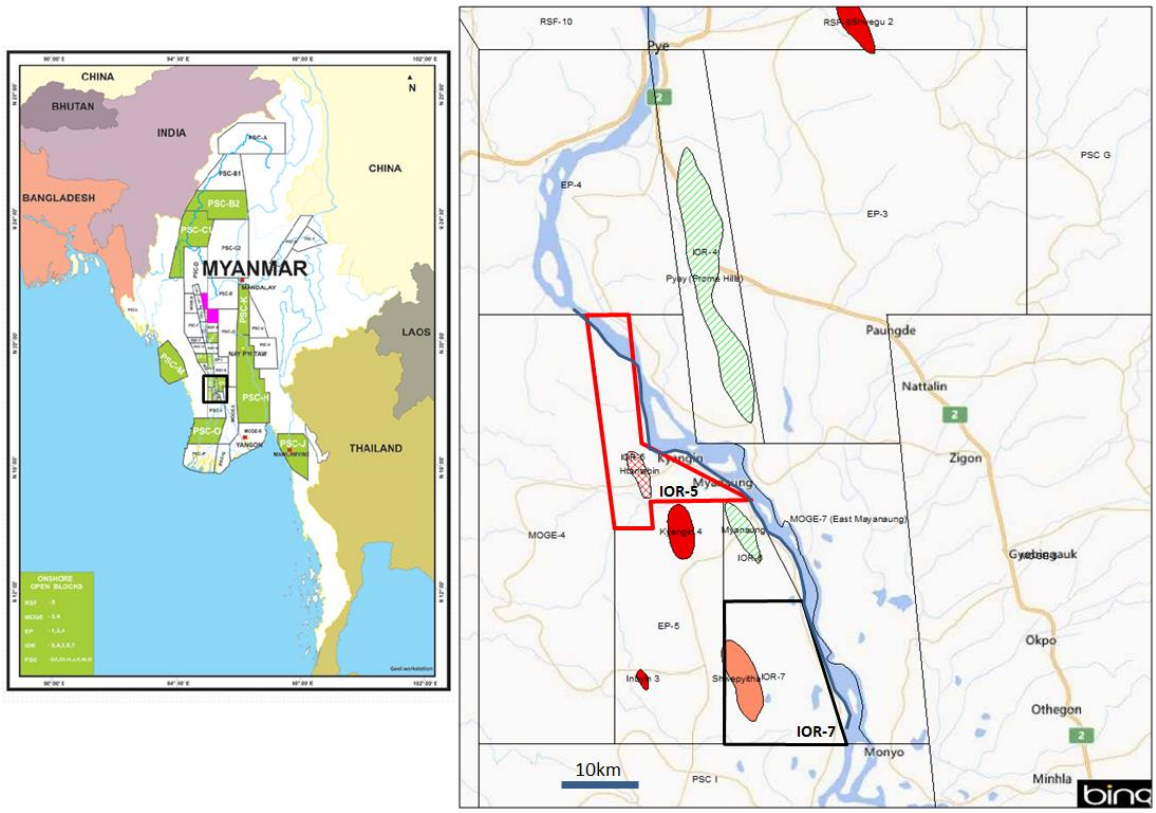
- Synthetic-based fluid (SBM): Synthetic-based fluid is a mud where the base fluid is synthetic oil. This is most often used on offshore rigs because it has the properties of an oil-based mud, but the toxicity of the SBM fluid is much less than an oil-based fluid. This is important when men work with the fluid in an enclosed area.

- Non Aqueous Fluid System (NAF): The NAF system was developed to provide: maximum shale inhibition, lubrication, and wellbore stability. Use of an NAF system in the mid sections (vs. a WBM system) will significantly reduce the risk of mechanical failure of the open hole, which could result in the drill pipe getting stuck requiring a back-off and side track. It will also increase the penetration ratio, thus reducing cost and time the rig will be on-site and minimum environmental impact.

The PCMI drilling program will only use Chloride free High performance Water Based Mud (WBM) for the drilling campaign. There shall not be any chloride additives in the mud system.

4.5.2.3 Geological Prognosis

Block IOR-7 in Shwepyitha Field is located about 35km to the south of the Block IOR-5 in the Pyay Sub-Basin (**Figure 4-4**). Oil and gas occurs in the Kyaukok Formation (Middle Miocene) and the Obogon Formation (Middle – Upper Miocene). Up to now 19 hydrocarbon bearing sands are found in Obogon/Kyaukok Formations. The Generalized stratigraphy of Block IOR-7 is shown in **Table 4-4**.



Source: PCMI, 2018

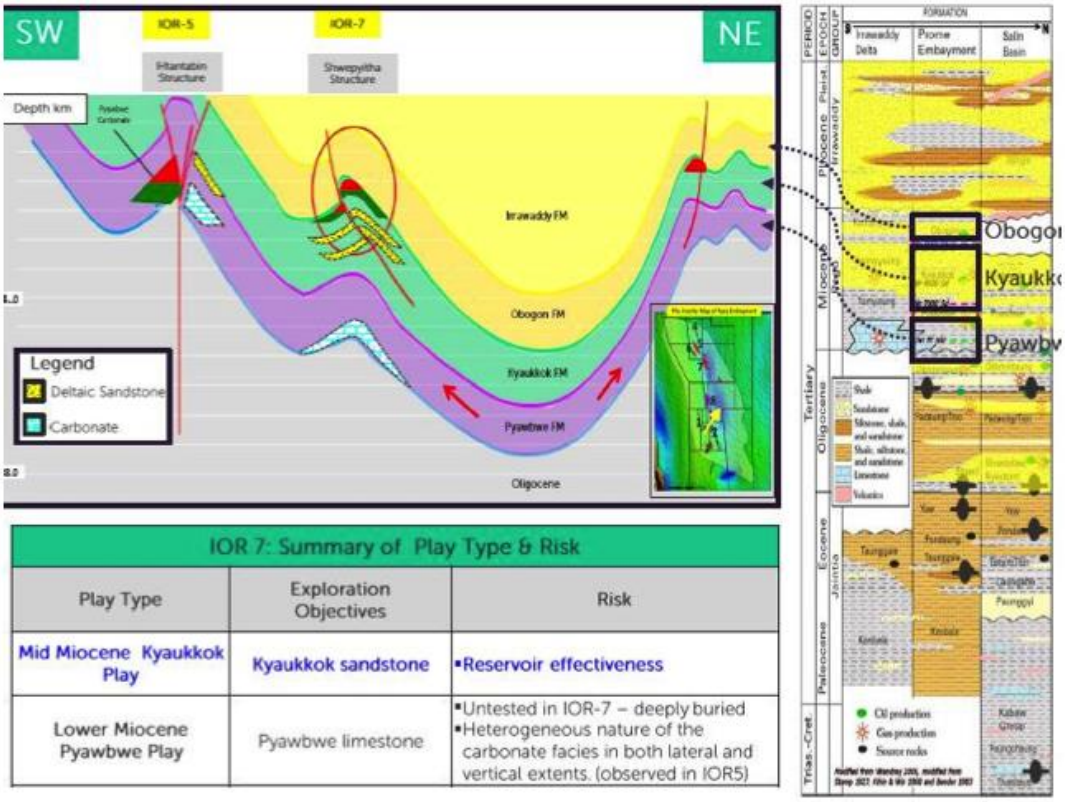
Figure 4-4: Location map of the Block IOR 7 in the Pyay Sub-Basin.

Table 4-4: Generalized stratigraphy of the Block IOR 7 (Modified after MOGE, 2013)

Stratigraphic Units	Stratigraphic Age	Dominant Lithology	Thickness (ft)
Irrawaddy Fm.	U. Miocene - Pliocene	Yellowish brown medium grained sandstones	1000+
Obogon Fm.	Middle to Upper Miocene	Fine sandstones, siltstones, clay-shales (Sandy alternations)	1280
Kyaukkok Fm.	M. Miocene	Yellowish brown, very fine, siltstone-sandstones, shales	1480+
Pyawbwe Fm.	L. Miocene	Grey – dark grey, bluish shale-clay, massive Foraminiferal limestones (grainstone – packstone – wackestone)	5080+

4.5.2.3.1 Geological Structure of the Block IOR-7

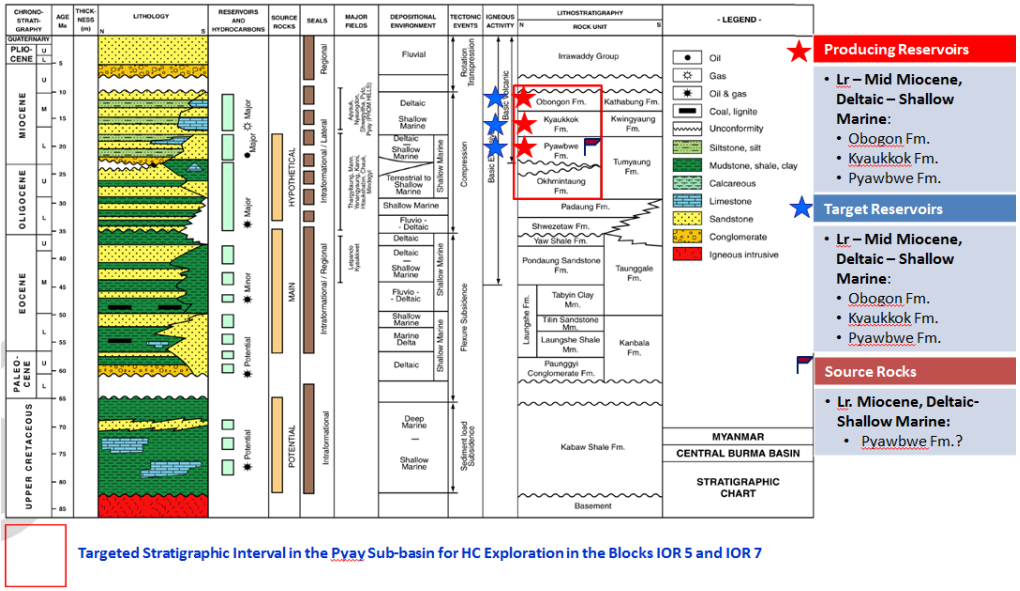
The Block IOR 7 in Shwepyitha Field is an NNW – SSE trending anticline structure, plunging towards the south and it is divided into two major structural units by a zone of disturbance running ENE – WSW with a throw of about 1000 ft in the south central part. The east flank is dipping gently from 8 to 12 degrees whereas the west flank dips from 15 to 33 degrees. The anticline is thrusted towards the west a thrust fault parallel to the major axis of the structure. The oil and gas accumulation is compartmentalized by these major faults. The structure is divided into 4 blocks. Two blocks are developed in the supra-thrust area and the other two blocks are in sub-thrust area.



IOR 7: Summary of Play Type & Risk		
Play Type	Exploration Objectives	Risk
Mid Miocene Kyaukkok Play	Kyaukkok sandstone	▪Reservoir effectiveness
Lower Miocene Pyawbwe Play	Pyawbwe limestone	▪Untested in IOR-7 – deeply buried ▪Heterogeneous nature of the carbonate facies in both lateral and vertical extents. (observed in IOR5)

Source: PCMI, 2018

Figure 4-5: Schematic structural cross section of Block IOR-7 in the Pyay Sub-Basin showing the subsurface stratigraphic units and the structural styles.



Source: PCMI, 2018

Figure 4-6: Regional stratigraphic framework of the Central Myanmar Basin and possible Petroleum System of Block IOR 7, showing the producing reservoirs, target reservoirs and possible source rocks.

Hydrogen Sulphide Potential

The exploration and infill wells are not expected to encounter hazardous levels of H_2S. Regardless, any gas produced from the wells will be constantly analysed for its composition and for the presence of H_2S.

H_2S detection and safety equipment is standard issue (see **Section 4.10**). PCMI's emergency response plan (ERP) includes an H_2S Contingency Plan. Furthermore, the drilling contractor will have their own H_2S Contingency Plan.

4.6 Project Schedule

The exploration drilling wells would be drilled during the dry season after the monsoon season. The drilling campaign aims to finish before the 2019 monsoon season arrives at End of May 2019.

The IOR-7 project timeline is shown in **Table 4-5**.

Table 4-5: IOR-7 Project Schedule

Activity	Well 1	Well 2
Spud Date	1st November 2018	15th December 2018
Drilling duration	30 days (30 November ,2018)	30 days (15 January 2019)
Completion duration	15 days (15th December 2018)	15 days (1 February 2019)
Well testing duration	(15 days) Perform with different rig in Q1 2019	(15 days) Perform with different rig in Q1 2019

Source: PCMI, 2018

4.7 Project Location

4.7.1 Drill Site Location

The two exploration wells in Block IOR-7 will be drilled from a single well pad. The nearest villages are over 500 m from the well site as shown in **Figure 4-7**.

The existing condition of the well pad is paddy field and the land acquisition has been completed with the well pad orientation designed to offer the safest conditions with lowest construction requirements as shown in **Figure 4-8**.

The well pad is located next to the exiting MOGE road; therefore a small access road will be constructed to allow site access as shown in **Figure 4-9**.

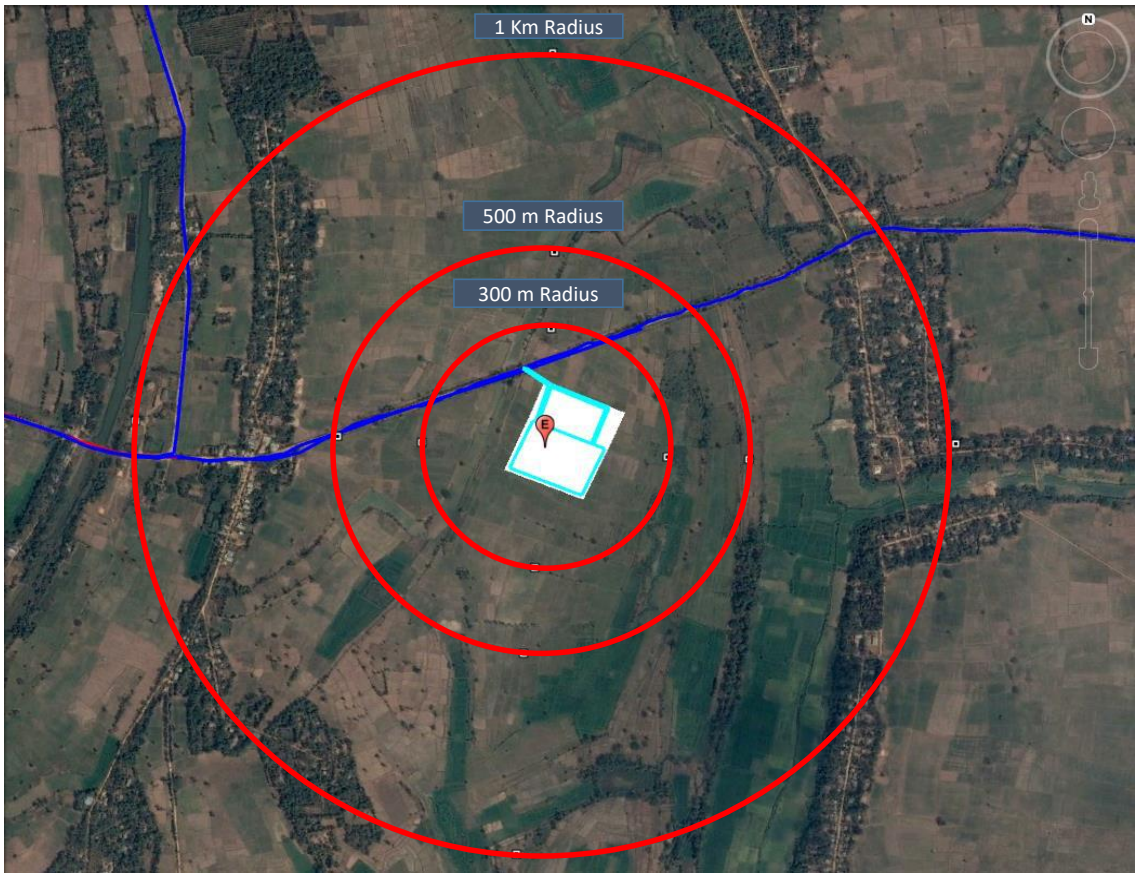


Figure 4-7: Distance from well site to Villages and Access Road (300, 500 & 1000 meters)

Figure 4-8: Present Condition of well site location and MOGE Access Road.

Figure 4-9: Present condition of MOGE Access Road

4.8 Overview and Layouts of the project

4.8.1 Layout and Facilities in Well Site Area

The proposed rig pad orientation for IOR7 is shown in **Figure 4-10**. The well pad size is 120 m x 180 m (21,600 m^2). The well pad includes a campsite and office space. There will be two main access roads that are 6 meters wide and two emergency exits for personnel. The cellars for Cellar for IOR7-1 and IOR7-2 will be constructed next to each other with distance of +/- 3 m as both wells will be drilled from the same pad. A flare pit will be built inside the well pad. The flare pit will only be used during well testing if high-pressure gasses need to be flared. No other drainage or discharge will be allowed in the flare pit.

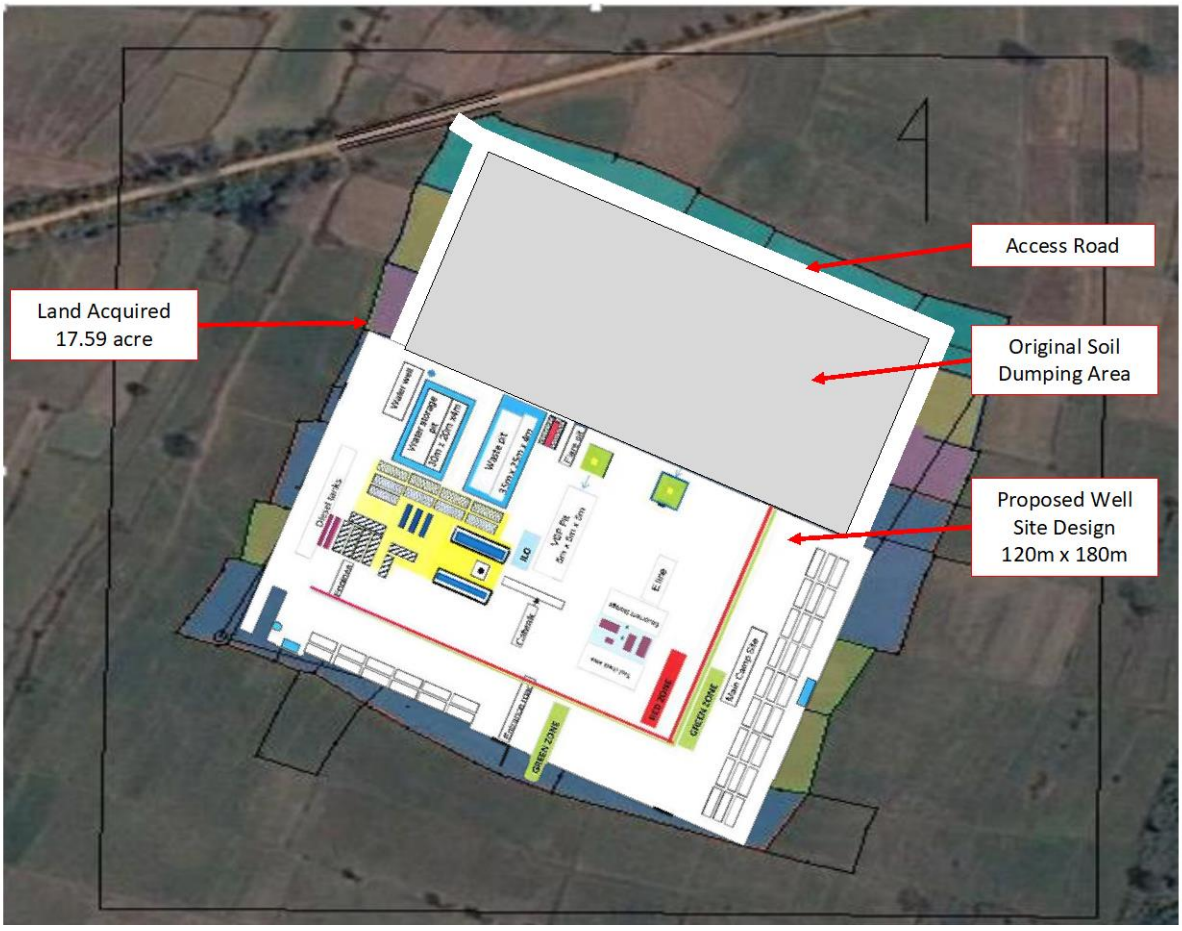


Figure 4-10: Rig Pad Orientation & Access on Acquired Land

The main facilities at the rig pad are shown in **Table 4-6**. The rig pad layout is shown in **Figure 4-12**.

Table 4-6: Drilling Facilities Overview

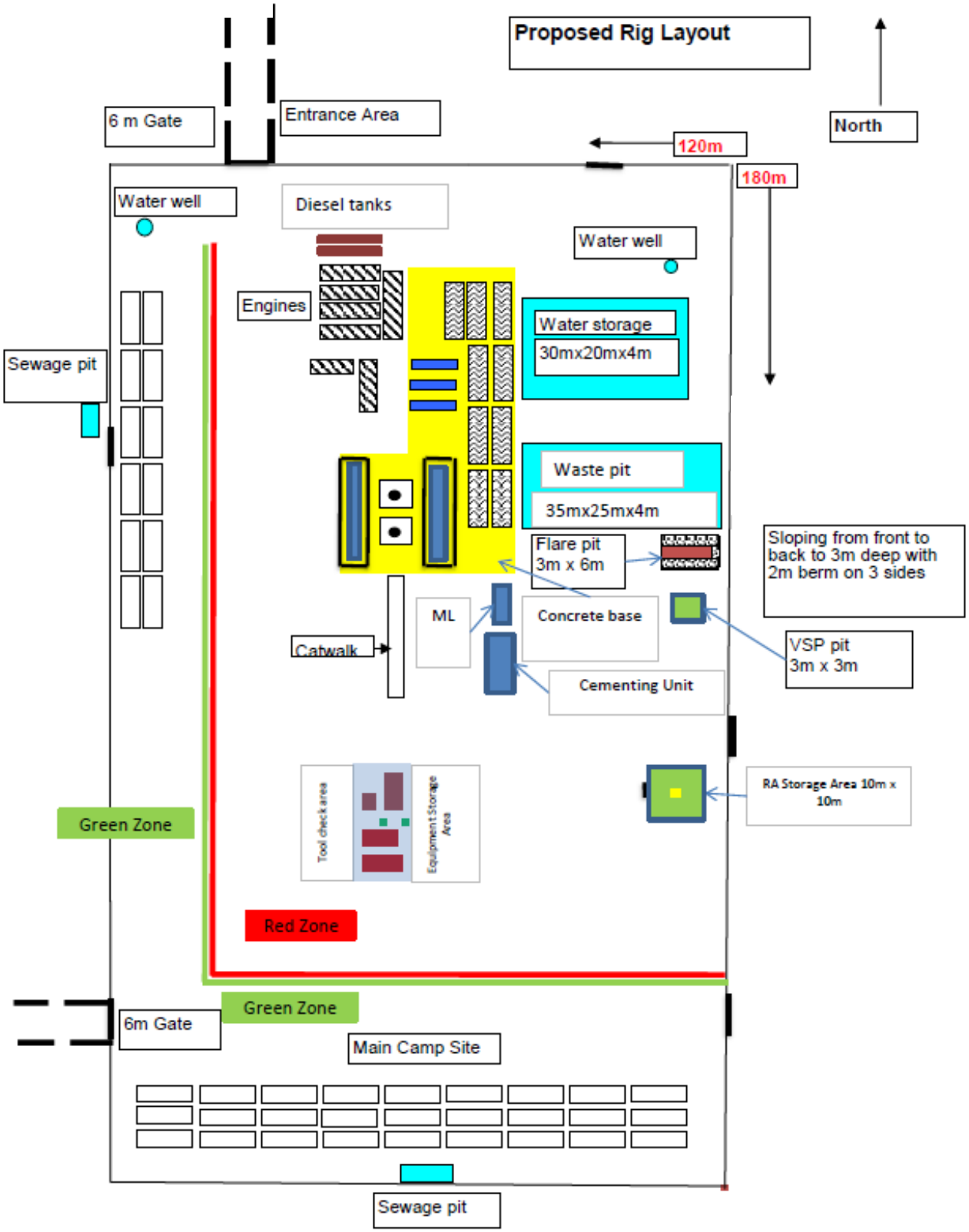
Description	Quantity	Remark
Amount of upgrading/repair the access road	25 – 30 Km	Estimated for the whole project
Cellar Size	3.5 x 3.5 x 3.5 meters height	Based on one well
Drilling Waste Pit with geomembrane liner	6,000 m^3	Based on one well
Water Pit with geomembrane liner	2,000 m^3	Based on one well
Fuel storage	300 mm height	Bund wall complete with one layer of plastic membrane
Chemical storage	10 x 10 m	Ground with geomembrane liner / concrete pad and chemicals Covered with Tarpoline, as drilling will be conducted during dry season only. Chemicals to be stored in flood proof warehouse during rainy season.
Drilling Fluid (Mud) storage	400 bbls each tank X 5 units	Rectangular Steel tanks, up to 2000 bbls in total

4.8.2 Drilling Rig

PCMI intends to use a land drilling rig for this drilling campaign. An example of a land rig is shown in **Figure 4-11**. The rig's Drawworks has a power rating of 1,800 – 2,000HP. The rig is powered by four diesel driven generator sets and each rated 600 KVA to supply the rig site with power.

Source: PCMI 2018

Figure 4-11: Onshore Rig Example



Source: PCMI, 2018

Figure 4-12: Conceptual Drilling Well Site Layouts

4.8.2.1 Cellar and Rig Pad

Within the well pad, two holes will be dug and lined with concrete–to form the inline cellar for each well (3.5 x 3.5 x 3.5 meters deep). This forms the rig "cellar", into which is fitted a short length of 30 inch steel pipe, extending 6 to 12 metres into the ground; this is the "conductor pipe" that acts as a guide to the drill bit and drill string while drilling the uppermost portion of the well. The cellar also houses the well-head and the blow out preventers.

A reinforced concrete rig pad, measuring approximately 20 m by 20 m will be constructed around the cellar. This acts as the foundation upon which the drilling rig, mud tanks, shakers, generators and fuel tanks sit on.

4.8.2.2 Cuttings & Dirty Water Pit

For the IOR-7 drilling campaign – a waste pit will be installed at the well site to hold the drilling wastes / cutting and dirty water from the drilling campaign. All the cuttings/waste and dirty water from drilling activities will be channelled to this waste pit (**Figure 4-13**). This pit will measuring approximately 35 m by 25 m by 4 m deep with a volume of 6,000 m^3. The pit will be lined with a high density polyethylene (HDPE) 2mm thick impermeable geomembrane liner to form an impermeable barrier. The contaminated runoff water from well site will drain only to the waste pit. No wastewater will be drained to the flare pit. The flare pit will be separated and bermed to stop any run-off from entering the flare pit. The dirty water collected in the waste pit will be treated onsite by DOWA with a dewatering unit. The drilling solids will be dried and land buried as per IFC guidelines and all other hazardous wastes will be removed and transported for disposed at the DOWA waste disposal area.

The estimated typical amount of runoff during a rainstorm varies according to the month of the year from wet season to dry season. All Runoff from the rig pad enters the waste pit. The pit is sufficient in size to contain any runoff from storms. It is not expected that discharge of water will be required unless there is unusually prolonged storm activity during the rainy season. If the pit becomes full from closely spaced heavy rainstorms, water can be released at the down-slope side of the site from the water pit to the perimeter drain, first passing through a series of specially constructed oil traps. Assuming a rainfall intensity of the wettest month's equivalent rainfall (129 mm/hr) for a ½-hr duration storm, the runoff from the well site combined with rain falling on the waste pit totals 391.2 m^3. The waste pit has an actual holding capacity of 6,000 m^3. The pit can therefore contain much more rainfall than the rainfall intensity of a ½-hr duration storm with a return period of 50 years. The drilling campaign will be completed in the dry season to reduce any potential impact from accidental fluid discharge because there would be no rain or water discharge expected during the dry season.

Figure 4-13: Top view of drill cuttings waste pit

4.8.2.3 Well Site Drainage System

The drilling pad area is made of concrete, which prevents leakage of contaminated water to the surrounding area. Machines within the drilling pad area that could potentially release contaminated water include skip tank, dirty water & cuttings pit, cement mixer, and drilling rig. Runoff within the drilling area will be drained via drainage track into the dirty water /cuttings pit, which will accumulate all of the runoff and contaminated water generated within the drilling area. Therefore, contaminated water from this area will go through a large oil trap and end up in the pit and won't escape to contaminate surrounding areas. The contaminated water, cuttings and mud will be treated onsite as per IFC emission standards by DOWA before disposal.

The volume of runoff from the well site is calculated from the volume of the heaviest rainfall within 30 minutes with a month's equivalent rainfall in one hour (129 mm/hr) as 391.2 m^3. The volume of the waste pit (6,000 m^3) is much more than the volume of the extremely heavy runoff. Therefore, the waste pit has the capacity to retain all the runoff within the drilling area even under heavy rainfall. The level of water in the waste pit will be monitored regularly. If water level in the waste pit is high, it will be pumped into another container (such as a tanker truck) to make sure that the water will not overflow from the pit. The drilling will be completed in the dry season to limit the risk of run-off due to heavy rain.

4.8.2.4 Mud Tanks

The drilling mud will be contained in steel mud tanks. These are rectangular shaped tanks with 2000 bbls capacity. They will be located on the rig pad at a designated area next to the mud circulation system. The mud circulation system is shown in **Figure 4-14**.

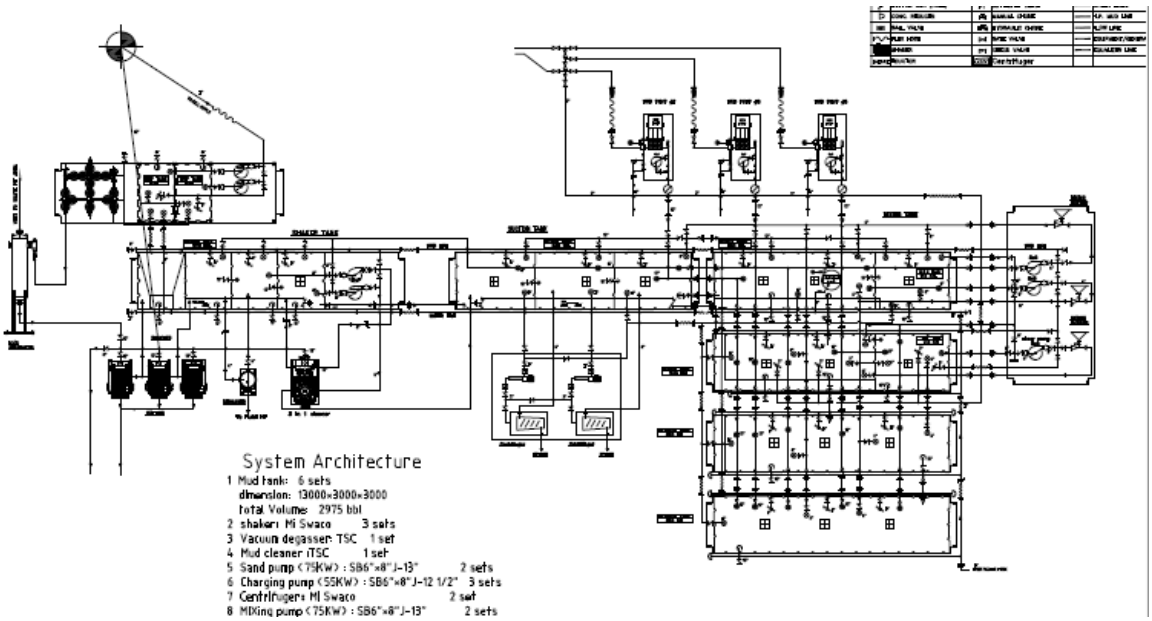


Figure 4-14: Mud Circulation System

4.8.2.5 Chemical and Equipment Storage Areas

Mud chemicals shall be stored in a covered and concreted warehouse before transportation to the drilling site. The warehouse shall be in YANGON. Once transported to site, the chemicals shall be stored on an impermeable geo-membrane based area with in a bunded area. Most of the chemicals are dry powdered chemicals, hence the chemicals shall be covered with tarpoline at site to protect from rainwater. The geomembrane lined chemical storage area will be 10 m by 10 m.

Other storage areas such as parts, equipment and repair shops will be contained in converted portable 40 foot containers. These containers will sit on concrete blocks. Workshop for vehicles maintenance will be in a bumded area fitted with oil trap/separator to stop oil spills. The site will have spill kits available to be used if any accidental spill happens during operations. The mud chemicals are all dry powder so spill or leakage is low, spill kits will be used for any oil or liquid spills. All chemical will be handled as per PCMI HSEM 2.1 – SUPERVISORY SAFETY PROCEDURES MANUAL (**Appendix 2**).

4.8.2.6 Fuel Storage Area

The fuel tanks – one at the rig and another one near the camp (approximate 110 m^3 & 25 m^3 capacity) will be set on the higher ground and will be completely surrounded with a bund to contain any spillage. The bund will be 300 mm high around the entire fuel storage area.

The site will have spill kits available to be used if any accidental fuel spill happens during operations. PCMI has an oil spill contingency plan if there is any accidental release. Any spill will be managed as per PCMI Oil Spill Response Plan (**Appendix 3**)

4.8.2.7 Flare Stack

The flare stack will be a horizontal burner directed to an earth bermed flare pit to ensure the safety of workers at the well site. The nearest community will be located over 500 m away (for all the proposed well sites); thus, impact from light and sound from the flare stack should be minimal (detailed description in **Chapter 6 - Impact Assessment**).

No waste fluids will be discharged to the flare pit. The reservoir fluids will be burned. The produced water will be separated and directed into the wastewater pit. The flare pit is only used for the emergency burning of high-pressure hydrocarbons. The flare pit soil will be tested at the end of project and if contaminated will be disposed as per the PCMI Waste Management Plan (**Appendix 4**).

	
Geomembrane lined and bunded dry powder mud chemical storage area	Perimeter drain with weir and oil trap

	
Concrete rig and storage pad with segregated drainage channel	Campsite in background (generators on rig concrete pad in foreground)

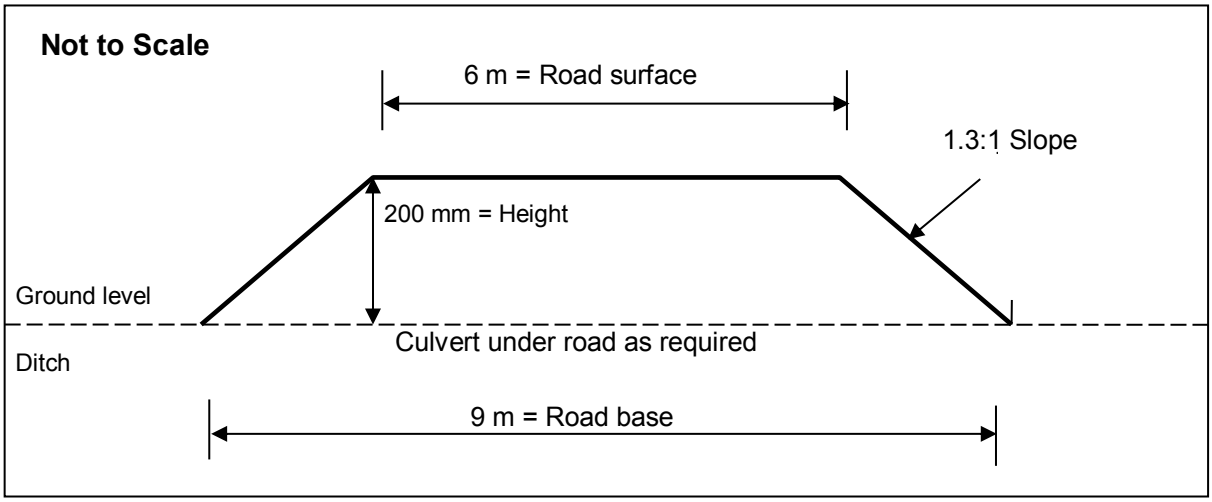
Source: Pictures provided by IEM, 2018

Figure 4-15: Photos of a Typical Exploration Drilling Well Site and Facilities

4.8.2.8 Access Roads

PCMI plans to use the Pathein – Monywa Highway Road to Kyangin and then to Myanaung. Then proceed to Well Site area via MOGE road starting from Mingone Junction. The MOGE road is designed for rig move and PCMI will maintain this road including raise the road level if required. In areas that require upgrade, PCMI will widen the MOGE road up to six (6) meters upon the MOGE agreement. The maximum total road upgrading is expected to be 25-30 km along the MOGE road.

The well site is located in an agricultural area near the existing MOGE road, therefore PCMI will need to construct a short site access way to connect the well site to the existing main roads for transportation of drilling rig and drilling equipment. The access roads will be designed as dual lane, un-surfaced roads, constructed of compacted granular material. The roads will be 6 m with side slopes of 1.5 m for total width of 9 m, constructed with 200 mm of compacted granular material as shown in **Figure 4-16**.



Source: PCMI, 2018

Figure 4-16: Longitudinal-Section of Proposed Access Road

4.8.3 Stages of Operation

Major activities of project consist of Construction Operations, Drilling Operations, Well Testing Operations and Well Completion, Suspension, Abandonment or Contingency Well. The activity chart of the project is shown in **Figure 4-17**.

1. **Construction Phase**

   Details are preparation and construction of the drilling area, access road construction, rig and equipment installation and elements of the drill area.

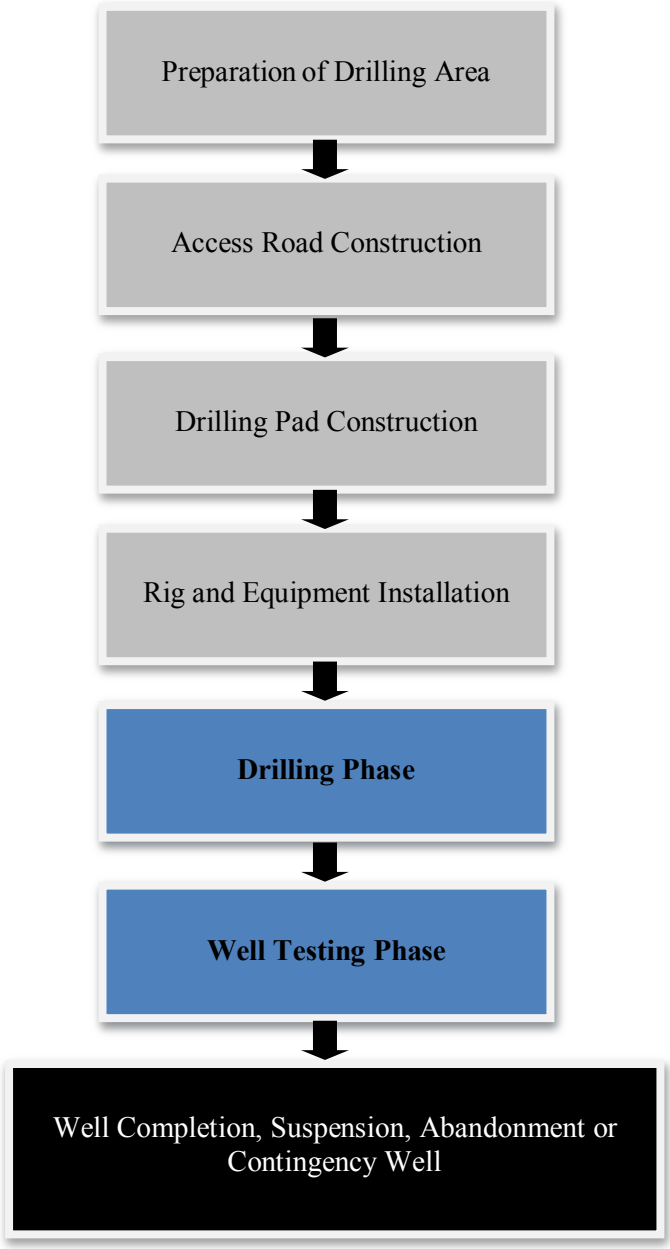
2. **Drilling Phase**

   Details are hole and casing design, drilling exploration methodology, types and components of drilling mud, drilling mud volume, volume of cutting from drilling and wire line logging.

3. **Well Testing Phase**

   Details are well testing equipment installation; well testing operation, waste management from well testing operation.

4. **Well Completion, Suspension, Abandonment or Contingency Well**



Note

Construction Phase

Drilling Phase

Well Testing Phase

Well Completion, Suspension, Abandonment or Contingency Well

Figure 4-17: Activity chart of project

4.8.3.1 Construction Phase

4.8.3.1.1 Well Pad and Work Camp Pad Construction and Access Road

The site topsoil will be striped before construction begins, the stripping shall consist of excavation, removal, and stockpiling of usable topsoil next to the well site in a designated area. Topsoil shall not be stripped under wet conditions. Usable topsoil shall be stored separately for usage in the case of planting of trees or vegetation during restoration.

A temporary surface drainage system shall be developed and maintained during the course of clearing, stripping and filling operations. This temporary drainage system shall be designed to an appropriate gradients and flows to facilitate storm water runoff. Particular care shall be used to protect upstream and downstream users of any stream, drainage ditch or other watercourse by avoiding damming, clogging with debris or otherwise changing its course or hydraulic properties. Standing and creeping vegetation obstructing or growing within the natural width of watercourses shall be felled, cleared and removed.

The well site and adjacent accommodation campsite will be levelled and elevated by cut and fill methods and compacted using bulldozers, dump trucks, water trucks and graders. The compacted pad will be approximately 200 mm thick.

The entire well pad and work camp pad will be surrounded by a barbed wire fence to keep animals and unauthorized persons from entering the site. Security guards will also be employed and stay on site 24 hours per day, 7 days per week throughout rig mobilization, set up, drilling, optional testing operations and until the site is abandoned.

Dimensions of the well site and accommodation campsite to be constructed are summarised in **Table 4-7**.

Table 4-7: Dimensions of Well Pad, Work Camp Pad

Item	Dimensions	Area	Estimated Fill
Each Well Site			
Drilling and Work Camp pad	120 m x 180 m x (200 mm thick)	21,600 m^2	4,320 m^3 (1)

(1) Estimate based on an average of 200 m thick

All of the materials to be used for constructing the well pad and facilities are to be provided by the civil engineering contractor. This contract will be issued to a local construction company as per PCMI's policy of ensuring that the economic benefits of the project are concentrated within the Province. The civil engineering contractor will obtain fill materials from local extraction sites operating under permit from the relevant local authorities.

It will be the responsibility of the civil engineering contractor to source the fill materials and the materials must also be of a high quality grade for use as un-surfaced road building material and acceptable to PCMI for construction of the well pad.

4.8.3.1.2 Rig Installation

PCMI intends to use a typical land rig for this drilling campaign. The rig's Drawworks has a power rating of 1,800 to 2,000 HP. The rig is powered by four diesel driven generator sets and each rated 600 KVA to supply the rig site with power. Rig components can be described as follows:

1) Hoisting system consists a derrick and platform or derrick floor used for clinging and installing the drilling equipment to the tower. The drilling equipment include crown block handed on a cable, which use to raise and lower a drill string in the well.

2) Rotating system consists of a hydraulic top drive to spin, raise and lower the drill string equipped with a drill bit.

3) Mud & Cuttings circulating system

During drilling operation, drilled cuttings and fluids are removed from the well. Mud is added to the pipe and flows out at the hole of drill bit to: carry cuttings to the surface, transmit power and lubrication to the drill bit; exert a hydrostatic head to help prevent caving or sloughing of the formation; prevent flow of formation fluids into the borehole; and maintain dense materials such as cuttings and barite in suspension in the borehole to maintain downward pressure in the well.

4) Mud mixing unit consist of mud mixing tank and mud pump. The equipment functions as chemical mixing unit for mud.

5) Cementing unit consists of cement mixing tank, cement storage tank and cement pump. The equipment functions as chemical mixing unit for cement. Cement will be used to prevent fluid infiltration to borehole.

6) Power system

Rig may be located far from main power supply (Electric Transmission Line). Therefore, three units of diesel electric generator must be installed in the rig to supply electricity.

7) Wireline logger

A mobile truck-mounted wireline logging unit will be used for geophysical tests. (Wireline logging).

8) Drill mud recorder

Drilling mud recorder will continuously monitor the drilled well by determining inner borehole condition.

9) Drilling mud laboratory

Drilling mud laboratory will be equipped with drilling mud testing equipment.

For rig installation cranes will be used and the procedure will take approximately 2 days.

4.8.3.2 Drilling Operations Phase

All operations on these wells will be carried out in accordance with the appropriate international API standards, PCMI Well-Site Operations Management System and the PCMI Well-Site Operations Management Plan, copies of which will be at the rig site and must be read and understood by everyone involved in these well operations.

Drilling operations and associated services will be conducted on a 24-hour basis. Drill crews will work alternate 12-hour shifts rotated from duty on a maximum 60-day schedule.

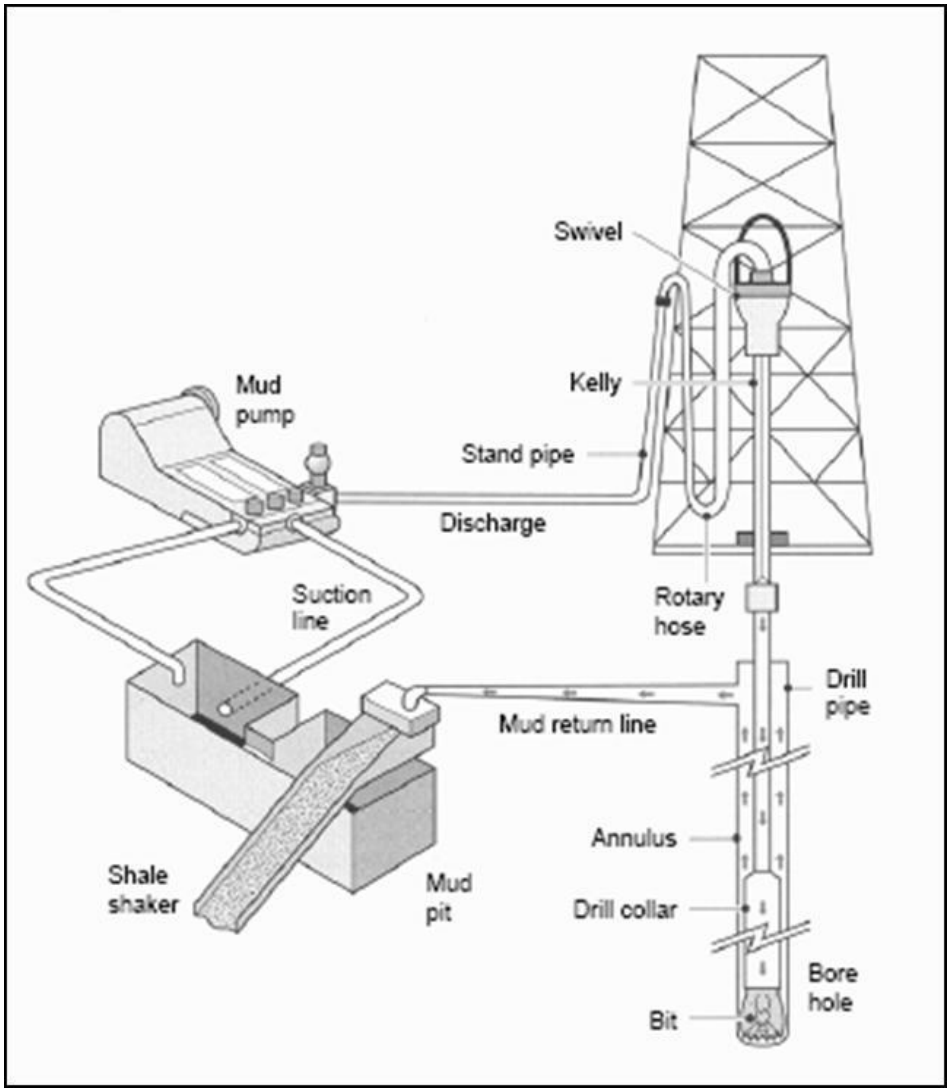
For this exploration drilling program, a "conventional hole" well construction process will be used. The basic steps of drilling an exploration well are summarized below.

- Drilling the Hole - The drill string is a series of long, hollow steel pipes, which can be screwed together. The drill bit, which has a larger diameter than the drill string, is the cutting tool and is screwed to the end of the drill string. A hoist system within a derrick over the well allows the drill string to be assembled and broken down into manageable sections.
- Drilling Fluids System - The drill string and bit are lubricated and cooled by a drilling fluid, commonly referred to as mud. This mud is stored in large steel tanks beside the rig, from where it is pumped down through the drill string.

- Mud Cleaning Equipment - When the drilled cuttings are brought to the surface with the drilling fluids, they will first pass through a mud treatment system commonly consisting of shale shakers. This comprises of a vibrating frame fitted with a series of fine mesh screens, which separate the vast majority of the drill cuttings from the drilling mud. The mud passing through the screen is re-circulated while the cuttings are further processed using a cuttings dryer with recovered mud returned to circulation and the dried cuttings dumped to skips.

A typical drilling schematic is provided in **Figure 4-18**.

Casing and Cementing - Various sections of the hole will be drilled at different diameters, with the size of the borehole decreasing with depth. Each section of the hole will be lined with thick steel tubing, known as casing, which will be fully cemented in place. This ensures that the hole remains stable and that the surrounding geological formations, in particular those that may act as fresh water aquifers, are not contaminated. This casing also helps in the process of controlling the pressure of any gas that the well might penetrate, as it is prevented from flowing into shallower, less pressurised formations.



Source: PCMI 2018

Figure 4-18: Typical Drilling Rig and Mud System

4.8.3.2.1 Hole and Casing Design

The well design for each well will have 4 bore hole sizes of 26-inch (0.660 m), 17½-inch (0.445 m), 12 ¼-inch (0.311 m) and 8 ½-inch (0.216 m). The general hole and casing dimensions are summarized in **Table 4-8**. Hole and casing schematic diagrams for each well are shown in **Figure 4-19** and **Figure 4-20**.

Table 4-8: Hole and Casing Design for each Well

Well sites	Interval	Hole Diameter (inches)	Casing Size (inches)	True Vertical Depth	
			External	Well 1 (ft)	Well 2 (ft)
Wells 1-2	Surface	26	20	235	235
	Intermediate	17.5	13 3/8	2015	2057
	Production	12.25	9 5/8	4335	4473
	Hole	8.50	Open	5650	6335

Source: PCMI, 2018

4.8.3.2.2 Drill Exploration Process

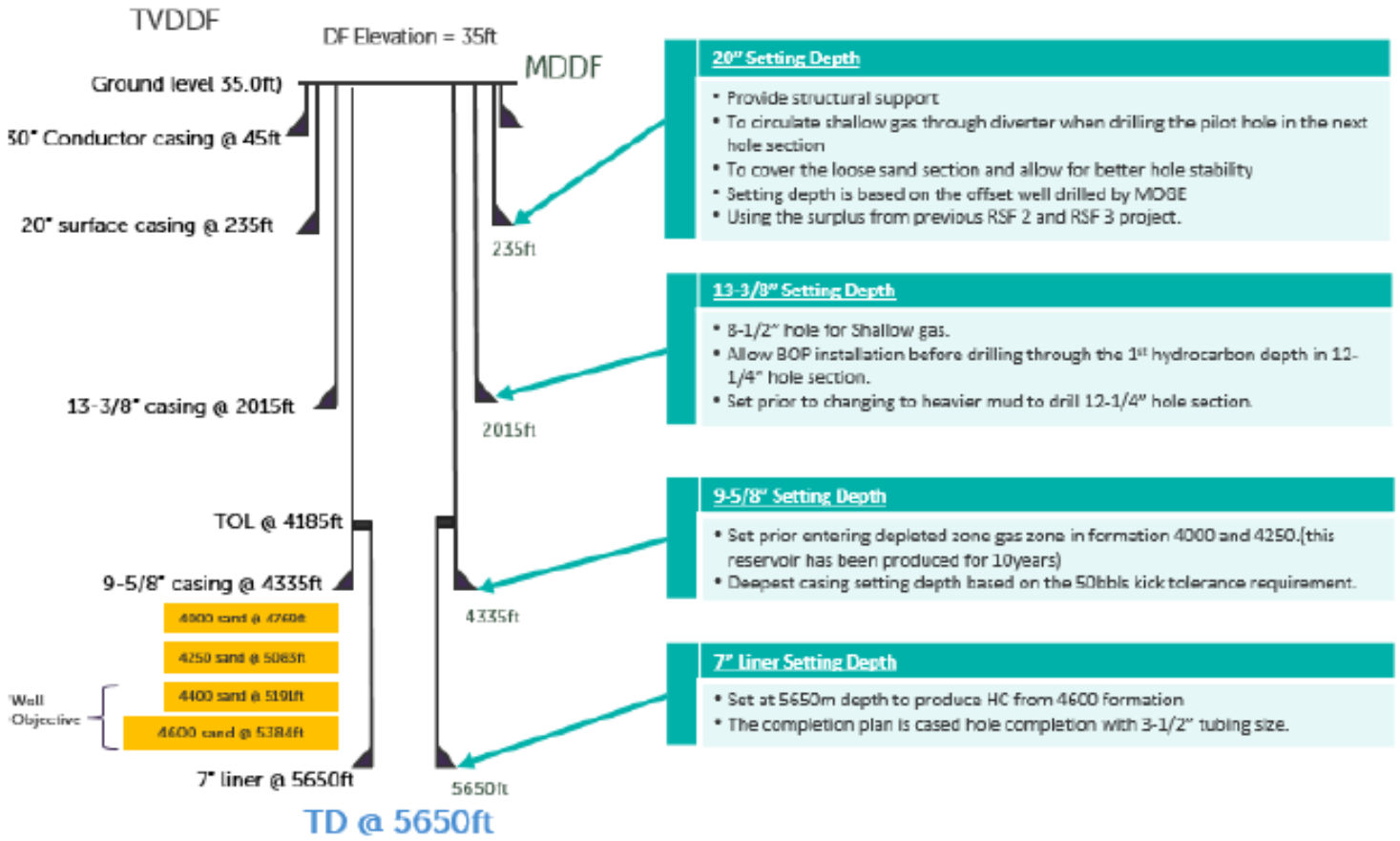
Drilling and Casing

- **26-inch Hole-** The well drilling operations will begin by drilling a 26-inch (0.660 m) hole from surface to the designated depth. This section will be drilled with a basic water-based mud system. Hi-viscosity mud sweeps will be pumped to clean the hole during connections. A 20-inch surface casing will be run and cemented to surface. A surface blowout prevention (BOP) stack will be installed before drilling the next section. No shallow gas is expected in this project.
- **17 ½-inch Hole** - A 17 ½ -inch hole will then be drilled to the designated depth. This section will be drilled with a low toxicity Water Based Mud (WBM). The 13 3/8" casing string will be run and set to the designated depth.
- **12 ¼-inch Hole** - The 8 ½ -inch hole will then be drilled to the designated depth. This section will be drilled with a low toxicity Water Based Mud (WBM) system as the previous section. The 9 5/8" casing string will be run and set to the designated depth.
- **8 ½ -inch Hole** - The 8 ½-inch hole (the reservoir section) will be drilled with Water Based Mud (WBM). A 7-inch production line will be used as a contingency.

Technical or operational constraints

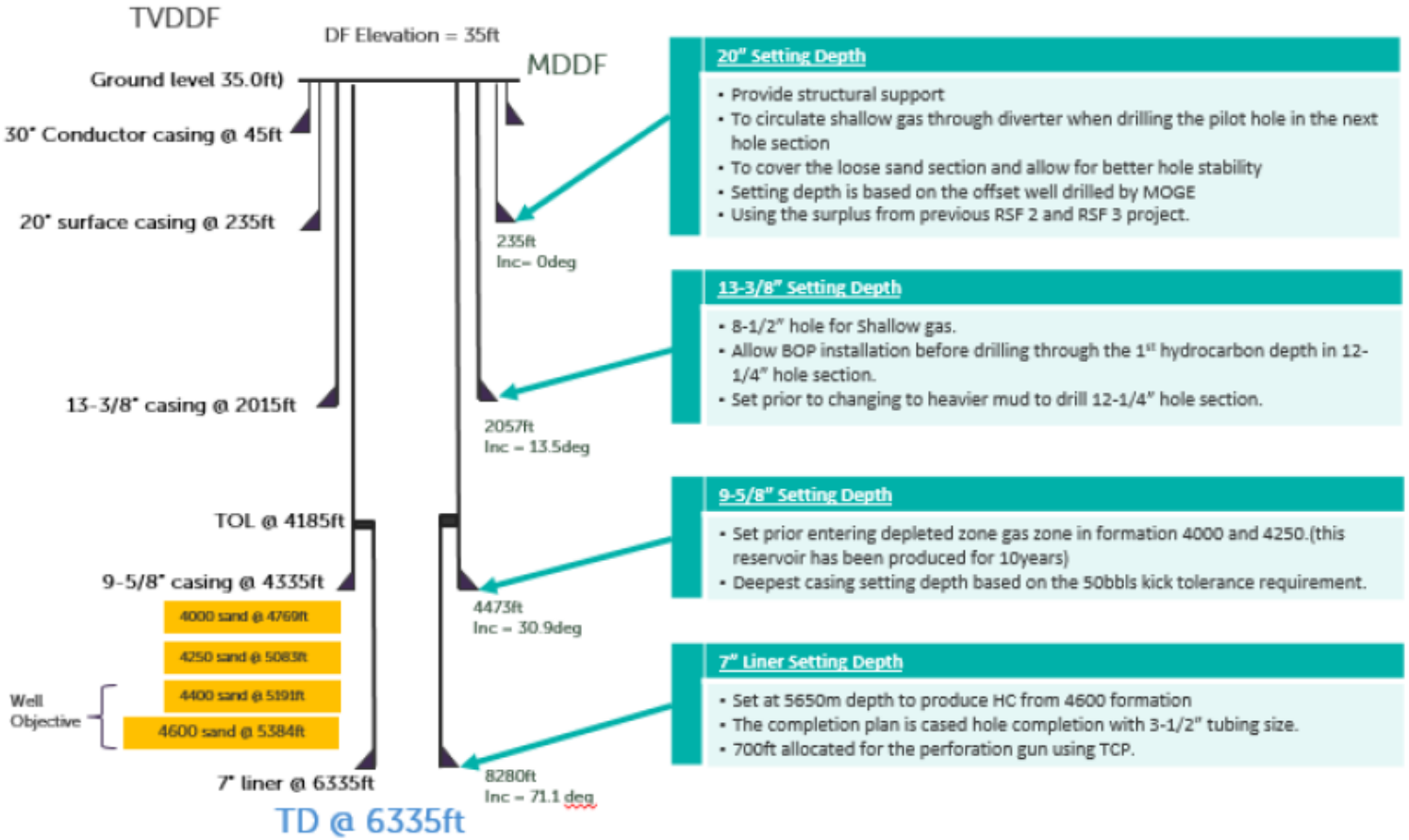
The following operational constraints have been considered for thee well design:

a. Loss circulation at surface hole section (300m – 800m TVD)
b. Loss circulation at bottom hole section (2200m -2500m TVD)
c. Borehole stability due to earth's stress



Source: PCMI 2018

Figure 4-19: Tentative Hole and Casing for Well 1



Source: PCMI 2018

Figure 4-20: Tentative Hole and Casing for Well 2

Drill Cuttings

Drill cuttings are formation particles generated by the drill bit during the drilling process and vary in size from small slivers (less than 10 mm in length) to dispersed clays and ultra fine particulates (less than 0.002 mm). The exact nature of the cuttings will depend on the geological formations drilled though. **Table 4-9** provides the estimated drill cuttings volumes expected for the drilling per well.

As stated earlier, the drilling plan (including hole and casing design) for re-drilling an exploration well (contingency well) cannot be provided at this stage. However, based on a similar design to the planned wells, a similar amount of cuttings could be generated for each additional contingency well.

Table 4-9: Estimated Volume of Cuttings per Well

Item	Well 1	Well 2
Drill cutting volume	1256 bbls or 200 m^3	1444 bbls or 230m^3
Drilling mud volume	9875 bbls	4000 bbls

Drilling Mud

Mud performs a number of functions during the drilling. Apart from carrying cuttings to the surface, it: transmits power and lubrication to the drill bit; exerts a hydrostatic head to help prevent caving or sloughing of the formation; prevents flow of formation fluids into the borehole (which could lead to a blowout); and maintains dense materials such as cuttings and barite in suspension in the borehole to maintain downward pressure in the well, when circulation is interrupted (as when adding a new joint of drill-pipe).

The drilling fluid used in exploration drilling plan is Water Based Mud (WBM). The components of the mud system are summarized below:

- WBM: Caustic Soda, Soda Ash, Bentonite, Polyanionic Cellulose, Xantangum, Potassium chloride, partially hydrolyzed polyacrylamide, sodium bicarbonate, graphite, calcium carbonate, cloud point glycol, potassium sulphate, sodium chloride, magnesium oxide, monoethaloamine, quartenary amine.

Drilling fluids will be circulated in a closed loop system to recycle the drilling mud and contain all wastes. Details of the expected mud volumes per well are shown in **Table 4-10** and Health and Safety Information for the WBM components are shown in **Table 4-13**. Full MSDS sheets are to be provided at the work site.

Table 4-10: Total Mud Volumes per Well

Hole Section	Total Mud Volumes (bbls)
26” (0.660 m)	4,000
17 ½” (0.445 m)	3,500
12” ¼ (0.311 m)	1,375
8 ½ “ (0.216 m)	1000
Total	**9,875**

Summary of Drilling Mud

The summary of drilling mud systems per well section are shown in

Table 4-11: Mud System for Each Well Section

Mud System	Hole Size	Weight	Remarks
Bentonite Spud Mud	26" hole section	9.0-9.5 ppg	
K2SO4, PHPA, Chloride free Amine system	17.5" hole section	10-11.0 ppg	Potassium sulphate based
K2SO4, Chloride free Amine system	12.25" hole section	`14.0 -15.0 ppg	Potassium sulphate based
K2SO4, Chloride free Amine system	8.5 " hole section	16.2-16.5ppg	Potassium sulphate based

The mud characteristics for each well section are detailed in **Table 4-12**.

Table 4-12: Mud Characteristics for Each Well Section

Mud Type	Bentonite Spud Mud	K2SO4, PHPA, with Chloride free Amine system	K2SO4, with Chloride free Amine system	K2SO4, with Chloride free Amine system
Section	26" hole	17.5" hole	12 ¼" hole	8 ½" hole
Max Mud Density, ppg	9.5ppg	11.0 ppg	15.0ppg	16.5ppg
Plastic Viscosity, cp	Funnel Viscosity (>70 secs)	PV< 27	PV<42	PV<50
Yield Point, lb/100 sq ft	>40	20–30	25-30	25-30
Initial Gel Strength, lb/100 sq ft(10 sec/10 mins)	N/A	10-13/11-15	10-15 / 15-20	10-15/15-25
6 rpm Fann Reading	N/A	16-18	12 - 15	10 - 15
API Fluid Loss, cc/30 mins	<10ml	< 5ml	<5ml	<5ml
pH	10-11.0	9.0-9.5	9.0-9.5	9.0-9.5
K2S04 (fixed) by weight	N/A	10%	10%	10%
Chloride free amine (fixed)	N/A	4%	4%	4%
Bridging agent CaCO3	N/A	20ppb	20ppb	20ppb

Cementing Chemicals

The cementing chemicals are used downhole to cement the casing in place. These chemicals are not used in the mud system and will not be released to the pits. They are mixed and cemented in place in the drill hole. The common cementing chemicals are listed below:

1. D047 – Antifoam
2. D206 – Defoamer
3. D065 – Dispersant solid
4. D075 – Extender
5. D080 – Dispersant liquid
6. D081 – Retarder
7. D153 – Anti-settling agent
8. D167 – Fluid loss control agent powder
9. D168 – Fluid loss control agent/Gas block agent liquid
10. D193 – Fluid loss control agent liquid
11. D207 – Fluid loss control agent powder
12. D182 – Spacer agent
13. D208 – Viscosifier/free water control agent
14. D500 – GasBLOK agent
15. D600G – HT GasBLOK agent
16. D801 - Retarder
17. D907 – Cement
18. F103 – Surfactant
19. F110 – Surfactant
20. S001 – Accelerator
21. U066 – Solvent

The cementing chemical HSE information are detailed in **Table 4-14**.

Table 4-13: Health and Safety Information for the Additives to the Water-Based Drilling Mud

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
Break-Free NW	• CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 1999/45/EC AND ITS AMENDMENTS • Flammable • Irritating to eyes and skin • Limited evidence of a carcinogenic effect • HARMFUL – May cause lung damage if swallowed • Vapours may cause drowsiness and dizziness	• Ingestion may result in nausea, pain, vomiting. • Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes. • Swallowing may cause breathing difficulty, headache, nausea, vomiting, upper respiratory tract irritation, mucous membrane irritation, central nervous system depression.	• Slippery when split.	• Store in original containers in approved flammable liquid storage area	• Remove all ignition sources. • Clean up all spills immediately. • Alert Fire Brigade and tell them location and nature of hazard.	• Flammable liquid • Land transport ADR/RID Class: 3 • Air Transport ICAO/IATA Class: 3 • Maritime Transport IMDG Class: 3
Break-Free	• This substance is NON-HAZARDOUS SUBSTANCE, NON-DANGEROUS GOODS according to the Criteria of NOHSC, and the ADG Code. • May produce discomfort of the respiratory (limited evidence).	• The liquid is discomforting to the gastro-intestinal tract. • The liquid may produce eye discomfort causing transient smarting, blinking. • The liquid may be discomforting to the skin if contact is prolonged. • The vapour is mildly discomforting to the upper respiratory tract.	• Place in a suitable labeled container for waste disposal • Prevent spillage from entering drains or water ways • Wash area and prevent runoff into drains or waterways. • If contamination of drains or waterways occurs, advise emergency services.	• Store in original containers. • Keep containers securely sealed. No smoking, naked lights or ignition sources. • Store in a cool, dry, well-ventilated area. • Store away from incompatible materials and foodstuff containers. • Protect containers against physical damage and check regularly for leaks.	• Remove all ignition sources. • Clean up all spills immediately. • Avoid breathing vapours and contact with skin and eyes. • Control personal contact by using protective equipment. • Contain and absorb spill with sand, earth, inert material or vermiculite.	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
Calcium Carbonate	• Considered a dangerous substance according to directive 1994/45/EC and its amendments.	• Dust may irritate respiratory system or lungs. • May cause discomfort if swallowed. • Powder may irritate skin. • Particles in the eyes may cause irritation. • Contains a small quantity of quartz. Prolonged and repeated exposure by inhalation to concentrations of crystalline silica exceeding the maximum exposure limit may lead to chronic lung disease such as silicosis. Because of quantity and composition, the health hazard is small.	• Do not allow to enter drains, sewers or watercourses.	• Store in original containers. • Keep containers securely sealed.	• Avoid generation and spreading of dust. Shovel up and place in a labelled sealable container for subsequent safe disposal	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).
Caustic Soda (sodium hydroxide)	• CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 1999/45/EC AND ITS AMENDMENTS. • Reacts violently with water. • Causes severe burns. • Risk of serious damage to eyes. • Classification: R14/34/41	• The material can produce severe chemical burns within the oral cavity and gastrointestinal tract following ingestion. • The material can produce severe chemical burns to the eye following direct contact. • Vapours or mists may be extremely irritating. • The material can produce severe chemical burns following direct contact with the skin.	• Do not allow to enter drains, sewers or watercourses.	• Store in original containers. • Keep containers securely sealed. • Store in a cool, dry, well-ventilated area. • Store away from incompatible materials and foodstuff containers. • Protect containers against physical damage and check regularly for leaks. • Observe manufacturer's storing and handling recommendations. • DO NOT store near acids, or oxidising agents. • No smoking, naked lights, heat or ignition sources.	• Remove all ignition sources. • Avoid contact with skin and eyes with personal protective equipment. • Use dry clean up procedures and avoid generating dust. • Place in a suitable labelled container for waste disposal.	• CORROSIVE • ICAO/IATA, ADR/RID, IMDG Class: 8

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
DRILL-BAR	• This substance is NON-HAZARDOUS SUBSTANCE, NON-DANGEROUS GOODS according to the Criteria of NOHSC, and the ADG Code. • Cumulative effects may result following exposure (limited evidence). • May produce discomfort of the respiratory system (limited evidence).	• The material may be mildly discomforting and abrasive to the eyes and skin. • The dust may be discomforting to the upper respiratory tract. • Prolonged or repeated skin contact may cause drying with cracking, irritation and possible dermatitis.	• Prevent spillage from entering drains, sewers or water courses. • If required, wet with water to prevent dusting. • Wash area down with large quantity of water and prevent runoff into drains. • If contamination of drains or waterways occurs, advise emergency services.	• Store in original containers. • Keep containers securely sealed. • Store in a cool, dry, well-ventilated area. • Store away from incompatible materials and foodstuff containers. • Protect containers against physical damage and check regularly for leaks. • Observe manufacturer's storing and handling recommendations.	• Wear impervious gloves and safety glasses. • Vacuum up (consider explosion-proof machines designed to be grounded during storage and use). • Control personal contact by using protective equipment and dust respirator. • Put residues in labelled plastic bags or other containers for disposal.	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).
DRILL-GEL	• This substance is NON-HAZARDOUS SUBSTANCE, NON-DANGEROUS GOODS according to the Criteria of NOHSC, and the ADG Code. • May produce discomfort of the eyes (limited evidence).	• Slightly discomforting to the gastro-intestinal tract. • May produce eye discomfort and abrasive eye inflammation. • May be abrasive to the skin.	• Prevent, by any means available, spillage from entering drains or water courses.	• Keep dry. • Store under cover. • Protect containers against physical damage. • Observe manufacturer's storing and handling recommendations.	• Clear area of personnel and move upwind. • If exposure to workplace dust is not controlled, respiratory protection is required; wear SAA approved dust respirator. • Use dry clean up procedures and avoid generating dust. • Recover uncontaminated product in clean, dry, labelled containers. • Collect recoverable product into labelled containers for recycling.	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
FIBRO-SEAL	• This substance is NON-HAZARDOUS SUBSTANCE, NON-DANGEROUS GOODS according to the Criteria of NOHSC, and the ADG Code.	• Discomforting to the gastro-intestinal tract. • May produce laxative effects. • May be mildly discomforting to the skin. • The dust is slightly discomforting to the upper respiratory tract.	-	• Keep dry. • Store in original containers.	• Remove all ignition sources. • Clean up all spills immediately.	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).
Glutaraldehyde	• CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC AND ITS AMENDMENTS.	• Oral (rat) LD50: 134 mg/kg • Toxic by inhalation and if swallowed. • Causes burns. • May cause SENSITISATION by inhalation and skin contact. • The material can produce chemical burns to the eye following direct contact.	• Very toxic to aquatic organisms.	• Store in original containers. • Keep containers securely sealed.	• Clean up all spills immediately. • Avoid breathing vapours and contact with skin and eyes • Clear area of personnel and move upwind. • Alert Fire Brigade and tell them location and nature of hazard.	• CORROSIVE, TOXIC • ICAO/IATA, ADR/RID, IMDG Class: 8
HYDRO-BUFF	• HAZARDOUS SUBSTANCE and DANGEROUS GOODS According to the Criteria of NOHSC and the ADG Code. • Harmful by inhalation and in contact with skin. • Toxic if swallowed. • Causes burns. • Risk of serious damage to eyes	• Oral (rat) LD50: 2050 mg/kg • The material can produce chemical burns within the oral cavity and gastrointestinal tract following ingestion. • The material can produce chemical burns to the eye following direct contact. • Vapours or mists may be irritating & corrosive to the mouth / throat.	• Neutralise/decontaminate residue. • Prevent runoff into drains. • If contamination of drains or waterways occurs, advise emergency services.	• Store in original and securely sealed containers. • Store in a cool, dry, well-ventilated area away from incompatible materials and foodstuff containers. • Protect containers against physical damage and check regularly for leaks. • Observe manufacturer's storing and handling recommendations.	• Clean up all spills immediately. • Avoid breathing vapours and contact with skin and eyes. • Control personal contact by using protective equipment. • Contain and absorb spill with sand, earth, inert material or vermiculite. • Wipe up.	• CORROSIVE • ICAO/IATA, ADR/RID, IMDG Class: 8

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
		• The material can produce chemical burns		• DO NOT store near acids, or oxidising agents, heat or ignition sources.	• Place in a suitable labelled container for waste disposal.	
HYDRO-CAP L	• CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 1999/45/EC AND ITS AMENDMENTS.	• The liquid is discomforting to the gastro-intestinal tract and may be harmful if swallowed. • Toxic effects may result from skin absorption. • The material may accentuate any pre-existing skin condition. • The vapour is discomforting to the upper respiratory tract.	-	• Store in original containers. • Keep containers securely sealed.	• Clean up all spills immediately. • Avoid breathing vapours and contact with skin and eyes	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).
HYDRO-CAP XP	• Not considered a dangerous substance according to directive 1999/45/EC and its amendments.	• Ingestion may result in nausea, abdominal irritation, pain and vomiting.	-	• Store in original containers. • Keep containers securely sealed.	• Remove all ignition sources. • Clean up all spills immediately.	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).
HYDRO-DEFOAM A	• Not considered a dangerous substance according to directive 1999/45/EC and its amendments.	• Primary routes of exposure are usually by inhalation and skin/eye contact.	-	• Store in original containers. • Keep containers securely sealed.	• Remove all ignition sources. • Clean up all spills immediately	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).
HYDRO-PAC ALL GRADES	• Not considered a dangerous substance according to directive 1999/45/EC and its amendments.	• Primary routes of exposure are usually by inhalation and skin/eye contact.	-	• Store in original containers. • Keep containers securely sealed.	• Remove all ignition sources. • Clean up all spills immediately	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
HYDRO-PLAST	• Not considered a dangerous substance according to directive 1999/45/EC and its amendments.	• Principal routes of exposure are by accidental skin and eye contact and inhalation of generated dusts. • Chronic exposure to the fumes may cause central nervous system depression, liver and kidney changes.	-	• Store in original containers. • Keep containers securely sealed.	• Remove all ignition sources. • Clean up all spills immediately	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).
HYDRO-STAR HT/ STAR CMS/ STAR NF	• NON-HAZARDOUS SUBSTANCE and NON-DANGEROUS GOODS according to the Criteria of NOHSC, and the ADG Code.	• The material may produce mild skin irritation; limited evidence or practical experience suggests.	• Prevent dust cloud. • Prevent, by any means available, spillage from entering drains or water course.	• Store in an indoor fireproof cabinet or in a room of noncombustible construction. • Provide adequate portable fire-extinguishers in or near the storage area	• Remove all ignition sources • Clean up all spills immediately • With clean shovel (preferably non-sparking) place material into clean, dry container and cover loosely. • Move containers from spill area. • Control personal contact by using protective equipment.	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).
HYDRO-ZAN ALL GRADES	• Not considered a dangerous substance according to directive 1999/45/EC and its amendments.	• Principal routes of exposure are by accidental skin and eye contact and inhalation of generated dusts.	• Prevent spillage from entering drains, sewers or water courses.	• Keep dry. • Store under cover. • Store in a well ventilated area. • Store away from sources of heat or ignition.	• Clean up all spills immediately with dry-clean up procedures and avoid generating dust. • Avoid contact with skin and eyes and wear impervious gloves and safety glasses.	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
				• Observe manufacturer's storing and handling recommendations.	• Place spilled material in clean, dry, sealed container	
OX-SCAV	• HAZARDOUS SUBSTANCE and DANGEROUS GOODS According to the Criteria of NOHSC and the ADG Code. • Contact with acids liberates toxic gas. • Causes burns. • Risk of serious damage to eyes.	• The material produces severe ocular lesions which are present twenty-four hours or more after instillation. • The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). • The material may produce respiratory tract irritation. • Inhalation of mist or sulfur dioxide vapour may cause nose, throat and lung irritation.	• Prevent, by any means available, spillage from entering drains or water course. • Neutralise/decontaminate residue. • Wash area and prevent runoff into drains.	• Store in original containers. • Keep containers securely sealed. • Store in a cool, dry, well-ventilated area. • Store away from incompatible materials and foodstuff containers. • Protect containers against physical damage and check regularly for leaks. • Observe manufacturer's storing and handling recommendations. • Store between 10 and 25 deg. C. • DO NOT use mild steel or galvanised containers.	• Clean up all spills immediately. · Avoid breathing vapours and contact with skin and eyes. · Control personal contact by using protective equipment. · Contain and absorb spill with sand, earth, inert material or vermiculite. · Place in a suitable labelled container for waste disposal.	• CORROSIVE • ICAO/IATA, ADR/RID, IMDG Class: 8
Potassium Chloride	• Not regarded as a health hazard.	• Oral (man) LDLo: 20 mg/kg • Oral (rat) LD50: 2600 mg/kg • Ingestion may result in nausea, abdominal irritation, pain and vomiting. • material may cause eye irritation	• Do not allow to enter drains, sewers or watercourses.	• Store in original containers. • Keep containers securely sealed. • Store in a cool, dry, well-ventilated area. • Store away from incompatible materials and foodstuff containers. • Protect containers against physical damage and check regularly for leaks. • Observe manufacturer's storing and handling recommendations.	• Wear impervious gloves and safety glasses. • Use dry clean up procedures and avoid generating dust. • Sweep up or Vacuum up (consider explosion-proof machines designed to be grounded during storage and use). • Place spilled material in clean, dry, sealable, labelled container.	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
Potassium Sulphate	• Not considered a dangerous substance according to directive 67/548/EEC and its amendments.	• Oral (rat) LD50: 6600 mg/kg	• Do not allow to enter drains, sewers or watercourses.	• Keep dry. • Store in original containers. • Keep containers securely sealed. • No smoking, naked lights or ignition sources. • Store in a cool, dry, well-ventilated area. • Store away from incompatible materials. • Protect containers against physical damage. • Check regularly for leaks. • Observe manufacturer's storing and handling recommendations.	• Avoid contact with skin and eyes. • Wear impervious gloves and safety glasses. • Use dry clean up procedures and avoid generating dust. • Sweep up or Vacuum up (consider explosion-proof machines designed to be grounded during storage and use). • Place spilled material in clean, dry, sealable, labelled container.	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).
Soda Ash (sodium carbonate)	• CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 1999/45/EC AND ITS AMENDMENTS. • Irritating to eyes, respiratory system and skin. • Harmful by inhalation. • Classification: R20/36/37/38	• Oral (rat) LD50: 4090 mg/kg • The material may cause skin irritation • Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS)	• Do not allow to enter drains, sewers or watercourses. • If product enters drains, waterways or watercourses, flush at least ten (10) times the volume of water to the drain.	• Store in original containers. • Keep containers securely sealed. • Store in a cool, dry, well-ventilated area. • Store away from incompatible materials and foodstuff containers. • Protect containers against physical damage and check regularly for leaks. • Observe manufacturer's storing and handling recommendations.	• Use dry clean up procedures and avoid generating dust. • Place spilled material in clean, dry, sealable, labelled container. • Collect residues and seal in labelled drums for disposal. • Wash spill area with large quantities of water.	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
Water Based Mud	• Not regarded as a health hazard.	• Long-term exposure to the product is not thought to produce chronic effects adverse to health.	-	• Store in original containers. Keep containers securely sealed. Store in a cool, dry, well-ventilated area. Store away from incompatible materials and foodstuff containers.	• Clean up all spills immediately. Avoid breathing vapours and contact with skin and eyes. Control personal contact with the substance, by using protective equipment. Contain and absorb spill with sand, earth, inert material or vermiculite.	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).
Zinc Carbonate	• Not considered a dangerous substance according to directive 67/548/EEC and its amendments.	• Gastrointestinal tract discomfort may produce nausea and vomiting. • Primary route of exposure is usually by inhalation of generated dust.	• Prevent spillage from entering drains, sewers or water courses. • Avoid generating dust.	• Store in a cool, dry place. • Protect containers against physical damage. • Keep containers securely sealed. • Check regularly for spills and leaks.	• Clean up all spills immediately. • Avoid contact with skin and eyes. • Wear impervious gloves and safety glasses. • Use dry clean up procedures and avoid generating dust. • Place spilled material in clean, dry, sealable, labelled container.	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).

Table 4-14: Health and Safety Information for the Cementing Chemicals

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
D047 – Antifoam	• Not classified as hazardous substance.	• Inhalation of vapours in high concentration may cause irritation of respiratory system. • May cause slight irritation. • Prolonged contact may cause redness and irritation. • Ingestion may cause stomach discomfort.	• Not be allowed to enter drains, water courses or the soil.	• Keep containers tightly closed in a dry, cool and well-ventilated place. • Keep away from open flames, hot surfaces and sources of ignition • Store away from incompatibles, Strong oxidising agents	• Absorb with earth, sand or other non-combustable material and transfer to containers for later disposal. • After cleaning, flush away traces with water.	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).
D206 – Defoamer	• Classification according to EU Directives 67/548/EEC or 1999/45/EC	• Inhalation of vapours in high concentration may cause irritation of respiratory system. • May cause slight irritation. • Prolonged contact may cause redness and irritation. • Ingestion may cause stomach discomfort.	• The product should not be allowed to enter drains, water courses or the soil.	• Keep containers tightly closed in a dry, cool and well-ventilated place. • Protect from freezing Store below 86F (30C). • Incompatible with oxidising agents and materials which react with water.	• Absorb with earth, sand or other non-combustable material and transfer to containers for later disposal. • After cleaning, flush away traces with water.	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).
D065 – Dispersant solid	• WARNING • H232 - May form combustible dust concentrations in air.	• Inhalation of vapours in high concentration may cause irritation of respiratory system. • Dust may cause mechanical irritation. • Prolonged contact may cause redness and irritation. • Ingestion may cause stomach discomfort.	• The product should not be allowed to enter drains, water courses or the soil.	• Keep containers tightly closed in a dry, cool and well-ventilated place. • Keep away from direct sunlight. • Protect from moisture • Use specially constructed containers only.	• Avoid generating or breathing dust. • Take up mechanically and collect in suitable container for disposal. • After cleaning, flush away traces with water.	• The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
D075 – Extender	• Classification according to EU Directives 67/548/EEC or 1999/45/EC	• Inhalation of vapours in high concentration may cause irritation of respiratory system. • May cause slight irritation. • Prolonged contact may cause redness and irritation. • Ingestion may cause stomach discomfort.	• The product should not be allowed to enter drains, water courses or the soil.	• Ensure adequate ventilation. Keep airborne concentrations below exposure limits. • Keep containers tightly closed in a dry, cool and well-ventilated place. • Avoid contact with: Aluminum Zinc Metals • Avoid frost. Keep at >32°F / 0°C • Use specially constructed containers only • Do not use steel or aluminum tools or equipment	• Absorb with earth, sand or other non-combustable material and transfer to containers for later disposal. • After cleaning, flush away traces with water.	• Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.
D080 – Dispersant liquid	• Chronic aquatic toxicity in Category 2 • HAZARDOUS SUBSTANCE and DANGEROUS GOODS, classified as Hazardous according to the criteria of NOHSC.	• Inhalation of vapours in high concentration may cause irritation of respiratory system. • May cause slight irritation. • Prolonged contact may cause redness and irritation. • Ingestion may cause stomach discomfort.	• The product should not be allowed to enter drains, water courses or the soil.	• Keep containers tightly closed in a dry, cool and well-ventilated place. Store in original container • Do not freeze Store above 0°C • Avoid contact with: Oxidizing agents Acids	• Absorb with earth, sand or other non-combustable material and transfer to containers for later disposal. • After cleaning, flush away traces with water.	• Hazardous to the environment • ICAO/IATA, ADR/RID, IMDG Class: 9
D081 – Retarder	• Not classified as hazardous substance.	• May cause irritation of respiratory tract. • May cause temporary eye irritation. • May cause pain, redness, discomfort. • Ingestion may cause stomach discomfort.	• The product should not be allowed to enter drains, water courses or the soil.	• Keep containers tightly closed in a dry, cool & well-ventilated place. • Keep away from direct sunlight & away from strong acids or oxidising agents	• Absorb with earth, sand or other non-combustable material and transfer to containers for later disposal. • After cleaning, flush away traces with water.	• Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
D153 – Anti-settling agent	• Serious health hazard • H373 - May cause damage to organs through prolonged or repeated exposure.	• Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough. • May cause respiratory irritation. • Repeated or prolonged inhalation of crystalline silica dust can cause delayed lung injury, and other diseases, including silicosis and lung cancer. • Dust may cause mechanical irritation. • Repeated exposure may cause skin dryness or cracking. • Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.	• The product should not be allowed to enter drains, water courses or the soil.	• Keep containers tightly closed in a dry, cool and well-ventilated place. • Protect from moisture • Avoid contact with: Hydrofluoric acid (HF) Strong oxidising agents	• Vacuum up. • Avoid generating dust. • Put into suitable containers for disposal. • After cleaning, flush away traces with water.	• Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.
D167 – Fluid loss control agent powder	• WARNING • May form combustible dust concentrations in air	• Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough. • Dust may cause mechanical irritation. • Repeated exposure may cause skin dryness or cracking. • Not an expected route of exposure. Ingestion may cause stomach discomfort.	• The product should not be allowed to enter drains, water courses or the soil.	• Keep away from open flames, hot surfaces and sources of ignition. • Keep containers tightly closed in a dry, cool and well-ventilated place.	• Sweep up and shovel into suitable containers for disposal. • After cleaning, flush away traces with water.	• Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
D168 – Fluid loss control agent/Gas block agent liquid	• NON-HAZARDOUS SUBSTANCE. • NON-DANGEROUS GOODS.	• Inhalation of vapours in high concentration may cause irritation of respiratory system. • May cause slight irritation. • Prolonged contact may cause redness and irritation. • Ingestion may cause stomach discomfort.	• The product should not be allowed to enter drains, water courses or the soil.	• Keep containers tightly closed in a dry, cool and well-ventilated place • Store above freezing temperature • Store away from incompatibles	• Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. • After cleaning, flush away traces with water.	• Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.
D193 – Fluid loss control agent liquid	• Health hazard/Hazardous to the ozone layer • May cause an allergic skin reaction	• May cause allergic skin or respiratory reactions in sensitive individuals or those with pre-existing skin or respiratory conditions. • May cause irritation of respiratory tract. • May cause redness, itching, and pain. • Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.	• The product should not be allowed to enter drains, water courses or the soil.	• Keep containers tightly closed in a dry, cool and well-ventilated place. • Store above 0°C • Avoid extreme temperatures. • Protect from freezing	• Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. • After cleaning, flush away traces with water.	• Not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).
D207 – Fluid loss control agent powder	• No classified physical hazards. • May cause mechanical irritation to eyes.	• May cause mechanical irritation. • Accidental ingestion of small amounts is not expected to cause adverse effects. • Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough.	• Keep out of waterways. • Prevent entry into sewage.	• Keep material dry. • Provide appropriate exhaust ventilation at places where dust is formed. • Take precautionary measures against static discharges.	• Sweep up and shovel into suitable containers for disposal.	• Not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
D182 – Spacer agent	• Not classified as hazardous substance.	• Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough. • Dust contact with the eyes can lead to mechanical irritation. • Repeated exposure may cause skin dryness or cracking. • Ingestion may cause stomach discomfort	• The product should not be allowed to enter drains, water courses or the soil.	• Keep containers tightly closed in a dry, cool and well-ventilated place • Keep away from open flames, hot surfaces and sources of ignition • Keep away from direct sunlight Incompatible with oxidising agents.	• Sweep up and shovel into suitable containers for disposal. • Take precautionary measures against static discharges. • After cleaning, flush away traces with water.	• Not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).
D208 – Viscosifier/free water control agent	• Not classified as hazardous substance.	• Inhalation of dust in high concentration may cause irritation of respiratory system. • Dust contact with the eyes can lead to mechanical irritation. • Prolonged contact may cause redness and irritation. • Ingestion may cause stomach discomfort.	• The product should not be allowed to enter drains, water courses or the soil.	• Keep containers tightly closed in a dry, cool and well-ventilated place. • Keep away from open flames, hot surfaces and sources of ignition • Keep away from direct sunlight Store away from incompatibles	• Avoid generating or breathing dust. • Product is slippery if wet. • Sweep up and shovel into suitable containers for disposal.	• Not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).
D500 – GasBLOK agent	• HAZARDOUS SUBSTANCE • NON-DANGEROUS GOODS. • Skin sensitisation, Category 1 • Health hazard / Hazardous to the ozone layer	• Inhalation of vapours in high concentration may cause irritation of respiratory system. • Contact with eyes may cause irritation. • May cause sensitisation by skin contact. • Ingestion may cause stomach discomfort.	• The product should not be allowed to enter drains, water courses or the soil.	• Keep containers tightly closed in a dry, cool and well-ventilated place • Protect from freezing • Keep at 41 - 131°F / 5 - 55°C	• Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. • After cleaning, flush away traces with water.	• Not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
D600G – HT GasBLOK agent	• Not classified physical hazards.	• Swallowing large amounts may be harmful.	• Keep out of waterways	• Avoid freezing. Freezing may destroy emulsion. • Keep away from direct sunlight.	• Put into suitable containers for disposal.	• Not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).
D801 - Retarder	• Not classified physical hazards.	• Inhalation of vapours in high concentration may cause irritation of respiratory system. • May cause slight irritation. • Prolonged contact may cause redness and irritation. • Ingestion may cause stomach discomfort.	• The product should not be allowed to enter drains, water courses or the soil.	• Keep containers tightly closed in a dry, cool and well-ventilated place. • Do not freeze Keep away from direct sunlight	• Absorb with earth, sand or other non-combustable material and transfer to containers for later disposal. • After cleaning, flush away traces with water.	• Not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).
D907 – Cement	• Health hazard / Hazardous to the ozone layer • Corrosive • Skin corrosion/irritation, Category 2 • Serious eye damage/eye irritation, Category 1 • Specific target organ toxicity (single expose), Category 3	• Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough. May cause allergy or asthma symptoms or breathing difficulties if inhaled. • Causes serious eye damage. • Causes skin irritation. • Ingestion may cause irritation to mucous membranes.	• The product should not be allowed to enter drains, water courses or the soil. • Prevent entry to sewage.	• Keep containers tightly closed in a dry, cool and well-ventilated place • Protect from moisture • Store away from incompatibles, Powdered aluminum Acids Oxidizing agents	• Do not dry sweep dust. Wet dust with water before sweeping or use a vacuum to collect dust. • Pick up and transfer to properly labelled containers. • Keep in suitable, closed containers for disposal. • Clean contaminated surface thoroughly. • After cleaning, flush away traces with water.	• Not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
F103 – Surfactant	• Health hazard/Hazardous to the ozone layer • Corrosive • Flammable • Acute toxicity - Oral, Category 4 • Skin corrosion/irritation, Category 2 • Serious eye damage/eye irritation, Category 1 • Specific target organ toxicity - Single exposure, Category 3	• Inhalation of vapours in high concentration may cause irritation of respiratory system. May cause drowsiness or dizziness. • Causes serious eye damage. • Causes skin irritation. Components of the product may be absorbed into the body through the skin. • Harmful if swallowed.	• The product should not be allowed to enter drains, water courses or the soil.	• Keep containers tightly closed in a dry, cool and well-ventilated place Keep away from direct sunlight Keep away from open flames, hot surfaces and sources of ignition • Protect from freezing • Store above 0°C • Store away from incompatibles, Strong oxidising agents Strong bases Aluminium	• Take precautionary measures against static discharges. Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. • Use clean non-sparking tools to collect absorbed material. • Ground and bond containers when transferring material. After cleaning, flush away traces with water.	• Flammable • ICAO/IATA, ADR/RID, IMDG Class: 3
F110 – Surfactant	• DANGER • Flammable Liquid • **HMIS classification:** - Health: **3** - Flammability: **3** - Physical hazard: **0**	• Severe eye irritation. • Causes pain and redness. • Prolonged or repeated contact may cause mild burn. • Severe skin irritation. • May cause headache, narcosis. • May cause dizziness, nausea, vomiting, diarrhea.	• Prevent further leakage or spillage. • Keep out of waterways.	• Keep away from heat, sparks, and flame. • Store out of direct sunlight in well-ventilated area. • Keep container closed when not in use. • Use with adequate ventilation.	• Contain with dikes. • Use explosion proof equipment to recover. • Remove all sources of ignition. • Soak up residual on inert absorbant (sand). • Put in steel or plastic drum approved for flammables.	• Flammable • IMDG/IMO, ICAO/IATA, TDG: Class 3, Toxic 6.1.
S001 – Accelerator	• Serious eye damage/eye irritation, Class 2 • Health Hazard/Hazardous to ozone layer.	• Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough. • Causes serious eye irritation. • May cause skin irritation and/or dermatitis.	• The product should not be allowed to enter drains, water courses or the soil.	• Keep containers tightly closed in a dry, cool and well-ventilated place • Avoid: High temperatures. • Avoid contact with water and moist air.	• Avoid generating or breathing dust. Sweep up and shovel into suitable containers for disposal. • After cleaning, flush away traces with water.	• Not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).

Product Name Chemical Name	Hazards Identification	Toxicological Information	Environmental Precautions	Storage Requirements	Spill Clean Up Methods	Transport Information
		• Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.				
U066 – Solvent	• Health hazard / Hazardous to the ozone layer • Acute oral toxicity, Category 4 • Acute dermal toxicity, Category 4 • Acute inhalation toxicity - Vapour, Category 4 • Skin corrosion/irritation, Category 2 • Serious eye damage/eye irritation, Category 2	• Harmful by inhalation. • Causes serious eye irritation. • Harmful in contact with skin. May be absorbed through the skin in harmful amounts. Irritating to skin. • Harmful if swallowed.	• The product should not be allowed to enter drains, water courses or the soil. • Keep out of waterways.	• Keep containers tightly closed in a dry, cool and well-ventilated place • Keep away from open flames, hot surfaces and sources of ignition • To avoid ignition of vapours by static electricity discharge, all metal parts of the equipment must be grounded • Keep away from direct sunlight Incompatible with oxidising agents	• Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. • After cleaning, flush away traces with water.	• Not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).

4.8.3.2.3 Wireline Logging Operations

A series of petrophysical logs will be run to identify the rock properties and hydrocarbon potential. The petrophysical tools are lowered into the well using a cable and winch. Some of the wireline tools run in the hole will contain a radioactive source. High safety standards are employed while handling and storing the source on the surface. It is stored in a lead container in a dedicated area away from personnel and the main working area.

In logging the well, typically four main types of equipment are used:

- The downhole instrument (which measures the data),
- The computerized surface data acquisition system (to store and analyze the data),
- The cable or wireline (which serves as both mechanical and data communication link with the downhole instruments), and
- The hoisting equipment to raise and lower the instruments.

The downhole instruments (also known as tools or sondes) are first lowered to the bottom of the well, then slowly retrieved, probing the formations continually by using various non-destructive techniques. This process provides a continuous stream of data up the wireline to the surface computer. Data are recorded on a "log" that displays information about the formation as a function of depth.

Well logs are used to:

1. Define physical rock characteristics such as lithology, porosity, pore geometry, and permeability;
2. Identify productive zones of hydrocarbons;
3. Determine the depth and thickness of zones;
4. Distinguish between oil, gas and water zones in a reservoir; and
5. Determine facies relationships.

A wireline logging operation will run into the borehole via cable in order to inspect the potential for hydrocarbon, geological condition and record geophysical properties of the formation and fluids in the bore: e.g. Electricity Conductivity (EC), porosity, resistivity, density, radioactive property etc. In some cases, samples of fluids will be taken in order to appraise potential of the petroleum reservoir. Wireline logging will take about 3-4 day for each section.

During the wireline logging operation, the following measurements are made: gamma rays log, resistivity log, density log and neutron log. Gamma rays will be used to identify rock type – a low ratio indicates sandstone, a high ratio indicates claystone. Neutron rays will be used to search for the volume of reflected fraction. Some fraction is absorbed by Hydrogen in the formation cavity. If a high ratio is found, it indicates the formation has low density or may have high porosity. Determination of EC in the formation, the equipment will generate electric current into the formation which will make the fluids act as a conductive. If a reading is low, it indicates the formation is a water bearing formation. If the reading is high, it indicates the formation may contain gas or oil. Results of the wireline operation are displayed in a graph format which requires interpretation to obtain information on type of petroleum and rock, porosity, density, and etc. which can determine if the well contains water, productive oil or natural gas.

The logging program tentatively planned for the wells is described below:

One logging run will be performed for 12 ¼" - 8 ½" and 7" hole.

Run 1: Induction-Density-Neutron-Spectral Gamma Ray-Caliper-Head Tension.

4.8.3.3 Well Testing

Oil and gas well testing (also known as drill stem testing) are performed at various stages of drilling, completion and production. Test objectives can be as simple as identification of produced fluids and reservoir productivity to the characterization of reservoir features. Current technology improvements in downhole sensors and better control of down-hole environment have significantly increased capabilities of well testing operation. A typical well testing arrangement is shown in **Figure 4-21**.

Generally, well tests are conducted to:

- ✓ Identify produced fluids
- ✓ Measure reservoir pressure & temperature
- ✓ Obtain representative samples, surface and downhole for PVT analysis
- ✓ Determine well productivity and flow performance i.e. productivity index, skin
- ✓ Obtain hydrocarbon composition and impurities i.e. Mercury, CO2 and H2S

There are two (2) main categories of drill stem test:

- ✓ **Open Hole Drill Stem Test** - provides rapid and economical means to quickly assess production potential of the formation. This technique requires hole to be in a very good condition and highly consolidated. Packer still needs to be set in casing/liner if annulus hydraulic operated tools are chosen. Mini drill stem test using straddle packer can be an alternative to full bore drill stem test.

- ✓ **Cased Hole Drill Stem Test**- also known as full-bore drill stem test. This technique utilizes pressure controlled system to eliminate the need for pipe manipulation that is crucial for offshore drilling with floating rigs. Moreover, services such as thru tubing perforating, slickline conveyed sampling and production logging can readily be programmed into the test sequence even as contingency measures.

4.8.3.3.1 Well Test Equipment

Well testing equipment consists of mainly four (4) parts:

1. Perforation

Perforating gun is a critical part of the well testing process which essential for better well productivity an operating efficiency. Two (2) basic perforating techniques are available for well test job:

- ✓ **Thru Tubing Gun** - Guns are lowered into the well thru test string using either wireline or coiled tubing. Mostly applicable for add-on perforation job.

- ✓ **Casing Gun** - Large diameter guns are lowered as part of the test string bottom-hole assembly in a conventional well test. The guns may be conveyed with wireline, drillpipe and etc. as well for shoot and pull before running in test string.

2. Drill Stem Test (DST) Tools

A set of drill stem test tools consist of down-hole hardware used for temporary completion of a well. They are run to provide a safe and efficient method of controlling formation during the well test operation. Basic tool functions cover well isolation, down-hole circulation, down-hole shut-in, pressure test, emergency shut-in / circulation and as gauge carrier.

DST tools are designed for a wide range of operating environments and to perform different functionalities.

- ✓ Retrievable / Permanent Packer
- ✓ Downhole Test Valve
- ✓ Reverse Circulation Valve
- ✓ Slip Joint
- ✓ Hydraulic Jar
- ✓ Safety Joint
- ✓ Safety Valve
- ✓ Gauge Carrier
- ✓ Downhole sampler

3. Subsurface Safety System

Well tests on semi-submersible and floating drilling vessels will require subsea control valve tool in the BOP. This tool is designed to allow the rig to shut-in the well, quickly disconnect from test string and safely move off location in the event of excessive heave.

Additional safety features of these tools have been incorporated into fixed and jack-up type drilling rigs as well.

4. Surface Well Test Equipment

Produced fluids during well test are normally handled using temporary production facilities / surface testing package. This equipment needs to be assembled and designed to safely and reliably fulfil a wide range of operations:

- ✓ Pressure control and shutting in the well
- ✓ Separate produced fluids into gas, oil and water phases allowing all constituents to be measured
- ✓ Allow representative samples of produced fluids to be taken
- ✓ Dispose of produced fluids in an environmentally acceptable manner
- ✓ Data acquisition

Each of surface components must be designed for expected operating conditions.

- ✓ Flowhead
- ✓ Choke Manifold
- ✓ Heater / Heat Exchanger
- ✓ Test Separator
- ✓ Gauge / Surge Tank
- ✓ Pumps and Manifolds
- ✓ Emergency Shutdown System
- ✓ Surface Safety Valve
- ✓ Burner head, vertical flare stack

4.8.3.3.2 Well Test Design

Design and implementation of well testing program has to be in line with the latest standard. Stringent safety requirements, environmental concerns and a greater need for cost efficiency require the entire testing sequence from design to data evaluation be conducted intelligently. Proper test design, correct handling of surface effluents, high performance gauges, flexible down-hole tools and perforating systems, well site validation and comprehensive interpretation are keys to successful well testing.

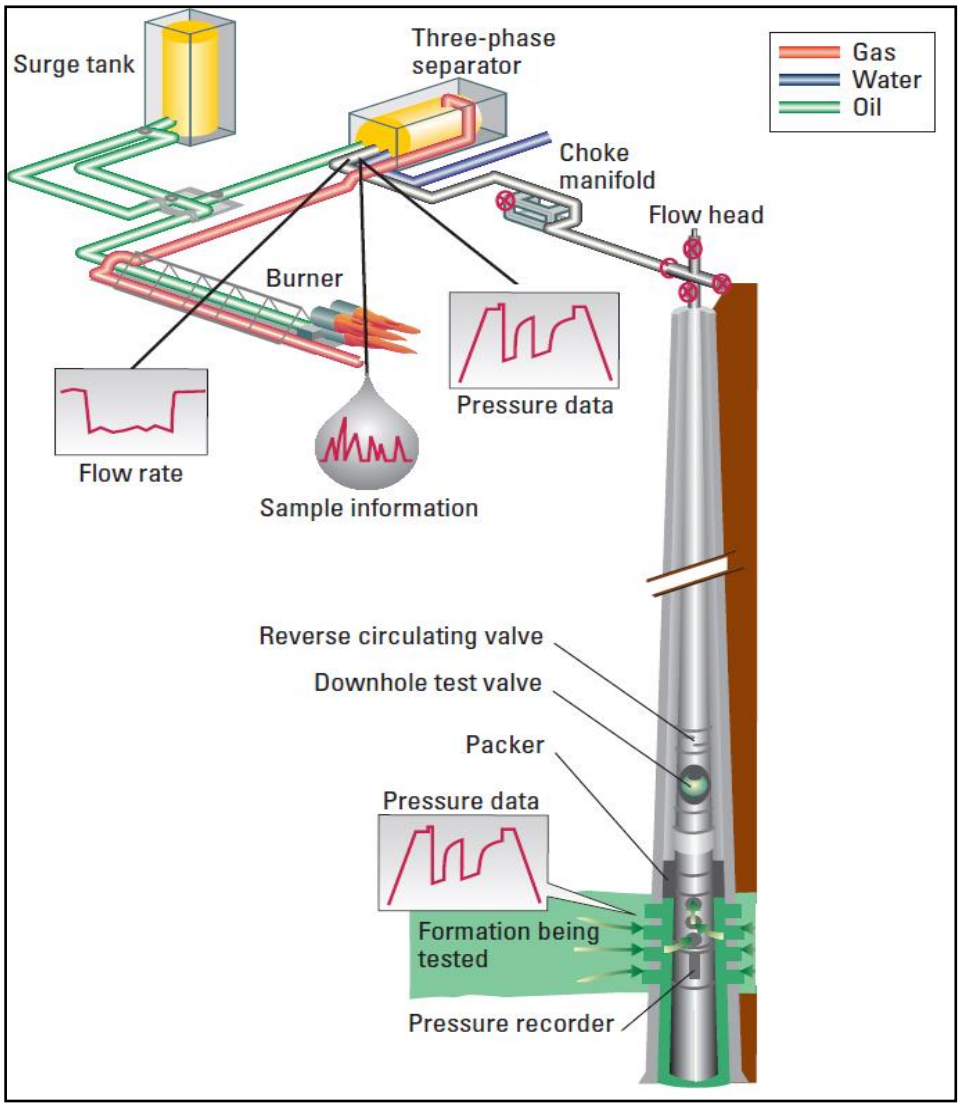
Types of well or reservoir data will drive the type of well test to be run i.e. conventional drill stem test, underbalanced drill stem test, etc. Later, sequence of flow and shut-in are determined with various flow rate and realistic duration as to generate the expected interpretation patterns. Different types of well tests can be achieved by altering production rates and shut-in well at downhole / surface.

- ✓ Initial Flow & Initial Build-up
- ✓ Clean-up Flow
- ✓ Main Flow (draw down test)
- ✓ Main Build-up (build-up test)
- ✓ Sampling Flow (bottom hole sampling)
- ✓ Multi Rate Test (recommended for oil testing)
- ✓ Modified Isochronal Test (recommended for gas testing)
- ✓ Maximum Flow

Diagnostic plots of simulated data should be examined to determine when essential features will appear i.e. wellbore storage effects, duration of infinite acting radial flow, emergence of external boundary effects, constant pressure boundary and etc. Final step of test design process is to select instrumentation and equipment for data acquisition.

In summary, surface and down-hole equipment should be versatile to allow for safe and flexible operations. Among of the key factors to consider:

- ✓ Controlling down-hole environment to minimize wellbore storage
- ✓ Combining perforation and testing technique to minimize rig time
- ✓ Choosing reliable down-hole recorders to ensure successful and good quality data retrieval
- ✓ Selecting surface equipment to safely handle expected rates and pressures
- ✓ Environmentally sound disposal of produced fluids



Source: PCMI, 2018

Figure 4-21: Well Testing Set-Up with Horizontal Flare Burner

4.8.3.3.2.1 Flaring

If it is decided to test the well (DST or LPT) a significant quantity of gas could be flared from the well. The actual flow rate of the reservoir at this location is a parameter which the drilling of the well is intended to determine.

The rate of gas production will range between 0-30 mmscfgd (30 mmscfgd being the maximum handling of the rig's processing equipment). If a DST found less than 5 mmscfgd an LTP test would unlikely proceed. If an LTP test is to proceed, the drilling rig would be de-mobed and a smaller well testing package brought in to conduct the LTP test. During an LPT test flaring would be conducted at various rates and sustained rates combined with shut-ins to observe pressure build ups and flowed again. The data gathered is used to establish reservoir characteristics. The maximum flow during an LPT tests generally never exceed 10 mmscfgd. Thus a worst case scenario flaring is a sustained flow rate of 10 mmscfgd for 7 days.

4.8.3.3.2.2 Blowout Preventative Measures

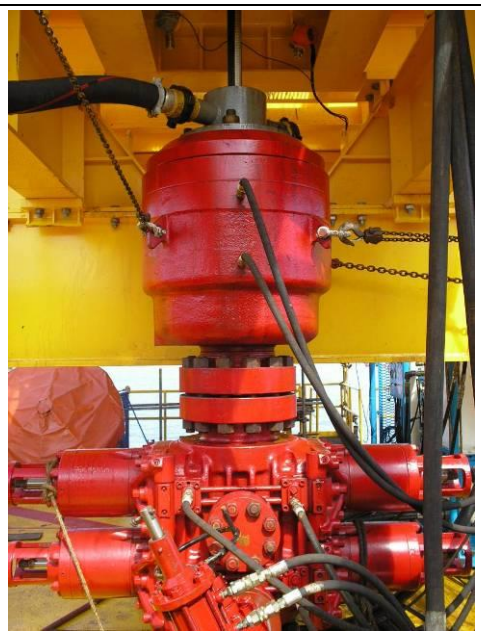
A complex series of valves, known as the "blowout preventer" (BOP), is attached to the top of the conductor below the derrick floor. All further casing strings are also attached into this blowout preventer. These are powerful hydraulically-activated valves and rams that can be closed around the drill pipe to isolate the well bore should unexpectedly high formation pressure be encountered. If formation pressure exceeds the hydrostatic head of the drilling mud, it may cause the well to flow strongly, referred to as a "kick". A kick can also occur if a highly permeable formation, such as a naturally fractured limestone, is encountered and a large volume of mud is suddenly lost into the formation.

The blowout preventer is the primary safety mechanism for well control. The series of valves act independently and when closed in an emergency form a series of increasingly secure barriers that isolate the well so that a plan of action can be developed to bring it back under control.

Maximum pressure for the project prospect wells is expected to be not exceeding 9,500psi. PCMI will use a 5,000 psi rated 21-1/4" BOP and a 10,000 to 15,000 psi BOP with double ram preventers in the 13-5/8" section.

The BOP is tested and certified as per API standards to 10,000 psi before installation. Once the BOP stack is installed it is pressure tested to API specification (API RP 53) to 10,000 psi. Once in service the BOP stack must be tested ever 3 weeks as per API specification. PCMI's standard operation procedures require the BOP to be tested every 2 weeks which is more stringent than API specification. Also, every time a connection is made (i.e. wellhead connection) the BOP must be pressure tested again to as per API specification. BOP unit will have separate generator which will use power supply to generate pressure in the accumulator to operate BOP that is always available.

A blowout is a very low probability event with the use of an appropriately sized BOP. Any blowout event will be managed under the PCMI – Myanmar Operation Emergency Management Plan included in **Appendix 5**. This plan defines the procedures that are to be used in the event of a well control emergency occurring in their onshore exploration drilling.



Blowout Preventer (Example)

Source: PCMI, 2018

4.8.3.4 Well Completion, Suspension, Abandonment or Contingency Well

If the well proves to be highly productive it is likely that the well will be completed and temporarily suspended rather than permanently abandoned, given the high cost of drilling a replacement well at a later date.

At the end of the drilling or the well completion operations, the rig and associated equipment will be broken down and loaded onto trucks to be moved to the next operator's drilling location.

4.8.3.4.1 Commercially Successful Well

4.8.3.4.1.1 Well Completion

A commercially successful well will be suspended for future completion. After testing, the well will be killed with clean brine at appropriate weight. (Calculated overbalance) Then a minimum of 1 mechanical retrievable or drillable bridge plug will be set above the perforated zone and pressure tested. A kill string will be run and landed in the well head with the tubing hanger and a BPV (Back Pressure Valve) The tubing hanger will be secured with the tie down screws. Then the BOP is removed and suspension cap installed.

4.8.3.4.1.2 Well Pad Suspension

If the well is completed as a future producer, the drilling rig, associated equipment, accommodation units and warehousing will be removed from the site. The entire site will be cleaned up and made ready for suspension. The waste pit will be emptied and cleaned out with any material extracted removed for treatment and disposal.

The concrete rig pad and other foundations will be left intact for future use. The internal and intermediate drains around the rig pad and well pad site will be cleaned and any material extracted removed for treatment and disposal offsite. The external flood water diversion drain around the well site will be cleaned out and put in a state of good repair.

An inspection will be made of the entire well pad by a civil engineer and any defects put right and any modifications made to ensure it will be able to withstand an entire rainy season without significant deterioration. The site will be inspected before and after each rainy season and any repair work conducted accordingly.

The well site will have 2 security guards on duty at all times 24/7.

4.8.3.4.2 Commercial Failure, Well Abandoned

It is considered unlikely that this well will be a commercial failure. However, if it is so decided then the well will be permanently abandoned and the well site restoration work commenced immediately. The requirements for the physical abandonment will follow best industry practices and as per PCMI PPGUA. The following procedure for plugging and abandoning the well bore will ensure that the land is returned as near as possible to its original state.

The procedure for abandonment and restoration of such a well site is long established and is a relatively routine operation.

The well abandonment will follow normal industry practices and procedures, conforming to all International regulations. A section of the 7" casing will be filled with heavy kill weight mud and a cement plug will be put in position, 30m below top of liner lap and 30m above as one 60m long plug. (Minimum length) After curing/thickening time, the position of the plug will be confirmed physically by tagging with the cementing string. It will then be pressure tested. Then a 30m (Minimum length) cement plug will be spotted at surface. Wellhead will then be removed and casing will be cut off at

bottom of cellar. A steel plate will be welded on the top of the cut off casing. The cellar will then be removed and the cellar back filled with clean soil.

The well site will then be cleared of all equipment and cleaned up. The rig cellar will be removed and a steel plate welded on top of stump, a minimum 3 m below ground level. The concrete rig pad, other foundations and the water pit will be broken up and all material removed off site for disposal as normal building rubble. The Civil Work Contractor will have stripped and stockpiled the top 500 mm topsoil layer while constructing the well site area.

Once campaign finished, the surface of the well pad, consisting of compacted fill will be broken up and the contours of the site restored to their original levels then the civil work contractor will remove all borrowed soil from well site and put back the topsoil to the well site area to restore to original condition.

4.8.3.4.3 Contingency Wells

During drilling of the well, technical issues may occur that require the exploration well to be re-drilled. A contingency well would be in the form of a side track or a new hole next to the first hole within the same pad built for the well. Examples of some technical issues that could require drilling of a contingency well are: tools or drill string lost down hole; surface casing collapse or weakened; unexpected hydrocarbon reservoir encountered shallower than objective; poor quality reservoir. Although these issues are unlikely to occur, a second or third contingency well may have to be drilled from the well pad to meet the objectives of this project.

The technical issue encountered would be reviewed and PCMI would evaluate the best option to overcome the issue. Drilling a contingency well is just one of many possible options but would be a worst case and last resort scenario.

4.8.4 Employment and Accommodation

4.8.4.1 Employment

The workforce active on the project will vary with time, depending on the phase of the operation. Up to 100 to 120 personnel could be employed for this exploration drilling project. An estimate of the number of personnel active during each phase is provided in **Table 4-15**.

Table 4-15: Estimated Work Force

Project Phases	Number of Personnel
Construction Phase	60 – 80
Drilling, Testing Operations Phase	100 – 120
Well Testing Phase	20-30
Well Suspension or Abandonment Phase	15 - 25

The site construction and abandonment or restoration phases will be conducted using a civil engineering contractor and their local staff. The ration of skilled and unskilled workers during the construction phase will be 20: 80 with an expected number of local hires of between 40 – 50 persons.

During drilling operations, the ratio of skilled and unskilled workers will be 30: 70 with an expected number of local hires of between 40 – 50 persons. The expected number of local hires will be 20 MOGE staff. Where possible it is PCMI's company policy to encourage the hiring of local staff.

4.8.4.2 Accommodations

The construction of accommodation in the work camp will be in compliance with Requirements of the IFC Guidance on Workers' Accommodation (August 2009). The civil and drilling campsite will be international industry-standard accommodations, consisting of container-based sleeping and living quarters, messing and recreation facilities, with a capacity to accommodate all personnel. It will have its own cooking, freezer food storage, laundry and sanitation facilities as well as its own power generation by diesel powered generators.

The civil works campsite will be built near the well site construction zone. The camp will include a minimum one (1) Shower per ten men, one toilet per fifteen men and one wash basin per fifteen men. The construction dining Unit shall have minimum seating capacity for 20 men at any time. All Camp equipment will be maintained in good condition, clean and has access to a Camp Maintenance Repair man on short notice. The temporary construction sewer pits must be constructed 100 meters from the camp site

Drilling rig contractor will provide the drilling campsite during the drilling phase; it will be located next to the well pad area in the designated green zone. The accommodations will be container type accommodations as per industry standard, they will be moved onto site and contain a minimum of 1 Man Sleeper, 2 Man Sleeper, 4 Man Sleeper per unit with a bath room attached. The containers will all have air conditioning. A separate dining unit will be provided and have a minimum seating capacity for 40 persons at any time

The rig crew and service personnel work 12-hour shifts and are rotated from duty on a maximum 28-day schedule, as is standard industry practice. Essential management and supervision staff will be accommodated at the well site. These will include the two Drilling Supervisors, the MOGE representative, the Well-Site Geologist, the Tool Pusher, and the Night Pusher. The site will also have up to 2 additional sleeping quarters to accommodate visits by the Drilling Manager and Drilling Engineer and other specialists normally based in Yangon.

PCMI will also ensure that a full time doctor will stay at the site 24 hours a day, 7 days a week during the drilling phase. MOGE provides at its discretion an on-site representative, who observes operations and provides advice on compliance with Myanmar regulations.

4.8.5 Facilities and Utilities

4.8.5.1 Water Supply and Usage

4.8.5.1.1 Potable Water

Maximum daily usage is expected to be 10.4 m^3 per day during drilling (80L/person/day for maximum crew of 120) when the camp is accommodating a full crew. Potable water will be supplied by two deep tube well installed at the camp site. If tube type wells are not successful or water not suitable, water will be sourced and transported by tanker from near by water source as approved by the Local Authorities. Local authorities will be consulted before water hauling. All potable water for showering washing will be put through a filter system with black light and chlorine injection to prevent disease.

All drinking water will be sourced from local retail suppliers. The maximum demand from the operation, estimated to be 200 litres per day, will have a beneficial impact on the local sales of bottled drinking water.

4.8.5.1.2 Industrial Water

It is estimated that a total of 6000 m^3 of industrial grade fresh (non-potable) water will be required during the drilling operation (to be used as makeup water for the drilling mud, cement mixing and losses). Water will be supplied to each well site from two deep tube wells at the well site. If tube type wells are not successful or water supply rate not suitable, water will be sourced and transported by tanker from near by water source. Local authorities will be consulted prior water hauling begins.

The industrial water will be stored on the well site in an in clean water ground storage pit 30 m x 15 m x 4 m deep for a maximum capacity of 1,800 m^3.

4.8.5.2 Power Supply

4.8.5.2.1 Well Site Power

Estimated fuel consumption is 8 m^3 per day during drilling. On-site fuel storage capacity will consist of an 80 m^3 tank.

All electrical power for the well site, drilling rig and associated equipment will be provided by four diesel fuelled generator sets. Estimated total fuel usage is 960 m^3 (based on 90 days of drilling and 30 days testing for both wells). During well testing phase, power consumption is minimal (i.e., only power for instruments and lights is required which can be powered from the work camp generators).

4.8.5.2.2 Work Camp Site Power

All power for the camp site will be provided by the camp's 10 KVA diesel-fuelled generators. Expected fuel consumption is 1.5 m^3 per day during full accommodation. On-site fuel storage capacity will consist of one 25 m^3 tank. Estimated total fuel usage is about 180 m^3 (based on 90 days of drilling and 30 days of well testing).

4.8.5.2.3 Drainage and Flooding Prevention

During construction, a civil engineering contractor will be required to survey the road to be upgraded and the driveway to be constructed. The contracted civil engineer will determine and recommend if culverts or additional ditches are necessary to manage surface water runoff. If culverts are required or requested, the size of culvert to be installed will depend on the civil engineer's recommendation and/or local authority's recommendation. Generally, culverts in this area are 60 cm in diameter, made of reinforced concrete and purchased prefabricated.

4.8.5.2.4 Drainage Control in the Rig Pad (drilling) area

Water drained from the concrete rig pad on each well site will be channelled into the waste pit with dimensions 40 m x 30 m and a depth of 4 m. The pit has a capacity of 6,000 m^3. The pit with have an embankment enclosed to prevent the excess water drain into the pond.

The runoff from the well site combined with rain falling on the waste pit during extreme heavy rain (rainfall intensity of a ½-hr duration storm with a month's equivalent of rainfall) totals 391.2 m^3. The waste pit has an actual holding capacity of 6,000 m^3. The waste pit can therefore contain much more rainfall than the extreme heavy rain. In the unlikely event that the waste pit should become full and overflow, tanker trucks are prepared to drain rainwater from the pit. This can be stored for later use as mix water, or if contaminated, will be disposed of at approved government sites.

4.8.5.2.5 Drainage Control within Camp Site

Any rainwater runoff from the work camp pad will be diverted to an oil trap before discharging offsite. There are no potentially harmful chemicals stored at the camp site that could drain offsite. The fuel tank for the camp generator will be placed on an impermeable membrane and bunded to contain potential fuel leaks.

4.8.5.3 Camp Site Sewage System

The waste water and sewage will be collected in a concrete-lined closed sewage tank with a capacity of 8 m^3 (8,000 litres) and equipped with degreasers to reduce the organic load. It is estimated that some 3-4 m^3 (3,000 to 4,000 litres) of combined sewage and waste water will be produced each day during maximum manned operations. The sites grey water to be discharged to an infiltration field if site conditions allow for the proper installation of an infiltration field.

4.8.5.4 Transportation

The overview of transportation requirements for the drilling program is detailed in **Table 4-16**.

Table 4-16: Transportation Requirements for Drilling Program

Description	Quantity	Remark
Estimated number of round trips for rig equipment	175	Based on previous onshore campaign by PCMI in 2015.
Estimated number of round trips for drilling support equipment (Including casing, chemical and etc)	100	One well is about 50 trips.
Estimated number of round trips for personnel	100	One well is about 50 trips.
Transport Requirement & Route for produced oil	-	Produced oil will go to MOGE production facilities.

The equipment transportation route is shown in **Figure 4-22**. The rig and equipment transportation route is via the Pathein – Monywa Highway Road to Kyangin and then to Myanaung. Then proceed to Well Site area via MOGE road starting from Mingone Junction. The distance from Yangon to Well Site is 418 Km for this route. The type of transportation for equipment is heavy truck with 1-2 day travel duration.

The type of Transportation for equipment is:

- Trucks
- Travel Duration: 1 - 2 Days

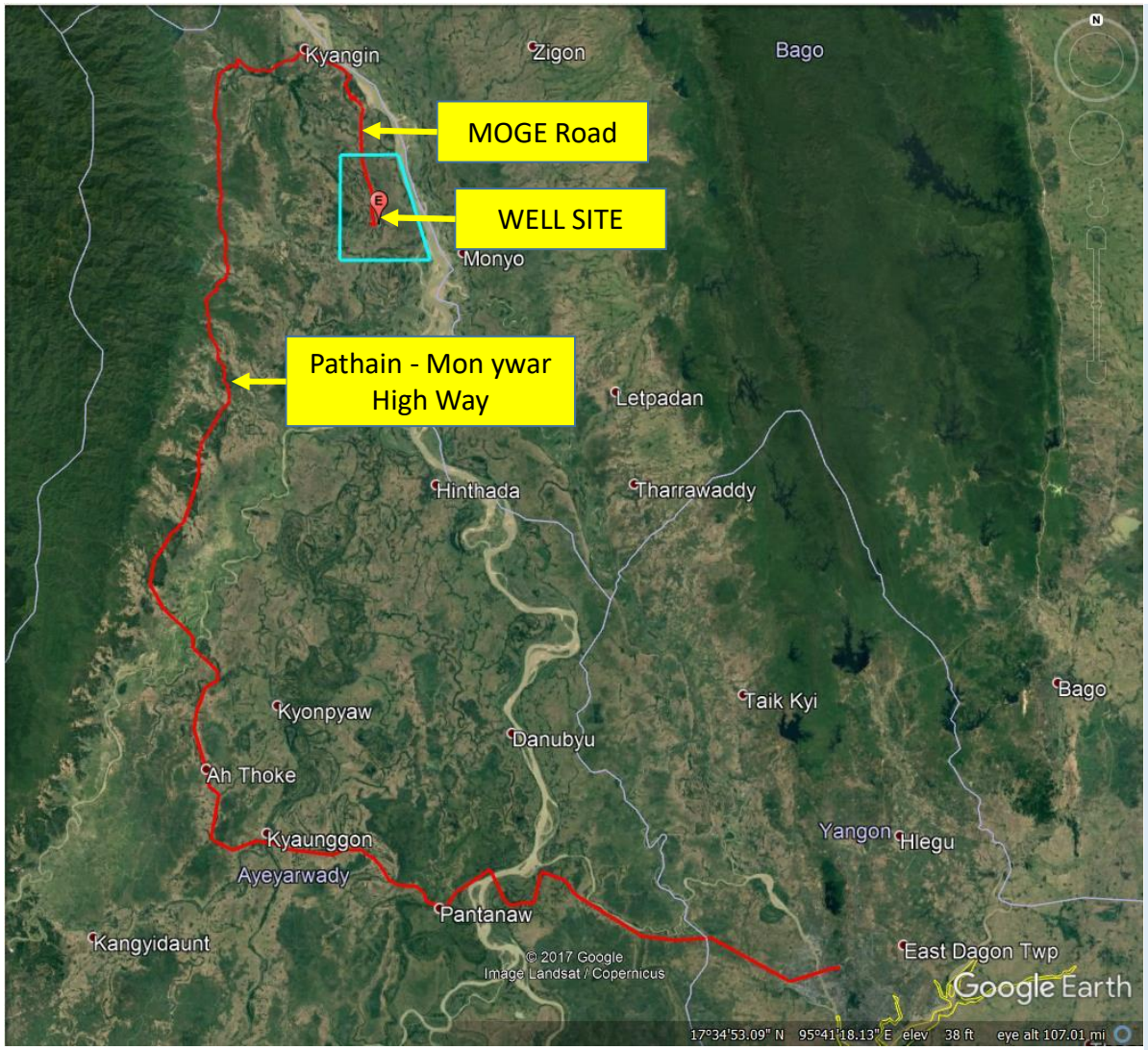


Figure 4-22: Proposed Equipment Transportation route to well site

The personnel transportation route is shown in **Figure 4-23**. he personnel transportation route is via the Yangon – Hinthada Road. The distance from Yangon to the Well Site is 324 km.

The type of transportation will include:

- Cars, Mini Bus
- Travel Duration: 8 – 10 hours

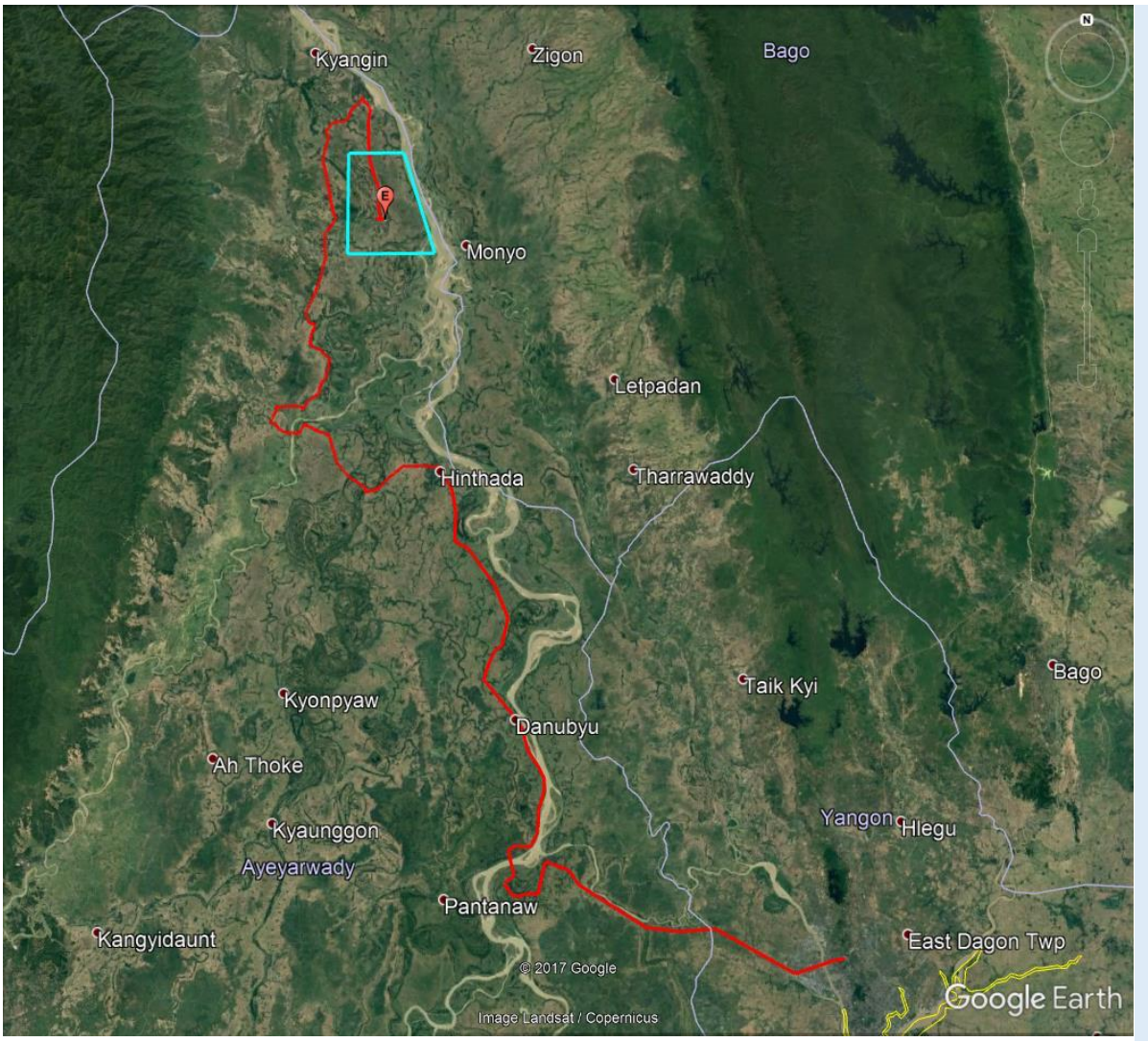


Figure 4-23: Proposed Personnel Transportation Route to well site

4.9 Exploration Drilling Emissions, Discharges and Waste Generation

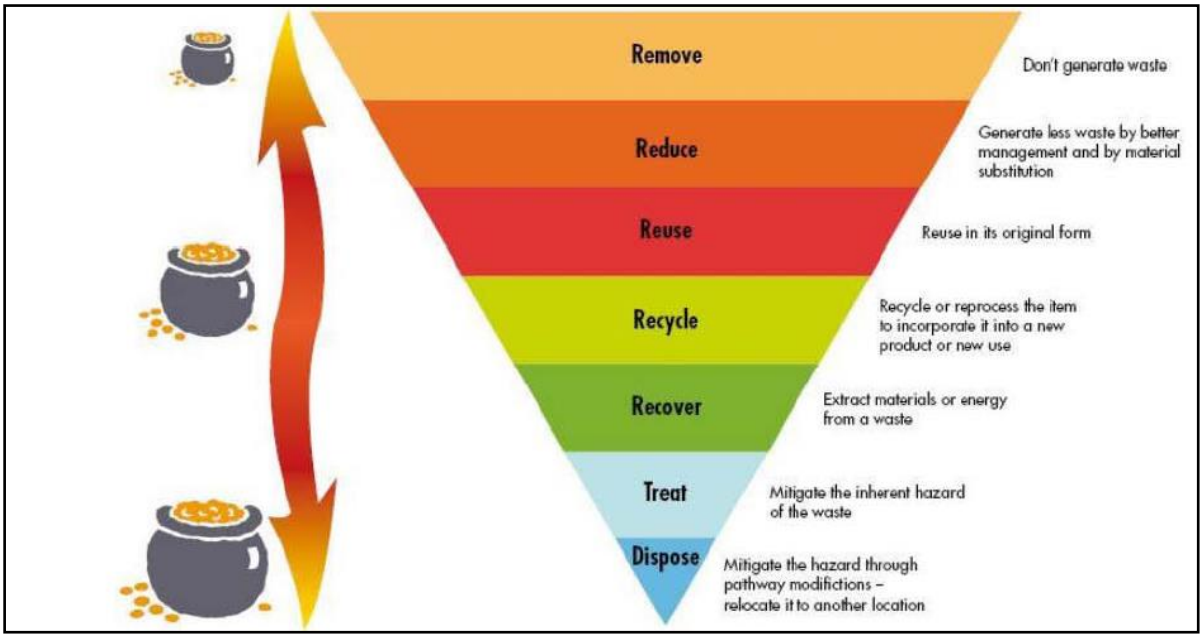
Emissions, discharges and waste generation will conform to applicable government regulations in Myanmar.

All wastes produced will be assessed and classified by type prior to treatment, transport, disposal or recycling. Wastes are classified as:

- Drilling Mud and Cuttings;
- Wastewater (effluent);
- Hazardous waste (e.g., chemical waste, waste oil etc.);
- Non-hazardous solid waste (e.g., wood, paper, steel, food waste etc
- Air emissions;
- Noise
- Fluids Produced from the Separators During Drilling and Testing.
- Waste Management Plan

4.9.1 Waste Classification

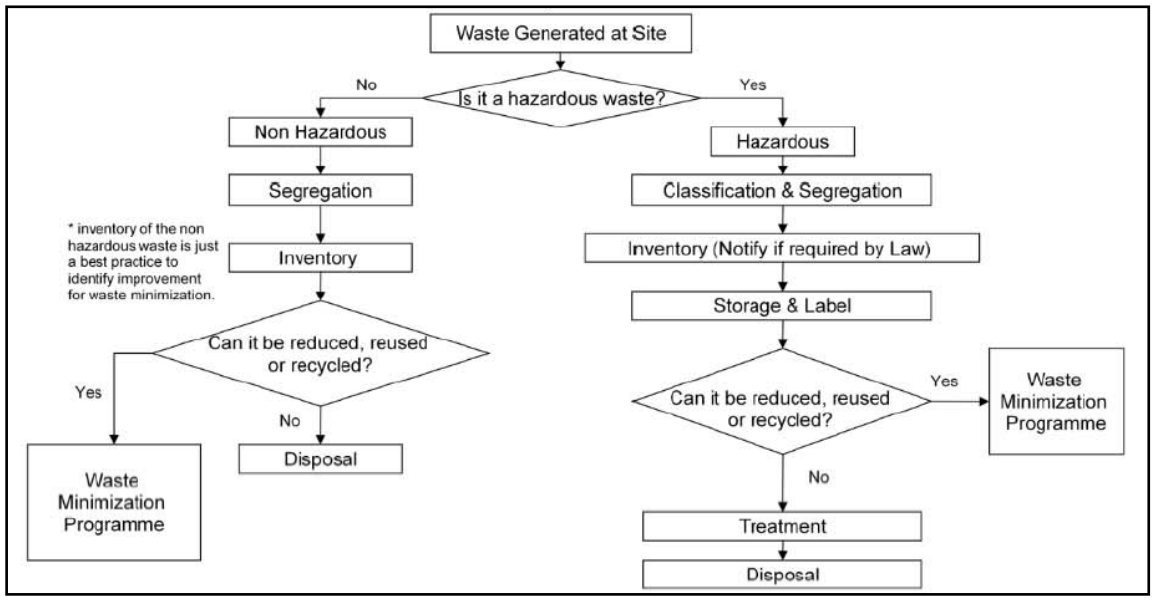
The PCMI exploration program will handle waste according to PETRONAS Standards. The waste management will follow the best practices shown in **Figure 4-24**.



Source: PCMI, 2018

Figure 4-24: Waste Management Best Practice

All wastes will be classified and segregated before responsible disposal. The classification and segregation process is shown in **Figure 4-25**.



Source: PCMI, 2018

Figure 4-25: Waste Classification and Segregation Process

4.9.1.1 Containers

All wastes will be collected, stored, and segregated in arranged containers. All provided containers will be as follows:

- Install adequately in the working area, accommodation and office area,
- Make from durable materials compatible with the waste to be collected, leakage proof, sturdy, stable and easily handled,
- Prevent the ingress of animals, escaping odor and place under cover to avoid leachate,
- Medical or clinical waste shall be separated from other wastes because, they may contain infectious agents and potentially toxic substance for example sharp objects shall be packed in puncture-proof containers.

Containers used for medical waste shall be marked prominently with universal warning signs and/or the word “Medical waste”. Used needles and syringes represent a particular threat as failure to dispose of them safely may lead to recycling and repacking. Where possible, management of medical/clinical wastes should be integrated into existing healthcare waste management system.

4.9.2 Air Emissions

The air emissions from the well site would be from the following sources:

1. Dust
2. Combustion Products

4.9.2.1 Dust

During construction and upgrading of access roads and well site construction, the principle air quality issue will be control of dust. Standard operating procedures require the civil engineer contractor to ensure daily sprinkling of water on all non-sealed surfaces to subdue the amount of dust and to restrict

speed of traffic on portions of the road that have not yet been sealed. Daily consultations by the construction contractor with the local villages will ensure that any significant problems are identified and resolved.

The handling and storage of bulk drilling mud additives, including barite, bentonite, calcium carbonate and cement powder will result in relatively minor fugitive dust emissions. Any emissions will be reduced significantly by the standard procedure of equipping all silos with bag filters.

4.9.2.2 Combustion Products

Combustion products from the proposed exploration-drilling project consist of diesel combustion and flaring emissions.

Diesel combustion from the on-site electrical power generation units and from vehicles will emit greenhouse gases. The amount of emissions will vary with time, depending on the operational activity and power demand. Emissions have been estimated using typical fuel consumption rates, with details provided in **Appendix 6**. The overall greenhouse gas emissions from diesel combustion are estimated including the potential worst-case scenario of drilling two contingency wells per site. The emissions from diesel consumption per well site are provided in **Table 4-17**.

If it is decided to test the well (DST or LPT), a significant quantity of gas could be flared. The actual flow rate of the reservoir at this location is a parameter, which the drilling of the well is intended to determine.

The rate of gas production will range between 0-30 mmscfgd (30 mmscfgd being the maximum handling of the rig's processing equipment). If a DST found less than 5 mmscfgd an LTP test would unlikely proceed. If an LTP test is to proceed, the drilling rig would be demobed and a smaller well testing package brought in to conduct the LTP test. During an LPT test flaring would be conducted at various rates and sustained rates combined with a shutin to observe pressure build-ups and flowed again. The data gathered is used to establish reservoir characteristics. The maximum flow during an LPT tests generally never exceed 10 mmscfgd. Thus a worst-case scenario flaring is a sustained flow rate of 10 mmscfgd for 7 days.

The overall greenhouse gas emissions including flaring for the project are provided in **Table 4-17**.

Table 4-17: Greenhouse Gas Emissions

Project Phase	Activity	One Time CO_2 Release (ton CO_2)
Site Preparation	Granular Fill Transport	9.2
Drilling	Drilling rig mobilization / demobilization	187.2
	Equipment and Supplies	107.0
	Heavy equipment use	3,898.6
	Generator to power drilling rig and camp site	5,713.0
Testing Activity	Generator to power beam pump	121.7
	Flaring	9,632.5
Abandonment and Restoration	Heavy Equipment and transportation.	276.5
Total per well		**19,945.7**

This entire project is estimated to generate a worst case maximum of 19,945.7 tonnes of CO2 equivalent for two well sites, based on 30 days drilling, 15 days of completion and 15 days of well testing for each well. Air emissions and their impacts are discussed in the Impact Assessment **Chapter 6**.

4.9.3 Noise

During the construction phase, noise will primarily be generated from project vehicles, generators, and construction equipment such as bulldozer, backhoe, grader, dump trucks and others (**Table 4-18**).

Table 4-18: Noise Level from Construction and Drilling Equipment

Source	Maximum dB(A) at source	Number of Sources at one time
Bulldozer	85	1
Backhoe	80	1
Grader	85	1
Compactor	82	1
Heavy trucks (dump trucks)	88	1
Water truck (Lmax truck)	84	1
Jack-hammer	80	1
Drilling Rig (auger)	85	1
Generator (for drilling & testing)	81	4
Flue gas.	77.6	1

Source: US Federal Highway Administration, US Department of Transportation, 2008; reference distance 50 ft (15.24 m); (http://ops.fhwa.dot.gov/wz/workshops/accessible/Schexnayder_paper.htm)

During drilling phase, noise will be generated from project vehicles, generators and drilling operations. Noise will be generated from equipment and flaring during well testing operations. Potential impacts from noise during the well abandonment phase will be virtually identical to those in the construction phase. The same mitigation measures should be applied, and the impact significance will be similar.

4.9.4 Wastewater & Sewage

The wastewater and sewage will be collected in a concrete-lined closed sewage tank with a capacity of 8 m^3 (8,000 litres) and equipped with degreasers to reduce the organic load. It is estimated that some 3-4 m^3 (3,000 to 4,000 litres) of combined sewage and wastewater will be produced each day during maximum manned operations. The sites grey water to be discharged to an infiltration field if site conditions allow for the proper installation of an infiltration field.

The design of the disposal of the clarified outflow will consider specific techniques, such as sub-irrigation, if site conditions allow. The septic tank(s) will be:

- properly designed to treat the estimated maximum daily rate of wastewater and installed in accordance with local regulations and guidance to prevent any hazard to public health or contamination of land, surface or groundwater;
- well maintained to allow effective operation;
- installed in areas of stable soils that are nearly level, well drained, and permeable, with enough separation between the drain field and the groundwater table or other receiving waters.

Septic storage tanks will be located away from areas with a high water table (i.e. floodplain areas) or from water abstraction wells.

The settled sludge in the septic tank will be vacuumed out by tanker trucks as required and the contents sent by the waste transporter to the DOWA licensed waste treatment site. At the end of operations during closure of the camp the septic storage tank and its contents on site will be removed and sent for disposal at the DOWA licensed facility.

4.9.5 Non Hazardous Waste

Both the well site and the accommodation camp site will generate non-hazardous waste daily, consisting of "domestic" garbage such as food scraps, plastic packaging, paper, cardboard, tin cans and glass. In addition there will be "industrial" waste such as wooden cases, large glass containers, ferrous and non-ferrous metal items, plastic and metal drums and containers, plastic and cardboard packaging.

General waste will be separated on-site to facilitate recycling. Domestic and general waste should be segregated and stored using suitability labelled containers to ensure safe collection segregation and handling of all waste streams generated. This waste will be stored in appropriate containers to be transported off site for recycling, reuse, treatment and/or disposal.

It is estimated that the well site will generate between 1 and 10 tonnes of "domestic" waste and 1 to 40 tonnes of "industrial" waste per month. It is estimated that the accommodation campsite will generate between 1 and 4 tonnes of "domestic" waste per month.

All solid general waste will be sent for recycling or disposal to at the DOWA Waste Management Facility.

4.9.6 Hazardous Waste

The well site and accommodation campsite combined will generate a low volume of hazardous waste, estimated to be between 2 and 5 tonnes per month. Hazardous waste items include:

- Used lubricating oil
- Used hydraulic oil
- Solvents
- Used batteries and
- Medical waste.
- Filters contaminated with oil
- Drums and containers used for oil or chemical transportation and storage
- Mud additive chemicals
- Rags, paper, plastics and other materials contaminated with oil

All materials brought onto the well site and accommodation campsite will be logged and all sources of potential toxic waste will be identified by the relevant supplier or contractor. Equipment or materials containing heavy metals, such as batteries, will be identified and a special container designated for their disposal as waste. All used chemical and lubricant containers will be collected in separate containers.

The drilling contractor is to ensure appropriate and safe storage until this waste is picked up by the waste transporter and taken to the DOWA Waste Management Facility.

4.9.7 Waste Drilling Mud & Cuttings

The major waste products from the drilling operations are used drilling muds and cuttings.

As described in earlier sections the drilling rig equipment contains a standard closed mud circulation and treatment system, that takes the drilling mud as it leaves the well bore, removes the cuttings and suspended fine solids, and returns the cleaned mud to the rig's holding tanks for reuse. The subsequent treatment and disposal of the cuttings and drilling mud are discussed below.

Some of the drilling fluid portion will be lost to porous rocks, such as sandstones, and some of the additive solids will be lost to form a mud-cake along the wall of the hole. The volume of these "losses" cannot be calculated accurately as they depend on the local geology.

A portion of the mud will be attached to the cuttings (the separation system is efficient but cannot remove all the mud from the cuttings). At the end of drilling the surface hole, fresh water-based mud held in the rig storage tanks will need treatment and disposal.

Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil. In the case of production, and after drilling the cuttings burial site would be compacted and used as land for other purposes. Drilling mud would be dewatered and treated before disposal into drill cutting pits. The dewatering unit will reduce the solids in the water and treated to disposal. DOWA shall be treating the fluids onsite to disposal level as per IFC 2007 regulations.

4.9.7.1 Waste Mud Treatment and Disposal

There is a standard process that is followed for the treatment and disposal of water-based muds. The solid and liquid phases are separated on-site by industry standard physical and chemical means (shaking, centrifuging and flocculation). The solids from the shale shakers are moved to the cuttings dryer by an auger system.

The liquid phase is held in a series of settling and treatment tanks and will be analyzed to determine if any additional treatment is necessary.

The mud and cuttings treatment will be completed onsite by DOWA. The treatment process is outlined below:

- **Step 1:** Onsite treatment for Water Based Mud, separation into "Solid" and "Liquid using centrifuge.
- **Step 2:** Onsite treatment for "The water from separation from cutting mud" and " The water from WBM" using water treatment process.
- **Step 3:** Onsite treatment or Offsite treatment for brine water by removing from site and disposing of it in our factory in Thilawa with water treatment facility".

The DOWA onsite treatment at the site will require about 3-5 month for each well to complete. The process diagram is shown in **Figure 4-26**.

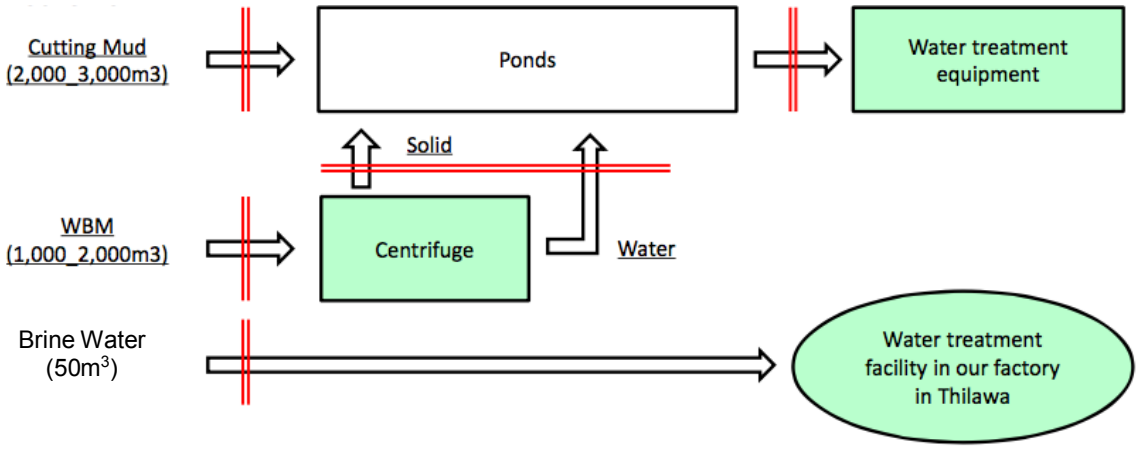


Figure 4-26: Dowa Onsite Treatment & Management of Mud & Cuttings

Step 1: Centrifuge Separation

The centrifuge treatment of the water-based mud will be completed as shown in **Figure 4-27**. The overall process consists of the following steps:

1. **Processing tank:** Add neutralizer and flocculants to remove harmful substances as solid sediment.
2. **Settling Tank**: Settle solid and pump up it to centrifuge. The top layer pump up to your main pond (Liquid part) through storage tanks.
3. **Centrifuge:** Separate it into "Solid" and "Water". "Solid" take to your main pond (Solid part). "Water" pump up to your main pond (Liquid part).

Figure 4-27: Centrifuge Process and Steps

Step 2 - Onsite Water treatment process

The influent water is separated from the water based mud and the held in the cuttings pit. The cuttings generated is expected to be 200 – 250 m^3 per well. The water based mud generated is expected to be 1000-2000 m^3 per well.

The process water from the cuttings pit will be treated onsite as per the onsite wastewater treatment as shown in **Figure 4-28**.

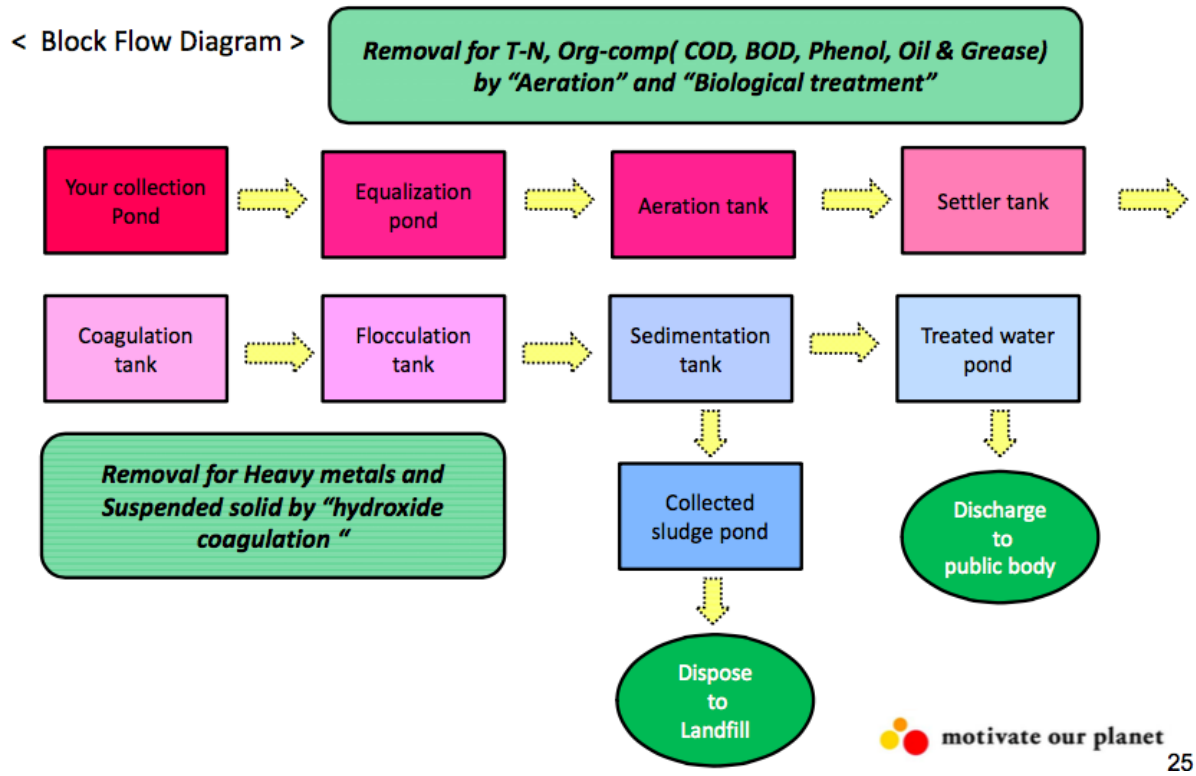


Figure 4-28: Flow Diagram for Onsite Waste Water Treatment

The treated water will be monitored to ensure it meets IFC and Myanmar National Emission guide-lines before being discharged from the site. The resulting treatment sludge will be removed from site and disposed at DOWA disposal area as shown in **Figure 4-29**.

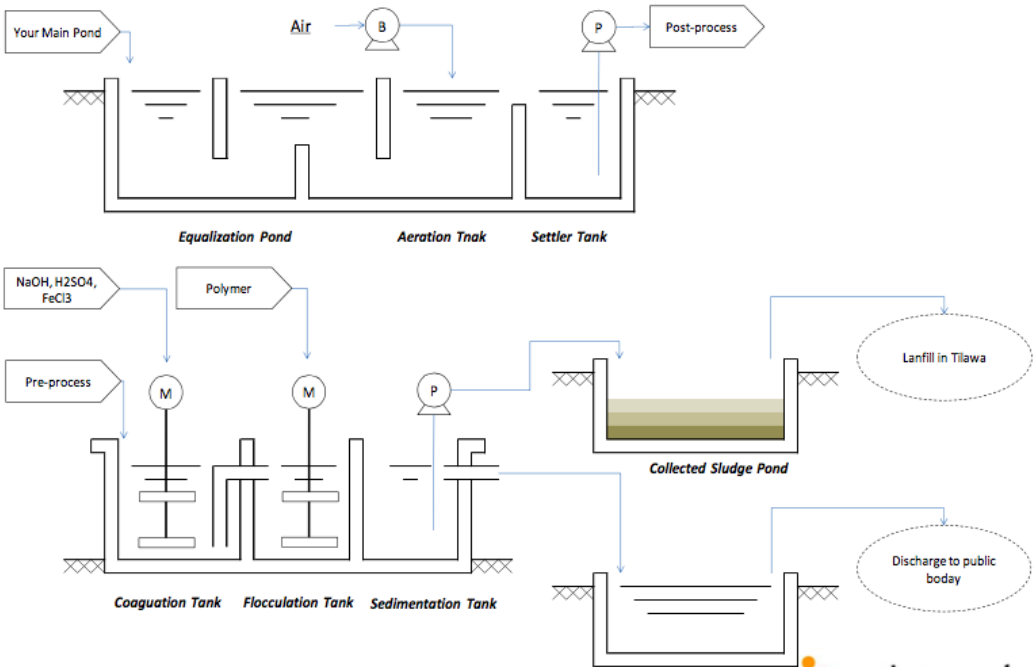


Figure 4-29: Process Flow Diagram for Onsite Water Treatment and Sludge Removal.

The effluent a standard before discharge will be maintained according to Guidelines values of Produced water in the Myanmar *"National Emission Guidelines"* and IFC *"Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development"* as shown in **Table 4-19**.

Water will be monitored every 2 weeks before discharging. The required water quality guidelines will be checked and monitored before disposal.

Table 4-19: Effluent Standards before Discharge

No.	Item	Guideline value
1	Total hydrocarbon content	10mg/L
2	pH	6-9
3	BOD(5)	25mg/L
4	COD(Cr)	125mg/L
5	TSS	35mg/L
6	Phenols	0.5mg/L
7	Sulfides	1mg/L
8	Heavy metals(total): (As, Cd, Cr, Cu, Pb, Hg, Ni, Ag, V*, Ag)	5mg/L
9	Chlorides	600mg/L(average), 1,200mg/L (maximum)

Source: IFC, Guideline value of Produced water in "Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development"

Step 3 – Offsite Disposal and Water treatment process

Sludge from the onsite process and the hazardous brine water which is resulting from the onsite treatment will be removed from the site and disposed and treated at the DOWA Thilawa disposal area.

4.9.7.2 Waste Drilling Solids

A lined cuttings pit will be installed onsite. The cuttings from the shale shakers will be placed in the concrete lined cuttings waste pit. The possibly contaminated runoff water from concrete drill pad and shaker area will drain to the cuttings waste pit. To avoid the cutting pits being contaminated with oil from any emergency spill on the drill pad, the engineering team will add the oil separator unit on both sides of drain gutter to trap oil before flowing down to the cutting pit.

The waste cuttings disposal and management proposed is a dilution burial option, the cuttings pass through the solids control treatment equipment, the cuttings from the shakers are conveyed to the cuttings pit. The disposal process is as follows:

- Take the cutting sample from the pit for analysis by the certified 3rd party laboratory.
- If the test result is shown with no significant issues. Then PCMI will dry off and re-backfill (cap) with clean soil.
- If the test result is shown with significant issues (contain any heavy metal) the waste will then be classified as hazardous waste material. In this case DOWA will transport to its hazardous waste landfill site at Thilawa Industrial Estate.

- If the test result is shown with only high Electrical Conductivity and salinity value, PCMI will either wash out in the pit with natural water for dilution and pumping the water out to spray on ground or mix the cutting with clean soil. The process will be repeating until lower EC and salinity to disposal criteria. (Sample will be collected and tested).
- Then re backfilling to pit and cap with natural soil

Potential key contaminants of concern are:

- Electrical Conductivity (EC); similar to salinity which could create soil and groundwater contamination leading to agriculture & plantation impact;
- Heavy Metals - If the content is high, the waste is considered as Hazardous Waste.
- Minor concerns on hydrocarbon due to low concentration.

4.9.8 Fluids Produced from Separators During Testing

Should testing be conducted, the produced reservoir fluids will be separated at the surface. The gas portion will be flared while the liquid portion will be separated into water and a condensate-water emulsion. The water portion will be stored in the dirty water pit. The condensate-water emulsion will be moved to a series of settling tanks where natural buoyancy of the emulsion breaks down, separating the water and condensate phases further. The separated water will be stored in the dirty water pit for treatment and the remaining condensate and emulsion will be collected in storage tanks for disposal.

4.9.8.1 Management and Disposal of Condensate

The expected condensate-to-gas ratio is 5 bbl (0.795 m^3) per 1 mmscfg. Based on a worst case of a 10 mmscfgd during a LTP test for 30 days (for both wells) – equating to an average condensate production of 50 bbl (7.95m^3) per day, the total condensate production potential could be 1,100 bbl (175 m^3).

Condensate will be decanted from the settling tanks and stored to await disposal. After analysis the condensate will be transported by road tanker to the waste management facility or directly flared on site. A detailed manifest and chain-of-custody form will be maintained for the management of condensate.

4.9.9 SUMMARY OF WASTE INVENTORIES

A summary listing of wastes generated by this proposed project is provided in **Table 4-20**.

Should the well encounter technical difficulties that require contingency wells to be drilled, additional waste will be generated (drilling mud and cuttings, domestic waste, industrial waste, hazardous waste and sewage and grey water).

Table 4-20: Waste Inventory

Waste Type	Estimated Quantity	Proposed Disposal Contractor	Disposal Plan
Drill cuttings and attached WBM	~430 m^3	Treated / Separated on Site by DOWA	• **Water Separated from the Mud and Cuttings and treated on Site.** • **Drill Cuttings disposed of in a dilution land burial process.**
Water-based mud	1000-2000 m^3/well	Treated / Separated on Site by DOWA and residues sent to Waste Management Facility - DOWA	• **Stored in mud storage tanks** • **Liquids treated on site and WBM residues send to DOWA Landfill.** • In case of the well is actually abandoned rather than completed as a producer, some of this mud will be used to make the kill weight spacer between the cement plugs
Brine Water & Sludge	50 m^3	Waste Management Facility - DOWA	• **Water Treatment Sludge and Brine Water Disposed at Dowa Facility for treatment and final disposal**
Unused chemicals	N/A	Licensed chemical supplier or Waste Management Facility - DOWA	• **Returned to supplier or kept for future drilling campaigns.**
Domestic waste	1 – 10 tonnes/month well site 1 – 4 tonnes/month camp site	Waste Management Facility - DOWA	• **Landfill** • **Incinerated**
Industrial waste (scrap metal, plastic, paper, wood, glass etc.)	1 – 40 tonnes/month	Waste Management Facility - DOWA	• **Recyclable or reusable materials to be sold or donated.** • **Other non-recyclable or reusable waste goes to licensed landfill**
Hazardous waste	2 – 5 tonnes/month	Waste Management Facility - DOWA	• **Landfill** • **Incinerator**
Sewage & grey water	3 – 4 m^3/day	Treated On Site	• **Septic tank.** • **Treated in on-site bio-digester or infiltration field**
Septic Sludge & Black Water	4 m^3 at end of project	Waste Management Facility - DOWA	• **Disposed at Dowa and Landfilled**
Fluids produced from the separators during testing	0 – 7.95 m^3/day/well	Waste Management Facility - DOWA	• **Gas Flared** • **Separated Fluids disposed at Dowa and Landfilled**

4.10 Health, Safety and Environmental Management

PETRONAS Carigali is committed to Health, Safety and Environment (HSE) and shall take reasonable and practicable steps to prevent and eliminate the risk of personal injury, occupational illnesses and damage to properties. PETRONAS Carigali shall take proactive steps and measures in the protection and the conservation of the environment.

In line with PETRONAS' Group Policy Statement on Health, Safety and Environment, PETRONAS Carigali shall therefore:

Comply with HSE legal requirements wherever we operate;

Implement effective risk control measures in all our activities; including operations covering acquisition, exploration, development, production and abandonment, which will eliminate, prevent or reduce risks to a level as low as reasonably practicable (ALARP);

Build an effective and resilient HSE Management System as an integral part of our business philosophy and cultivate a desired HSE Culture;

Provide competent workforce, adequate resources and organisation in all our activities in ensuring a safe environment at the workplace;

Promote HSE engagement between joint venture partners, regulatory authorities, Contractors and key stakeholders;

Drive and promote continuous improvement in HSE performance;

Establish effective crisis management and emergency response capabilities in all our operations.

PETRONAS Carigali requires all its employees, Contractors and others to strictly adhere to this policy at all times. Joint venture partners of PETRONAS Carigali are expected to implement an effective HSE Management System which is in line with industry best practices.

4.10.1 Potential for Accidents, Hazards and Emergencies

PCMI will ensure the contractor will have an Emergency Response Procedures Manual that includes response procedures for blowout, fire, earthquake, medical emergency, release of hazardous/toxic substances, etc. PCMI has an Emergency Response Plan (ERP) that will be updated specifically for each well site operations and site specific location.

This ERP is considered a standard E&P Emergency Management System and is based on Industry accepted standards and practices (e.g. ISO, BCI, EMI, BS etc.). Topics of the ERP are outlined in **Table 4-21**.

Table 4-21: Emergency Response Plan

Main Sections	Topics
Procedure & Responsibilities	Drilling Superintendent On-Scene Commander PIC (Person-In-Charge)
Emergency Organisation	Introduction Emergency Response Philosophy Overview of the Response Organisation
Emergency Arrangements And Facilities	Major gas release / H2S Explosion / fire Accommodation fire Blow-out Oil spill land Hazmat spill Helicopter incident Man missing Loss or damage of radioactive source Traffic accident Medevac Bomb threat / terrorist act Fatality On-scene Commander Field Arrangements and facilities
Risk Management	Major Hazards Emergency Plans

The Emergency Response Procedures are detailed in **Section 8.1, Emergency Response Plan**.

4.10.2 Gas, Smoke and Fire Detection Systems

The following detection systems are installed at each drilling site.

4.10.2.1 Gas Detection

- **H_2S Monitoring System (portable and fixed)**
- **Combustible Gas Monitoring System (portable and fixed)**
- **Explosimeters**
- **CO_2 Gas Detectors (portable)**
- **O_2 Meter (portable)**
- **Fire/Smoke Detectors**
- **Fire detectors/alarms**
- **Smoke detectors/alarms**

4.10.2.2 Fire Fighting Systems

Rig Site

Each rig site will be equipped with two separate fire fighting systems designed for different purposes. The first is a comprehensive set fire extinguishers, the second is a water deluge system explained below.

Fire Extinguishers

A comprehensive set of dry chemical all-purpose fire extinguishers will be positioned around the well site, within accommodation cabins, equipment cabins, adjacent to equipment units and around the rig floor:

- The majority of these will be standard size 9 kg hand portable extinguishers, suitable for containing or extinguishing minor fires.
- A set of larger 25 kg extinguishers will be positioned strategically around the rig site to act as back-up in case of a larger fire or prolonged containment is required.
- A set of spare extinguishers will be kept at both the dry storage area and the equipment store.
- Larger 50-kg foam extinguishers will be positioned where fuel and lubricants are stored.

The rig contractor will be responsible for ensuring that all extinguishers are serviced and certified before mobilisation and periodically checked during the operation. PCMI's rig manager will be responsible for verifying this process.

The rig contractor is responsible for training their crew in fire fighting techniques and to hold regular practice drills. PCMI's rig manager will be responsible for verifying this process.

Water Deluge System

The rig will be equipped with a water deluge system, with banks of spray-heads surrounding the well head and BOP, the solids removal chokes of the drilling surface equipment and the flare stack.

Water for this deluge system will be provided from the waste pit and water storage tanks by a series of electrical pumps, which will be permanently installed and equipped with independent diesel generators to ensure they continue to function even if the rig's electrical generators are off line or power lines are severed during an incident.

This system is designed to contain or prevent a fire resulting from any leaks or ruptures in the hydrocarbon handling system when the well is flowing during well testing. It will protect the major pieces of equipment until the well is shut in by the blowout preventers and the flow of hydrocarbons stopped.

Accommodation Camp Site

A comprehensive set of dry chemical all-purpose fire extinguishers will be positioned around the accommodation camp site, within all accommodation cabins, utility cabins and adjacent to equipment units:

- The majority of these will be standard size 9 kg hand portable extinguishers, suitable for containing or extinguishing minor fires.
- A set of larger 25 kg extinguishers will be positioned strategically around the site to act as back-up in case of a larger fire or prolonged containment is required.
- A set of spare extinguishers will be stored on the site.
- Larger 50 kg foam extinguishers will be positioned where fuel and lubricants are stored.

The rig contractor, who is also providing the accommodation camp trailers and equipment, will be responsible for ensuring that all extinguishers are serviced and certified before mobilisation and periodically during the operation. PCMI's rig manager will be responsible for verifying this process.

The rig contractor is responsible for training their crew in fire fighting techniques and to hold regular practice drills. PCMI's rig manager will be responsible for verifying this process.

Fire fighting Facilities in Project Area

In the event of a large fire beyond the control of the designated crew fire team members on site, then necessary efforts must be made to seek professional fire fighting services.

4.11 Land Acquisition

The land required for the IOR-7 well location is situated near Daung Kya village close to Shwe Pyi Tha Oil Field with owner plots as shown in **Figure 4-30**.

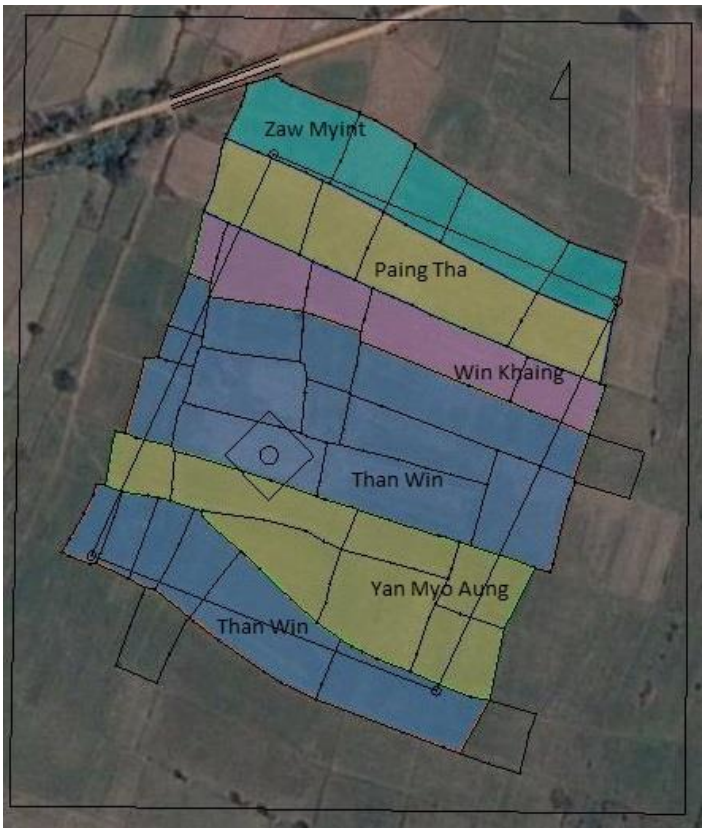


Figure 4-30: Land Acquired for IOR-7 well pad

The land acquisition procedure is detailed in **Section 8.17, Land Acquisition Procedure.**

A Grievance Mechanism has been established in the form of HSE Complaint Process Flow (**Section 8.14, Community Consultation & Grievance Mechanism).** Grievance mechanism is a mechanism through which communities and individuals affected by the project activities can formally communicate or channel their concern and grievances to the company and facilitate resolutions that are mutually acceptable by the parties, within a reasonable timeframe. The grievance mechanism along with the Community Liaison Officers (CLO) appointed to facilitate the grievance process is a management tool designed to help address stakeholder concerns promptly and facilitate a trustworthy and constructive relationship.

5 ENVIRONMENTAL SETTING

5.1 Introduction

This section presents the existing environmental, social, economic and health conditions of the project area, including physical and biological resources, human use values, and quality-of-life values.

5.1.1 Study Area

Block IOR-7 is located in Central area of Myanmar, in Ayeyarwady Region at the west bank of Ayeyawady River. Most of block area covers Myan Aung Township of Hinthada District.

Block IOR-7 lies within Shwepyitha Area of Ayeyarwady Region. The total area of this block is 95 sq. mile or 246 sq.km. The Ayeyarwady River is flowing at the eastern boundary of the block. Few major towns are situated inside the block namely Shwegyin, Nyaunghtaw, and Ngapiseik.

Geologically IOR-7 block is situated near the southern edge of Pyay Embayment. In the MOGE geological map it is named as Shwepyitha area. Shwepyitha field is still currently in production. It is producing 143 BBL of Oil and 0.786 MMSCF of Gas from 14 producing wells.

For the purpose of describing the baseline environmental, socio-economic and health conditions potentially affected by the project and affecting the project (**Figure 5-1**), the project Study Area includes a 5km-radius of the proposed drilling well in the southern part of Block IOR-7. Data and observations from the region are also referenced where appropriate for the purpose of establishing context. The Local Study Area's focus is on the proposed drilling well and adjacent biophysical, and land use within its 5 km radius. The baseline sampling program was conducted within a 1 km-radius of the proposed drilling well.

The proposed drilling well is located at Lat 18° 3' 23.090" N Long95° 21' 50.883" E in Daung Kya village township (VT) and local study area cover VT Daung Kya, VT Nyaung Tone Le, VT Tha Yet Taw, VT Kyu Taw, VT Yaik, VT Ka Nyut Kone, and VT Htu, in DT Hinthada, TS Myan Aung (**Figure 5-2**).

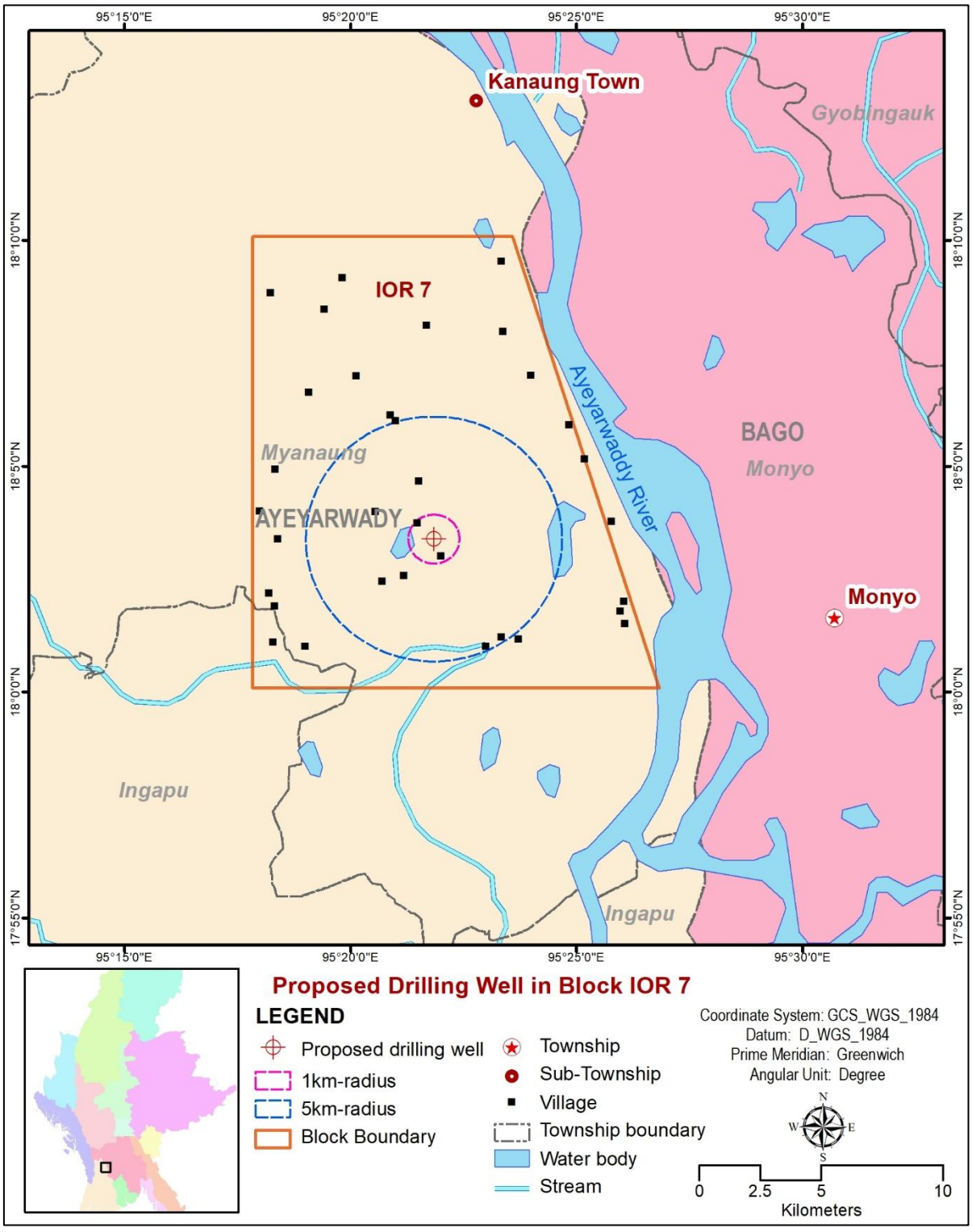


Figure 5-1: Proposed Drilling Well Location

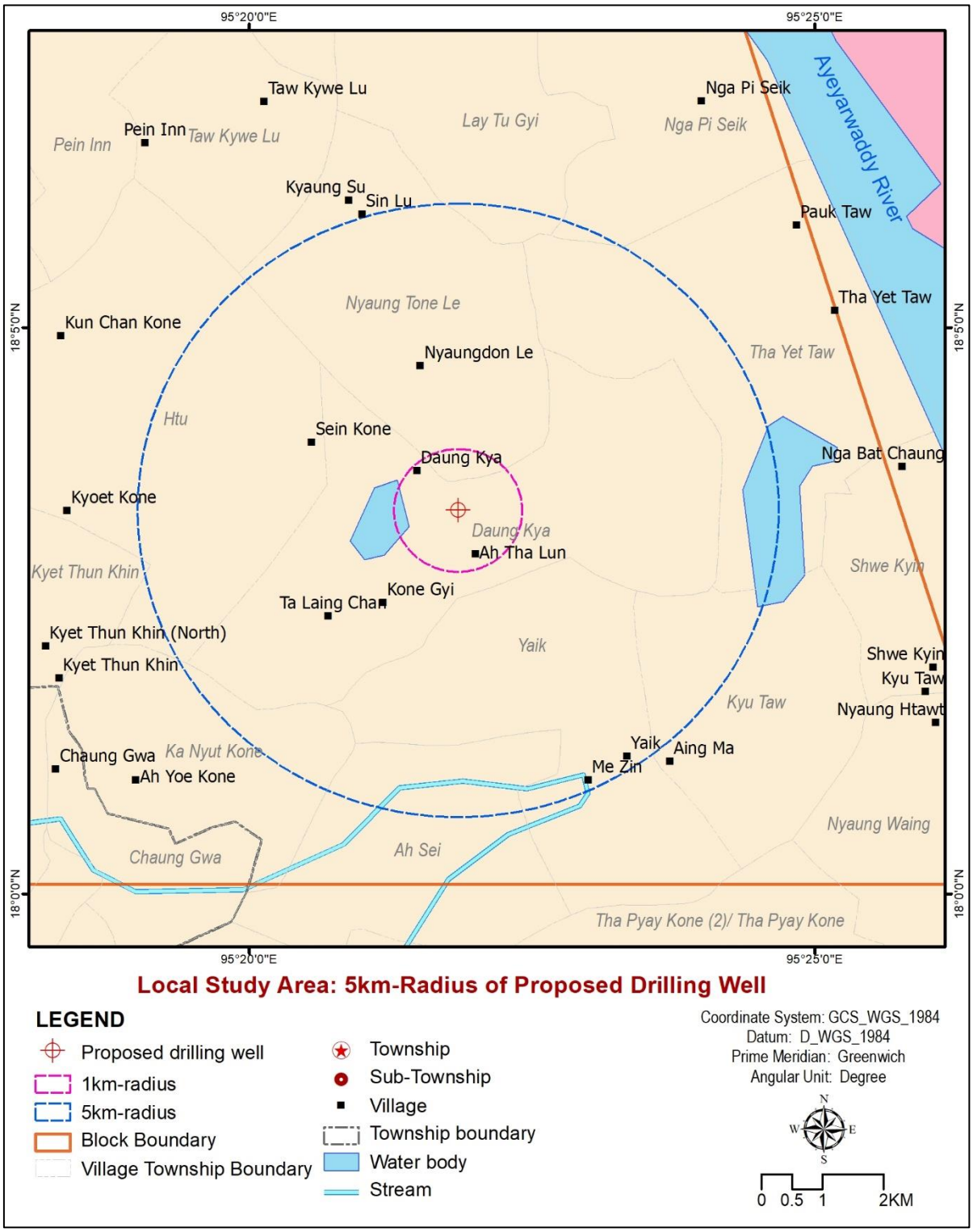


Figure 5-2: Local Study Area

5.1.2 Scope of Study

The environmental setting of the Project consists of physical (earth, air, water, acoustic), biological, and human components. The human component includes land use, demographics, socio-economic, cultural and quality of life aspects. The study is focused on the conditions found within the block, however, broader regional information is provided where it provides relevant context to the assessment.

5.1.2.1 Data Sources

5.1.2.1.1 Primary Data

For the baseline survey, a detailed, field sampling plan was developed to supplement the existing secondary database for the Study Area.

A total of 4 community-based sampling locations were selected in the block (**Table 5-1** and **Figure 5-3**). The sampling locations for soil, surface water and groundwater were shown in **Figure 5-4**.

Table 5-1: Community environmental and socio-economic sampling sites.

No.	Date	Village	VT	TS
1	05/12/2017	Ah Tha Lun	Daung Kya	Myanaung
2	05/12/2017	Zee Kone	Daung Kya	Myanaung
3	06/12/2017	Daung Kya	Daung Kya	Myanaung
4	06/12/2017	Kyoe Gone	Daung Kya	Myanaung

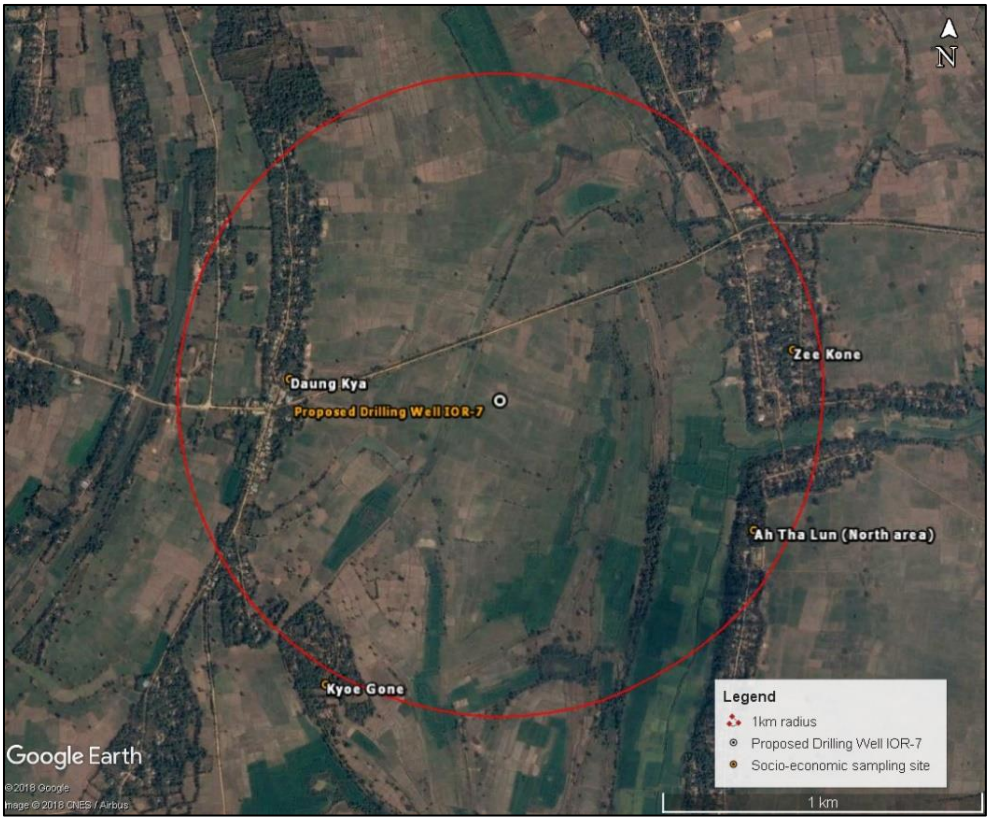


Figure 5-3: Community Environmental And Socio-Economic Sampling Sites

Figure 5-4: Baseline Sampling Locations

Primary data collected during the field survey included the followings:

- Surface water samples
- Groundwater samples (from water wells)
- Local perception of water quality
- Air quality samples
- Local perception of air quality and climate change
- Soil and sediment samples
- Baseline Noise Measurements
- Terestrial flora and fauna (habitat and presence based on observations and local knowledge), and aquatic biota
- Land Use and landscape observations
- Infrastructure and services
- Socio-economic and demographic data
- Health and Health Care Data
- Cultural heritage/archaeology
- Local perspective, concerns and interests regarding oil and gas development

The geographical scope of the baseline survey provided an overview of site conditions believed representative of sensitive receptors of the Block IOR-7 exploration drilling and further infill drilling/ production program. The specific methodologies and results from the analyses performed for Block IOR-7 are discussed in the corresponding sections in this report.

5.1.2.1.2 Secondary Data Sources

Secondary data sources came from literature, relevant authorities in the project area including previous study for PCMI seismic survey program in 2014. The secondary data sources are cited throughout this report, and listed in the references section.

5.2 Physical Environment

5.2.1 Topography

The main geographic features of Myanmar can be divided into five physiogeographic zones, consisting of the northern mountains, the western ranges, the eastern plateau, the central basin and lowlands, and the coastal plains[1], characterized by elongated north-south topographic trends.

The PCMI exploration drilling & infill drilling/production project is located entirely in the lower central basin and lowlands physiographic zone lying between the Rakhine Mountains and the Shan Plateau. This area is structurally connected with the folding of the western ranges and predominantly occupies the eastern area near the Ayeyarwady River on Ayeyawady floodplain (**Figure 5-5**).

Topographically the study area is generally flat and mostly cultivated with paddy, which is the main source of income for the people in this area. The elevation of study area ranges from 14 – 21m MSL. The proposed wellsite elevation is 15.3 m MSL. The slope of the study area from W-E is approximately 0.2-0.3% (**Figure 5-6**).

From the field survey and sattlelite image, the land use in the study area consists of swamp, agricultural area and community area.

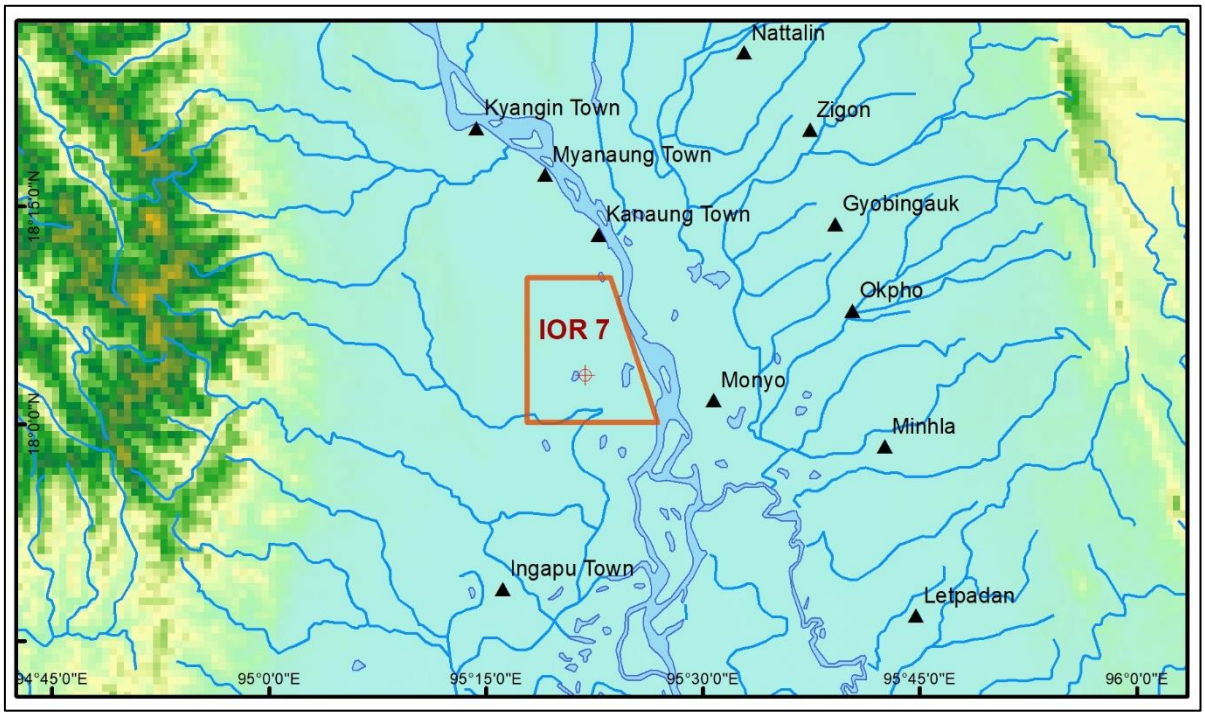


Figure 5-5: Central Basin and Lowlands Showing Block IOR-7 and Proposed Drilling Well

[1] Michael Arthur Aung-Thwin David I. Steinberg Maung Htin Aung (2018) ***Myanmar***. Retrived from Encyclopædia Britannica: https://www.britannica.com/place/Myanmar. Access on 26 Jan 2018

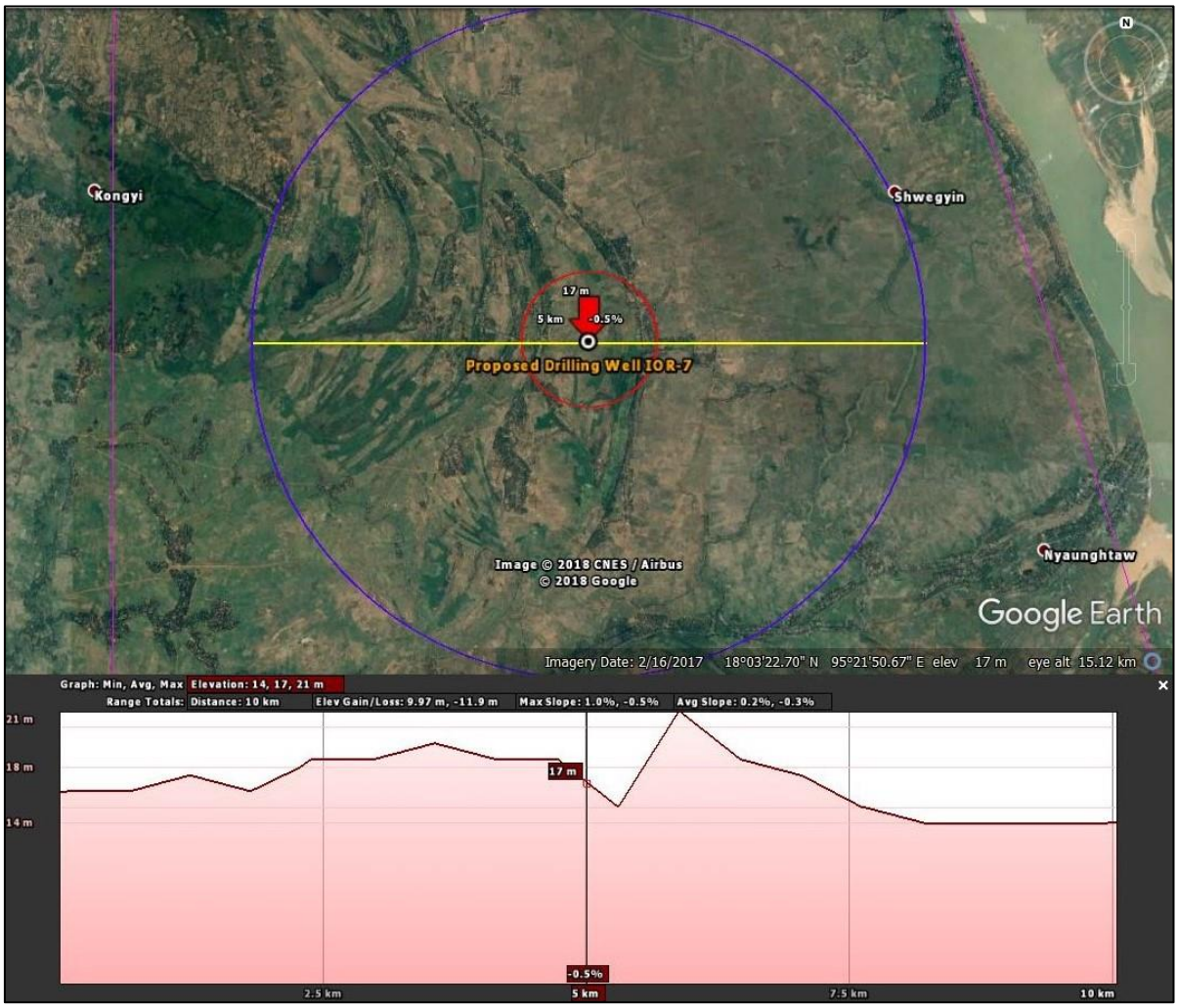


Figure 5-6: Profile W-E of Study Area

5.2.2 Climate and Air quality

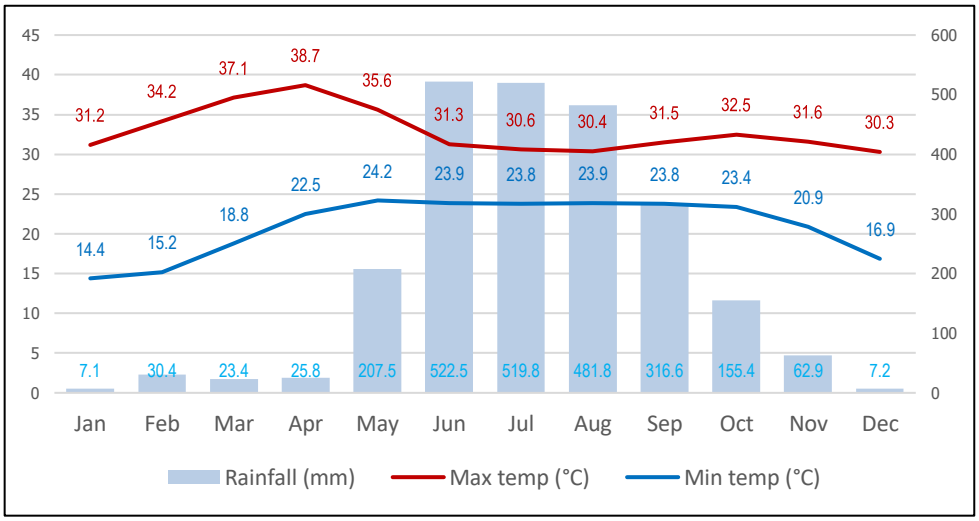
The climate of Myanmar is a tropical monsoon climate influenced by the presence of major landforms. The mountain ranges generally run north-south and act as effective climate barriers for the southwest monsoon (approx. end of May through October) in the summer and the northeast monsoon in the winter (approx. December through April).

According to Köppen and Geiger, the Ayeyarwady region has two different climates and is dominated by the Tropical monsoon climate in areas including Pathein, Bogale, Mawlamyinegyunn, Yedgy and Ngatainchao. While the Tropical savanna climate predominates in areas including Pyapon, Kyaiklat, Maubin, Wakema and Hinthada where the study area situated.

The weather overall is divided into three seasons consisting of (1) Winter or Northeast monsoon season (November - February), (2) Summer or Hot weather season (March - Mid May), and (3) Rainy or Southwest monsoon season (Mid May - October)

5.2.2.1 Temperature and Precipitation

The weather station tnear the study area is Hinthada which is located in Hinthada Town, 45km SE away from the proposed well. This station is representative of the weather condition of the study area. Over a 30 year period, the average annual rainfall was 2,360 mm **Figure 5-7**. The minimum temperature ranged between 14.4-24.2 °C and the maximum temperature ranged between 30.3-38.7 °C throught out the year.

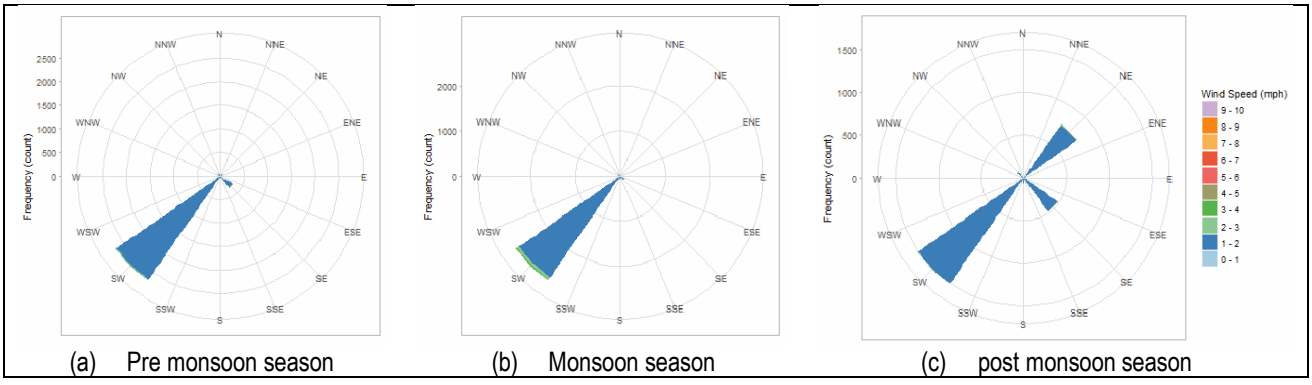


Source: Modified from Lai Lai Aung, et al (2017)[2]

Figure 5-7: Temperature and Precipitation at Hinthada Weather Station in 30-Year-Period (1981 -2010)

5.2.2.2 Wind

Dominant wind patterns in the Study Area are driven primarily by regular southwest monsoon wind in the rainy season and northeast monsoon wind in the winter or cold-dry season. These wind patterns are mediated by mountainous terrain to the West and East. Localized meteorological conditions are also influenced by diurnal thermal cycles and cloud cover. Maximum sustained wind speeds can approach 40 km/hr under certain conditions. The win rose of Bago represent the wind speed and direction in the study area.



Source: Modified from Lai Lai Aung, et al (2017)[2]

Figure 5-8: Wind rose of Bago (Nearest Station to Study Area)

[2] Lai Lai Aung, *et al*. (2017). ***Myanmar Climate Report***. Department of Meteorology and Hydrology Myanmar and Norwegian Meteorological Institute, Norway. Retrived from https://www.met.no/publikasjoner/met-report/_/attachment/download/c4122b3a-0f79-43cd-ac86-e3887177ad07:859e8b441ab11b1e7d3d1a08679f8d67089a3497/MyanmarClimateReportFINAL11Oct2017.pdf

5.2.2.3 Air Quality

Air quality monitoring stations were deployed in the 5km-radius of the proposed drilling well during December 4th – 7th, 2017 to collect ambient air monitoring data along with meteorological data including wind speed, wind direction, temperature and relative humidity. These data are compared with the Myanmar and WHO standards.

5.2.2.3.1 Methodology for Study

The air quality sampling methodology used for this project is described as follows:
The air monitoring survey was conducted with the HAZ-SCANNER EPAS Wireless Environmental Perimeter Air Monitoring System (EPAS) which is factory calibrated with the appropriate USEPA certified target gas and correlated with USEPA methods. (Ref: Code of Federal Regulation 40CFR part 53).

The 24hr survey monitored continuously the following parameters:

1) Particulates: TSPM, PM10

2) Gases: NO_2, SO_2, CO, VOC

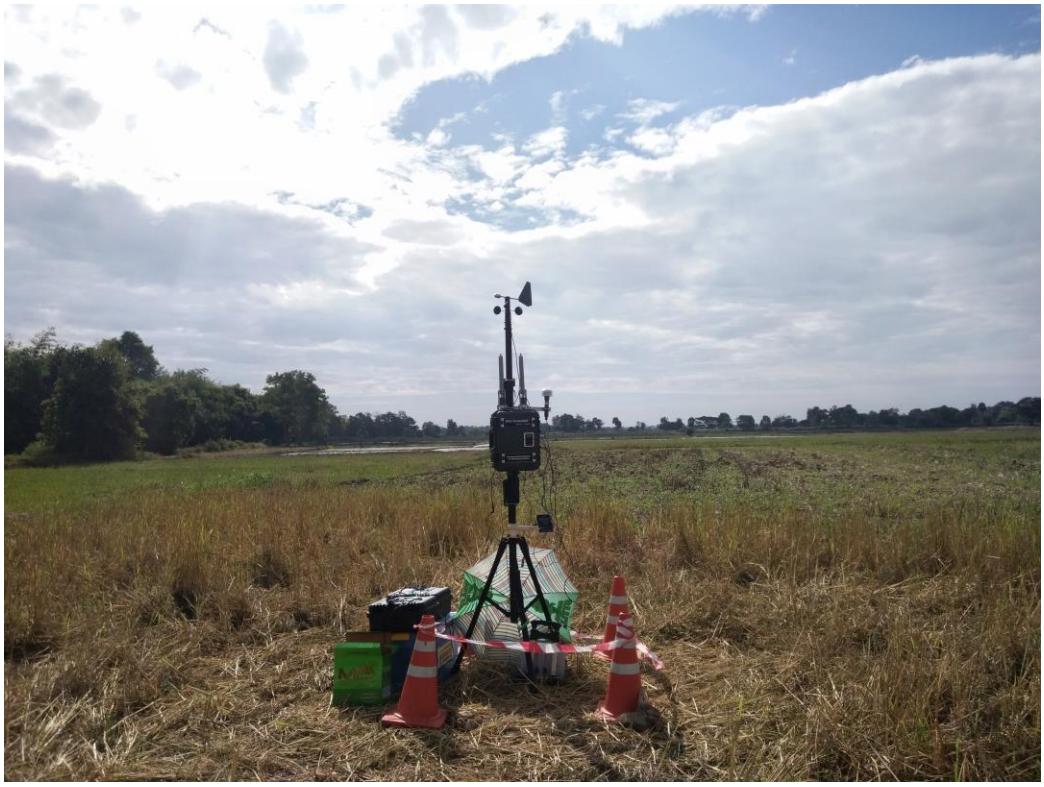
3) Meteorology: Temperature, Relative Humidity, Wind Speed, and Wind Direction

5.2.2.3.2 Sampling Location

One ambient air sampling location was set at Kyo Gone village, the nearest village within the 1km-radius of the proposed drilling well.

Table 5-2: Air Sampling Locations for IOR-7 Drilling Program in 2017

Station	Village	Coordinates (GCS WGS84)		Start Date	End Date
		Latitude	Longitude		
A/N_d1	Kyo Gone Village	18˚02' 56.6"	95˚21' 26.2"	5.12.2017	6.12.2017



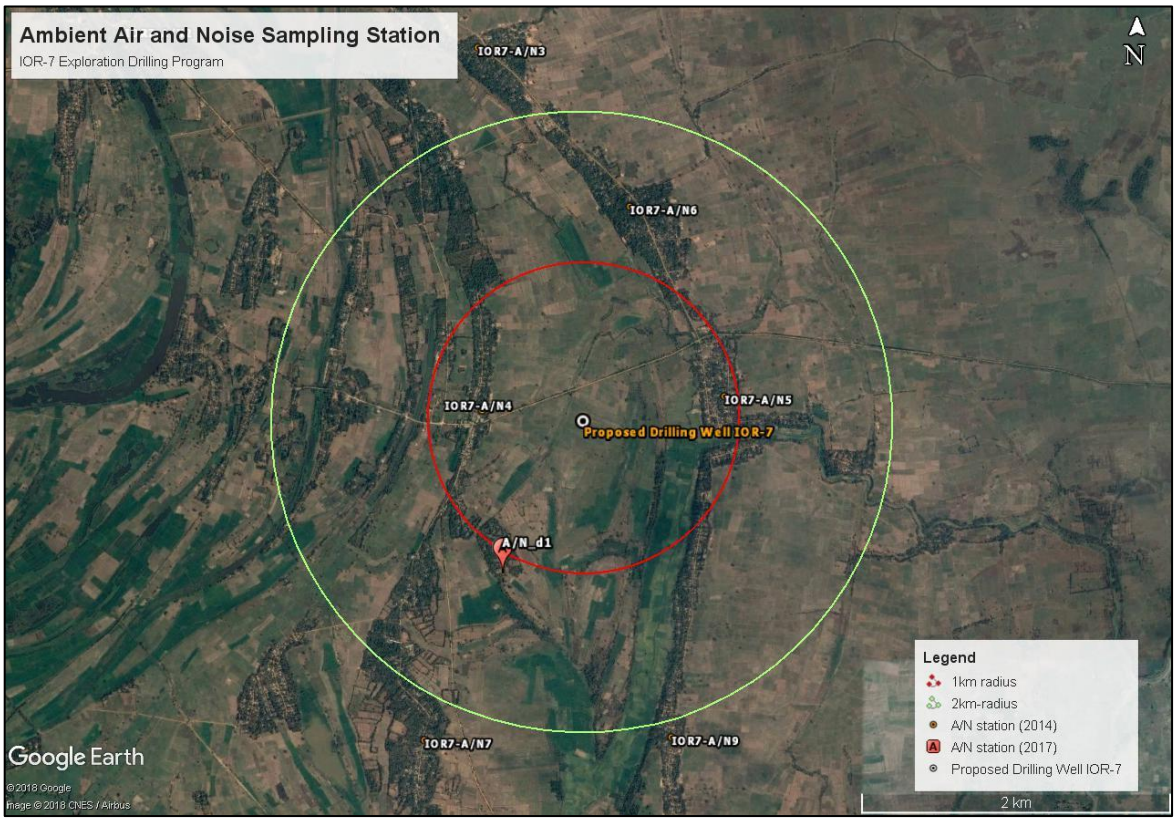
From the previous EIA study conducted in Block IOR-7 in 2014 for the seismic program, 10 ambient air sampling stations were set in 10 villages. There were 5 stations located near to 2 km from the proposed drilling well. The sampling stations are listed in **Table 5-3.**

The ambient air stations of the baseline survey in 2014 and 2017 were shown in **Figure 5-4**.

Table 5-3: Air Sampling Locations for IOR-7 Seismic Survey Program in 2014

Station	Village	Coordinates (GCS WGS84)		Start Date	End Date
		Latitude	Longitude		
IOR7-A/N4	Daung Kya	18°03'18.8"N	95°21'19.9"E	18.11.2014	19.11.2014
IOR7-A/N5	Zee Kone (Duang Kya)	18°03'38.0"N	95°22'18.2"E	15.11.2014	16.11.2014
IOR7-A/N6	San Ta Khwe	18° 03'51.5"N	95°22'11.8"E	13.11.2014	14.11.2014
IOR7-A/N7	Kyoet Kone	18°03'21.0"N	95°20'43.5"E	19.11.2014	20.11.2014
IOR7-A/N9	Ah Tha Lun	18° 03'05.6"N	95°22'19.8"E	16.11.2014	17.11.2014

Source: IEM, 2014[3]



Source: IEM, 2014[3] and Field survey in 2017

Figure 5-9: Air and Noise Sampling Stations within 2km-radius of drilling well (2014 and 2017)

[3] IEM (2014). Environmental, Social and Health Impact Assessment (ESHIA) for Seismic Acquisition & Exploration Drilling in Block IOR-7, PETRONAS Carigali Myanmar Inc.

5.2.2.3.3 Comparing Air Quality Legislation and Guidelines

Ambient air quality in this report will be compared to the following:

1) Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012[4],
2) WHO Air quality guideline (2006) and its updated.

5.2.2.3.4 Result of Study

Table 5-4: Meteorology data obtained from Baseline Survey Comparing 2017 and 2014

Elements*	Year	2017	2014				
	Station Village	A/N_d1 Kyo Gone	IOR7-A/N4 Daung Kya	IOR7-A/N5 Zee Kone	IOR7-A/N6 San Ta Khwe	IOR7-A/N7 Kyoet Kone	IOR7-A/N9 Ah Tha Lun
Temp (°C)	Avg.	21	28	28	33	27	27
	(min.-max.)	(18-27)	(21-47)	(22-44)	(22-54)	(21-48)	(21-45)
Wind speed (kph)	Avg.	-	1.5	0.8	0.8	0.2	0.7
	Max.	-	12.1	10.5	8.7	5.6	12.1
Wind direction (degree)		298 E	35.5 NE	194.5 SSW	208.8 SSW	192.2 SSW	162.6 SSE
Relative humidity (%)	Avg.	75	83	82	72	85	82
Remark: * Measurement duration was 24hrs							

[4] The Pyidaungsu Hluttaw Law No. 9/2012

Table 5-5: Ambient Air Quality in 2km-radius of Drilling Well Comparing 2017 and 2014

Substance*	Unit	Year	2017	2014					Standard/guideline	
		Station	A/N_d1	IOR7-A/N4	IOR7-A/N5	IOR7-A/N6	IOR7-A/N7	IOR7-A/N9	Myanmar EQG (2015)	WHO AQG (2006) / USEP
		Village	Kyo Gone	Daung Kya	Zee Kone	San Ta Khwe	Kyoet Kone	Ah Tha Lun		
Gas quality										
NO_2	ug/m^3	Avg.	47 (24 hr) 47 (one hr)	70	75	71	68	70	200 ug/m^3	200 ug/m^3
		(Min.-Max.)	(3.76-103.6)	(24 -120)	(28 -160)	(6 -169)	(2 -143)	(2-162)	(1hr)	(1hr daily max)
SO_2	µg/m^3	Avg.	**42**	**113**	**110**	**144**	**107**	**105**	20 ug/m^3	20 ug/m^3
		(Min.-Max.)	(0 - 315)	(3 -386)	(1 -672)	(3 -2955)	(3 -307)	(3-333)	(24hr)	(24hr)
CO	µg/m^3	Avg.	49 (24 hr) 55 (one hr)	257	266	279	185	213	30,000 µg/m^3	N/A
		(Min.-Max.)	0 - 824	(2-2290)	(2 -1831)	(2 -1962)	(2-1119)	(2-1735)	(one hr)	
VOC	ppb	Avg.	0.001	85	1	116	53	1	N/A	N/A
		(Min.-Max.)	(0 – 0.071)	(1-13377)	(1 -18)	(1 -8638)	(1 -2560)	(1 -12)		
NH_3	ppm	Avg.	3	2	2	1	2	1	N/A	N/A
		(Min.-Max.)	(2 - 4)	(0 -7)	(0 -8)	(0 -7)	(0 -4)	(0 -4)		
CH_4	ppm	Avg.	28	6	6	5	6.2	5.9	N/A	N/A
		(Min.-Max.)	(10-65)	(5 -8)	(5 -7)	(4 -7)	(4.6 -7.1)	(4.6 -6.8)		
O_3	µg/m^3	Avg.	20 (24hr) 20 (8 hr)	14	22	16	12	16	100 ug/m^3	100 ug/m^3
		(Min.-Max.)	2 - 40	(0 -54)	(0 -48)	(0 -42)	(0 -48)	(0 -52)	(8hr daily max)	(8hr daily max)
Atomic Radiation	CPM	Avg.	15	16	16	15	16	16		25-75 CPM
Particulates										
TSPM	µg/m^3	Avg.	-	453	394	486	489	287		N/A
		(Min.-Max.)	-	(1 -6225)	(1 -7330)	(1 -9127)	(1 -5424)	(1 -5345)		
PM2.5	µg/m^3	Avg.	21	-	-	-	-	-	25 ug/m^3	25 ug/m^3
		(Min.-Max.)	(1 - 685)	-	-	-	-	-		
PM10	µg/m^3	Avg.	30	**227**	**103**	**92**	**223**	**98**	50 ug/m^3	50 ug/m^3
		(Min.-Max.)	(2 – 134)	(4 -1616)	(2 -821)	(2 -821)	(8 -2446)	(2 -1050)	(24hr)	(24hr)

Remark:

* Measurement duration was 24hrs

N/A - Not available

Local Climate

The onsite meteorology data measured by the EPAS monitoring station indicates Temperature, Relative Humidity, Wind speed and Wind direction as shown in **Table 5-4**. In 2014, the wind direction generally came from the south and southeast, during the 2017 study the wind came from the east. Generally, in 2014 the average ambient temperature was ***28 degree Centigrade***, wind speed average was ***0.8 kph*** and relative humidity was ***81%***. In 2017, the average temperature was 21 ***degree Centigrade and the*** relative humidity was ***75%.***

Summary of Air Quality Results

Myanmar EQG and WHO air quality guidelines (updated 2005) which were designed as limits for protection of public health, welfare and environment were used to compare with the results of the baseline survey and to determine the existing baseline status of air quality at the locations within the proposed well site area.

The selected villages where the air quality samples were collected in 2014 in agriculture-based areas. The baseline data gathered at these locations were considered to be representative and typical of other nearby locations. The variation in ambient air concentration will be more or less similar due to the same topography, land use and meteorological conditions. The results from the 2014 baseline survey indicate that the 24-hour average levels of PM10 did not meet the WHO guideline. Air quality for SO_2 did not meet standards and likely to affect the health and environment of the exposed population. It must be noted that during the time of sampling during the 2014 survey, extreme weather conditions were observed during the baseline air monitoring period. The soil types around the proposed project areas generated dust during dry conditions. Therefore, the composition of aerosol particles was mainly from wind-blown dust of mineral oxides from natural sources, weather and the local existing activities such as open burning, transportation and operation of the oil and gas exploration wells are the main contributors affecting the ambient air quality.

In order to determine the existing baseline air quality status at and around the proposed IOR-7 drilling site, a follow up air / noise monitoring station was established at the Kyo Gone Village, Myanaung Township, Ayawaddy division. The levels of ambient air parameters monitored throughout the survey period were compared with National air quality guidelines stated by Environmental Conservation Department (ECD). Regarding the findings of average ambient air concentrations monitored at Kyo Gone Village, the existing baseline particulates level (PM10 and PM2.5) met the guidelinesThe other parameters incuding the one hour average level of NO2, one hour average of CO, and 8 hr average of O3 did meet the WHO guidelines. . The 24 hr average level of SO2 did not meet WHO guidelines, which is similar to the 2014 results. The increased SO2 level may be due to open burning of crop residues and increased sulphur contents from fuel usage.

5.2.2.4 Local perception of Air Quality and Climate Change

During IEM's socio-economic health and opinion survey of 100 households in 4 communities within a 1km-radius of the proposed drilling well, residents were asked both socio-economic questions as well as for information on their perceptions of environmental conditions.

Air Quality

Villagers interviewed (94%) have not noticed changes to air quality (**Chart 5-1**). Possible causes to any change in air quality was attributed to dust from traffic (86%) and warmer climate (14%) (**Chart 5-2**).

Chart 5-1: Response of Villagers In Regard To Perceived Changes Observed In Air Quality.

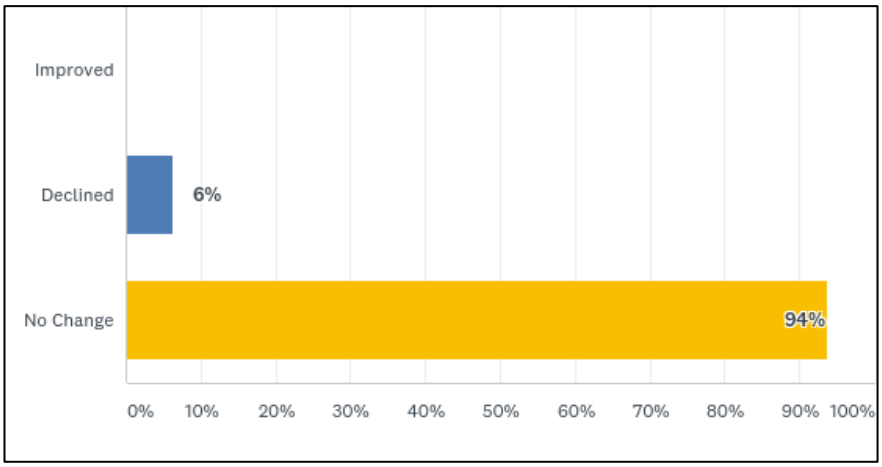
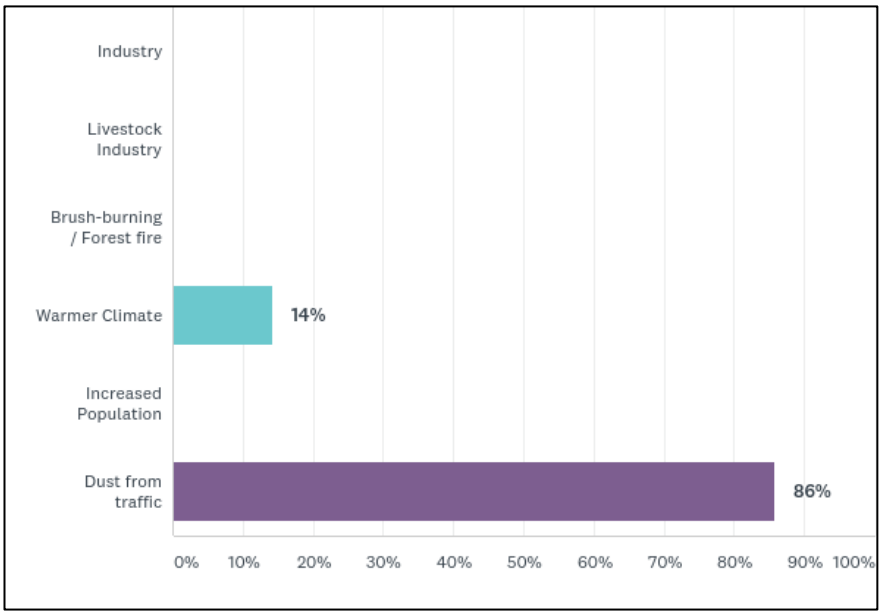


Chart 5-2: Response of Villagers In Regard To Cause of Change In Air Quality



Climate Change

With regard to climate change, 66% of the respondent perceived that the climate was warmer while 33% indicated that it was unchanged and 1% thought that it was cooler (**Chart 5-3**).

Survey participants (76%) perceived that the climate was drier while 17% felt unchanged and 7% felt the climate was wetter (**Chart 5-4**).

Chart 5-3: Response of Villagers in Regard to Perceived Changed in Climate (Temerature)

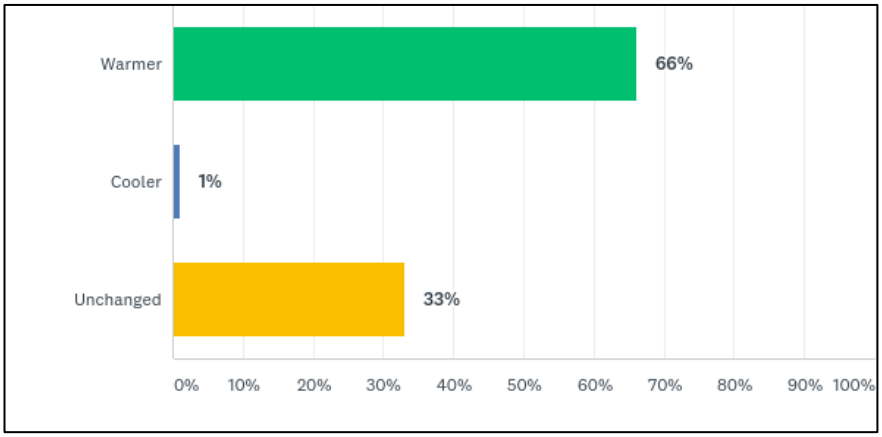
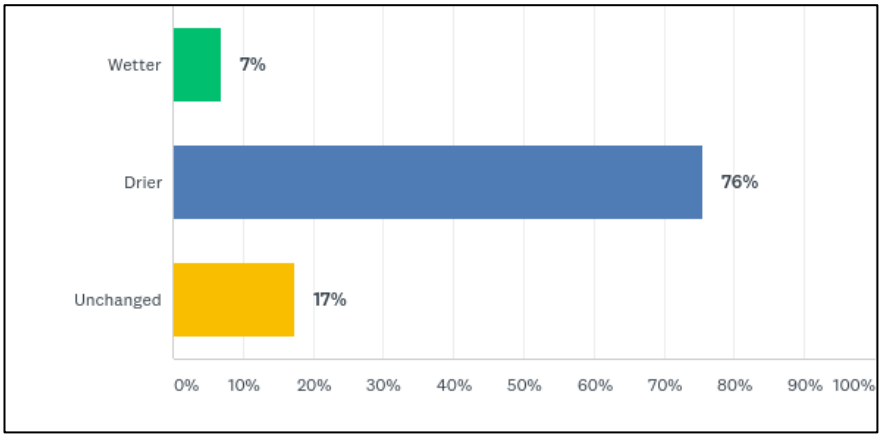


Chart 5-4: Response of Villagers in Regard to Perceived Changed in Climate (Precipitation)



5.2.3 Noise

5.2.3.1 Methodology for Study

The internationally recognised 'A' weighting scale (dBA) was used to measured noise. This level corresponds roughly to the overall level of noise that is heard by the average human. 24-hour equivalent noise (L_{eq}) were taken every 5 minutes for one day, sound level baseline noise was measured using a sound level meter model SL-4023SD.

5.2.3.2 Sampling station

Ambient noise monitoring surveys for exploration drilling program in IOR-7 were also undertaken in Kyoe Gone village (same location with Air Quality) during December 4-6, 2017 (**Table 5-2**) and previously conducted noise measurement in 10 villages for seismic survey program in 2014. There

were five stations located near to 2km-radius from proposed drilling well (**Table 5-3**). All sampling stations in 2014 and 2017 were presented in **Figure 5-4**. The communities were

- Kyo Gone
- Daung Kya
- Zee Kone (Duang Kya)
- San Ta Khwe
- Kyoet Kone
- Ah Tha Lun

5.2.3.3 Comparing Noise Levels to Guideline

Ambient noise leveld in this report were compared to:

1) Myanmar National Environmental Quality (Emission) Guidelines, Effective since 2015 in accordance with The Environmental Conservation Law, 2012, and
2) WHO Guideline for community noise (1999).

5.2.3.4 Results

Ambient noise measurements taken within IOR-7 in 2014 had 24-hour equivalent noise levels ranging from 37.8 dB (A) to 47.4 dB (A). These results indicate that on average ambient noise levels are below WHO and EQG standards. The night noise level for Kyo Gone and Kyoet Kone and Ah Lha Lun were above the WHO standards. The increased evening noise is most likely the result of motorbike traffic and the use diesel generators for electricity in the evening near the sampling stations.

During the 2017 sampling, the findings of average noise levels within the project area, the existing background noise levels met the National ambient noise quality guideline. Looking at the source of noise generation at and around the surrounding environment, people activities are the contributing factors. Ambient noise measurement data recorded in each community is summarized by community in **Table 5-6**.

Table 5-6: Average Ambient Noise Level in 2km-radius of Drilling Well Comparing 2017 and 2014

Station[/1]	Community	L_{eq}	$L_{eq\text{-}Day}$	$L_{eq\text{-}Night}$	L_{min}	L_{max}
A/N_d1	Kyo Gone	43	45	40	31	97
IOR7-A/N4	Kyo Gone	45.0	43.6	**46.2**	33.0	59.5
IOR7-A/N5	Zee Kone (Duang Kya)	39.9	40.1	39.7	33.0	59.1
IOR7-A/N6	San Ta Khwe	39.3	38.7	39.9	27.8	76.0
IOR7-A/N7	Kyoet Kone	47.4	46.0	**48.9**	42.5	54.4
IOR7-A/N9	Ah Tha Lun	44.6	44.6	**44.6**	33.0	56.1
Myanmar EQG[/2]		**N/A**	**55**	**45**	**N/A**	**N/A**
WHO Guideline[/2]		**50**	**N/A**	**40**	**-**	**-**

Remark: [/1] Receptor is residential
[/2] Maximum allowable ambient noise levels 1hour Leq (dBA)
Bold indicates higher than guidelines

5.2.4 Geology

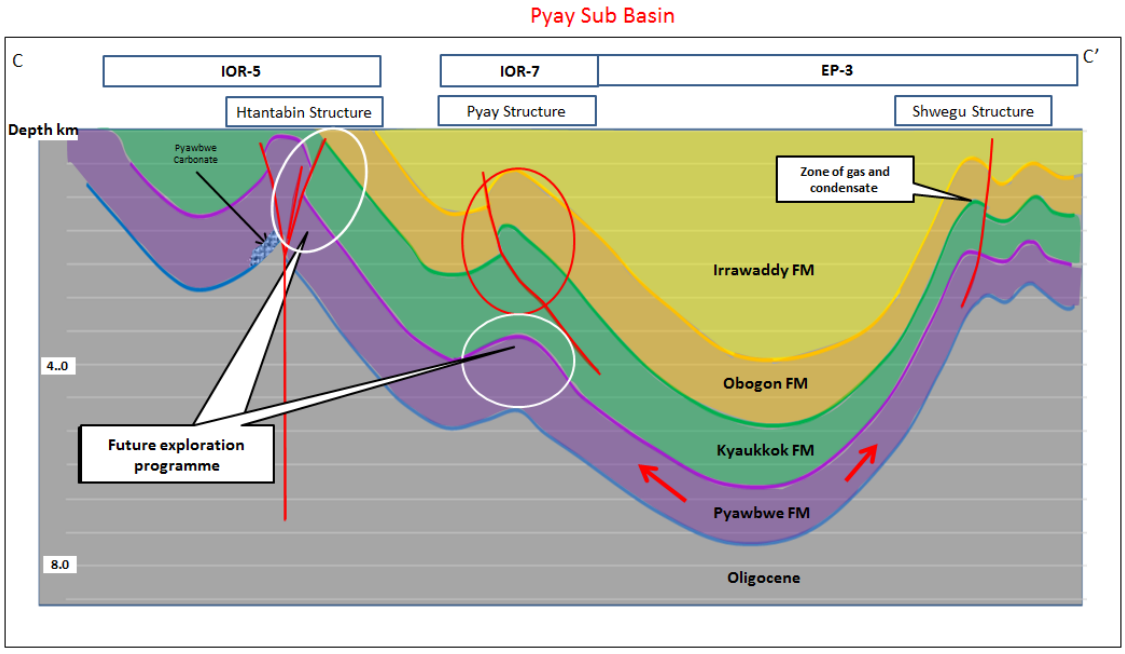
Geologically IOR-7 block is situated near the southern edge of Pyay Embayment which was named as Shwepyitha area. Two oil and gas fields named Myan Aung and Shwe Pyi Thar had been producing. Oil and gas occurs in the Kyaukok Formation (Middle Miocene) and the Obogon Formation (Middle – Upper Miocene). Up to now 19 hydrocarbon bearing sands are found in Obogon/Kyaukok Formations. Stratigraphic rock units of the block are shown in the **Table 5-7**.

Table 5-7. Generalized stratigraphy of the blocks IOR-7 (Modified after MOGE, 2013)

Stratigraphic Units	Stratigraphic Age	Dominant Lithology	Thickness (ft)
Irrawaddy Fm.	U. Miocene - Pliocene	Yellowish brown medium grained sandstones	1000+
Obogon Fm.	Middle to Upper Miocene	Fine sandstones, siltstones, clay-shales (Sandy alternations)	1280
Kyaukkok Fm.	M. Miocene	Yellowish brown, very fine, siltstone-sandstones, shales	1480+
Pyawbwe Fm.	L. Miocene	Grey – dark grey, bluish shale-clay, massive Foraminiferal limestones (grainstone – packstone – wackestone)	5080+

Geological Structure of the Block IOR-7

The Block IOR-7 in Shwepyitha Field is an NNW – SSE trending anticline structure, plunging towards the south and it is divided into two major structural units by a zone of disturbance running ENE – WSW with a throw of about 1000 ft in the south central part. The east flank is dipping gently from 8 to 12 degrees whereas the west flank dips from 15 to 33 degrees. The anticline is thrusted towards the west a thrust fault parallel to the major axis of the structure. The oil and gas accumulation is compartmentalized by these major faults. The structure is divided into 4 blocks. Two blocks are developed in the supra-thrust area and the other two blocks are in sub-thrust area (**Figure 5-10**).



Source: PCMI, 2018

Figure 5-10 : Schematic structural cross section of IOR-7 in the Pyay Sub-Basin showing the subsurface stratigraphic units and the structural styles.

5.2.5 Soil

Interpretation of the distribution of soil types in IOR-7 was based on internationally recognized classification, FAO-UNSECO classification system (1988, 1997), and updated MOECF Agricultural Atlas with GMS database. A limited field sampling program focusing on primarily agricultural soils was conducted within the study area.

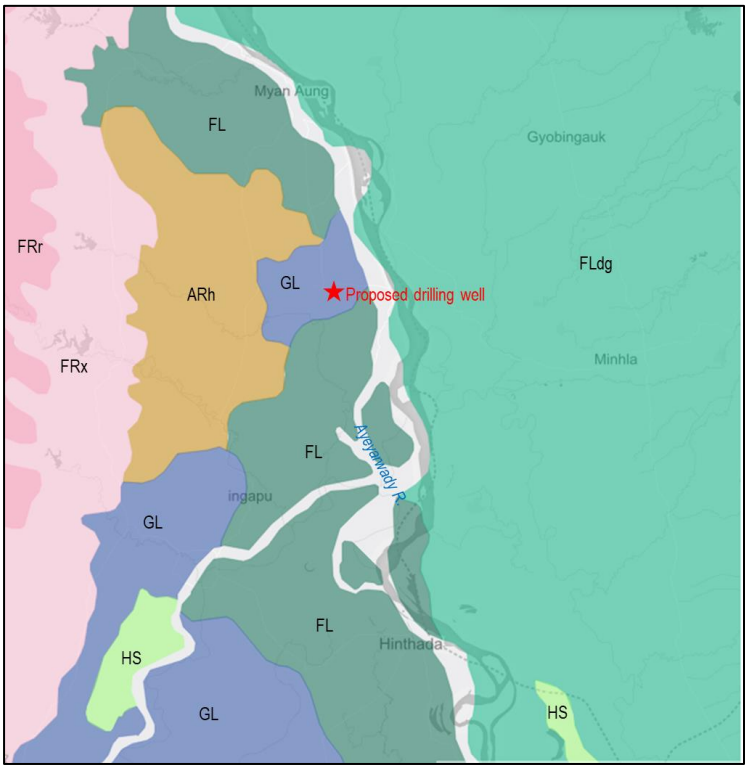
5.2.5.1 Soil Classification

Based on the FAO-UNSECO classification system (1988, 1997), soil in the study area is classified as Gleysol soil (Agriculture Atlas, MONREC referred in ICEM Website) while accoring to GMS database, soil in Block IOR-7 was classifiled more spefifically as Eutric Glysol.

Gleysols are wetland soils that, unless drained, are saturated with groundwater for long enough periods to develop a characteristic gleyic colour pattern. They are azonal soils and occur in nearly all climates, from humid to arid. The main obstacle to utilization of Gleysols is the necessity to install a drainage system to lower the groundwater table. Adequately drained Gleysols can be used for arable cropping, dairy farming and horticulture. Soil structure will be destroyed if soils are cultivated when too wet. Therefore, Gleysols in depression areas with unsatisfactory possibilities to lower the groundwater table are best kept under a permanent grass cover or swamp forest.

Glysal soil or Meadow soils or paddy soils are widely occurring in the different parts of Myanmar in river plains, delta and low coastal plains and valleys. All types of Meadow Soils have thick solum and are mostly having clayey texture. They are most suitable for paddy cultivation.

The Meadow soils of the lower Myanmar have yellow brown colour with acid to neutral soil reaction, the meadow soils which occur near the river plains with occasional tidal floods are non-carbonate. They usually contain large amount of salts. They contain more plant nutrients than the Meadow soils of Upper Mynamar. Regardless of the higher content of iron, the soils can be utilized for rice and vegetables. Meadow Alluvial soils (fluvic Gleysols) can be found in the flood plains, they have the texture of silty clay loam and they can be utilized for groundnut, sesame, sunflower, jute, sugarcane and vegetables in addition to rice cultivation. They have neutral soil reaction and are rich in available plant nutrients. Meadow Gley soils (Gleysol) and Meadow swampy (Histic Gleysol) occur in the regions of lower depressions where the lands are inundated for more than 6 months in a year. The texture of these soils are clayey to clay and usually having very strong acid reaction, and contain large amount of iron. Moreover, the soils with long periods of moisture content may contain large amount of aluminum and soluble iron, sulphur and manganese from chemical processes and can be toxic to plants. The humus content is high and usually deficient in phosphorus and potassium. Rice and jute can be grown in these soils after the floods recede.



Sources: ICEM (2018) Soil Types and Biochar Land Application Suitability and Hotspots || Greater Mekong Subregion. Retrieved on 31 Jan 2018 from http://icem.com.au/biochar/

Figure 5-11: Soil Map of IOR-7 Drilling Program Study Area

5.2.5.2 Soil Quality

5.2.5.2.1 Methodology for Baseline Study

Soil sampling was conducted at the well site location from drill-holes dug by a hand-auger drill. Sediment samples were collected by grab at the same sampling point to surface water samples within 1 km radius from the well site. The sampling areas in Block IOR-7 are shown in **Table 5-8**.

Each hand-augured hole was dug to approximately 15 cm depth. During sample collection, soil samples were collected according to the standard procedure and kept in a cooling box at -4°C and sent to an accredited laboratory for characterization (**Table 5-9**). Parameters to be tested included basic soil chemistry as well as hydrocarbons and metals.

Table 5-8: Soil / Sediment Sample Locations

ID	Date	Location		Photograph	Note / Land Use
		North	East		
Soil					
S_d1	5/12/2017	18°03'23.15"	95°21'51.01"		Paddy field
S_d2	5/12/2017	29°04'26.09"	95°09'06.75"		Groundnut field
Sediment					
SE_d1	6/12/2017	18°03'11.65"	95°21'36.13"		SW_d1 Village's pond
SE_d2	6/12/2017	18°03'16.79"	95°22'00.97"		SW_d2

Table 5-9: Laboratory Services For Soils and Sediment Analysis Provided to Project

Laboratory	Parameters
ALS Hong Kong Laboratory	Total Petroleum Hydrocarbon (TPH including Oil & Grease), Benzene, Toluene, Ethylbenzene, Total Xylenes, Selenium (Se), Arsenic (As), Cadmium (Cd,), Nickel (Ni), Barium (Ba), Copper (Cu), Zinc (Zn), Iron (Fe), Manganese (Mn), pH, Soil Texture, ECe, Chloride

5.2.5.2.2 Comparing Guideline

There are no standards for environmental soil and sediment quality in Myanmar under the National Environmental (Emission) Guidelines (2015). In the absence of local standards, soil quality results were compared against the following;

- Sediment Quality Guidelines for the Protection of Aquatic Life
- Soil Quality Guidelines for the Protection of Environmental and Human Health
- Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008.

5.2.5.2.3 Results

Soil

Soils were all consistent in being predominantly silty clay, with 25% - 48% clay across the sites sampled with various proportions of silt and sand (**Table 5-10**). Soil pH ranged from 5.5 to 6.3 with pH value at only location S_d2 was below the standard. All soil samples were free of hydrocarbon contamination.

With the exception of Hexavalent Chromium (Cr^{6+}), Nickel (Ni) and Selenium (Se) metals data shows that all values are in the range of standards for agricultural purposes. Hexavalent Chromium (Cr^{6+}) and Nickel (Ni) were found above standards for agricultural use at locations S_d1 and S_d2 Soil location S_d2 had Hexavalent Chromium (Cr^{6+}), Nickel (Ni) and Selenium (Se) metals above standards for agriculture use. These areas are agricultural rice paddy and ground nut fields that may have become contaminated by the accumulation of heavy metals and metalloids through land application of fertilizers, animal manures, sewage sludge, pesticides, wastewater irrigation, or atmospheric deposition.[5]

Sediment

Sediments were all consistent in being predominantly silty clay, with 75% - 77% clay across the sites sampled with various proportions of silt and sand (**Table 5-11**). Sediment pH ranged from 5.3 to 5.9 with locations (SE_d1 and SE_d2) outside the standard. All sediment samples were free of hydrocarbon contamination.

With the exception of Cr^{6+}, Cu and Ni, the result shows that those metals were in the standard range for agricultural purposes. Hexavalent Chromium (Cr^{6+}) and Nickel (Ni) were found above standards for agricultural use at locations SE_d1 and SE_d2. Sediment location SE_d2 had Cr^{6+}, Cu and Ni above standards for agriculture use. These areas are water containment and peatland areas next to the existing agricultural areas, they may have become contaminated by the accumulation of heavy metals and metalloids through the run off of from land application of fertilizers, animal manures, sewage sludge, pesticides, wastewater irrigation, or atmospheric deposition.

[5] S. Khan, Q. Cao, Y. M. Zheng, Y. Z. Huang, and Y. G. Zhu, "Health risks of heavy metals in contaminated soils and food crops irrigated with wastewater in Beijing, China," Environmental Pollution, vol. 152, no. 3, pp. 686–692, 2008.

Table 5-10: Summary of Significant Soil Quality Results from Field Survey Comparing Year 2017 and 2014

Parameter	Unit	Soil				
		2017		2014	Standard*	
		S_d1	S_d2	S7	Source	Limit
pH	-	6.3	**5.5**	7.1	CA	6 to 8
ECe	µS/cm	38	45	22	CA	2000
Moisture Content	%	14.9	19.7		N/A	-
Soil Texture	-	Silty Clay	Silt Loam	Silty Clay Loam	N/A	c
% gravel	%	1	0		N/A	-
% sand	%	4	8	3	N/A	-
% silt	%	47	67	56	N/A	-
% clay	%	48	25	35	N/A	-
Chloride	mg/kg	100	70	30	N/A	-
TPH C_6-C_9	mg/kg	<2	<2	<2	CCME	30
TPH C_{10}-C_{14}	mg/kg	<50	<50	<50	CCME	150
TPH C_{15}-C_{28}	mg/kg	<100	<100	<100	CCME	300
TPH C_{29}-C_{36}	mg/kg	<100	<100	<100	CCME	2800
Benzene	mg/kg	<0.1	<0.1	<2	CA*	0.24
Toluene	mg/kg	<0.2	<0.2	<2	CA	0.37
Ethylbenzene	mg/kg	<0.2	<0.2	<2	CA*	0.28
Total Xylene	mg/kg	N/A	N/A	<2	N/A	-
Iron (Fe)	mg/kg	49600	35700	41300	N/A	-
Mercury (Hg)	mg/kg	0.04	<0.02		CA	6.6
Arsenic (As)	mg/kg	5.2	4.8	6	CA	12
Barium (Ba)	mg/kg	159	75.3	146	CA	750
Cadmium (Cd)	mg/kg	0.05	0.05	<0.2	CA	1.4
Hexavalent chromium (Cr^{6+})	mg/kg	**1.3**	**0.7**		CA	0.4
Copper (Cu)	mg/kg	40.2	23.4	36	CA	63
Lead (Pb)	mg/kg	23.1	14.8		CA	70
Manganese (Mn)	mg/kg	971	647	701	N/A	-
Magnesium (Mg)	mg/kg	6710	4470		N/A	-
Nickel (Ni)	mg/kg	**144**	**86.4**	130	CA	50
Selenium (Se)	mg/kg	**1.6**	<0.5	<1	CA	1
Zinc (Zn)	mg/kg	100	53.9	86	CA	200

Remarks: CA -Standard for Coarse Grained Agricultural Soil from Canadian Council of Ministers of the Environment. 2007. Canadian soil quality guidelines for the protection of environmental and human health: 2Summary tables. Updated September, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

CCME -Canadian Council of Ministers of the Environment, CANADA-WIDE STANDARDS for PETROLEUM HYDROCARBONS (PHC) IN SOIL, 2008

CA* - Ontario Soil, Ground Water and Sediment Standards for Ontario, Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011, Canada

Table 5-11: Summary of Significant Sediment Quality Results from Field Survey Year 2017

Parameter	Unit	Sediment		Standard*	
		SE_d1	SE_d2	Source	Limit
pH	-	**5.9**	**5.3**	CA	6 to 8
ECe	µS/cm	19	35	CA	2000
Moisture Content	%	39.2	34.9	N/A	-
Sediment Texture	-	CLAY	CLAY	N/A	c
% gravel	%	1	0	N/A	-
% sand	%	2	4	N/A	-
% silt	%	22	19	N/A	-
% clay	%	75	77	N/A	-
Chloride	mg/kg	140	110	N/A	-
TPH C_6-C_9	mg/kg	<2	<2	CCME	30
TPH C_{10}-C_{14}	mg/kg	<50	<50	CCME	150
TPH C_{15}-C_{28}	mg/kg	<100	<100	CCME	300
TPH C_{29}-C_{36}	mg/kg	<50	<50	CCME	2800
Benzene	mg/kg	<0.1	<0.1	CA*	0.24
Toluene	mg/kg	<0.2	<0.2	CA	0.37
Ethylbenzene	mg/kg	<0.2	<0.2	CA*	0.28
Total Xylene	mg/kg	N/A	N/A	N/A	-
Iron (Fe)	mg/kg	48600	49600	N/A	-
Mercury (Hg)	mg/kg	0.09	<0.02	CA	6.6
Arsenic (As)	mg/kg	3.7	6.9	CA	12
Barium (Ba)	mg/kg	142	234	CA	750
Cadmium (Cd)	mg/kg	0.12	0.48	CA	1.4
Hexavalent Chromium (Cr^{6+})	mg/kg	**0.6**	**0.6**	CA	0.4
Copper (Cu)	mg/kg	48.0	**85.5**	CA	63
Lead (Pb)	mg/kg	21.3	42.4	CA	70
Manganese (Mn)	mg/kg	282	282	N/A	-
Magnesium (Mg)	mg/kg	6560	7790	N/A	-
Nickel (Ni)	mg/kg	**134**	**217**	CA	50
Selenium (Se)	mg/kg	<0.5	0.9	CA	1
Zinc (Zn)	mg/kg	116	156	CA	200

Remarks: CA -Standard for Coarse Grained Agricultural Soil from Canadian Council of Ministers of the Environment. 2007. Canadian soil quality guidelines for the protection of environmental and human health: 2Summary tables. Updated September, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

CCME -Canadian Council of Ministers of the Environment, CANADA-WIDE STANDARDS for PETROLEUM HYDROCARBONS (PHC) IN SOIL, 2008

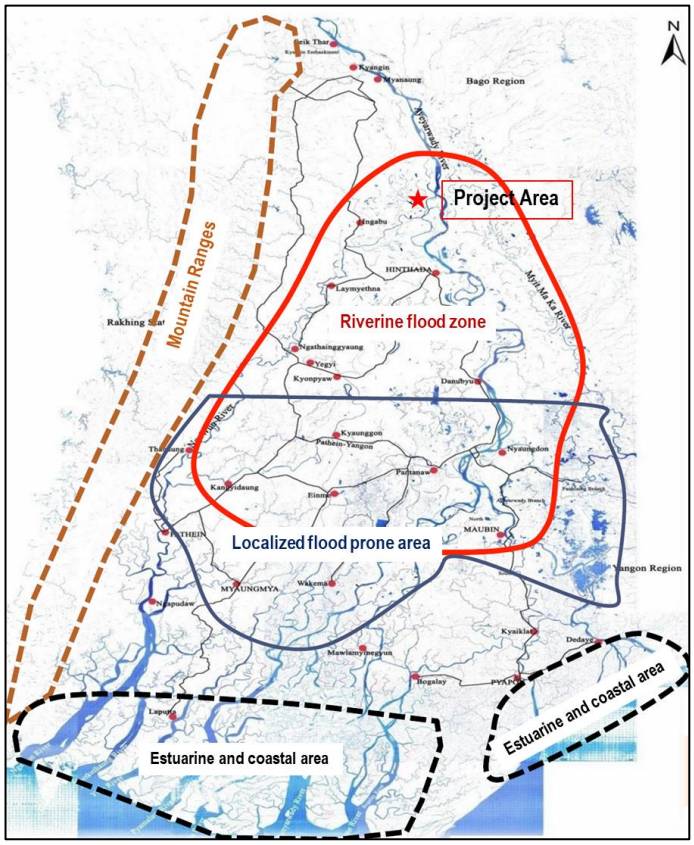
CA* - Ontario Soil, Ground Water and Sediment Standards for Ontario, Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011, Canada

5.2.6 Surface Water

5.2.6.1 Hydrology and Flooding

IOR-7 lies in the Lower Ayeyarwady watershed. The dominant hydrological feature in IOR-7 is the Ayeyarwady River which lies on east of the block. The other surface water features include the Gyan (Yoegyi) Chaung, Ma Mya Chaung, Sein (Seloatma) Chaung, Atha Tun Chaung streams. The monthly distribution of river flow closely follows the pattern of rainfall, i.e., about 80% during the monsoon season (May – October) and 20% in the dry season (November – April).

The proposed drilling well in IOR-7 is located within a seasonal flood plain area. Seasonal fishing in this flood plain is important to the local villages. Causes of flooding in the lower Ayeyarwady Basin (riverine flood zone) includes intense heavy rain due to pronounced monsoon trough persisting for at least 3 days over Northern Myanmar area and heavy rainfall due to cyclonic storms crossing Myanmar and Bangladesh coasts during early-monsoon.



Sources: http://www.gwp.org/globalassets/global/gwp-sas_images/gwp-sas-in-action/ldai/disaster-risks-in-ayd-deltairri-and-flood-protection30-5-2017.pdf

Figure 5-12: Flooded Area in Ayeyarwady Basin

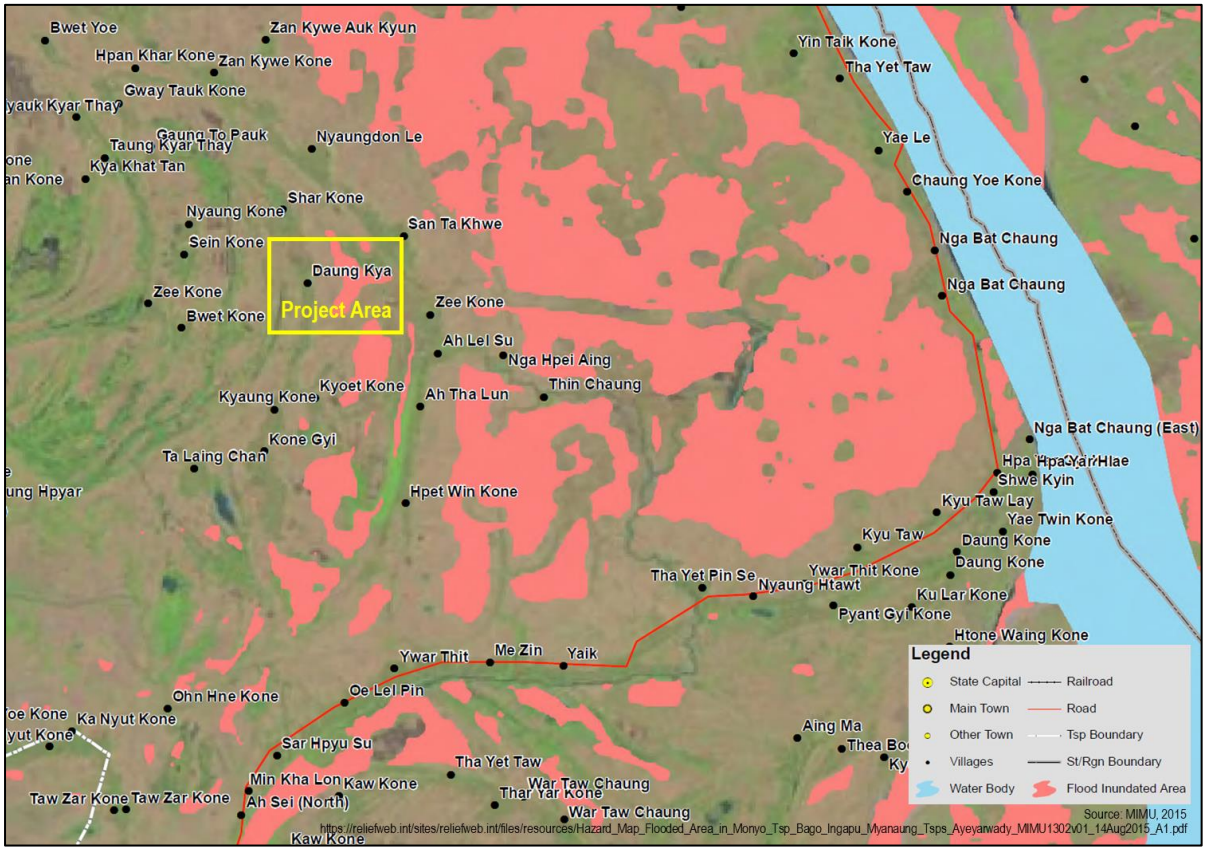


Figure 5-13: Flooding Surrounded Study Area in Flood Year 2015

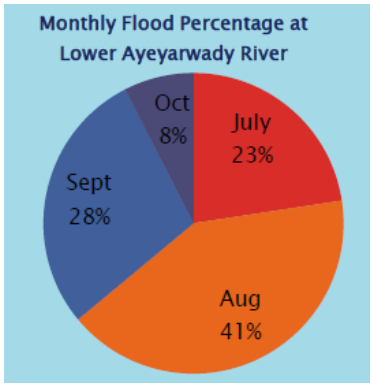


Figure 5-14: Monthly flood percenteage at lower Ayeyarwady River (Hinthada)

AIT Geoinformetics Center (2007-2008) studied the flood hazard area in Seiktha and Zalun Area along the Ayeyarwady River with different return periods using HEC-RAS with Landsat ETM+, river discharge and water level. Results showed that Hinthada and Tharyarwaddy were the worst affected districts by a 100-year flood affecting the Hinthada, Kayngin, Ngaputaw, Myangaung and Mingalardon towns, with flood depths up to 5m. The total area was inundated by a 100 year flood was 2,303 km^2.

During the severe flood in 2015, the project area was flooded **Figure 5-13**. The flood depth was <1-2m. The critical level at Seiktha Water Level Station is 1200cm.

Floods generally occur in July to October each year. The risk of flooding in each month in Hinthada, as representative to lower Ayeyarwady Basin, is shown in **Figure 5-14**.

5.2.6.2 Surface Water Quality

5.2.6.2.1 Methodology for Study

Surface water quality sampling was conducted at areas in the proposed seismic area boundary (**Table 5-12**). As sampling was conducted in the dry season, surface water was generally restricted to impoundments, seasonal drainage canals, rivers and stream. In general, either a grab pole or in some cases a bucket was used for collecting water in ponds or flowing water bodies (Direct immersion of meters) and dipping sample bottles were used in others. During sample collection, water samples were collected according to standard procedure and kept in a cooling box with ice.

The Total dissolved solid (TDS), electrical conductivity (EC), Dissolved Oxygen (DO), Temperature and pH value were measured on-site at the sampling stations and again at the laboratory along with other parameters (**Table 5-13**).

Table 5-12: Surface Water Sampling Locations

ID	Date	Location		Photograph	Note
		North	East		
SW_d1	6/12/2017	18°03'11.65"	95°21'36.13"		Community aquaculture pond. 1-1.5 m depth.
SW_d2	6/12/2017	18°03'16.79"	95°22'00.97"		Swamp not more than 1 meter depth.

Table 5-13: Laboratory Services for Surface Water Samples Collected Provided to Project

Laboratory	Parameters
ALS Hong Kong Laboratory	TSS, Total Petroleum Hydrocarbon (TPH including Oil & Grease), Benzene, Toluene, Ethylbenzene, Total Xylenes, Arsenic (As), Cadmium (Cd), Total Chromium (Cr), Lead (Pb), Nickel (Ni), Total Mercury (Hg), Selenium (Se), Barium (Ba), Copper (Cu), Zinc (Zn), Iron (Fe), Manganese (Mn)

*Analytical Methods followed to Standard Methods for the Examination of water and Wastewater, recommended by APHA-AWWA-WEF.

5.2.6.2.2 Comparing Guideline

There are no standards for environmental water quality in the Myanmar under the National Environmental (Emission) Guidelines (2015). In the absence of local standards, water quality results were compared against the internationally recognized agency, Canadian Council of Ministers of the Environment (CCME) as following;

- Canadian Water Quality Guidelines for the Protection of Aquatic Life (Freshwater)
- US EPA - US EPA National Recommended Water Quality Criteria - Human Health Criteria Table for consumption of water and organism

5.2.6.2.3 Results

The paramaters when compared to the Canadian Water Quality Guidelines for the Protection of Aquatic Life (Freshwater) showed that DO, Copper (Cu), Iron (Fe), Manganese (Mn), Total Chromium (Cr) were above recommended values for fresh water aquatic life. However, most of thse parameters were below the US EPA guidelines expect for Manganese. Managese was above the US EPA standard at SW4, SW5, SW12 (2014) and SW_d2 (2017).

The increased heavy metal concentrations in the area could be naturally occoring of the result of run-off of chemical fertizers and pesticides from land application around the area.

Table 5-14: Summary of Surface Water Quality Results For IOR-7 Baseline Survey

Parameter	Unit	2017		2014							Guideline	
		SW_d1	SW_d2	SW4	SW5	SW6	SW7	SW9	SW12	SW15	CA WQG (Fresh water)	US EPA
pH		6.9	7.2	7.12	7.3	6.92	6.92	7.01	7.64	8.04	6.5 - 9.0	5-9
Temp	°C	23.9	24.7	31.5	31.5	27.2	27.2	31.1	33.3	34.8	N/A	N/A
Conductivity	µS	81.5	165	103	170.8	93	93	88.9	198	1517	N/A	N/A
Salinity	ppt	0.04	0.08	51.2	79.7	46.1	46.1	45.5	91.1	705	N/A	N/A
TDS	mg/l	57.9	117	73.2	121	66	66	63.4	141	1080	N/A	250000
TSS	mg/l	23	30	74	139	12	16	22	124	5	N/A	N/A
DO	mg/l	4.40	**6.45**	3.2	4.2	1.6	1.6	4.6	3.8	**6.1**	>5500	N/A
Oil & Grease	mg/l	<5	-	-	-	-	-	-	-	-	N/A	N/A
BOD	mg/l	<2	<2	<2	<2	<2	<2	<2	3	<2	N/A	N/A
TPH C6-C9	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	N/A	N/A
TPH C10-C14	µg/l	<50	<50	<50	<50	<50	<50	<50	<50	-	N/A	N/A
TPH C15-C28	µg/l	<100	<100	<100	<100	<100	<100	<100	<100	-	N/A	N/A
TPH C29-C36	µg/l	<50	<50	<50	<50	<50	<50	<50	<50	-	N/A	N/A
Benzene	µg/l	-	-	<2	<2	<2	<2	<2	<2	<2	370	0.58-2.1
Toluene	µg/l	-	-	<2	<2	<2	<2	<2	<2	<2	2	57
Ethylbenzene	µg/l	-	-	<2	<2	<2	<2	<2	<2	<2	90	68
Total Xylene	µg/l	-	-	<2	<2	<2	<2	<2	<2	<2	N/A	10000
Arsenic (As)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5	0.018
Barium (Ba)	mg/l	0.014	0.014	0.021	0.017	0.016	0.018	0.019	0.014	0.305	N/A	1000
Cadmium (Cd)	mg/l	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.09	5
Copper (Cu)	mg/l	**0.004**	**0.003**	**0.002**	**0.003**	<0.001	<0.001	<0.001	**0.002**	<0.001	0.7	1300
Iron (Fe)	mg/l	**1.69**	**1.65**	**3.65**	**1.36**	**1.15**	**1.15**	**1.13**	<0.05	**1.25**	300	N/A
Lead (Pb)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	3.18*	Zero
Manganese (Mn)	mg/l	0.03	**0.076**	**0.377**	**0.454**	0.002	<0.001	<0.001	**0.143**	0.007	N/A	50
Mercury (Hg)	mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.026	2
Nickel (Ni)	mg/l	0.011	0.007	0.005	0.007	0.003	0.003	0.002	0.002	0.003	95.58*	610
Selenium (Se)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1	170
Total Chromium (Cr)	mg/l	**0.004**	**0.002**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1	100
Zinc (Zn)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.012	<0.01	<0.01	30	7400
											µg/l	µg/l

Remarks: CA WQG (Freshwater) – Canadian Water Quality Guidelines for the Protection of Aquatic Life (Freshwater)
CA WQG (Irrigation) – Canadian Water Quality Guidelines for the Protection of Agriculture (Irrigation)
US EPA - US EPA National Recommended Water Quality Criteria - Human Health Criteria Table for consumption of water and organism

5.2.7 Groundwater

5.2.7.1 Hydrogrology

Block IOR-7 lies in upper zone of the lower ayeyawady basin almost connected to Myanmar central dry zone. IOR-7 lies on an alluvium aquifer which consists of sand and silty sand. This aquifer occurs near major river courses and tributaries. It provides fresh water with high yield.

Groundwater is the principal source of potable domestic water supply in Blocks IOR-7. Groundwater is being exploited for domestic water. Impoundments are used primarily for watering livestock and some domestic use (Table 5-15). The groundwater table depth in the project area during the Block IOR-7 Survey varied from 3 m with artesian to 76 m (~250ft in tube well).

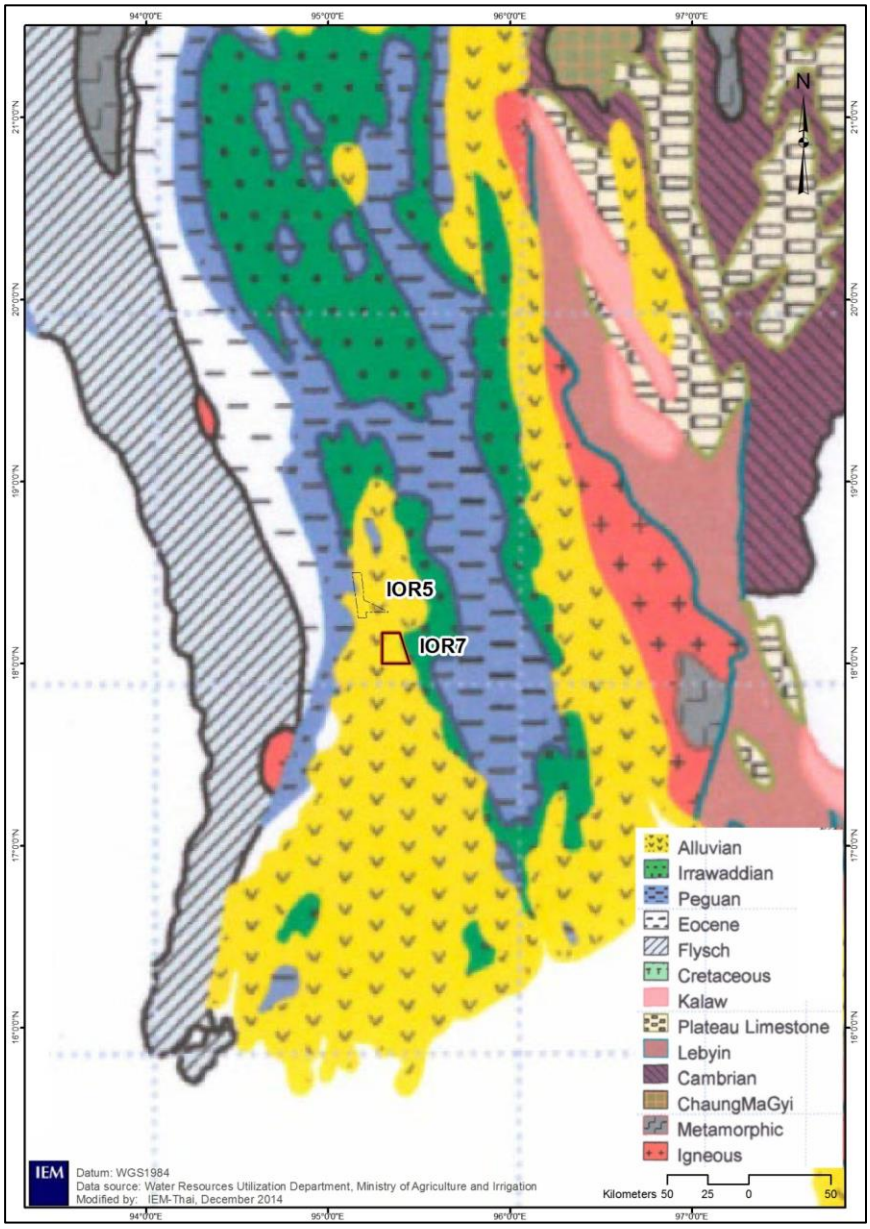


Figure 5-15: Major Aquifers of Myanmar Relative to IOR-7

5.2.7.2 Groundwater quality

5.2.7.2.1 Methodology

Information on local groundwater conditions was collected based on literature review, site-specific sampling tube wells and dug wells at various locations within the IOR-7 study area, as well as during interviews with local villagers using groundwater resources.

Groundwater quality sampling was conducted during field surveys at community locations strategically selected within IOR-7 (**Table 5-15**). The Total dissolved solid (TDS), electrical conductivity (EC) and pH values were measured on-site at the sampling stations and again at the laboratory along with other parameters (**Table 5-16**). During sample collection, groundwater samples were collected according to the standard procedure and kept in a cooling box with ice.

Results of the groundwater quality analysis and the analytical report are summarized in the subsection which follows.

Table 5-15: Groundwater Sampling Locations

ID	Date	Location		Photograph	Note
		North	East		
GW_d1	5/12/2017	18°03'14.92"	95°22'19.31"		Tube well
GW_d2	5/12/2017	18°02'55.63"	95°21'32.98"		Tube well

Table 5-16: Laboratory Services for Groundwater Sample Analysis Provided to Project

Laboratory	Parameters
ALS Hong Kong Laboratory	Total Petroleum Hydrocarbon (TPH including Oil & Grease), Arsenic (As), Cadmium (Cd), Total Chromium (Cr), Lead (Pb), Nickel (Ni), Total Mercury (Hg), Selenium (Se), Barium (Ba), Copper (Cu), Zinc (Zn), Iron (Fe), Manganese (Mn)

5.2.7.2.2 Comparing Guideline

There are no standards for environmental groundwater in the Myanmar under the National Environmental (Emission) Guidelines (2015). In the absence of local standards, groundwater quality results were compared against the following;

- US EPA - National Primary Drinking Water Regulations and National Secondary Drinking Water Regulations, published by the USEPA, May 2009.
- UK Drinking Water Standards from Water Supply (Water Quality) Regulations 2000, (SI 2000/3184) (as amended).

- Ontario Soil, Ground Water and Sediment Standards for Ontario, Use under Part XV.1 of the Environmental Protection Act, April 15, 2011, Canada

5.2.7.2.3 Results

In the 2014 survey, the area had high TDS levels, exceeding Suitable allowable levels were recorded at GW5 and GW6 (**Table 5-17**). From the 2014 study, samples near the project area had Manganese greatly over the maximum allowable level at all locations (GW4 to GW9). However, in 2017, although Manganese was detected, it was below the standards allowable level. Iron was deteceted in the 24 results above allowable levels in GW7,in the 2017 results, Iron was detected at both samples but below the standard limit. The results for the 2017 paramaters, show that all results were within the limits. No petroleum hydrocarbons were detected in any samples.

Table 5-17: Summary of Ground Water Quality Results For IOR-7 Baseline Survey

Parameter	Unit	2017		2014						Guideline	
		GW_d 1	GW_d 2	GW4	GW5	GW6	GW7	GW8	GW9	Source	Limit
pH	-	7.2	6.7	6.91	6.94	8.61	6.6	7.21	6.8	US EPA	6.5-8.5
Temp	°C	25.8	25.9	27.2	27.4	29.7	27.2	27.1	28.1	-	-
Conductivity	µS	519	456	397	856	1512	446	621	247	UK	2500
Salinity	ppt	0.24	0.21	179	390	703	200	281	112	N/A	-
TDS	mg/l	368	324	282	**608**	**1080**	316	441	175	US EPA	500
TPH C6-C9	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	CA	1000a
TPH C10-C14	µg/l	<50	<50	<50	<50	<50	<50	<50	<50		
TPH C15-C28	µg/l	<100	<100	<100	<100	<100	<100	<100	<100	CA	1000b
TPH C29-C36	µg/l	<50	<50	<50	<50	<50	<50	<50	<50		
Benzene	µg/l	<0.5	<0.5	<2	<2	<2	<2	<2	<2	US EPA	5
Toluene	µg/l	<0.5	<0.5	<2	<2	<2	<2	<2	<2	US EPA	1000
Ethylbenzene	µg/l	<0.5	<0.5	<2	<2	<2	<2	<2	<2	US EPA	700
Total Xylene	µg/l	<1.5	<1.5	<2	<2	<2	<2	<2	<2	US EPA	10000
Arsenic (As)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	US EPA	0.01
Barium (Ba)	mg/l	0.014	0.028	0.039	0.039	0.071	0.058	0.02	0.017	US EPA	2
Cadmium (Cd)	mg/l	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	US EPA	0.005
Copper (Cu)	mg/l	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	US EPA	1.3
Iron (Fe)	mg/l	0.26	0.22	0.06	<0.05	<0.05	**0.82**	<0.05	<0.05	US EPA	0.3
Lead (Pb)	mg/l	<0.001	<0.001	<0.001	0.001	0.002	<0.001	<0.001	<0.001	US EPA	0.015
Manganese (Mn)	mg/l	0.024	0.044	**0.67**	**0.014**	**0.018**	**0.725**	**0.277**	**0.12**	US EPA	0.05
Mercury (Hg)	mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	US EPA	0.002
Nickel (Ni)	mg/l	0.003	0.001	<0.001	0.001	<0.001	<0.001	0.001	0.003	US EPA	0.02
Selenium (Se)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	US EPA	0.05
Total Chromium (Cr)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	US EPA	0.1
Zinc (Zn)	mg/l	<0.01	<0.01	<0.01	<0.01	0.116	<0.01	0.013	<0.01	US EPA	5

Remark:

Analytical Methods followed to Standard Methods for the Examination of Water and Wastewater, recommended by APHA-AWWA-WEF.

US EPA - National Primary Drinking Water Regulations and National Secondary Drinking Water Regulations, published by the USEPA, May 2009.

UK - UK Drinking Water Standards from Water Supply (Water Quality) Regulations 2000, (SI 2000/3184) (as amended).

CA – Ontario Soil, Ground Water and Sediment Standards for Ontario, Use under Part XV.1 of the Environmental Protection Act, 9-Mar-04, Canada

a, b: The sum of both fractions must be less than 1000 ug/L

GW6 was not used for potable use

5.3 Biological Environment

5.3.1 Initial PCMI IOR-7 Local Ecological Knowledge (LEK) Summary

In November 2014, IEM conducted Traditional Ecological Knowledge interviews with 140 households in 8 villages in Myanaung District, Hinthada District, Ayeyarwady Region, located within Block IOR-7. The interviews were conducted after focus group meetings wtih one to six participants.

Participants were asked to characterize their observations in regard to their main crops and wild plants and animals in their area. Questions focused on whether they had observed any changes over the past ten years and whether they made use of any of the wild plants and animals. These data provide part of the ecological baseline against which future environmental change and impacts can be measured.

The following villages were included in the survey:

1. Gyan
2. Zan Kywe Kone
3. Nyaung Tone Lel
4. Zee Kone
5. San Ta Khwe
6. Daung Kya
7. Byoet Kone
8. Byoet Yoe

The traditional ecology knowledge survey consisted of 110 questions with a summary of the results presented in the following paragraphs.

The two main crops planted are rice and beans followed by sesame, groundnut and sugar cane. The most valuable crops grown are beans (59%) and rice. The majority of participants use fertilizers (96%) and pesticides (93%) Participants were asked whether their crop yields increased, decreased, or remained stable in the past ten years. Greater than half (55%) observed an increase, with being (86%) attributed any decrease in crop yields to lack of water:

More than half (61%) of participants observed a decrease in the abundance or distribution of wild plants in the past ten years, while a substantial group (32%) observed an increase. On the other hand, the majority (71%) of participants claim that the diversity or type of wild plants had remained stable in the past ten years. Approximately a fifth of participants (21%) cited a decrease. More than half (54%) of the participants who observed a change in the number and/or diversity of wild plants believed more harvesting to be the cause. Approximately one-third (34%) of participants blamed it on less harvesting. Wild plants are an important source of food or medicine for all participants (100%).

The majority (71%) of participants claimed that the number of wild birds has decreased in the past ten years, while a fifth (21%) of participants cited an increase. However, three-quarters (75%) of participants claimed that the diversity or type of wild birds has remained the same in the past ten years. Approximately a fifth (21%) of participants cited a decrease. More than half (60%) of the participants who claimed a change in the number and/or diversity of wild birds believed it was due to a change or loss in habitat, while a third (33%) blamed the change on increased hunting: Wild birds are an important source of food or medicine to most participants (86%):

Fewer than half (34%) of participants had observed a more than 25% decrease in natural habitats over the past ten years. Moreover, half (50%) of participants had observed a significant decrease in the amount of wildlife. All participants (100%) had also observed a significant population increase in the area in the past ten years. More than half (59%) of the participants claimed that the weather had changed significantly over the past ten years. All participants (100%) stated that wild plants and animals in their local environment are a significant and important part of their food or medicine. However, less than half (43%) of participants believe that wild plants and animals in the local environment are a significant and important source of their income.

The communities in IOR-7 believed that there are no important areas for wild plants (89%) within 3 miles of the their village. The majority (95%) of villagers claimed there were no important wild animals near the villages. Approximately one-third (39%) of participants considered wildlife conservation as of little importance, while 28% regarded it as highly important

5.3.2 IOR-7 Biodiversity Site Reconnaissance and Assessment

5.3.2.1 Approach and Methodology of the Study

The study essentially was carried out in two parts:

1) Review and synthesis of secondary data on local biodiversity, significant supporting habitat and landscape features in the project area of influence.

   Secondary sources which were included:

   a. Biodiversity data bases relevant to the area[6].
   b. Satellite imagery of vegetation cover and land use in the project area.
   c. Available information on Regional and Local Protected Areas or Sites: description, designation criteria (including boundaries, status, legal requirements, etc) and mapping
   d. IUCN listings of Threatened species according to the IUCN Red List.
   e. Information on endangered wildlife species listed as protected wild animals, in respect of their categories under the Forest Department Notification No. 583/94 (26 October 1994)
   f. Information on presence of endemic, migratory and congregatory species and/or key (highly threatened and/or unique) ecosystems in the project area of influence
   g. Information on key species ecology including distribution, habitat requirements, and sensitivities.
   h. Available information on culturally important and iconic species which may be present. .
   i. Available information on the potential presence of alien invasive species;

2) Collection of primary data within the seismic survey study area. Primary data was obtained using the following techniques:

   a. Field biodiversity reconnaissance surveys of representative habitat types within the study area. The present survey was practically constrained such that intensive, multi-season transect-based techniques to confirm the presence of species which typically occur at low density, are rare or uncommon were not feasible. Data collection on the occurrence of less common species relied instead on local ecological knowledge interviews as discussed below. Ground surveys for rare plants were not undertaken.
   b. Ecological knowledge interviews with Forestry Department and local residents were undertaken to tap into local knowledge and observation on species, seasonality, migration, etc. This activity was supported by reference to species photographs and drawings. Photographs included wildlife species, which are protected under Myanmar

[6] http://www.iucnredlist.org/
https://species.wikimedia.org/wiki/Main_Page
Endemics : http://Intreasures.com/burma.html
Flora and Fauna International : http://www.fauna-flora.org/explore/myanmar/
Biodiversity and Nature Conservation Association
https://myanmarbiodiversity.org/

Law or Threatened under IUCN, which had some potential to have historically occured in the broad area. A list of field guides used during the interviews is provided in the References section of this report.

Local knowledge is invaluable in providing long-term observation of biodiversity and ecological change in an area. Observations of species types which are not subject to routine harvest or which are not in conflict with the local population are less reliable than those that are.

The communities proximate to the well site areas are detailed in **Table 5-18**.

Table 5-18: Ecological & Biodiversity Interview Locations

No.	Date	Village / Authority	Township
1	05/12/2017	Forestry Department	Myanaung
2	06/12/2017	Forestry Department	Kyangin
3	05/12/2017	Ah Tha Lun	Myanaung
4	05/12/2017	Zee Kone	Myanaung
5	06/12/2017	Daung Kya	Myanaung
6	06/12/2017	Kyoe Gone	Myanaung

c. Review of species habitat requirements relative to available satellite imagery and ground reconnaissance date.
d. Mapping of Natural and Modified[7] habitats according to IFC Performance Standard 6 - Biodiversity Conservation and Sustainable Natural Resource Management; and of possible critical habitats, if any.

Mitigation measures were developed to be consistent with IFC Performance Standard 6 - Biodiversity Conservation and Sustainable Natural Resource Management and related Guidance Notes[8].

Globally threatened status of Fauna species were categorized using The IUCN Red List of Threatened Species as shown in below:

Status	Code
Critically Endangered	(CR)
Endangerd	(EN)
Vulnerable	(VU)
Near threatened	(NT)
and Least Concern	(LC)

Source: IUCN Red List of Threatened Species, Version 3.1. Accessed from www.iucnredlist.org on 01 November 2016.

[7] **Modified habitats** are areas that may contain a large proportion of plant and/ or animal species of non-native origin, and/ or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands. **Natural Habitats** are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.

8 http://www.ifc.org/wps/wcm/connect/a359a380498007e9a1b7f3336b93d75f/Updated_GN6-2012.pdf?MOD=AJPERES

5.3.2.2 Biological Ecoregions

Ecoregions are biogeographic units, which are relatively large units of land or water that contain distinct assemblages of natural communities, sharing a majority of species, dynamics and environmental conditions. Under this classification scheme, ecoregions exist within "bioregions" and typically contain numerous "ecozones". Within Block IOR-7, the *Irrawaddy Moist Deciduous Forest*, has been defined (WWF 2015).

This ecoregion is located within the Ayeyarwady River Basin, the catchments of the Bago Yoma Mountains, and the foothills of Rakhine Yoma. The ecoregion is strongly expressed within the study area and covers the entire region. The forest region covers large areas in Myanmar. The westward extension is across Ayeyarwady River onto the Yakhine Yoma foothills, and the northern extension is up to the Kachin State. Trees reach a height of more than 30 m.

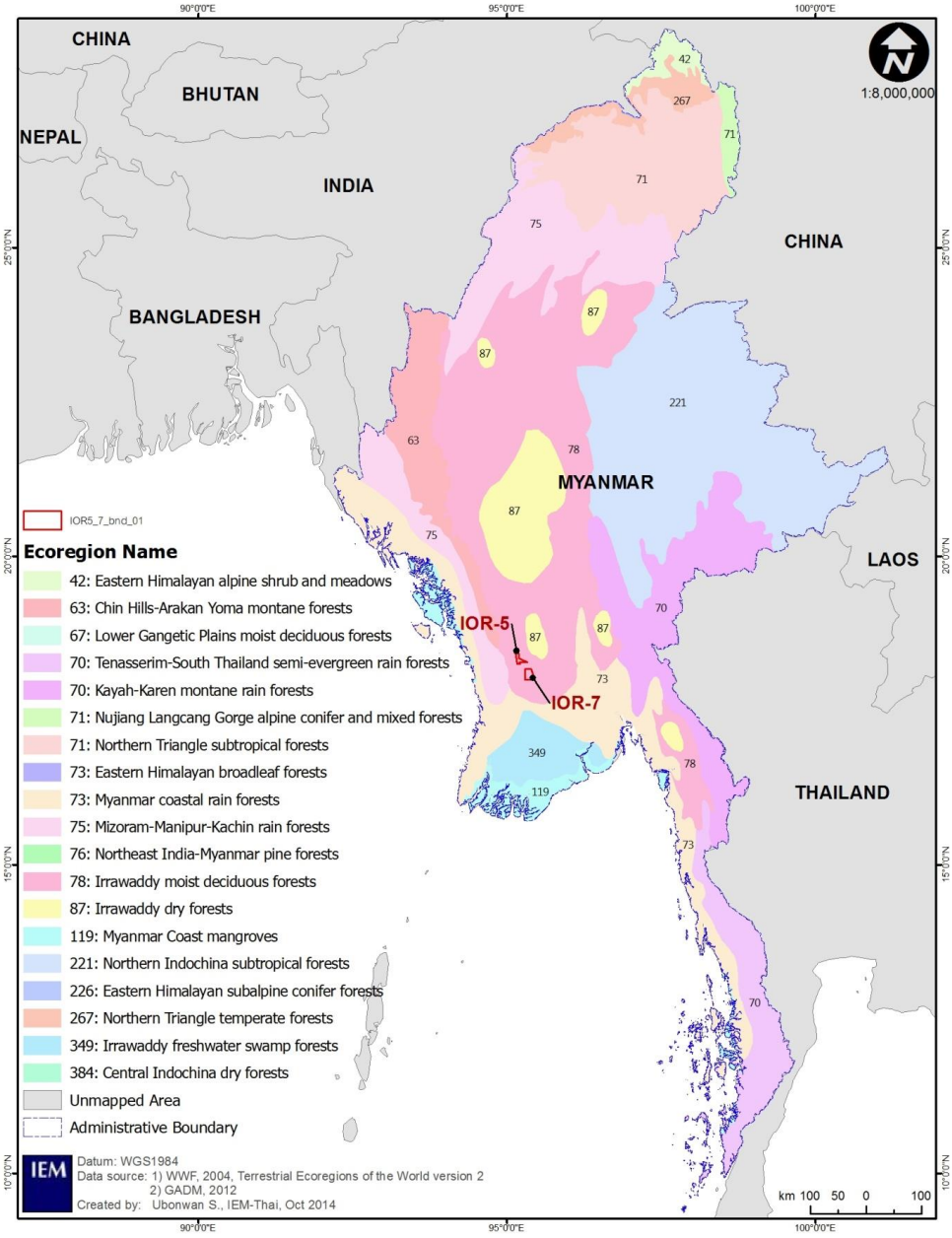


Figure 5-16: Terrestrial Ecoregions in Block IOR-7

5.3.2.3 Species of Concern

Block IOR-7 occurs in the semi open, dry interior region of Myanmar. Wildlife habitats have been converted to agricultural lands over extensive area. Local inhabitants also make continued use of wildlife for food and medicine. Many birds are found in this ecoregion, and they include both water and forest birds found in a wide variety of habitats.

The endangered species in the ecoregion identified from secondary data that that may occur in IOR-7 are list in **Table 5-19**.

Table 5-19: Endangered Animals of Irrawaddy moist deciduous forests

Scientific Name (Common Name)	IUCN Status
Aves (birds)	
Ardea insignis (White-bellied Heron)	CR
Asarcornis scutulata (White-winged Duck)	EN
Aythya baeri (Baer's Pochard)	CR
Emberiza aureola (Yellow-breasted Bunting)	EN
Gyps indicus (Indian Vulture)	CR
Heliopais personatus (Masked Finfoot)	EN
Leptoptilos dubius (Greater Adjutant)	EN
Rhodonessa caryophyllacea (Pink-headed Duck)	CR
Sarcogyps calvus (Red-headed Vulture)	CR
Sterna acuticauda (Black-bellied Tern)	EN
Mammalia (mammals)	
Axis porcinus (hog deer)	EN
Bos javanicus (banteng)	EN
Cuon alpinus (Dhole)	EN
Elephas maximus (Asiatic Elephant)	EN
Hadromys humei (Manipur bush rat)	EN
Manis javanica (Sunda Pangolin)	CR
Manis pentadactyla (Chinese Pangolin)	CR
Panthera tigris (Tiger)	EN
Prionailurus viverrinus (Fishing Cat)	EN
Trachypithecus phayrei (Phayre's leaf monkey)	EN
Reptilia (reptiles)	
Batagur trivittata (Burmese Roofed Turtle)	EN
Gavialis gangeticus (Gharial)	CR
Geochelone platynota (Burmese Star Tortoise)	CR
Indotestudo elongata (Elongated Tortoise)	EN
Nilssonia formosa (Burmese Soft-shelled Turtle)	EN

Source: http://www.globalspecies.org/, 2015

5.3.2.4 Protected Areas

A total of 45 protected areas have been established in Myanmar. The natural areas for protection are categorized as follows:

- Scientific Nature Reserve;
- National Park;
- Marine National Park;
- Nature Reserve;
- Wildlife Sanctuary;
- Geo-physically Significant Reserve; and
- Other Nature Reserve as determined by the Minister.

None of the 45 officially established protected areas are located in Blocks IOR-7. There are two Reserved Forests located in Myanaung Township as shown in **Table 5-20**. The Sint-Thay Reserved Forest is located about 3.5 km Northwest from the wellsite area.

Table 5-20: Reserved Forests in Myanaung Township

No.	Name of Reserved Forest	Forest Type	Name of Plant species	Name of Animal species
1	Sin-thay	Indaing	Pyinkado, In, Kanyin, Thitya, Tauk-kyant, Ingyin, Tha-pyae, Nabe, Thit-say, Kha-paung, Yae-mein, Ohn-taw, Myin-wa, Tin-wa	red muntjac, wild pig, rabbit, lesser bamboo rat
2	Yae-Nan-Taung	Indaing	Pyinkado, In, Kanyin, Thitya, Tauk-kyant, Ingyin, Tha-pyae, Nabe, Thit-say, Kha-paung, Yae-mein, Ohn-taw, Myin-wa, Tin-wa	red muntjac, wild pig, rabbit, lesser bamboo rat

5.3.2.4.1 Key Biodiversity Areas

The area also corresponds to the Ayeyarwady Plains Endemic Bird Area (EBA). The Ayeyarwady River Plains Endemic Bird Area is a key biodiversity areas in IOR-7 (**Figure 5-17**).

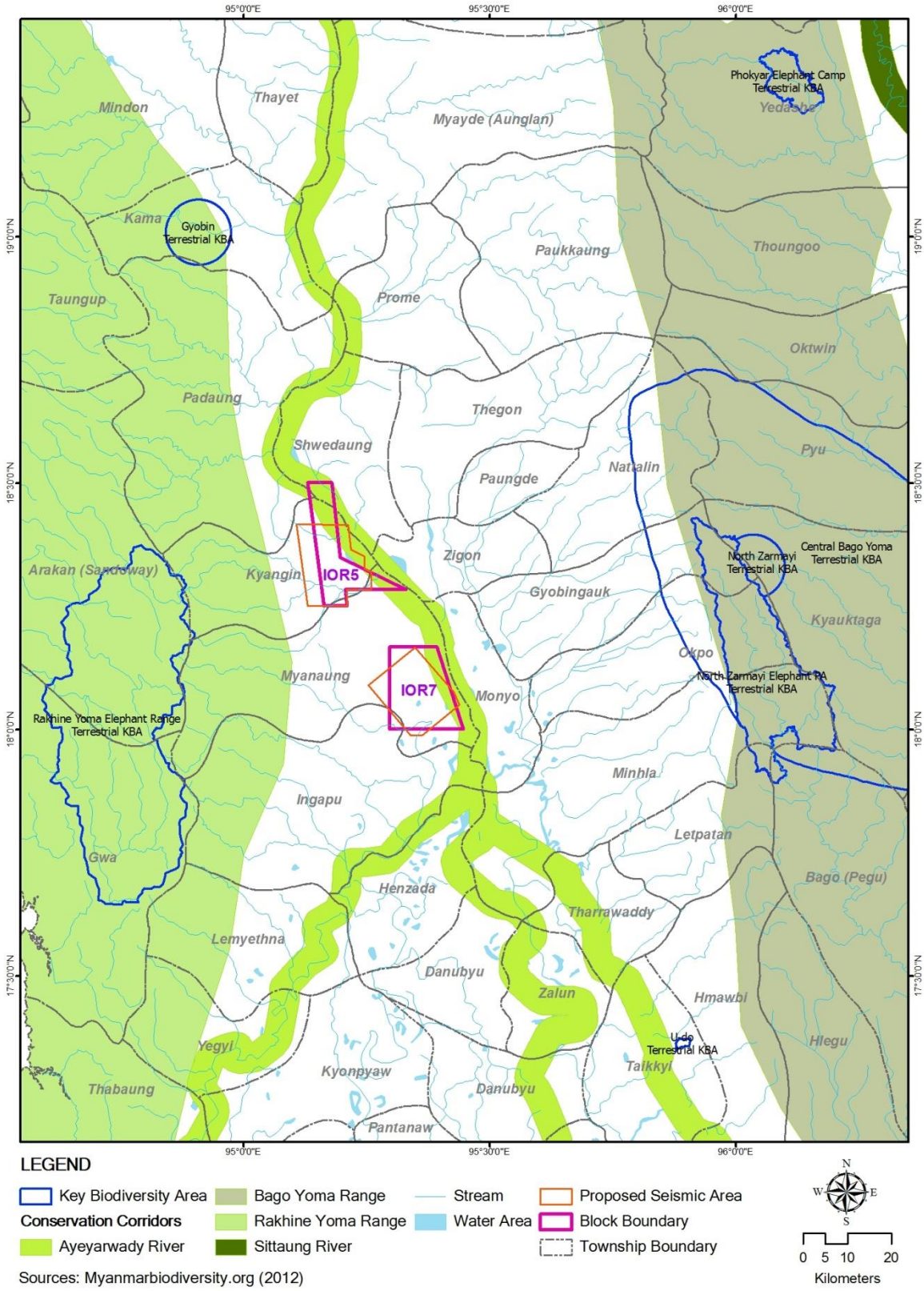


Figure 5-17: Key Biodiversity Areas

5.3.2.5 Tu In Peatland

Overview

There are about 57 In within the Myanaung Township. Among them, Tu In is the biggest peat land and it existed as a sanctuary since many years ago. According to the historical data, it is the unique area and 7 villages are connected with this area. Local people (about 1256) from 19 villages are dependent on this area. Now, agricultural land and fish ponds are gradually changed and replaced around the peat land. Villages around the peat land have ancient pagodas and temples. And Wa-Lu-Wun monastery and ancient pagodas are situated in the center of Tu In.

In 1291 Myanmar Era (AD 1929), His Majesty the King George V designated Tu In as the Sanctuary via the District Commissioner of Hinthada. Moreover, the then Prime Minister Galon U Saw, designated the land and lake area as the religious area belong to Vayluvon Monastery. This area was registered as the religious land with the number (436) at the Land Record Department.

The Peaty Soil in the main lake is 7 inch thick. The natural forest consists of various species of trees for commercial use, construction materials, Pasteur for cows and cattle, pane for export. In the surrounding area of the lake, there are many paddy fields, endangered bird species, migrated birds during winter, osprey, various and rare species of snakes and reptiles, various species of fishes, and many bio diversities. All in all, the lake exists as a natural lake free from chemicals or pollution sources.

Htu-In (Htu Lake) is one of the historical places for the local people who are living at the villages along the margin of the lake. It has a long history connected to Buddhist religion. It is also the biggest lake among more than 70 lakes in Myan Aung township. There are seven villages located along the margin of the lake. However, 19 villages (about 1256 housdholds) depend on their livelihood from the lake and its surrounding paddy farms and fish pounds.

The lake has significant environmental value due to its high biodiversity and invaluable ecosystem services. The lake also provides essential resources to the local populations through food, shelter and water for household use and livelihoods. Some areas of the margin of the lake are transformed into paddy field and fish ponds. There are ancient pagodas at the central island of the lake and margin villages which provide the historical and cultural values. Much of the lake is covered with a habitat of luxuriant growth of submerged and floating mats composed mainly of grasses.

Htu In Peatland area from Biodiversity Site Recconaisanse

Fishing Activities within the Htu in Peatland Area

Figure 5-18: Photos of Htu In Peatlan Area

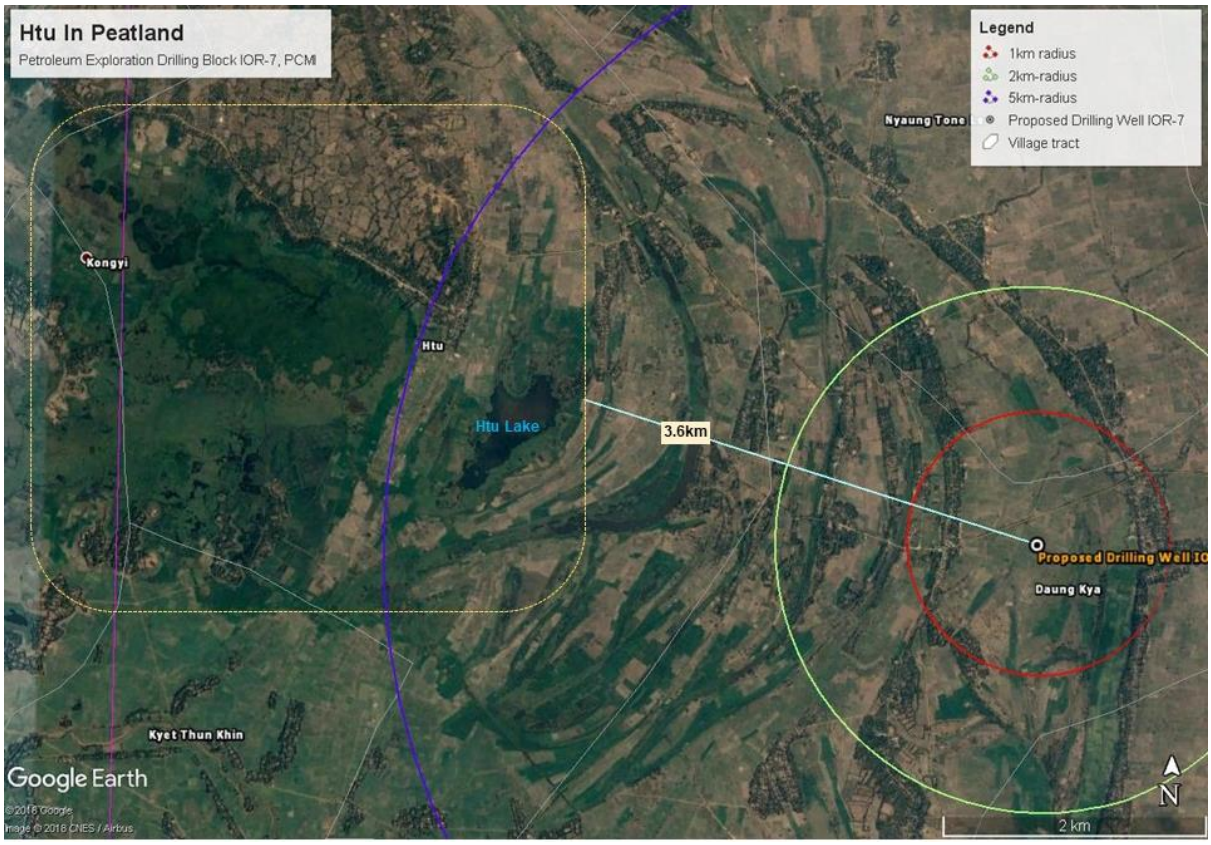


Figure 5-19: Location of Htu In Peatland Compared to Well site

Field Survey Data

An Initial Field Survey Report of Tu In Peat Land located in Tu village Track, Myanaung Township, Hintha District, Ayeyarwaddy Region from 28 to 29th March 2016 in the Tu In peat land. (3278-79/Ah-10), letter No. (11.3.2016) of Pathein Township, Forest Department, Director Office. The Field survey was conducted in Tu In peat land with the cooperation of the relevant departments of Myanaung Township and Environmental Conservation Department (ECD), Ayeyarwaddy Region. The survey results was received from the Myanaung Forestry Department.

On 28th March, 2016, Director U Thein Htay of ECD, Ayeyarwaddy Region and departmental representatives had discussions with the village administrators and local people from Tu village, Khun-Shan-Gone village, Ale-Su village, Ywar-Thit-Gone, Bok-Gone, Kyun-Gone, Nyaung-Gone, Jan-Gone, Min-Gone, Bok-Yoe about the natural condition, inherited businesses, agriculture and fishery industries, in the monastery of Shwe Pyi Thar Oil land, Myanaung township,

On 29th March, 2016, Director U Thein Htay (Environmental Conservation Department, Ayeyarwaddy Region), Staff Officer U Zaw Zaw Minn and members (Forest Department, Myanaung Township), Staff Officer U Tin Win and members (Department of Agricultural Land Management and Statistics), village administrator and members (Tu village tract) surveyed the natural plants and related businesses in Tu In peat land.

Area

According to the record of Department of Agricultural Land Management and Statistics, it is connected with Tu village tract, Ka-Nyin-Ngu village tract and Kyat-Thwin-Khin village tract. Over 19 villages from In-Pin village track, Tu village track, Kyat-Thwin-Khin village tract, Daung-Kya

village tract and Ka-Nyin-Ngu village tract are existing around the Tu In peat land. The area is 1571.81 acre as shown in the following.

Table 5-21: Tu in Area

Village Tract	Area of land	Area of stream (acre)
Ka-Nyin-Ngu	436 ac	741
Tu	436 ac	1081.87
Kyat-thwin-khin	437 ac	148.84
Total		1571.81 ac

According to the record of Forest Resource Environment Development and Conservation Association (FREDA), the area of Tu In is about 502 ha.

Flora:

Most of the natural plants are herbaceous plant. The flora of the lake is very diverse and has a very high biomass with the following species; *Arundo donax L, Lasia spinosa (L.) Thwaites, Eragrostis minor Host, Cyperus pangorei Rottb., Ludwigia adscendens (L.) H. Hara, Amomum croynostachyum Wall., Glochidion spp., Nelumbo nicifera Gaertn., Eichhorinia crassipes (Mart.) Solms, Colocasia affnis Schott, Enhydra fluctuans Lour, Monochoria vaginalis (presl) Kunth, Limnocharis flava (L.) Buchenau*

Fauna:

Birds: *Dendrocygna javanica, Porphyrio policephalus policephalus, Phalacrocorax niger, Gallinula chloropus, Heliopais personata, Phalaeroeorax earbo sinensis, Egretta garzetta garzetta, Andeola grayii*

Fishes: *Channa striata, Heteropnestes fossilis, Clarias barrachus, Wallago attu, Notopterus notopterus, Anabas testudineus, Oreochromis niloticas, Monopterus albus, Xenetondon cancila, Mystus vittatas, Ompok Pabo, Colisa fasciata, Puntinus chola, Botea berdmorei, Penacus merguinensis*

Amphibian species such as tortoise, fishes, wild-pig, lizard and monkey are also found in the area.

Condition of Peat Land

The Tu In Peatland area is a lowland peatland designated as a Community Conservation Area/Forest. It includes some State owned land and some margin areas of the lake are granted to farmers and fish ponds owners. According the site survey of Forest Resource Environment Development and Conservation Association (FREDA) in 2014, it is stated that there are the areas of about 2500 ha of peat land and under the floating island, the volume of peat land is 6 feet. It stated that water depth is about 45 feet between floating island and peat land. This peat land is evolved since many years ago. Herbaceous plants species such as Pein-pin, Pha-lan-pin, Wet-lar-pin are growing In Tu peat land and that herbaceous plants are decomposed every year and are existed as peat land. Some area of peat soil were already degraded and transformed into paddy field and fish ponds. Sustaining the lake is essential to sustain local community's livelihoods and sources of incomes, as well as maintaining a national asset.

Habitats

The project area is comprised of agricultural land area only. This would be classified under the 2012 IFC Performance Standard 6 (modified, natural and critical habitats) as modified. The Htu Tin Marsh

is the one natural or critical habitats identified near the project areas. However, this is located over 3.5 km from the well site and will not be impacted by the project.

This was confirmed by site biodiversity reconnaissance survey along with ecological knowledge interviews with villagers and the Thayet Forestry Department.

Under IFC PS 6 "Critical habitats" are areas with high biodiversity value, including:

i. Habitat of significant importance to Critically Endangered and/or Endangered species;
ii. Habitat of significant importance to endemic and/or restricted-range species;
iii. Habitat supporting globally significant concentrations of migratory species and/or congregatory species;
iv. Highly threatened and/or unique ecosystems; and/or
v. Areas associated with key evolutionary processes.

The Tu In Marsh been informally acknowledged by local conservation groups as supporting significant concentrations of any one wildlife species with special conservation status (Critically Endangered, Vulnerable) or for biodiversity overall. Based on the field observations, satellite image interpretation, literature and on-line source reviews, and anecdotal accounts obtained to date, it is further believed that the this area would satisfy IFC Crtiteria for Critical Habitat including any of the four Birdlife International criteria for an International Bird Area and/or Ramsar Criteria for Identifying Wetlands of International Importance.

In cases where Critical Habitats are present IFC specifies that:

1. In areas of critical habitat, the client will not implement any project activities unless all of the following are demonstrated:
    a. No other viable alternatives within the region exist for development of the project on modified or natural habitats that are not critical;
    b. The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values;
    c. The project does not lead to a net reduction in the global and/or national/ regional population of any Critically endangered or endangered species over a reasonable period of time; and
    d. A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program.

PCMI will not disturb the Tu In Peatland for the exploration drilling. The wellsite is located far away from the marsh at 3.6 km and none of the transportation routes or activitie will be conducted near the peatland.

Ecosystem Services

There are agricultural land (162.56 ac) of Tu village tract, 110.56 ac of Kyat-Thwin-Khin village tract and 190 ac of Ka-Nyin village tract around the peat land. Rice, bean, peanut, sesame and sunflower are planted on the agricultural land and betel nut, coconut, mangosteen, durian and banana are also planted on the farmland. In the previous time, small amount of seasonal crops are planted on the land. Moreover, buffalo, cow, chicken, pig, duck and fish industries are also conducted. Livelihoods of local people around the peat land area are dependent on the natural plants such as Pein-yoe, Za-yit, New-ni, Wet-hla, Gone-min and pha-lan.

Spatial & Human Pressure

In Tu In peat land, the volume of floating island is 15 feet, water depth is 45 feet and peat soil is 6 feet. As the existence area of Tu In peat land is about 2500 ha, if the peat land is shallow, the carbon dioxide will emit in the atmosphere due to the peat soil (carbon) burning. Some area of peat soil were

already degraded and transformed into paddy field and fish ponds. Sustaining the lake is essential to sustain local community's livelihoods and sources of incomes, as well as maintaining a national asset.

The suggestions included the requirements for the Tu In peatland area to be regulated as the conservation area and to manage sustainability. To ensure that the water does not dry up and to manage fire protection activities. It needs to consider the basic needs of local people in order to sustain and not to destroy Tu In peat land that their livelihoods of agriculture, fish ponds and the natural plants and freshwater fishes are dependent upon the peat land.

5.3.2.6 Field Findings / Observations of Flora

As the project area is located only within agricultural land; formal transect or plot field surveys for flora were not undertaken as part of the biodiversity reconnaissance, however, secondary data was examined in light of habitat conditions present in the IOR-7 Block.

Regional mapping of native vegetation cover and land use in Block IOR-7 shows the land is classified as scrubland. However, the predominance of land has been converted to agricultural purposes for most of the block. The dominant species are teak (*Tectona grandis*) and Pyinkado or ironwood (*Xylia kerri*). Species composition is varied and intimately mixed with bamboo groves.

Common tree species are teak, *Xylia kerri, Terminalia tomentosa, T. belerica, T. pyrifolia, Homalium tomentosum, Salmalia insigni, Ginelina arborea, Lannea grandis, Odina wodia, Pterocarpus macrocarpus, Millettia pendula, Berrya ammonilla, Mitravgyna rotundifdlia,* and *Vitex spp. Bambusa polymorpha* and *Cephalostachyum pergracile* are the most common bamboos in lower Myanmar. In the north *Dendrocalamus hamiltonii, D. membranaceus*, and *Cephalostachyum pergracile* are common bamboos.

The undergrowth often consists of *Leea spp., Barleria strigosa*, and other *Acanthaceae*. *Eupatorium odoratum*, a noxious weed, colonized the areas when timber extraction left gaps.

Common medicinal plants located in IOR-7 include local names Beat Hsat (*Eupatorium cannabium*), Mate Tahlin (*Zingiber cassumunar*), Tha Saung (*Caralluma umbellate*), Thet Yin Gyi noy (*Croton roxburghiamus*) and Gon Khar – noy (*Leptadenia reticulate*)

Threatened Species

In Myanmar, there are an estimated 50 threatened plant species, of which 18 Critically endangered, 16 Endangered and 16 Vulnerable based on the classification from IUCN Red List 9. Native vegetation cover within the exploration block has been subject to a prolonged period of alteration and human activity. Timber harvesting, fuel wood collection, clearing for agriculture and plantations and livestock grazing have occurred throughout much of the block.

The following endangered or critically endangered flora was identified to occur in IOR-7 including;

- Dalbergia cultrata Grah. (Yin-daik/ Htone-pauk /Thit-sa-nwin) which is NT
- Pterocarpus indicus Willd. (Taw-pa-dauk) which is VU A1d
- Dalbergia oliveri Gamble (Ta-ma-lan/ Htone-pauk) which is EN A1cd
- Anisoptera curtisii (Kaungmu) which is CR
- Anisoptera scaphula (Taung-sagaing) which is CR
- Bombax insigne (Didu/ Taung-letpan) which is CR
- Dipterocarpus tuberculatus which is which is CR
- Hopea apiculata, No common name which is CR

None of these species are present at the wellsite as the area is agricultural land only.

[9] https://myanmarbiodiversity.org/2014/plants-conservation-in-myanmar/

Endemic Species

Myanmar is reportedly home to over 1071 endemic species of flora[10]. It is likely that endemic flora do occur in the Block. No endemic species are present at the wellsite due to the area being used as agricultural land. Confirmation of the presence of uncommon local endemics would require intensive, potentially multi-season surveys. In some cases, particularly for herbaceous species, detection may only be practically detected in certain years and under certain conditions.

Iconic Species

No iconic flora species were detected near the well-site area.

Alien Invasive Species

During the biodiversity reconnaissance local community representatives were asked whether they had any unusual weed problems and whether they were seeing any new species of plant or animal in their area. In all cases the community representatives reported they did not have any major weed problems, nor had they noticed any new species in their areas.

Significant invasive plant species previously reported for Myanmar include *Prosopis spp., Acacia auriculiformis, Ageratum conyzoides, Leucaena leucocephala, Eucalyptus spp., Casurina equisetifolia, Chromolaena odorata, Hyptis suaveolens, Lantana camara, Mimosa diplotricha, Mikania micrantha, Sorghum halepense, Paspalum conjugatum, Imperata cylindrica, Echinochloa crus-galli, Eleusine indica, Pennisetum polystachion*. Previous assessment has noted that in Myanmar Dry Forest areas, *Prosopis juliflora and Euphorbia spp.* are widespread, particularly in more open areas.

Regional mapping of native vegetation cover and land use in IOR-7 shows the predominance of land converted to agricultural purposes for most of the block.

5.3.2.7 Field Findings / Observations of Fauna

The February 5 – 10, 2018 biodiversity focused community interviews identified potentially 21 species of bird, and 3 species of mammal, 9 species of reptile /amphibian, 1 species of invertebrate, and 40 species of fish (**Appendix 7**).

Suitable habitat for a number of these latter species was noted in the area; however, confirmation of the actual occurrence of these species would require extensive, multi-season investigation.

Table 5-22: Number of Species with Special Conservation Status[11] Reported By Local Community as currently Occurring in general vicinity of the IOR-7 Drilling Program

	Mammals	Birds	Reptiles & Amphibians	Insects	Fish
Critically Endangered	0	0	0	0	0
Endangered	0	0	0	0	0
Vulnerable	0	3	2	1	1
Near Threatened	2	4	4	0	6
Least Concern, DD or Not Evaluated	1	14	3	0	33

[10] http://www.fao.org/docrep/005/AC648E/ac648e08.htm

[11] Species with special conservation status were considered those receiving special protecton under Myanmar law and or species which are listed as Critically Endangered, Endangered or Vulnerable

Threatened Fauna

Mammals

The threatened mammals include; Asian Golden Cat or Golden Cat (*Catopuma temminckii*) is a Near Threatened species under IUCN and is listed as a Myanmar Complete Protected species. The other cat species identified was the Jungle Cat (Felis chaus) that is least concerned and a Myanmar Protected species. The common flying fox (Pteropus vampyrus) is a Near Threatened species identified in the area.

Protection of mammals from impacts from development relies on avoidance of critical habitats and implementing designs and practices that reduce the potential project specific hazards which may impact wildlife species.

Birds

The threatened birds identified include; Greater Spotted Eagle (Aquila clanga) is Vulneral and Myanmar Completely Protected. The Wood snipe (Gallinago nemoricola) is Vlberable and MCP. The Indian skimmer (Rynchops albicollis) is VU and MCP

The Painted Stork (Mycteria leucocephala) was identified which is NT and MCP. One woodpecker species similar to buff-necked woodpecker (Meiglyptes tukki) is NT and MCP. The laggar falcon (Falco jugger) is NT and MCP. The forestry reps informed that the black-headed ibis or Oriental white ibis (Threskiornis melanocephalus) NT and MCP and migrates in rainy season but is very rare.

As elsewhere in the region large water birds have decreased greatly across the country and continue to be threatened by persecution and human disturbance to their nesting and feeding areas. Protection of bird species from unnecessary development impacts relies on avoidance of important habitats and creation of hazards that attract or otherwise place birds at risk (e.g., contaminated waste water pits, spills, unshielded or higher risk lighting, garbage etc).

Reptiles

The following threatened snake and skink species were identified Kind Cobra (*Ophiophagus Hannah*) which is VU and MCP. The Burmese Python (*Python bivittatus*) is VU, the Spotted Cat Snake (Boiga multimaculata) is NT and potentially the Bowring's Supple Skink (Lygosoma bowringii)

Six species of trionychid (soft-shelled) turtles occur in Myanmar (*Amyda cartilaginea*, *Nilssonia formosa*, *Chitra vandijki*, *Lissemys scutata*, *L. punctata*, and *Dogania subplana*), three of which are endemic; the Burmese Peacock Softshell (*Nilssonia Formosa*), Burmese Narrow-headed Softshell (*Chitra vandijki*), and the Burmese Flapshell Turtle (*Lissemys scutata*) and of conservation importance. Only *L. scutata* is currently secure. Its small size, rapid growth rate, frequent reproduction, and ability to live in anthropogenic habitats, appear to make *L. scutata* have made it more resilient than other species. All other soft-shelled turtles are heavily exploited for export to food markets in southern China (Platt et al. 2000; Kuchling et al. 2004). Populations throughout Myanmar are believed to be declining rapidly due to foreign market exploitation as well as accidental drowning in fishing gear, destruction of nesting beaches by seasonal cultivation, and nest losses due to trampling by livestock. The Burmese Narrow-headed Softshell (Chitra vandijki) was identified to be in the area.

As with the large river turtles, project-related concerns in IOR-7 would only arise where there was potential for disturbance or pollution of riverine and wetland habitats. Again project activities which disturb riverine habitats and wetlands would be of greatest concern.

Amphibians

Amphibians included the Indoburman Torrent Frog (*Amolops indoburmanensis*), Giant River Frog (Limnonectes (Rana) blythii) which is NT and the Big-lipped Burrowing Frog (Glyphoglossus

molossus) which is also NT. From a project perspective, protection of amphibians hinges largely on avoiding direct disturbance to permanent and seasonal wetlands as well as preventing of offsite contamination of such locations.

Fish

The conservation status of fish in Myanmar is poorly understood. No specific references were identified for Central Myanmar and the project area; however, given the patterns of human exploitation, any species of fish present in these areas would be very vulnerable. A total of at least 40 species of fish were identified in the Block. Fish is important food source of the local people.The following threanetened or vulnerable species under IUCN were observerd:

- Mrigal carp (*Cirrhinus cirrhosis*) is VU
- Wallago catfish (*Wallago attu*) is NT
- Eel (*Anguilla bicolor eel)* is NT
- Indian mottled eel (*Anguilla bengalensis*) is NT
- Broadhead catfish (*Clarias macrocephalus*) is NT
- Mozambique tilapia (*Oreochromis mossambicus*) is NT
- Burmese snakehead (*Channa harcourtbutleri*) is NT

Extraction of surface water and or intentional or accidental release of contaminated liquids could both pose a significant impact to native fish species.

Invertebrates

The Golden Birdwing (Troides aeacus) was identified in the site biodiversity reconnaissance. Relatively little is known about invertebrate species within Myanmar sufficient to allow classification for the purpose of identifying conservation status and needs for protection. Pollinators such as wild bees and numerous others can play critical roles in ecosystem function as well as human food security and health. Some species groups can have very specific habitat requirements (e.g., butterflies) which, in the absence of knowledge could be locally extirpated. As a general guide, identification and avoidance of uncommon native plant assemblages and retention of native forest cover is a priority. Similarly, indiscriminate use of herbicides and pesticides and failure to control and manage other hazardous substance, and light pollution can increase risks to these and other native fauna.

Endemic Fauna

The identified endemic fauna in the project area comprises of the White-throated Babbler (*Turdotdes gularis*) bird. The Burmese Narrow-headed Softshell turtle (*Chitra vandijki*) and the Indoburman Torrent Frog (*Amolops indoburmanensis*). Other endemic fauna may be present, however, more intensive potentially multi-season surveys would be required.

Iconic Species

No iconic species of fauna (eg. large carnivores, large herbivores, high profile endangered species) are believed to occur in the project area.

Alien Invasive Species

No alien invasive species of fauna were reported to occur in the project area

5.3.2.8 Aquatic Biology

5.3.2.8.1 Methodology for study

Plankton

The plankton survey was conducted within a 1-km radius of the well sites. Freshwater was sampled by taking a 20L container then filtering with 20 µm-maze-size plankton net into containers which

were preserved with 5% formalin, stored in ice box, and sent to the laboratory to analyze the qualitative and quantity of plankton and to identify their diversity and abundance.

In this study the samples were collected from three stations, 2 samples at each station. The sampling stations were described in **Table 5-15**.

Benthos

The benthos survey was conducted within a 1-km radius of the well sites (same sampling station as for plankton). Duplicate sediment samples for benthos were collected using a Eckman grab sectional size 15 x 15 cm then screened with 1.18 mm and 0.425 mm-aperture-size sieves, the collected screened benthos samples were placed in containers and preserved with 10% formalin and stored in ice box, and submitted to laboratory to analyze the qualitative and quantity of plankton and to identify their diversity and abundance.

Table 5-23: Aquatic Biology Sampling Locations

ID	Date	Location		Photograph	Note
Ground Water					
SW_d1	6/12/2017	18°03'11.65"	95°21'36.13''		SW_d1 Community water pond. 1-1.5 m depth. There are water plants around.
SW_d2	6/12/2017	18°03'16.79''	95°22'00.97''		SW_d2 Small Swamp / Peatland not more than 1 meter depth. Aquatic plants are generally located.

Table 5-24: Laboratory Services for Aquatic Biology Analysis Provided to Project

Laboratory	Parameters
Myanmar Marine Science University	Benthic Species, Number & Density Phytoplankton & Zooplankton Species, Number & Density

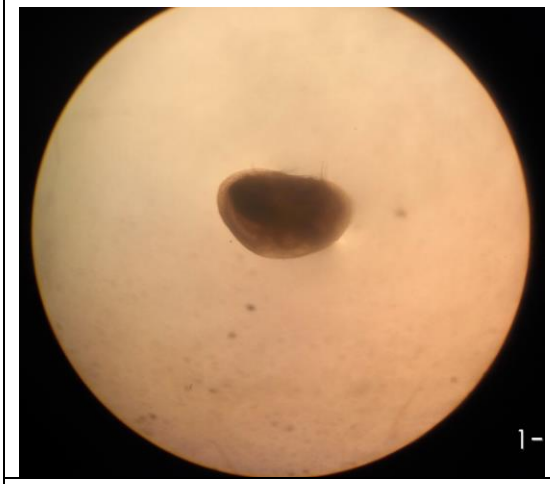
5.3.2.8.2 Results

The results indicated species of phytoplankton as follows; *Characium* sp. *A. Braun., Closterium* Nitzsch., *E. nymanniana* Grunow, *F. crotonensis Kitton, F. intermedia Grunow, G. olivaceum* (Lyngbye) Kutzing, *Gonatozygon* De Bary., *G. peisonis* (Grunow) Hustedt, *Hyalotheca* Kuetz, *L. ehrenbergii* Kitton, *N. distans* (Wm.Smith), *N. sigma* (Kutzing) W. Smith, *Pl. marimum* Ralfs, *Pl. directum* Grunow, *Pleurotaenium* Nag., *P. mican, R. hebetata* Norman ex Pritchard, *Stauroneis* Ehrengb., *S.ovalis* de Brebisson, *S. fasciculata* (Kutzing) grunow, *S. ulna* Ehrenberg, *T. fenestrata* (Lyngbye) Kutzing

The zooplanktons species identified are detailed in **Table 5-25**. Benthic species could not be identified.

Table 5-25: Zooplankton Species Identified

No.	Species	SWD1	SWD2
1	*Amoeba* sp.	+	+
2	Amphipoda	-	-
3	Bivalve larvae	+	+
4	Ceratopogonidae	-	-
5	Chironomidae	-	+
6	*Daphnia*	-	-
7	*Ctedoctema*	+	+
8	*Stenocypris*	+	+
9	*Hemicypris*	-	-
10	Dragonfly	-	-
11	Ephemeroptera	-	+
12	*Parambassis*	+	+
13	Isopod	-	-
14	Rhynchobdellida	+	+
15	Thaumaleidae	-	+
16	*Vorticella*	+	+
17	Waterbeetle	-	+
18	Watermite	-	-
19	*Oxytricha*	+	+
20	Nematode	+	+
21	*Macrobrachium*	+	+
22	Mucidae	-	-
	Total	**10**	**14**



Stenocypris (zooplankton)

Pl. marimum Ralfs (phytoplankton)

Figure 5-20: Identification Photo of Zooplankton and Phytoplankton

5.4 Human Use Values

The available primary and secondary data was obtained from the mutltiple sources as detailed below:

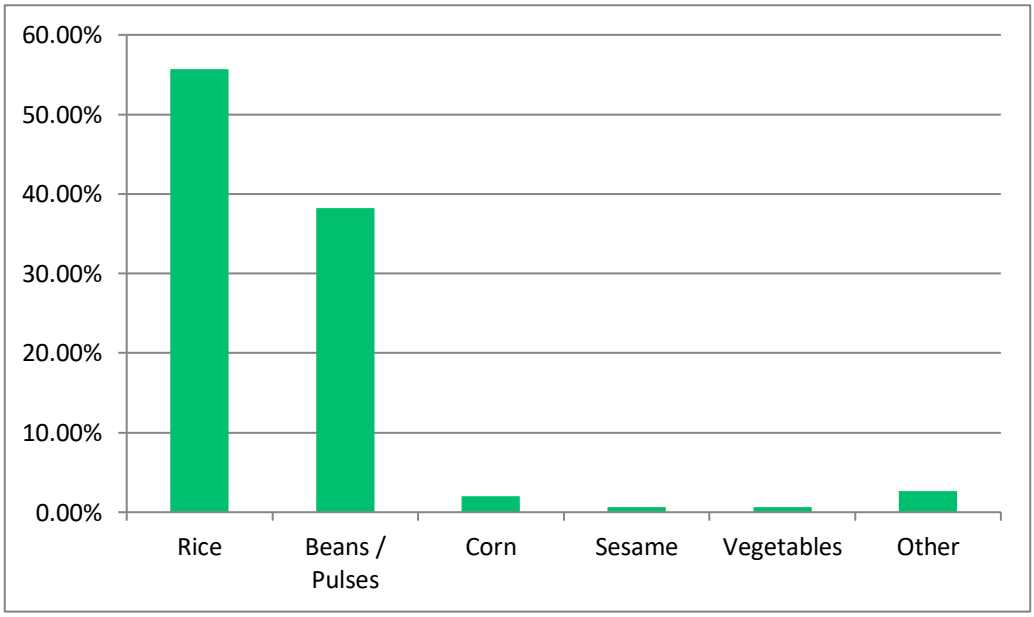
- During the seismic survey phase socio economic, health and opinion surveys of 400 villagers in 8 communities spread across IOR-7,
- During the drilling phase opinion and attitude surveys of 111 villagers in 4 communities within 1km of the well site area.
- 2014 Myanmar National Census data and other secondary data reports.

5.4.1 Agriculture and Industry

Land use in IOR-7 study area is dominated by agricultural activities particularly dry land cultivation along with some irrigated cropland.

The main agriculture crop in this area is rice (56%), with Beans/Pulses the next most common crop (38%). (**Chart 5-5)**. Most households (83%) had livestock, of which over 43% have cows and 14% have oxen.

Chart 5-5: Primary agricultural crops grown



5.4.2 Fishery and Aquaculture

Inland fisheries in Myanmar are mostly associated with riverine and estuarine systems. Inland water bodies, such as natural lakes, reservoirs, river systems and ponds, cover about 8.1 million hectares, of which 1.3 million hectares are permanent, the remainder being seasonally inundated floodplains. Ayeyarwady, Chindwin, Sittatung and Thanlwin are the main rivers, and extend from the eastern part of the Bay of Bengal to the Gulf of Martaban and along the eastern edge of the Andaman Sea.

For fisheries management (licensing and regulation) purposes, Myanmar divides its inland capture fisheries into two main categories:

- Leasable fisheries - These are important fishing grounds on floodplains, which are primarily fished through the erection of barrage fences around the lease area and collecting the catch with pens or traps. As of 2005, there were 3,722 designated leasable fisheries in Myanmar, of which 2,084 were licensed by the Department of Fisheries (DoF). These fisheries produced

about 434,320 tons of fish and prawn in 2004. The leases have traditionally been auctioned annually, but DoF is extending the lease period up to nine years to promote improved long-term management.

- Open fisheries - This covers fisheries in all areas other than the leasable fisheries, with licenses issued on an annual basis by DoF. All fishing gear requires the respective implement license.

The fishing techniques used in inland fisheries are drift net, gillnet, traps and pots, pole-and-line, stationary traps, and bamboo stake traps in the near shore of rivers.

Myanmar's fisheries and aquaculture are an important part of and represent 8% of the country's primary production. In 2014, fisheries directly employed more than 3 million people. Seventy per cent of the fish harvested is consumed nationally, which makes fish and fish products second only to rice in consumption. The Deparment of Fisheries (DoF) has reported increasing fish production from 0.83 million tons in 1994 to 5.05 million tons in 2013-2014. The Inland capture fisheries contribute a major portion of the produce fish with 1.3 million metric tons in 2013—a full 28% of total fish production. Management of inland fish resources remains constrained by the lack of comprehensive and reliable information on inland fisheries. Fish production is not evenly distributed throughout the country, with some areas, (e.g. Ayeyarwady Delta - AD), having a considerable fish surplus whilst others (e.g. Central Dry Zone - CDZ) suffering from an acute deficit and importing fish products from other parts of the country. Aquaculture has been growing quickly in Myanmar, at a rate of around 9% per year since 2004, and contributes 21% of the fish consumed nationally. In 2010, total production was estimated at 860,000 tonnes, (22% of total fisheries production). The bulk of this production is by large-scale producers and destined for export. One cultured fish species dominates Myanmar's fish exports; the Indian major carp, Rohu, (Labeo rohita). This single species (rohu), accounts for around 70% of the fish produced from aquaculture in Myanmar. Shrimp, a high value crop grown mainly for export, contributes just 5.6% of production. Aquaculture in Myanmar has become overly dependent on limited number of species and the lack of diversification is seen as a constraint to further growth of the aquaculture sector. Aquaculture is very concentrated geographically, with 90% of inland fish ponds located in the AD, close to Yangon. [12]

Major fish species cultured include Roho (*Labeo rohita*), Catla (*Catla catla*), Common carp (*Cyprinus carpio*), Grass carp (*Ctenopharyngodon idellus*), Mrigal carp (*Cirrhinus mrigala*), Silver carp (*Hypophthalmichthys molitrix*), Tilapia (*Tilapia spp.*), Striped catfish (*Pangasius sutchi*), Philippine catfish (*Clarias batrachus*). Recently, DoF successfully cultivated another three species of freshwater fish, namely *Piratus branchatus*, *Notopterus chitala* and *Osphronnemus gouramy*.

From the 2014 seismic survey data, 97% of those surveyed in Block IOR-7 were not involved in fishery. Similarly, 87% do not own fish or prawn ponds.

5.4.3 Irrigation and Agricultural Water Sources

The country has 18.2 million ha of arable land, of which only 13.3 million ha (73%) are cultivated at present. In the monsoon season, only 2.1 million ha of cultivated land are irrigated, while the remaining 11.2 million ha are rain-fed[13]

Irrigated areas were traditionally supplied through weirs for river diversion or dams and tanks, but wells and pumping in rivers have developed quite substantially in recent years (FAO, 1999). Pump irrigation was promoted in the 1980s by programmes implemented by the Agricultural Mechanization Department. Water Resources Utilization Department has been implementing pump irrigation water supply programme using high discharge capacity pumps since 1995. Other types of irrigation water

[12] Myanmar DoF statistics 2014-2015
[13] Republic of the Union of Myanmar: Irrigated Agriculture Inclusive Development Project, ADB 2016

supply include windmills, watermills, watering with buckets, ponds, etc. In the central dry zone, where most of the potential for economical run-of-the-river diversion schemes has been utilized, dams, irrigation projects and groundwater irrigation projects were started in the 1980s. Groundwater is mobilized mainly by diesel pumps. Salinization due to irrigation is mainly found in the central dry zone, near Meiktila in Mandalay Region, where groundwater is used for irrigation purposes (FAO, 2009).

5.4.4 Waste Management

Myanmar has been facing considerable challenges with the management of waste in the recent past as a result of increasing income and consumption levels, urban growth, and lack of effective waste treatment and disposal methods. Waste management in Myanmar has traditionally been the responsibility of township and city development committees designated within respective States and Regions. Waste collected by respective townships and city development committees is transported to open dumping sites. Recycling activities, if carried out is mostly by the informal sector, which includes waste pickers, waste collectors, and waste dealers.[14]

To consider the current condition of waste management practices conducted by Myan Aung City Development Committee a meeting was held with the Township Administrator from Myanaung GAD and Representatives from Myan Aung City Development Committee. Myuanaung CDC cannot handle manage wastes systematically. CDC is planning to buy 10 acres of land for waste disposal, however some local people are objecting about the land area. CDC informed that they collect and dispose at an open dump site. All wastes including domestic and industrial waste as disposed at the disposal area without separation.

Discussion with CDC near the waste disposal site

Waste Disposal Site

Figure 5-21: Photographs of Township Waste Management

5.4.5 Transportation

Central Myanmar has a relatively well developed transport system compared to other parts of Myanmar, including road, air, rail, and water. Due to its geography, central Myanmar, particularly Mandalay acts as the central hub for transport of people and goods with destinations further north, east and west in the country, as well as to China and India.

[14] Waste Management in Myanmar: Current Status, Key Challenges and Recommendations for National and City Waste Management Strategies, IGES 2017

5.4.5.1 Roads

The major mode of transportation in central Myanmar is roads. PCMI plans to transport the rig and equipment transportation via the Pathein – Monywa Highway Road to Kyangin and then to Myanaung. Then proceed to Well Site area via MOGE road starting from Mingone Junction. The personnel transportation route is via the Yangon – Hinthada Road. Traffic-related deaths rates are increasing in Myanmar. The rate of fatalities each year increased to 1,853 in 2008, 2,496 in 2011, 3,721 in 2013, and then to 4,313 in 2014. The 4,887 total deaths from 17,384 traffic accidents in 2016 is similar to the 4,375 deaths in 15,859 traffic accidents in 2015.[15] The absolute level of fatalities in Myanmar is still moderate when compared with that of similar countries. The rate of fatalities per 100,000 people was estimated to be 2.5 in 2006. It reached 8.4 in 2014. Despite the increase, this is not currently considered a high rate per 100,000 people on an international comparative basis. In 2010, the Philippines had a fatality rate of 8.3, Indonesia 17.7, Cambodia 17.6, and Thailand experienced a very high rate of 38.8.[16]

The traffic load for Myanmar roadways is shown in Figure 5-22. The transportation route will use a variety of roads with traffic levels of over 2,500 vehicles /day near Yangon, and then reducing to below 500 vehicles /day near the project area.

Source: Source: ADB estimates based on Ministry of Construction highway traffic data. 2013

Figure 5-22: Traffic Load on Myanmar Roadways

[15] Myanmar Transport Brief, Issue 21, 11 May 2017
[16] Asian Development Bank. Myanmar transport sector policy note: Road safety. Mandaluyong City, Philippines: ADB, 2016.

5.4.5.2 Railroad

Railroads in Myanmar generally run south to north with branch lines to east and west, with the Central Railway Station in Mandalay as a major hub. The main rail line for passenger and cargo is between Yangon and Mandalay. From Mandalay, the railroads branch east to Shan State, and west to Magway Region and continuing north to Kachin State.

5.4.5.3 Air

Central Myanmar has two international airports – Mandalay International Airport, and Naypyidaw International Airport. Similar to the road and rail transport network, these two airports serve as a central hub from which many flights to the east (Shan State) and north (Kachin State) are taken.

5.4.5.4 River Transport

Water transport in middle Myanmar is on the Ayeyarwady River.

5.4.6 Power Supply, Electricity

Installed capacity in Myanmar grew by a factor of four during 2000–2014 and reached 4,422 MW in 2014.[17] Since 1975, the 34.7 MW gas turbine power station in Myaunang, with annual production of 200 GWh, has been running for power supply in Ayeyarwady.[18] The Ministry of Electricity and Energy (MOEE) has pledged to provide an additional 3,600 megawatts of electricity within the next four years. Once planned project is the Myanaung 20-megawatt natural gas power project.[19]

The major source of lighting in Myanaung Township is from candle (41%), followed by battery (25%)[20] During socio-economic interviews in IOR-7 Respondents indicated that their source of light varied between battery (55%), candles (24%) and public electricity (8%) (**Chart 5-6**). Approximately (29%) of the respondents interviewed have power available with a ¼ mile from their residence, however (60%) have power available greater than 1 mile from residence. Most of the interviewee's (96%) cook with firewood (**Chart 5-7**).

[17] ADB - Power Sector Development in Myanmar, 2015
[18] Energy Sector Initial Assessment Myanmar, Asian Development Bank, October 2012
[19] News Article, Govt moves to complete five power projects, Access from http://www.elevenmyanmar.com/local/13159 on March 23, 2018
[20] 2014 Myanmar Population and Housing Census (2014 MPHC)

Chart 5-6: Response of villagers in IOR-7 in regard to source of lighting.

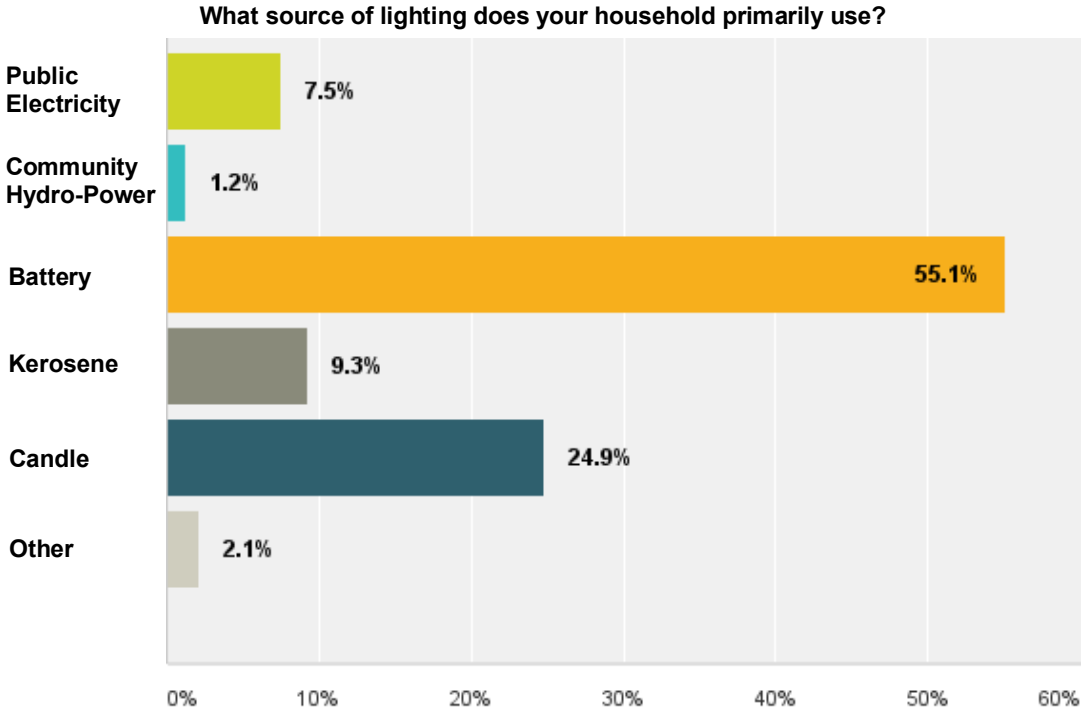
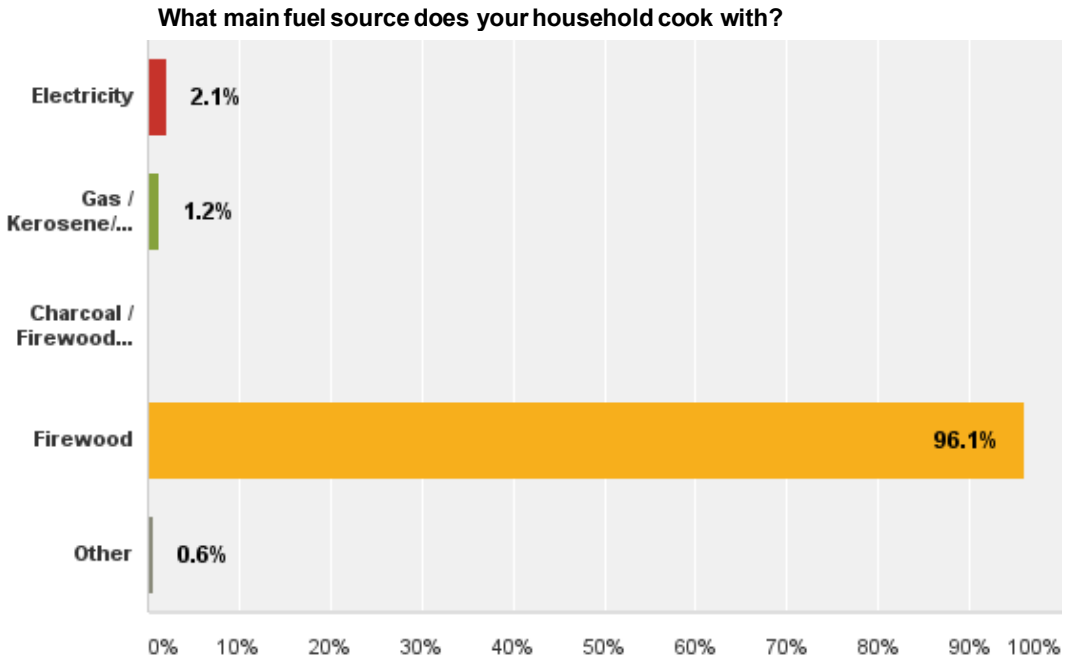


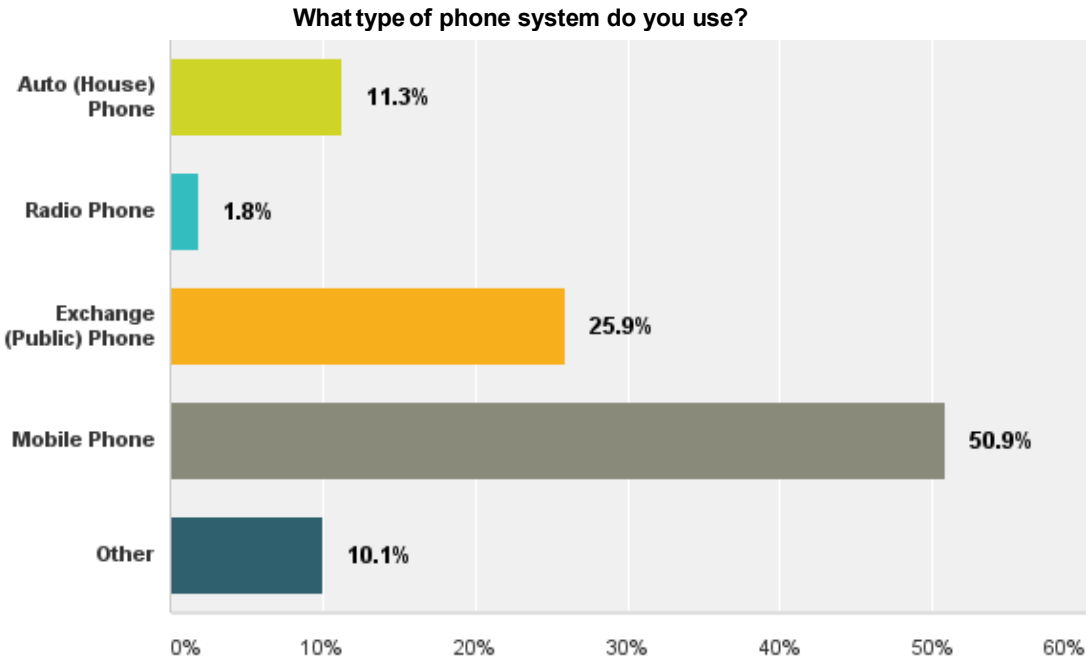
Chart 5-7: Response of villagers in IOR-7 in regard to source of energy for cooking.



5.4.7 Communications

The communications in Myanaung Township shows that mobile phones are used by (15%) and phone line is used by only 3.3%[21] Based on interviews with 400 villagers in 8 communities IOR-7 in, approximately 60% of villagers communicate with the use of mobile phones, 26% use exchange phones and 11% by house phones (**Chart 5-8**).

Chart 5-8: Response of villagers in IOR-7 in regard to use of telephone communications



5.5 Quality-of-Life Values

5.5.1 Administration

In Myanmar, states and regions are divided into districts. These districts consist of townships that include towns, wards and village-tracts. Village-tracts are groups of adjacent villages. The administrative structure of the states, regions and self-administering bodies is outlined in the new constitution adopted in 2008.

The project is located in the Myanaung Township, Hinthada District of the Ayeyerwady Region The Hinthada District is made up of six townships; Kyangin, Myanaung, Ingapu, Lemyethna, Hinthada and Zalu (**Figure 5-23**).

[21] 2014 Myanmar Population and Housing Census (2014 MPHC)

Source: Maps access from https://www.citypopulation.de/php/myanmar-admin.php?adm1id=1406

Figure 5-23: Administrative Region for Project

5.5.2 Governance

Each state or region has a Regional Government or a State Government consisting of a Chief Minister, other Ministers and an Advocate General. Legislative authority would reside with the State Hluttaw or Regional Hluttaw made up of elected civilian members and representatives of the Armed Forces.

The General Administration Department (GAD) under the Ministry of Home Affairs acts as the backbone of the local administration. Thus, at the township level the overall administration (and coordination functions) falls under the authority of township administrators, who are appointed by the GAD and replaced on a three-year basis. In addition sectorial line ministries deliver services and have departments at the township level and refer to the Union level government. While elections take place for the region/state level parliament (which has limited powers) and for the village tract/ward level (which forms the main point of interaction between the state and its citizens), no elected bodies exist at the township or district levels - although this may change in the future.

5.5.3 Demographics

The 2014 Myanmar Population and Housing Census (2014 MPHC) was conducted from 29th March to 10th April 2014. The 2014 MPHC shows that Myanmar's total population was 51,486,253 persons as of 29th March, 2014. Of these, 24,824,586 were males and 26,661,667 were females. This overall number includes an estimated population of 1,206,353 persons who were not enumerated in certain specific areas of the country. The census enumerated a total population of 50,279,900.

Myanmar is divided into 15 States and Regions. Accordingly, the 2014 Census results show that Yangon Region has the largest population (7.36 million), followed by Ayeyawady (6.18 million),

Mandalay (6.16 million), Shan (5.82 million), and Sagaing (5.32 million). These five States and Regions account for almost 60 % of the total population of the country.

With a population of 6,184,829 and population density of 177 persons per km^2, Ayeyawady is the third most densely populated States/Regions in Myanmar. The Region is primarily rural, with an urban population of only 14%. There are 3,009,808 (48.66%) men and 3,175,021 (51.34%)women in the region. The average household has 4.1 persons per household (the national average is 4.4). The Hunthada District population size in 1,138,710 with Myanaung Township accounting for 218,581 persons. The urban population in Myanaung Township is 10.3%.

5.5.4 Ethnicity

Bamar form the majority of the population in Ayeyarwady, with sizable numbers of Karen/Kayin, and a small minority of Rakhine in western coastal regions. The majority of the people are Buddhist, with small minorities of Christians and Muslims. There is no recent legacy of ethnic conflict in the region.[22]

5.5.5 Cultural Traditions and Historical, Archaeological Resources

The government and people of Myanmar place a very high degree of importance on their cultural traditions, religious and historic sites. Many active Buddhist sites are managed by trustees, sometimes with input from government authorities. Gazetted archaeological sites, such as Bagan, are managed by the Department of Archaeology, National Museum and Library, which is a division of the Ministry of Culture.

The ministry states in part that its mission is:

> "*to love and cherish the country and the people by taking pride in our traditions as well as by preserving, exposing and propagating Myanmar cultural heritage … to help develop unity, nationalistic spirit and patriotism among the people.*"

The Archaeology Department employs conservators and engineers to maintain and repair buildings and their contents, as well as research officers, who conduct excavations. The Township Administrator from Myanaung GAD confirmed that there is no Archaeological or Historic Department in Myanaung and no archaeological or historic sites are present in the Myanaung Township. The wellsite is located on agricultural land and no historic or archaeological sites are located near the planned project.

During the field program for the present project local residents were canvassed in regard to their cultural activities and cultural sites. The most important cultural focus in the communities of those is the Festival (65%) (**Chart 5-9**). Villagers interviewed indicated that 94% of them don't know of important cultural, historic and religious sites around their community and villagers felt that local cultural, historic and religious sites are not adequately protected (89%). (**Chart 5-10** and **Chart 5-11**).

[22] UNDP Local Governance Mapping – The State of Local Governance: Trends in Ayeyarwady Region

Chart 5-9: Response of villagers in regard to their most important cultural tradition in IOR-7

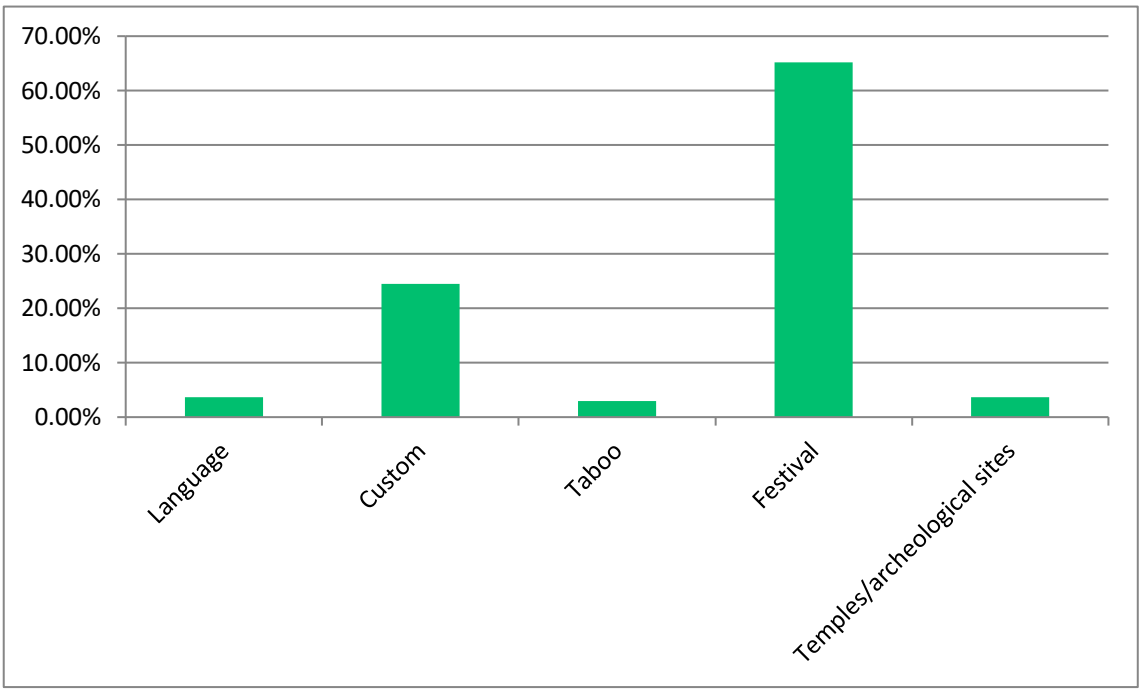


Chart 5-10: Awareness of proximate archaeological sites reported in IOR-7

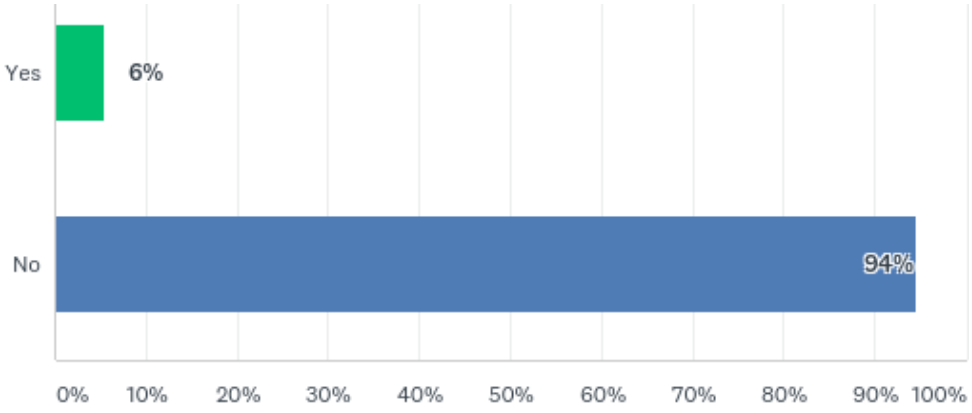
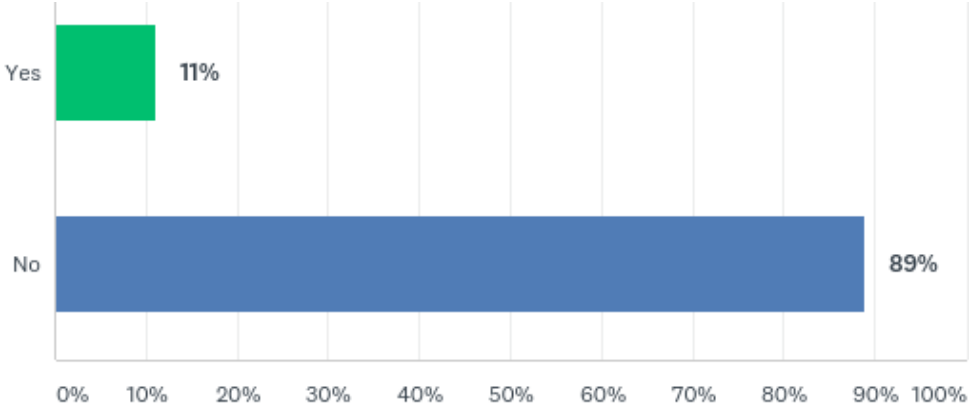


Chart 5-11: Perspectives on adequacy of protection of historic sites proximate to communities in IOR-7



5.5.6 Local Socio-Economic Context

Ayeyarwady Region covers mainly the fertile, low-lying and densely-populated areas also known as the Irrawaddy Delta, one of Myanmar's main river systems that the Region takes its name from. Rice cultivation and fishing dominate economic activity in still largely rural communities. Meanwhile, the development of industry, infrastructure and service sectors such as tourism still lag behind the Yangon-Mandalay areas. The geographical and climatic vulnerability of Ayeyarwady is a major development challenge for the Region Government, and for the Region's rural residents farming in flood and storm-prone areas. Rice cultivation and the development of Ayeyarwady's agricultural economy have taken place at the detriment of the Region's forestry resources. Deforestation - much of it to enable small-scale paddy farming - has depleted many natural forest areas. Its proximity to the country's commercial capital Yangon, which is just 4-5 hours by highway from Pathein, brings with it an opportunity for Ayeyarwady to develop its potential as a major industrial zone. There are already three designated industrial zones in the Region (Hinthada, Myaugmya and Pathein), and planning is underway for the development of a special economic zone (SEZ) in Pathein. Water transport remains a key means of mobility and communication in the Region. [23]

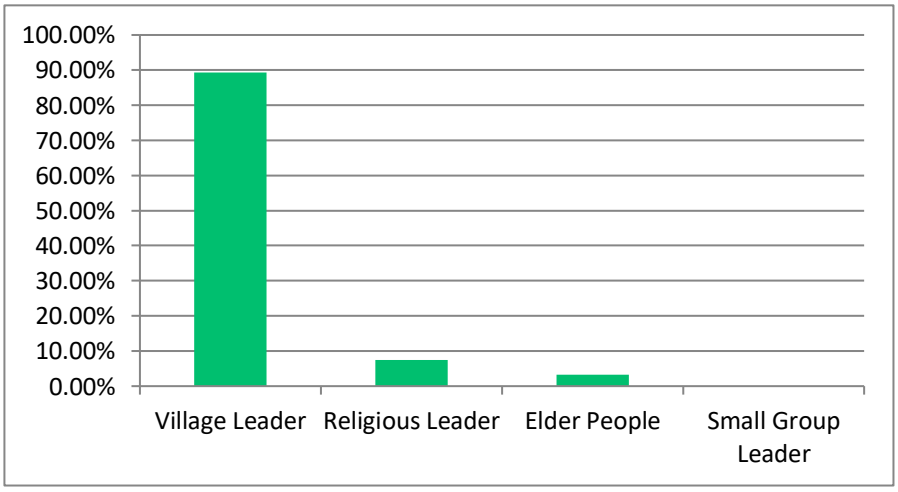
The Ayeyarwady River (also known as Irrawaddy; length 2170 km; drainage area 413,710 Km^2) is the largest river in Myanmar and has been described as the heart of the nation. Groundwater resources in the basin are believed to be even greater than surface water resources. It is rich in natural resources particularly forests, land and water in addition to biodiversity. The Ayeyarwady river also has extensive wetlands in the interior of the country, which are mostly seasonally inundated floodplains, most of which have been reclaimed for permanent agriculture. The swamp forest, found in the Ayeyarwady Delta is of high ecological importance for many bird species, which have suffered dramatic population declines across their global distributions. The Ayeyarwady River also has extensive wetlands in the interior of the country, which provide excellent feeding areas for large number of waterfowl and fertile spawning grounds for a number of fishes, such as carp, catfish and perch.

Within the project area, the socio-economic activity is based primarily on agriculture. The main crops grown are beans (peanut/groundnut and pulses), sesame, rice, and corn.

5.5.6.1 Community Decisions

At the community level, local villagers identified the elected Village Leader is responsible for most (90%) of community decision making (**Chart 5-12**).

Chart 5-12: Responsibility for community decision making in IOR-7



[23] UNDP Local Governance Mapping – The State of Local Governance: Trends in Ayeyarwady Region

5.5.6.2 Household Characteristics

The project area age structure of the respondent's families indicated that the majority (approx. 33%) of household members are between 40-50 yrs of age followed by those in the range of 30-40 and 50-60 yrs of age (**Chart 5-13**); 28% came from households with 4 family members followed by approximately 30% from 5 person families (**Chart 5-14**). Most (95%) of the individuals surveyed in the project area are Buddhist and 5% are Christian. Approximately 84% of those surveyed are Burmese and 16% are Kayin.

Chart 5-13: Age structure of Population in IOR-7

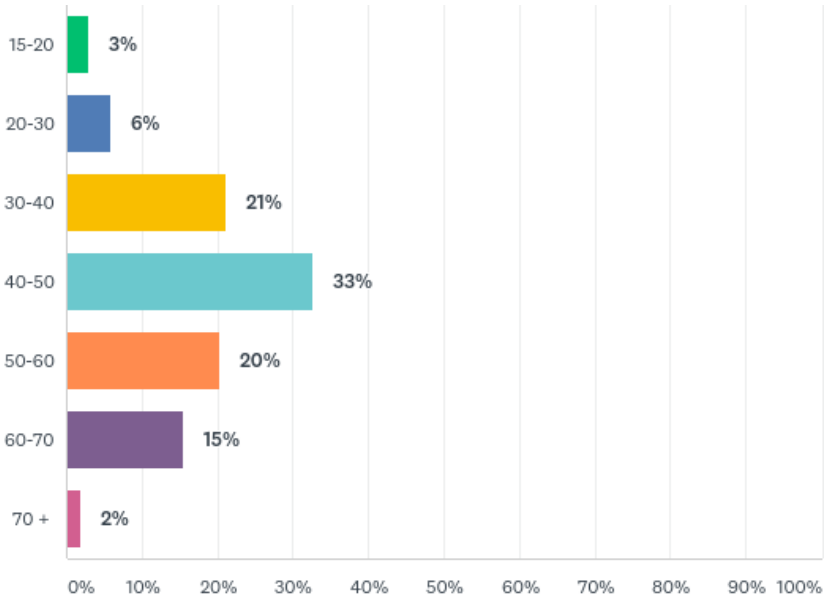
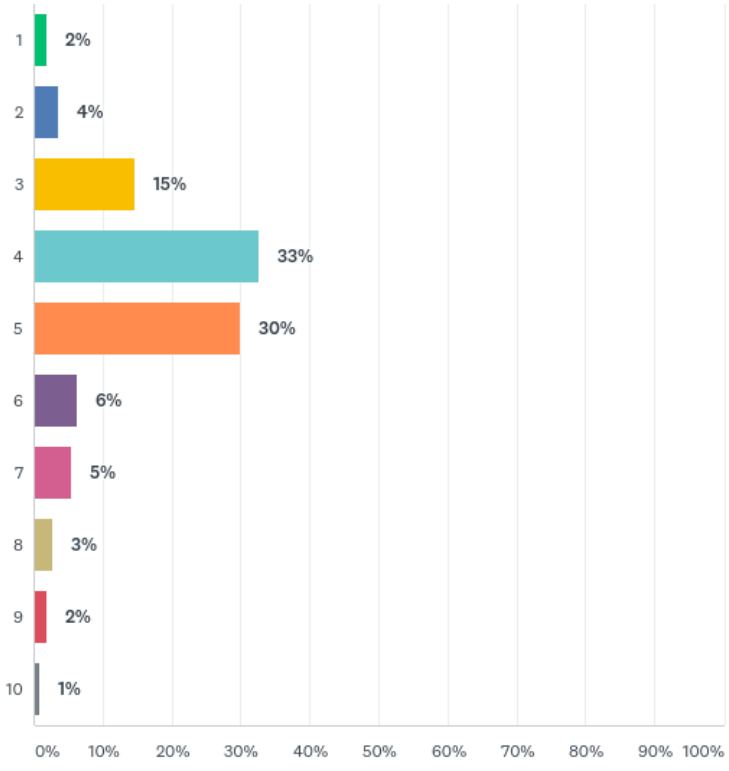


Chart 5-14: Number of household member reported in IOR-7



5.5.6.3 Land & Housing Ownership

The conditions of housing units are important characteristics which indicate the quality of life of the population. The 2014 Census showed that about four out of five households in Myanmar are owners of their housing unit. In urban areas, 66% of households own the housing units where they reside, 20% are tenants while 7% live in housing provided by the Government. In rural areas, 93% of households own the housing units where they reside and 2.4% are tenants. In the village surveys for this EIA, a substantial majority (93%) of the households surveyed own their land where they live (**Chart 5-15**). The households surveyed show ownership in varied ways: 71% of villagers have documents, 26% have permission but do not have documents, and 3% have neither document nor permission (**Chart 5-16**).

Chart 5-15: House lot ownership reported in IOR-7

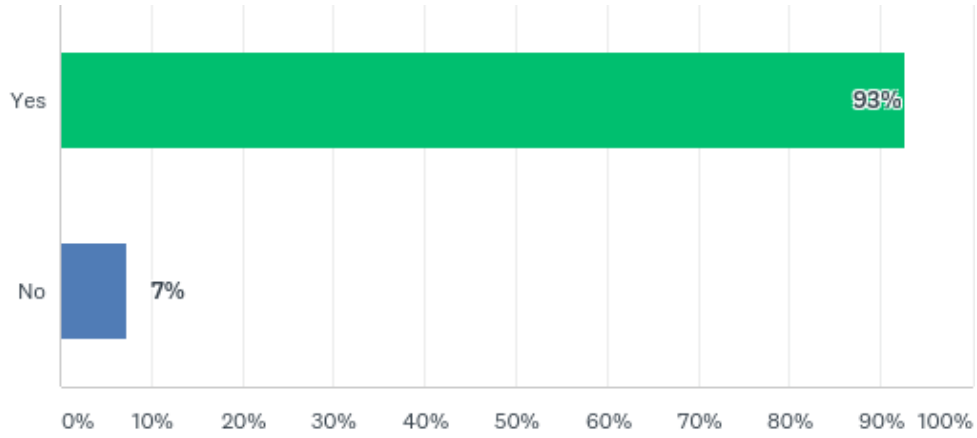
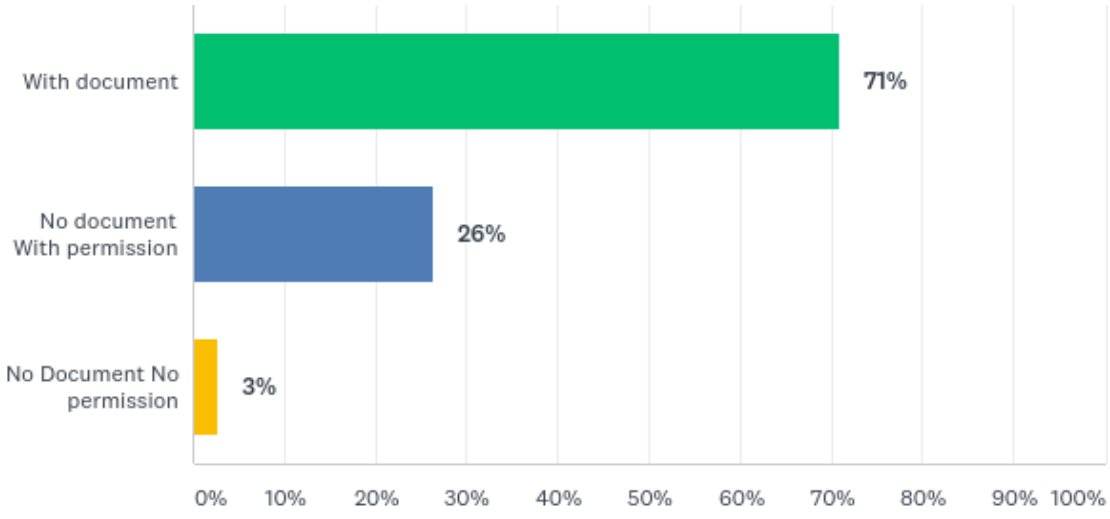


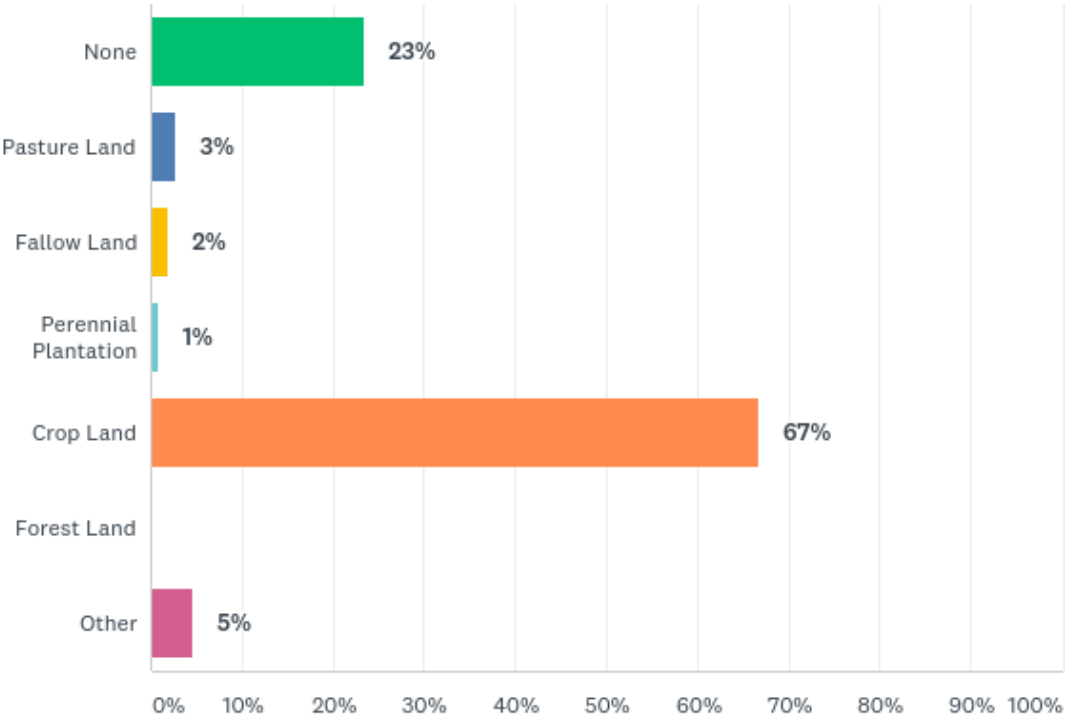
Chart 5-16: Ability to demonstrate land ownership in IOR-7



5.5.6.4 Farmland Ownership

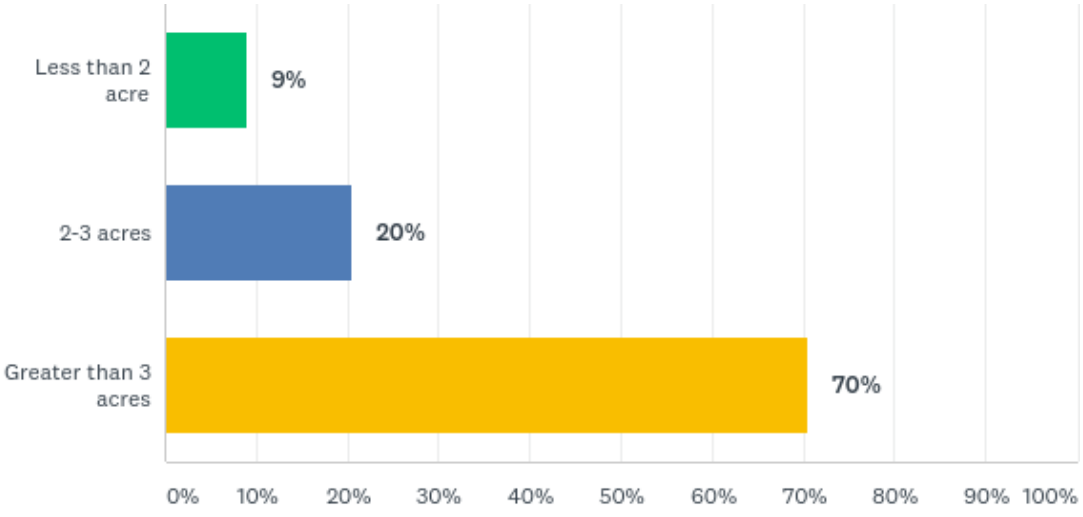
Land ownership patterns vary in central Myanmar. In some cases lack of rain has impoverished farmers with the result that lands may be sold and farmers and family members are forced to become tenants and or labour on other larger land holdings simply for survival. Within the project area; 67% of the household owners own farmland (**Chart 5-17)**.

Chart 5-17: Farmland ownership by households reported in IOR-7



The survey group indicated that 70% of the households own or lease greater than 3 acres of land. (**Chart 5-18)**.

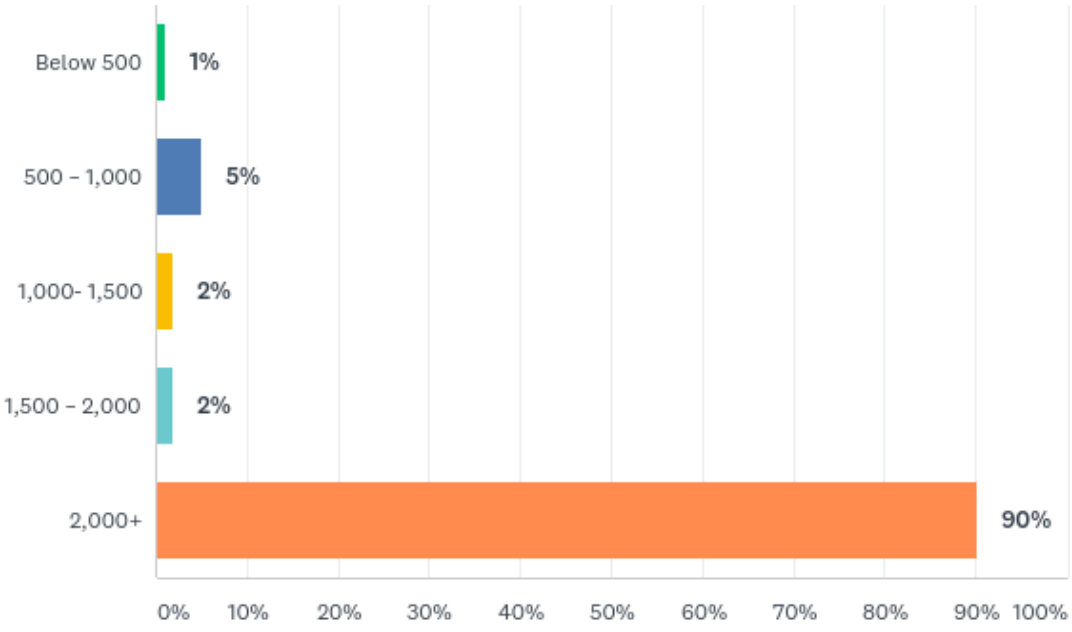
Chart 5-18: Area of farmland owned by households reported in IOR-7



5.5.6.5 Income and Employment in Project Area

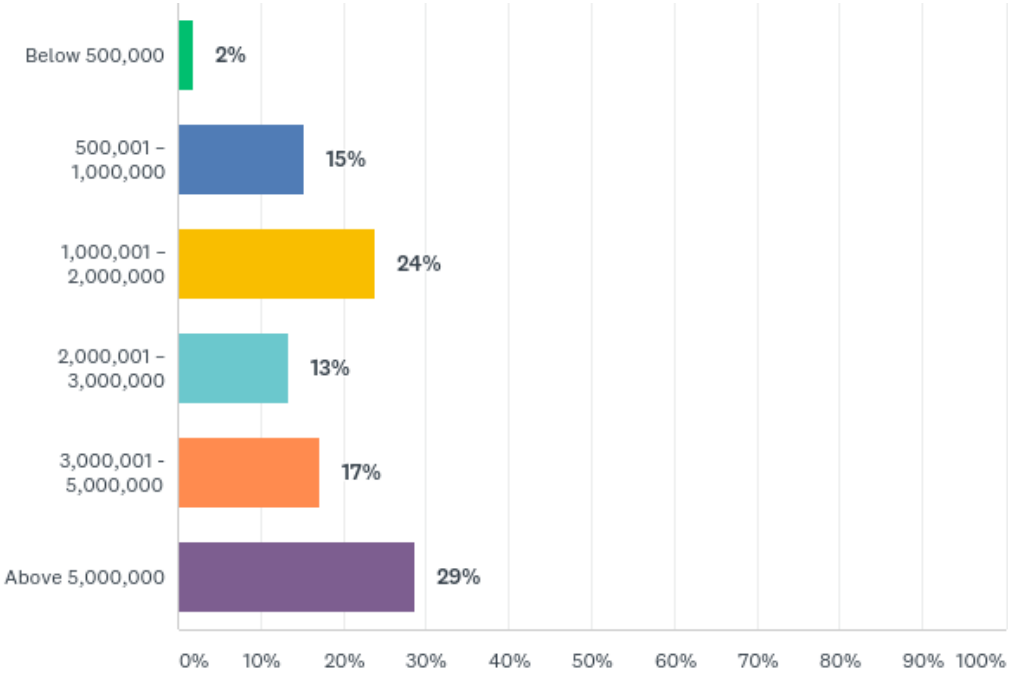
Approximately 90% of the villages had an average daily wage of over 2,000 (**Chart 5-19**).

Chart 5-19: Average daily income reported in IOR-7



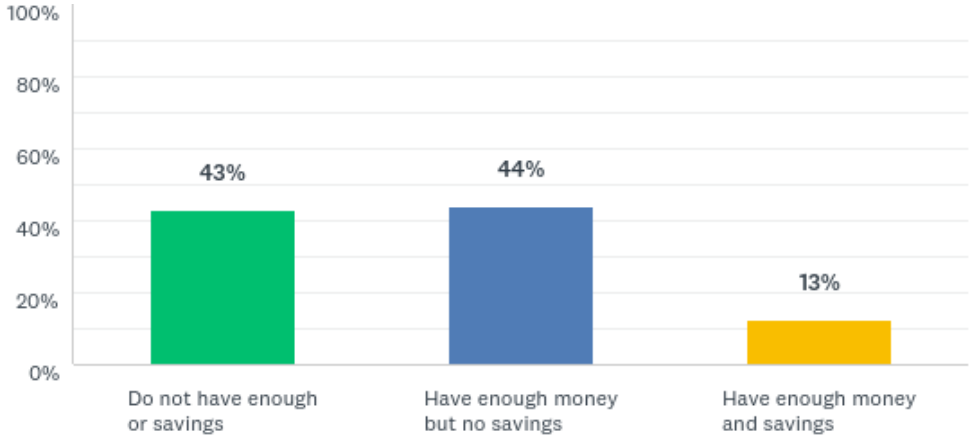
The survey group indicated that income varied with; 13% with an annual income of 2,000,0001-3,000,000 kyat; 15% had an annual income of 500,000-1,000,000 kyat; 17% with an annual income of 3,000,001-4,000,000 kyat; 24% with an annual income of 1,000,001-2,000,000 kyat; and the majority at 29% with an annual income of +5,000,000 kyat (**Chart 5-20**).

Chart 5-20: Annual household income reported in IOR-7



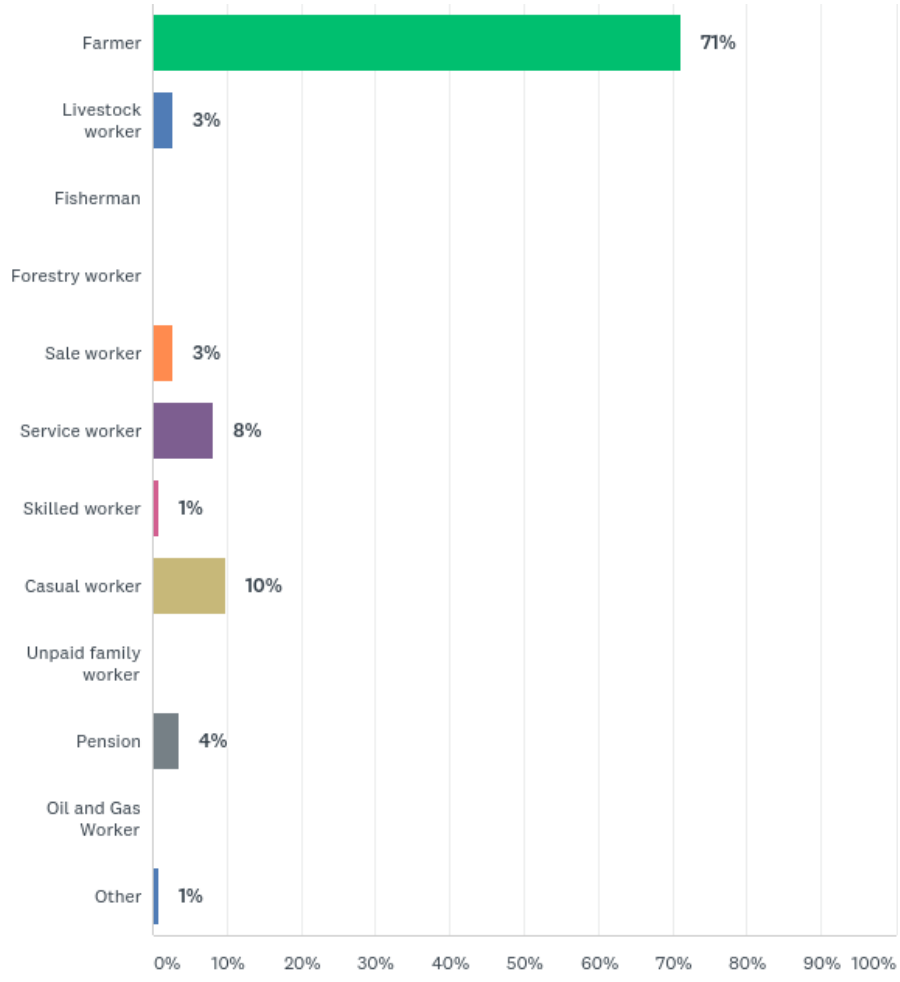
The survey group indicated that 44% have enough money but no savings, while 43% do not have enough money or savings (**Chart 5-21**).

Chart 5-21: Personal monetary situation reported in IOR-7



Over 71% of respondents described their primary occupation as "farmer" with the remainder of occupations typically accounting for about 10% or less of local employment (**Chart 5-22**). The oil and gas industry currently contributes to less than 1% of local employment.

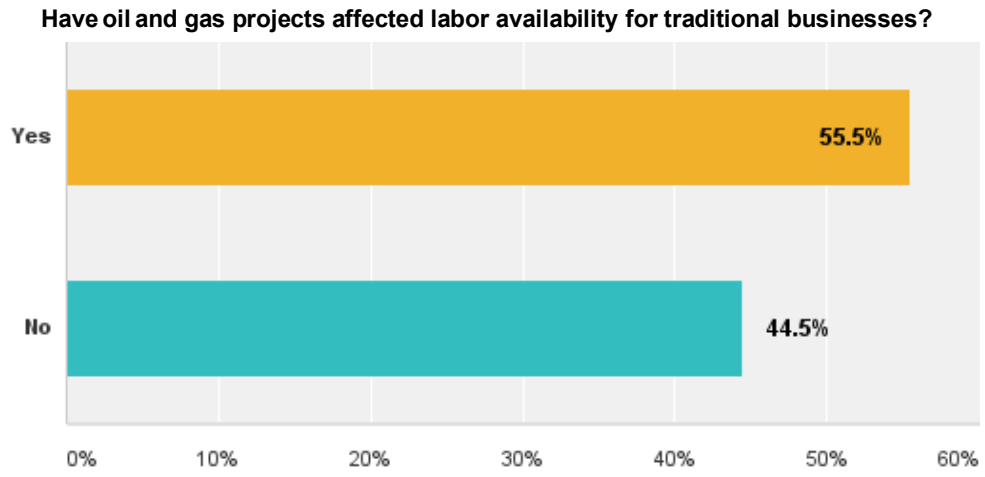
Chart 5-22: Primary occupation reported in IOR-7



5.5.6.6 Labour and Migration

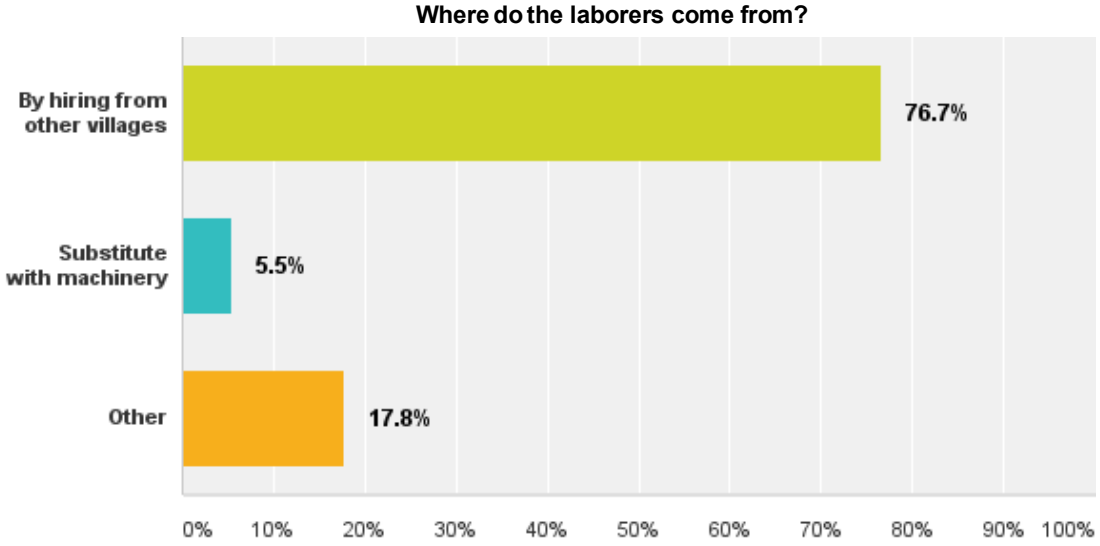
The 2014 Census shows that in Hinthada District, 77% of persons living aboad were male. From the seismic survey socio-economic questionnaire results; there was a perception among 56% of respondents that oil and gas development activity affects the availability of farm labour (**Chart 5-23**).

Chart 5-23: Perceived influence of oil and gas activity on labour reported in IOR-7



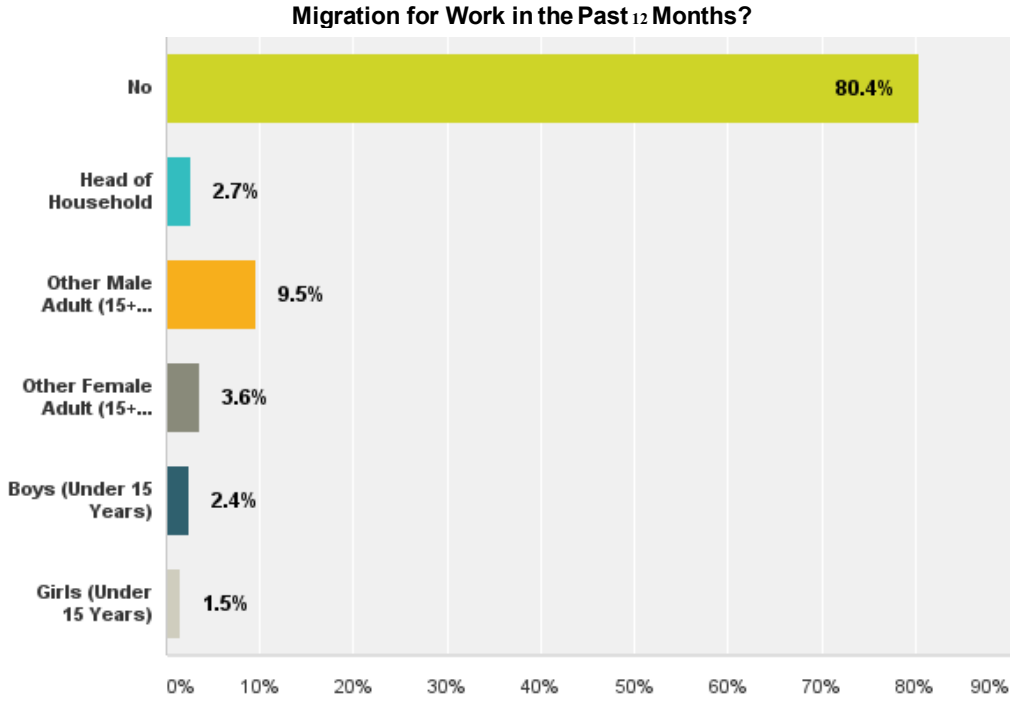
Of particular interest was the observation that by far the majority of farm labour appears to come from other communities than the ones being interviewed. In 77% of the cases respondents said labourers come from other communities (**Chart 5-24**).

Chart 5-24: Source of labourers reported by respondents IOR-7



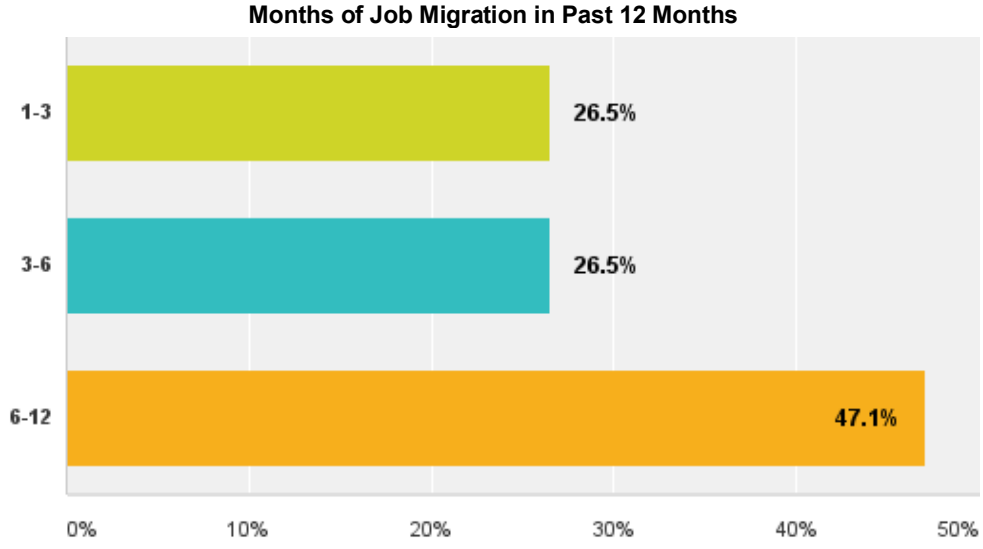
Of the survey group 80% did not migrate for work (**Chart 5-25**). Most migrants were the household older males (15+).

Chart 5-25: Pattern of migration reported in IOR-7



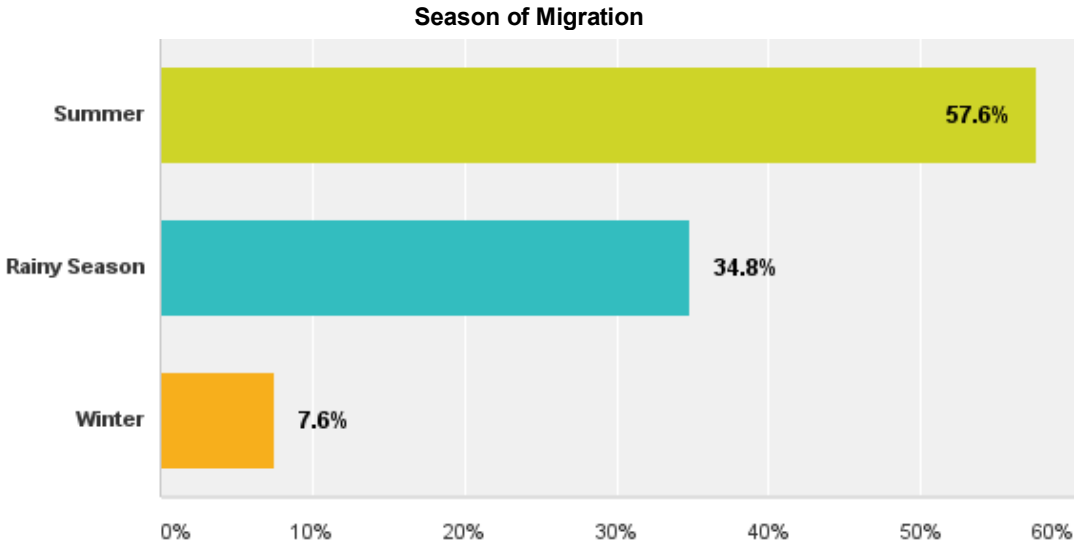
When individuals migrated for work approximately 47% of the time it was for periods of 6-12 months while for the remainder it was typically less than 6 months (**Chart 5-26**).

Chart 5-26: Period away from home by migrant workers reported in IOR-7



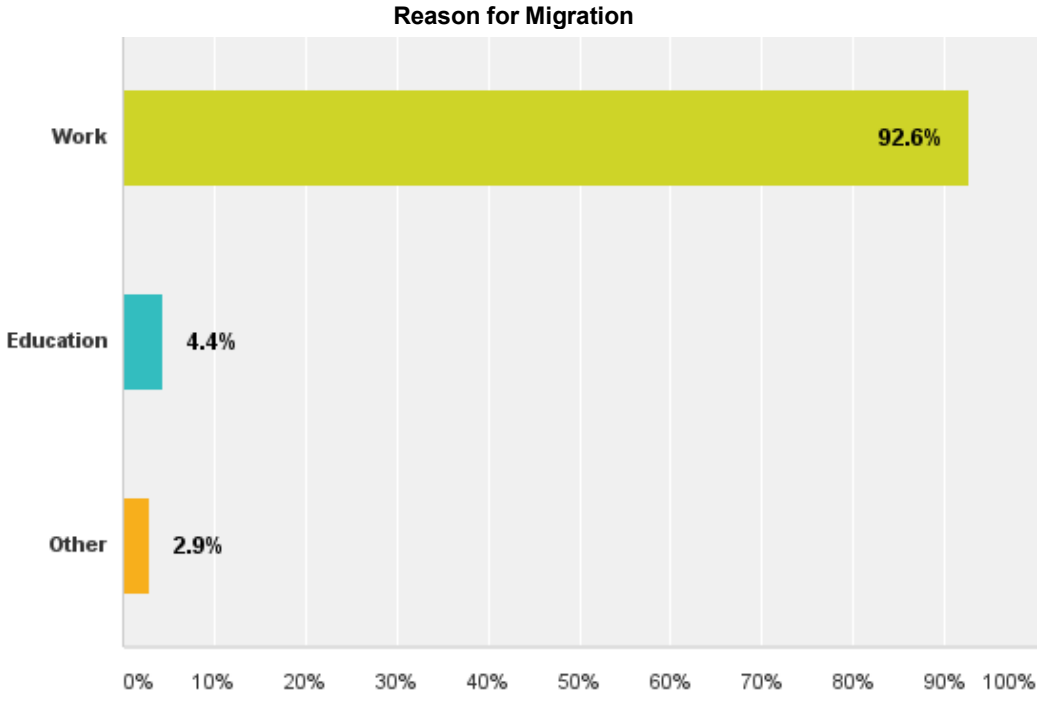
Most, 58% of migration for employment occurred during the summer season (**Chart 5-27**).

Chart 5-27: Season of job migration reported in IOR-7



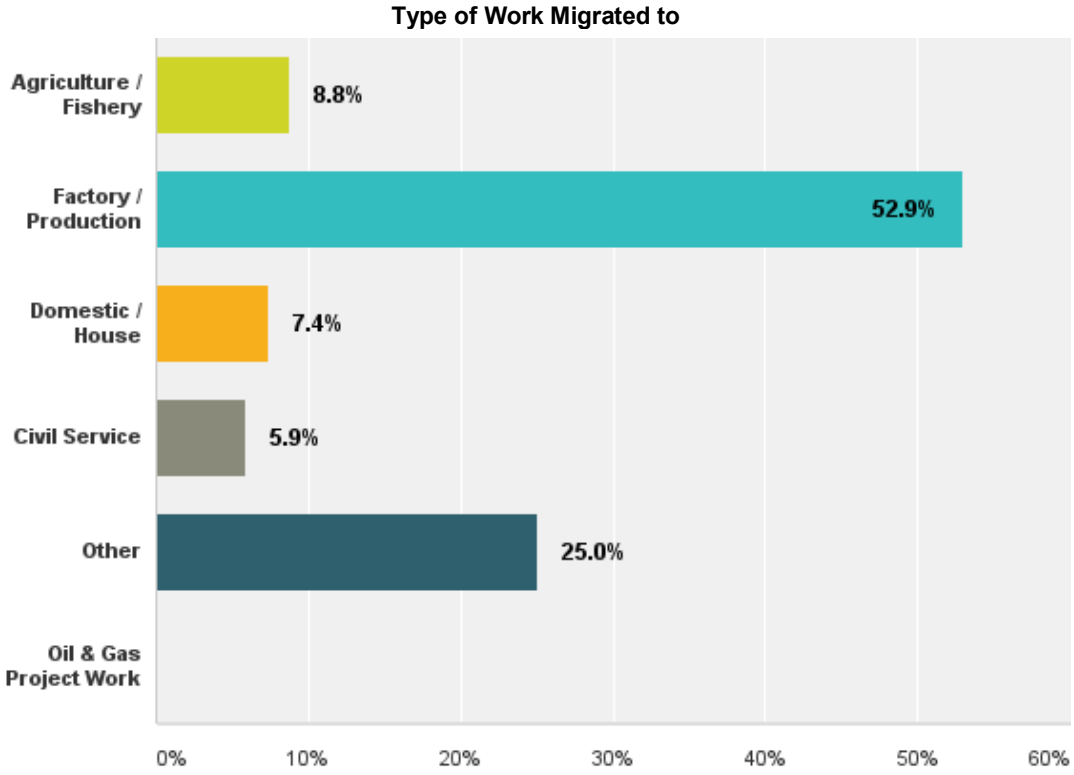
Over 93% of those that migrated did so for work related reasons (**Chart 5-28**).

Chart 5-28: Reason for migration reported in IOR-7



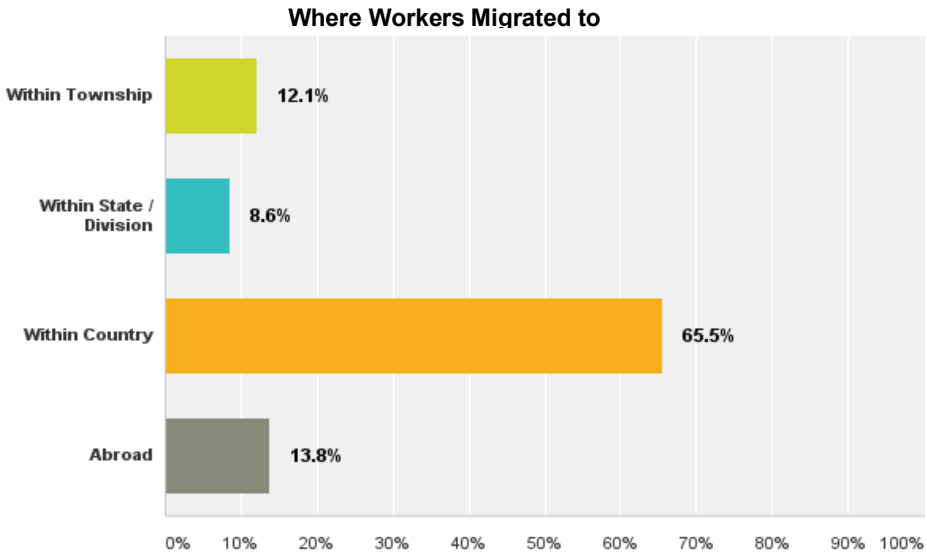
The main type of work that our survey group migrated was factory or production (53%). None moved to oil & gas project work (**Chart 5-29**).

Chart 5-29: Type of work pursued by migrating workers reported in IOR-7



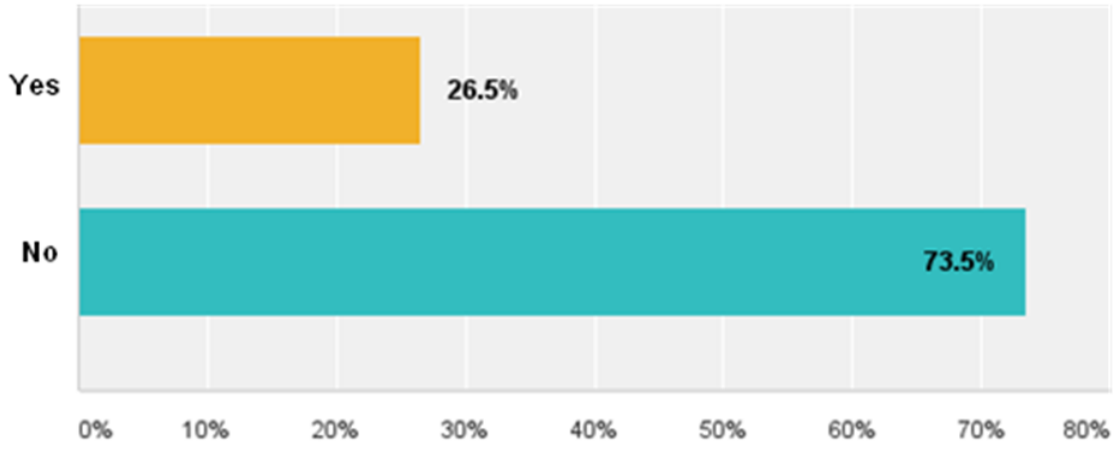
The greatest number (66%) of workers who migrated went to other areas within the country (**Chart 5-30**).

Chart 5-30: Destination of migrant workers reported in IOR-7



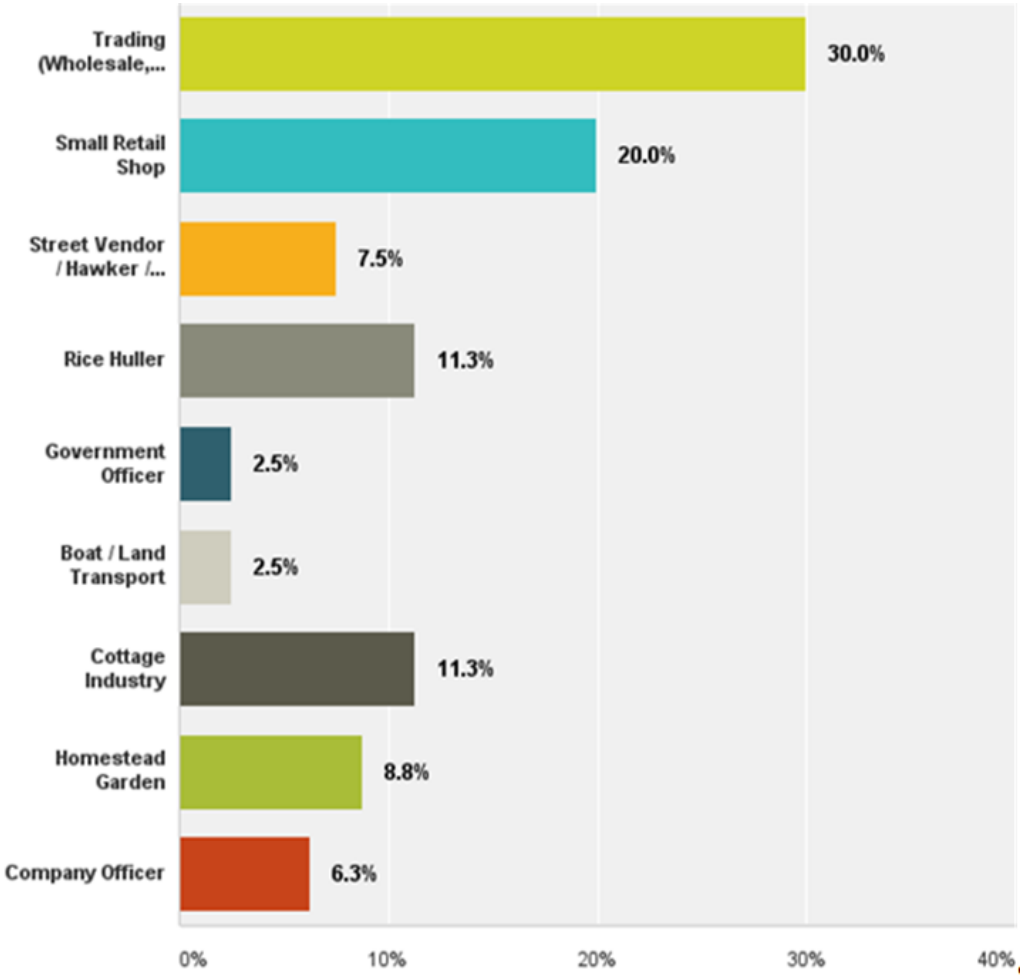
The majority of households (74%) do not participate in off-farm activities. (**Chart 5-31**).

Chart 5-31: Off farm activities reported in IOR-7



Of those involved in off-farm activities, 30% were involved in trading (wholesale or general trading) and 20% were involved in rice hulling (**Chart 5-32**).

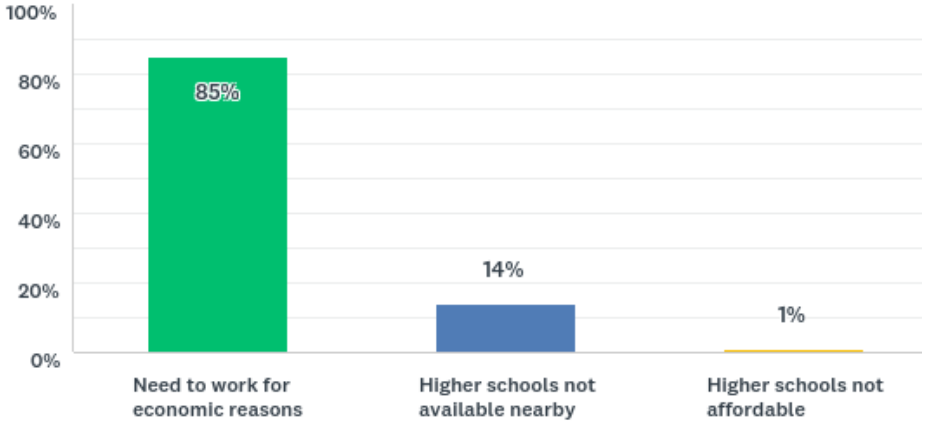
Chart 5-32: Type of household activity reported in IOR-7



5.5.6.7 Education

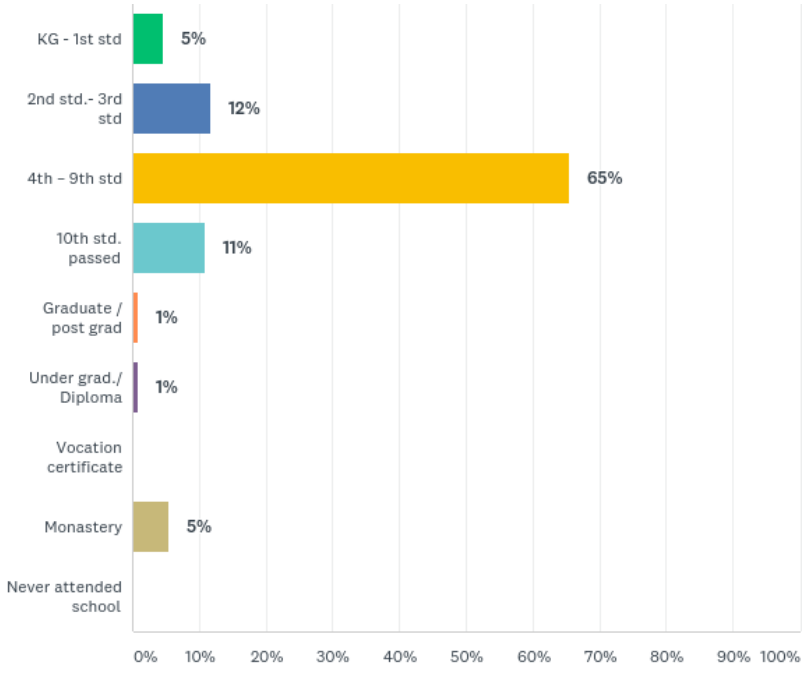
Over 85% of the household members indicated that the primary challenges for your household when it comes to achieving higher levels of education was the requirement to work for economic reasons (**Chart 5-33**).

Chart 5-33: Availability of access to education reported in IOR-7



The majority of respondents at 65% had an educational level between Grade 4-9 (**Chart 5-34**).

Chart 5-34: Education level reported in IOR-7



5.5.6.8 Public Health

The information on disability in the 2014 National Census included four categories (seeing, hearing, walking and remembering/mental) and the degree of difficulty a respondent experienced for each type. In the Myanaung Township (7.0%) have at least one type of disability. The most common type of disability is seeing, followed by walking, remembering/mental and lastly hearing[24].

[24] 2014 MPHC Census

In general villagers in IOR-7 did not suffer from high incidence of serious health issues or disability. Health care services in most communities were very basic and in most cases involved a midwife only. Midwives also performed at least some basic dental services.

Villagers, when asked what illnesses they had, 5% had none and other common sicknesses included the flu (29%), and colds (39%) (**Chart 5-35**). During Key Informant Interviews individuals mentioned that the most common illnesses were seasonal flu, cough, malaria, dengue and hypertension. Snake bites, eye disease and tooth aches were also reported in some communities. Based on national surveys, Myanmar experienced 0.723 malaria cases per 1000 people in 2016 (HMIS, Dept of Health Planning, Ministry of Health, 2016).

The survey group indicated that 60% have health care available to them (**Chart 5-36**). The following chart illustrates the most commonly used health services include Health Assistant (24%) Doctor services (27%), and Midwife (21%) (**Chart 5-37**). The majority (79%) indicated that health care in the village has not changed for the better or worse (**Chart 5-38**). Most (94%) of those surveyed did not have any physical disability (**Chart 5-39**). Almost 96% of those surveyed indicated that they had not had any accidents or injuries in the past 3 months (**Chart 5-40**). 89% of the survey group did not have problems with diarhea in the past month (**Chart 5-41**). All of the people (97%) in this region use a mosquito net while sleeping.

Chart 5-35: Health conditions reported by 400 villagers from 8 communities in IOR-7

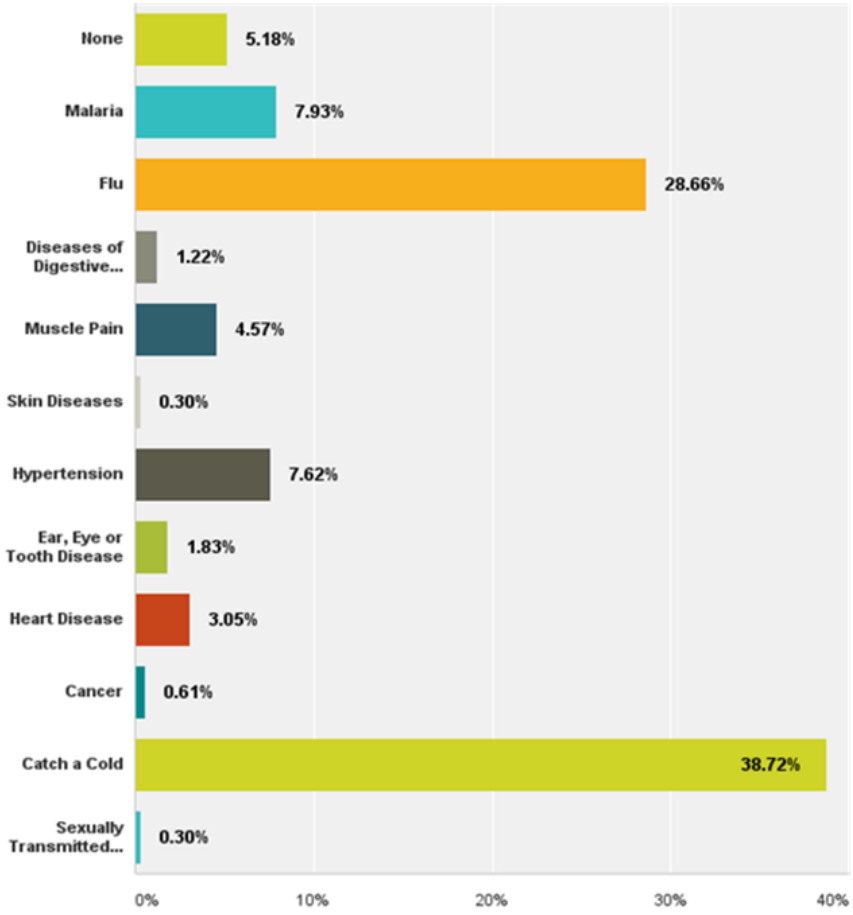


Chart 5-36: Availability of health care reported in IOR-7

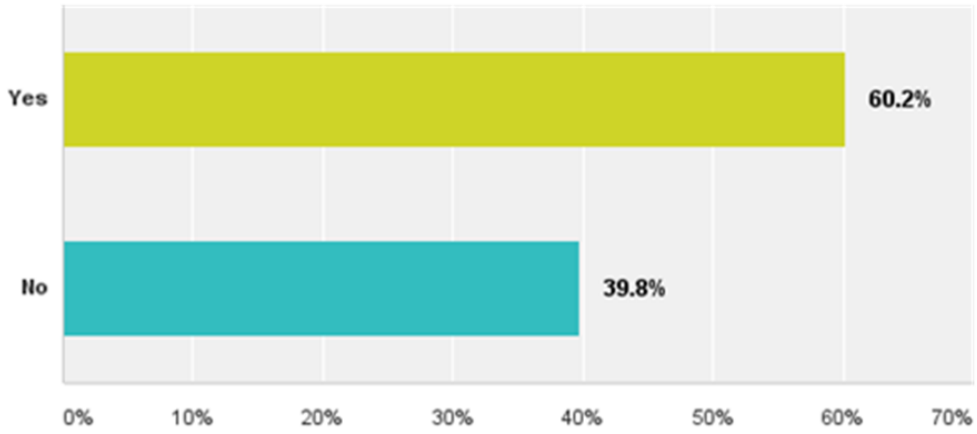


Chart 5-37: Use of health care providers in IOR-7

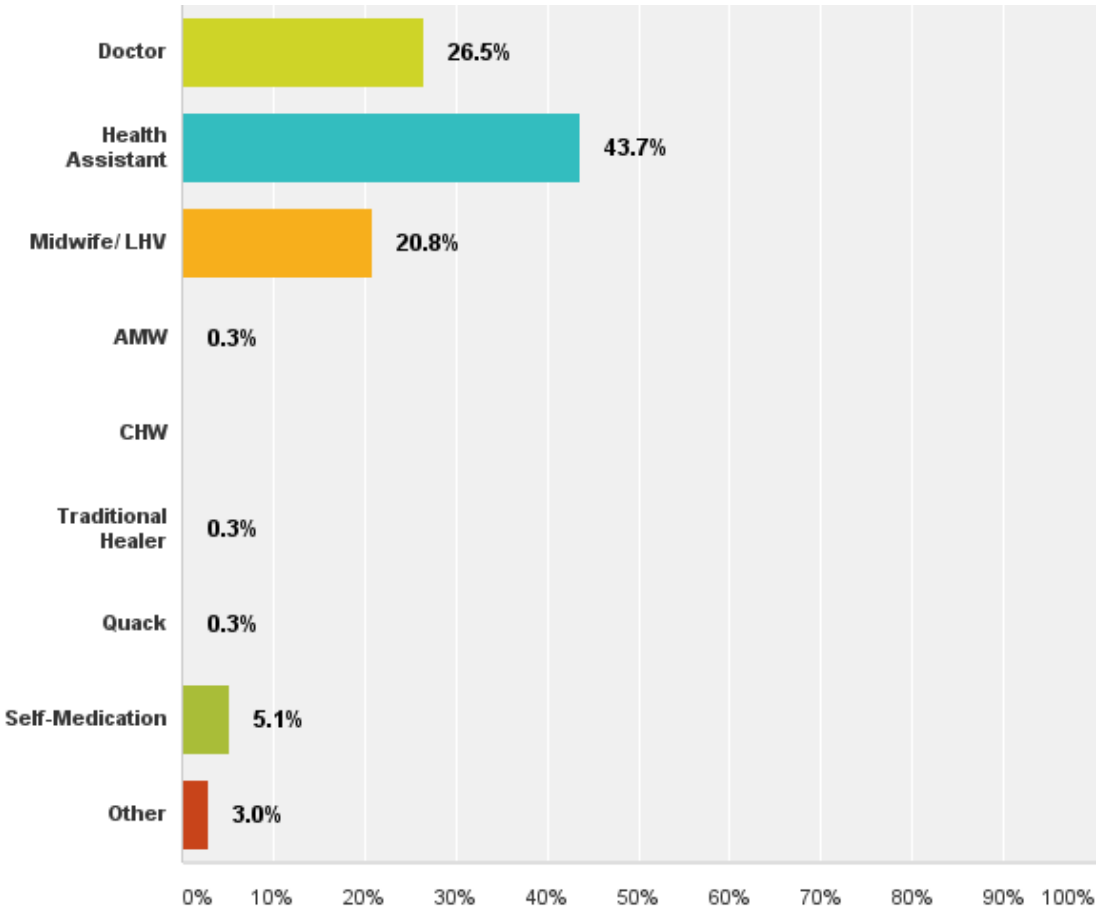


Chart 5-38: Trends in health care reported in IOR-7

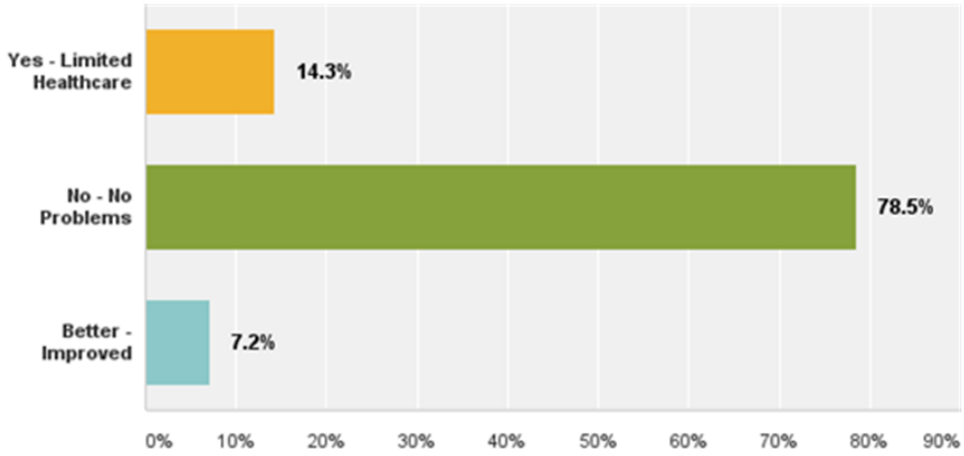


Chart 5-39: Disabilities reported in IOR-7

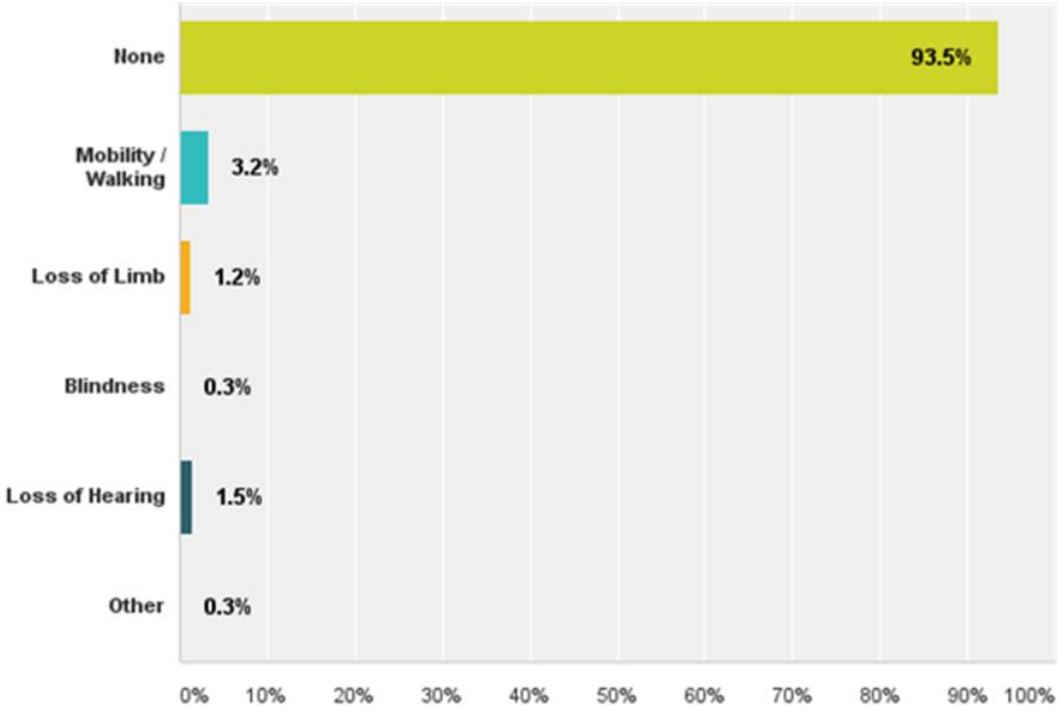


Chart 5-40: Occurrence of significant occupational injuries reported in IOR-7

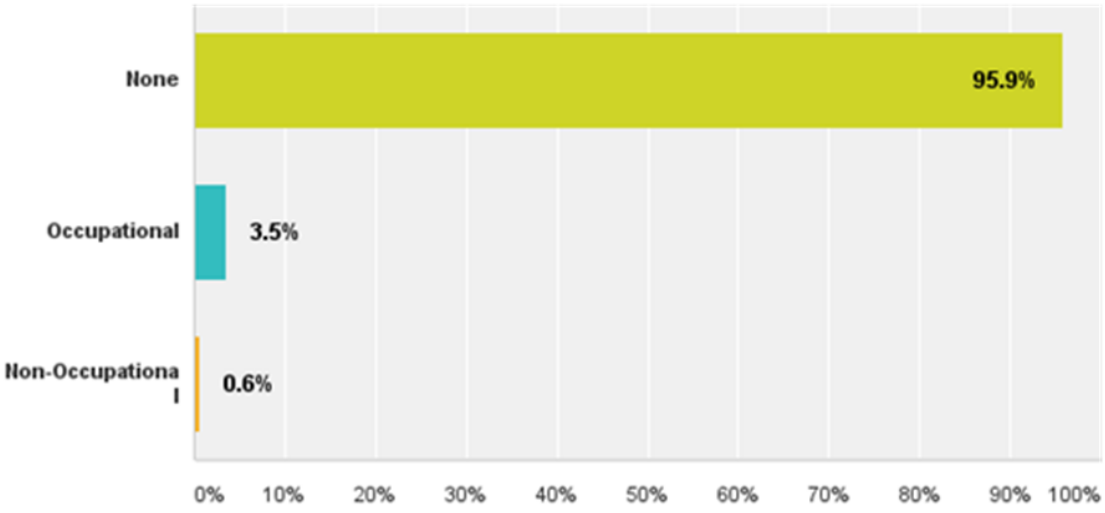
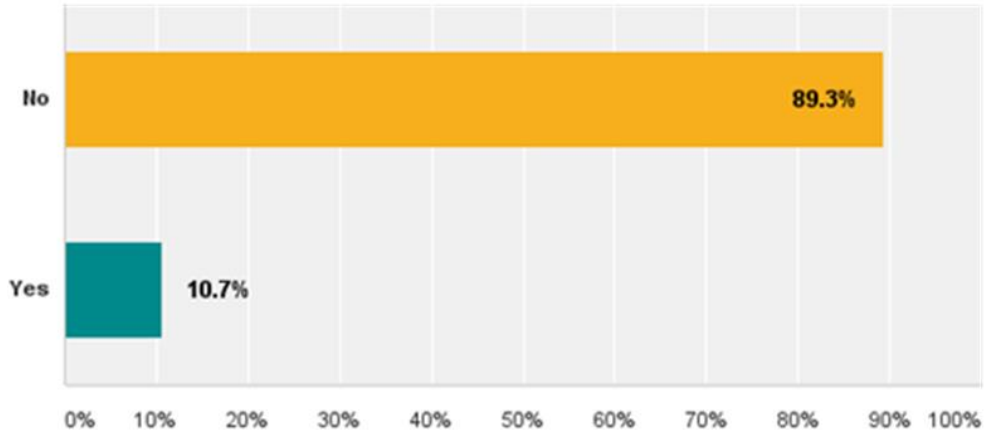


Chart 5-41: Occurrence of Diarrhea in IOR-7



5.5.6.9 Health Care

The 2014 census collected information on births and deaths that showed that for every 1,000 children born in Myanmar, 62 die before reaching their first birthday. This rate is higher in rural areas (68) than in urban areas (41). The Ayeyawady Region has a rate of 87 deaths per 1,000 live births, which is among the highest in the country. The Under-5 Mortality Rate for Ayeyawady Region is also one of the highest in the country at 105 deaths per 1,000 live births. The Union level Under-5 Mortality Rate is 72. The under-five mortality rate is 72 at Union level with Ayeyawady have a higher rate at 105.[25] In 2013, in Ayeyawady Region the leading causes of morbidity in the under-fives were "All other causes" (51%) "Disorders related to short gestation and low birth weight, not elsewhere classified" (6%), and "Heart failure" (6%). [26]

In 2013, the total numbers of Hospitals in Ayeyarwady Region increased to 101. The closest government hospital to Block IOR-7 is Myaunaung Hospital with 50 sactioned beds and total available beds of 80.

The hospital resources in the region are shown in **Table 5-26**

Table 5-26: Availability and Utilization of Hospital Resources in Ayeyarwady, 2013

Total number of hospitals	Sanctioned beds	Available beds	Admissions	Number of deaths	Hospital death rate	Out-patient attendances
101	3111	3917	170795	2817	1.7	338754

Source: Annual Hospital Statistics Report, 2013

5.5.6.10 Sanitation

The 2014 Census shows that in Myanaung Township the main sources of drinking water are tube well/bore well (67%), protected well/spring (14 %) and River/Stream/ Canal (6%). The main type of toilet facility in Myanaung Township is improved pit latrine (water seal) at 84% of households surveyed. It is important to note that 9% of households in the Township reported that they do not have their own toilet facility. [27]

During IEM's opinion & attitude surveys of 111 households in 4 communities near the well site, questions were asked in regard to water source, availability and quality. In regard to water source, The main source of drinking water used by the household for the past 12 months comes from tube wells (80%) (**Chart 5-42**). In regard to water quality and quantity, the majority (98%) of the villagers interviewed indicated that water quality or quantity has not changed over time (**Chart 5-43** and **Chart 5-44**). Villagers (74%) indicated that domestic wastewater is not treated. The majority of villagers (59%) take their solid waste to a community disposal area.

[25] 2014 MPHC Census
[26] Annual Hospital Statistics Report 2013, Department of Public Health in collaboration with Department of Medical Services
[27] 2014 MPHC Census.

Chart 5-42: Trends in Drinking Water Coverage in IOR-7

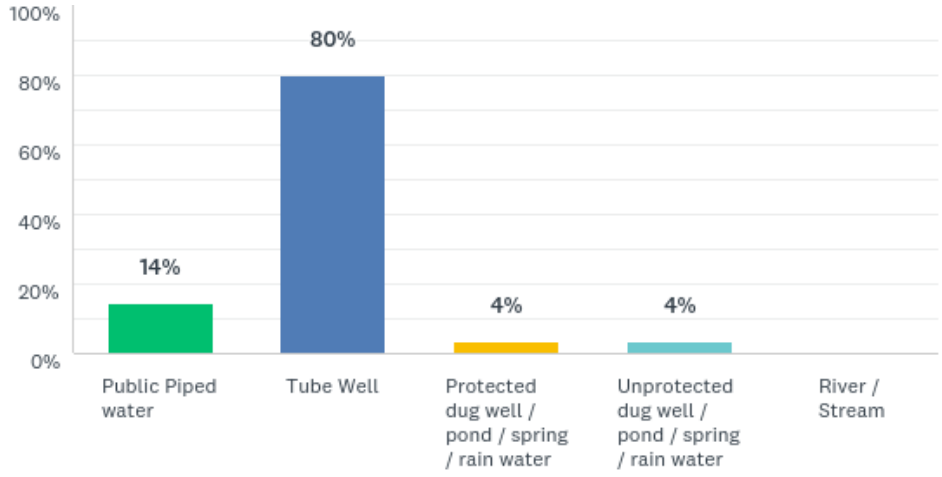


Chart 5-43: Responses for villagers in IOR-7 in regard to whether water quality had changed over time.

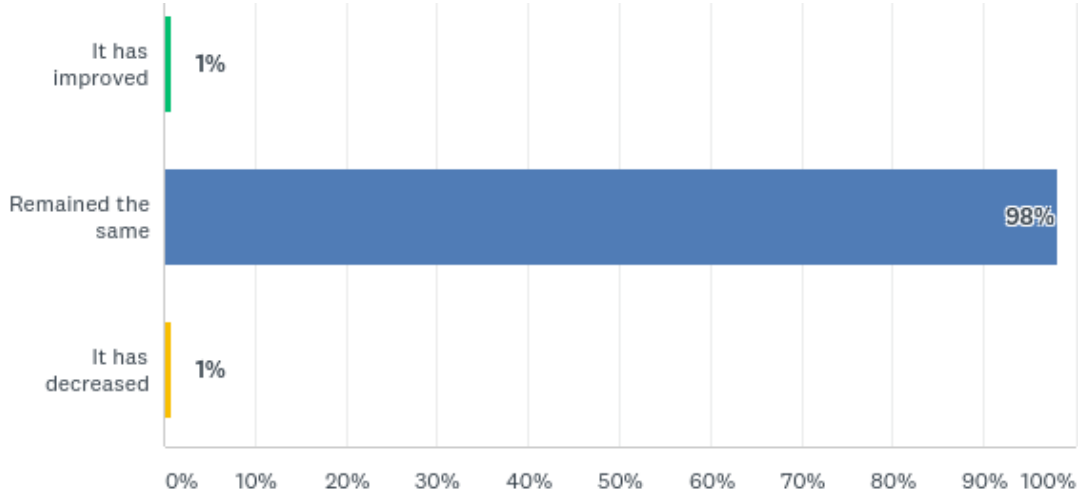
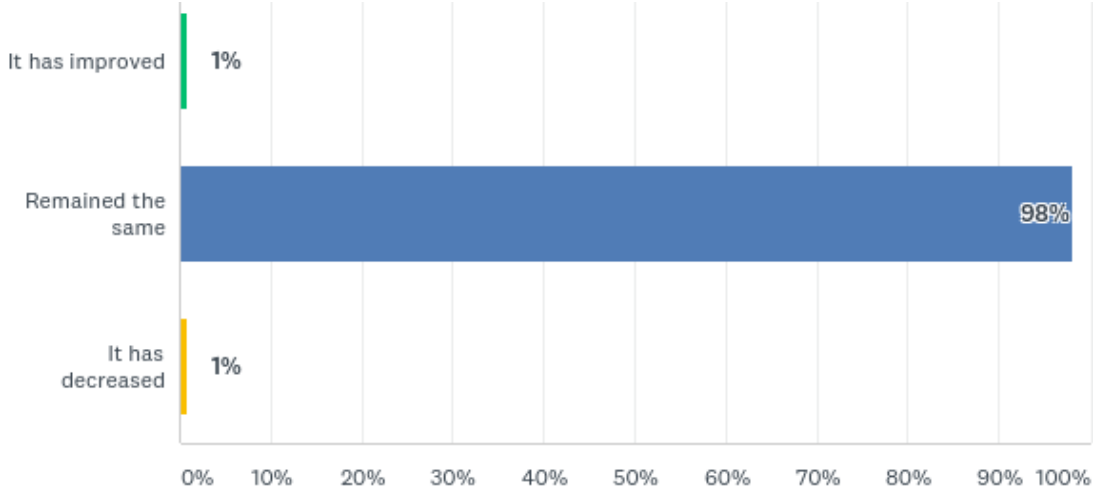


Chart 5-44: Response of villagers in IOR-7 in regard to whether water quantity was perceived to have changed.



Most of the villagers (72%) require 5-30 minutes to collect and return water (**Chart 5-45**). Water treatment was reported by 56% of respondents with the majority of villagers (47%) boil their drinking water to make it safe or use filtration (36%) (either ceramic, or sand).

Chart 5-45: Response of villagers in IOR-7 in the total water collection time per round-trip?

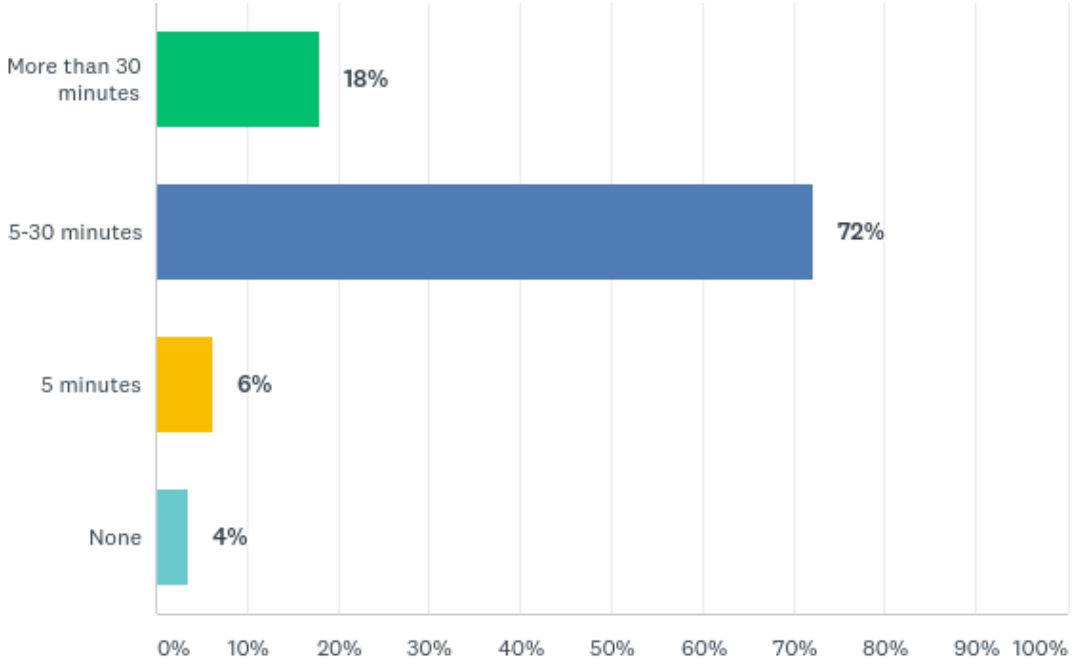
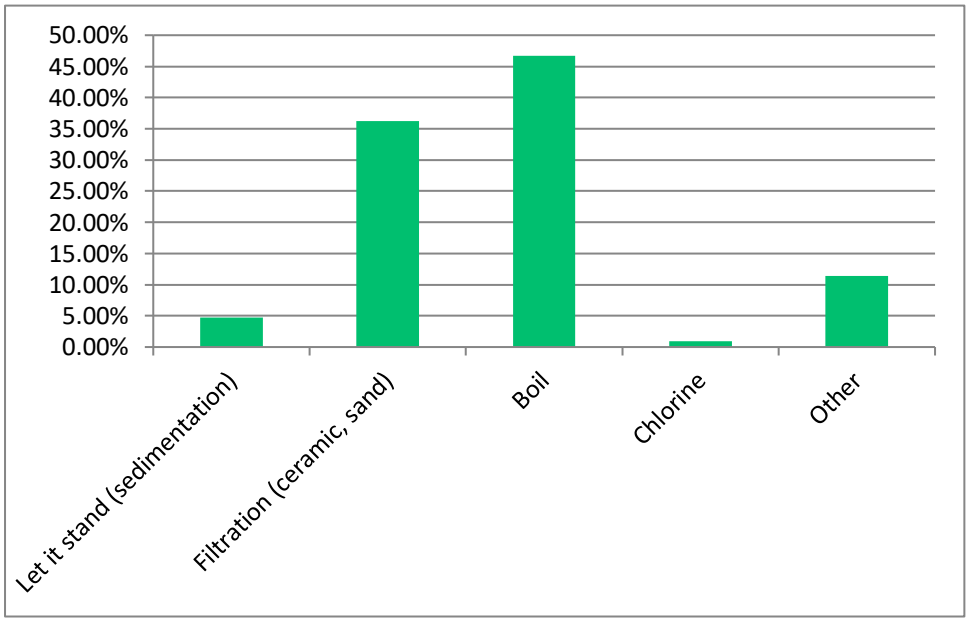


Chart 5-46: Response of villagers in IOR-7 in regard to how they treat their drinking water.



5.5.6.11 Tourist Attractions and Recreational Area

The Myanaung Township is not a popular Tourist or Recreational Area. In Myanmar, tourism is a relatively recent and developing sector, but the number of visitors is increasing yearly, and the government has been encouraging tourism. The total number of tourists arriving in Myanmar during 2015-2017 is shown in **Table 5-27**.

In the 2016-2017 fiscal year, 3,079,272 tourists visited Myanmar.

Table 5-27: Number of International Tourist Arrivals in Myanmar, 2015-2017

Year	Tourists			
	Total	by Air	by Sea	by Land
2015-2016	4,722,045	1,244,192	315,700	3,162,153
2016-2017	3,079,272	1,254,536	350,253	1,474,483

Source: Central Statistical Organization, Ministry of National Planning and Economic Development, http://www.csostat.gov.mm/

Ayeyarwady Region is also home to several beautiful beaches, among them, Chaungtha Beach. The drive along exposes you to a variety of landscapes; forested hills, a lush forest reserve, coconut groves, and rice paddies. The city of Pathein has numerous historic sights and temples. Pathein is known for its lively, hand-painted umbrellas; the city itself seems to take on new life during the Vesahka festival held during the full moon of Kason, during April and May.[28] However, hotel and transportation infrastructure is still very poorly developed in the Region.

[28] http://www.tourismmyanmar.com/ayeyarwaddy.htm

6. ENVIRONMENTAL, SOCIAL, AND HEALTH IMPACT ASSESSMENT

6.1 Methodology

An Environmental, Social and Health Impact Assessment (ESHIA) seeks to identify and, to the extent possible, quantify the potential negative impacts and positive benefits of a proposed project with respect to the environment (physical, ecological, human use, quality of life, and health values). Once these impacts have been identified, prevention, mitigation, and monitoring measures are proposed to prevent and/or mitigate possible negative impacts, and enhance positive impacts. An Environmental, Social, and Health Impact Assessment process incorporates a number of key steps as shown in **Figure 6-1** and discussed in detail in the following sections:

- Exploration Drilling Project –**Chapter 4**
- Environmental, Social and Health Setting – **Chapter 5**
- Stakeholder Involvement – **Chapter 9**
- Screening and Scoping–**Chapter 6**
- ESH Impact Assessment – **Chapter 6**
- Prevention & Mitigation Measures – **Chapter 6**
- Cumulative Impacts – **Chapter 7**
- Environmental, Social and Health Management Plan **– Chapter 8**

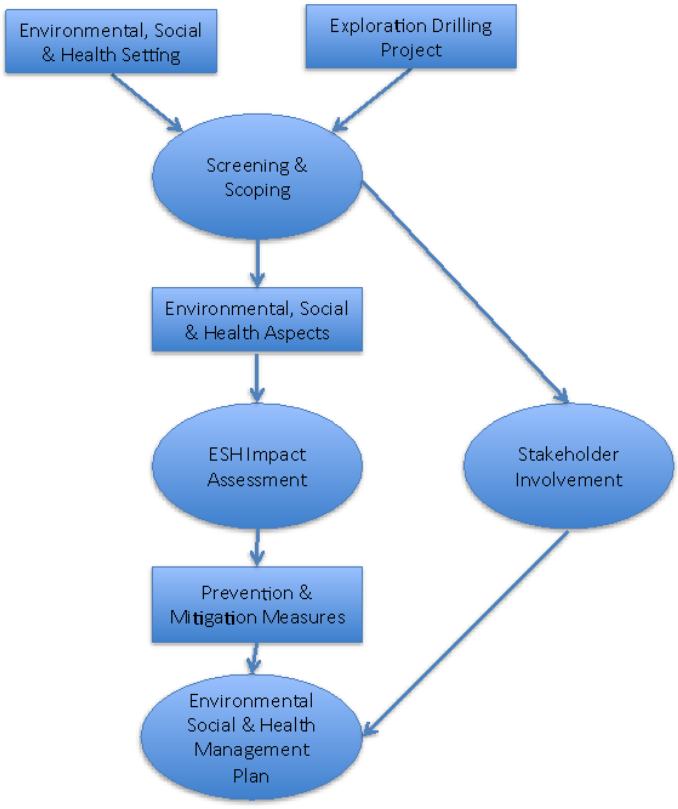


Figure 6-1: Method for Environmental, Social, and Health Impact Assessment

The assessment approach is risk-based, with the objective to make a conclusion on the level of risk development activities will pose to environmental, socio-economic and health receptors. This section describes the impact assessment process undertaken to evaluate the level of risk to environmental, socio-economic and health receptors from activities associated with the planned exploration drilling program. This description provides an account of the identification of potential impacts and benefits and the evaluation of their significance (scale of Risk Ranking). The ESHIA methodology applied is slightly modified from PCMI's Health, Safety and Environment Management System (Rev.2, March 11). Specifically, more detailed criteria were added to focus the social assessment for this project.

Activities associated with the exploration drilling program have been assessed to systematically identify potential impacts and the associated level of risk. This process assists in prioritising the development of management measures to achieve an overall acceptable level of risk.

Environmental Impact Assessment Terminology

Definitions for commonly used environmental impact assessment terminology are provided below:

Activity - Work associated with the Development during construction, commissioning, operation and decommissioning. For exampling: drilling, road construction.
Aspect - Associated with each activity are a number of aspects (or stressors). These are components of an activity that may have a potential to impact on the biological, socio-economic or cultural environment. For example: emissions, waste, noise.
Significance/Risk Ranking - The level of impact associated with an aspect.
Cumulative environmental effects can be defined as effects on the environment which are caused by the combined results of past, current and future activities**.**
Direct impact - Direct impacts occur through direct interaction of an activity with an environmental, social, or economic component. For example, a discharge of any industry or an effluent from the Effluent Treatment Plant (ETP) from the industrial estates into a river may lead to a decline in water quality in terms of high biological oxygen demand (BOD) or dissolved oxygen (DO) or rise of water toxins.
Indirect impact - Indirect **impacts** on the **environment** are these which are not a **direct** result of the project, often produced away from or as a result of a complex **impact** pathway. The indirect **impacts** are also known as secondary or even third level **impacts.**
Induced Impacts - The cumulative impacts can be, due to induced actions of projects and activities that may occur if the action under assessment is implemented such as growth inducing impacts and other effects related to induced changes to the pattern of future land use or additional road network, population density or growth rate. Induced actions may not be officially announced or be part of any official plan. Increase in workforce and nearby communities contributes to this effect.
Factor - The physical, ecological, socio-economic and cultural components of the environment. For example: water quality. Impact - Any change to the environment, whether adverse or beneficial, resulting from an environmental aspect. Impacts can be direct or indirect.
Indirect impact - Indirect **impacts** on the **environment** are these which are not a **direct** result of the project, often produced away from or as a result of a complex **impact** pathway. The indirect **impacts** are also known as secondary or even third level **impacts**
Inherent risk level - The level of risk before the application of management measures.
Likelihood - The probability or frequency of an environmental impact actually occurring.
Mitigation - Management measure that minimize and manage undesirable Risk Rankings.
Prevention - Management measure that reduces the likelihood of an aspect occurring.
Receptor – See Factor.
Residual significance/risk level - The level of significance/risk after the application of preventative and mitigation measures.
Risk - The chance of something happening that will have an impact on objectives.

6.1.1 Screening

Screening of issues is an important first step in an ESHIA. The purpose of the screening step is to systematically review all proposed project activities in order to identify potential environmental, social and health issues.

This screening step enables the detailed impact assessment component of this ESHIA to focus on the key issues that are relevant to people and the environment.

In this report, we have screened for environmental, social and health impacts both in a normal situation for each project phase (preparation phase before drilling, drilling phase, and well abandonment phase) and emergency situation for unplanned events.

6.1.1.1 Screening Methodology

In order to ensure a systematic evaluation of project activities and their possible impact on the environment, a thorough listing of project activities and environmental, social and health elements was obtained by the following means:

- ✓ Consultations with the PCMI planning the project activity;
- ✓ Applying International guidelines for onshore oil and gas exploration;
- ✓ Applying International guidelines for health impact assessment;
- ✓ Applying the World Bank checklist for onshore oil and gas development**;**
- ✓ IFC Environmental, Health, and Safety General Guidelines (2007);
- ✓ IFC Performance Standards on Environmental and social Sustainability (2012); and
- ✓ IEM's experience with similar projects.

Each of the activities carried out during the phases of the project was screened against each resource value, to determine if any impact may occur and therefore requires a more detailed assessment of impact.

6.1.2 Scoping of Environmental, Social, and Health Impacts

The Scoping of the proposed project will:

- define the study area, area of influence, time boundaries, project phases, and potential stakeholders;
- start the process of understanding the applicable regulations and standards, and their context for Project design and completion of the EIA;
- make a provisional identification of Environmental Impacts, focusing in particular on the environmental, social and health issues that need to be addressed in subsequent EIA studies;
- provide an indication of the depth and breadth of the subsequent EIA investigations including what baseline data and information are required, what further studies and investigations must be carried out, and how such data collection, studies and investigations shall be undertaken;
- provide an opportunity for consultants, relevant authorities, project developers, and interested and affected parties to express their views and concerns regarding the proposal before an EIA proceeds; and
- identify potentially affected communities and other stakeholders with an interest in the Project.

6.1.3 Environmental, Social, and Health Impact Assessment

6.1.3.1 Assessment of Potential Environmental and Social Impacts

The impacts that result from routine (planned) activities are assessed, as are those that could result from credible accidental or unplanned events within the project scope (e.g. a fuel spill) or in the external environment affecting the project.

The approach to assess the significance of potential impacts is discussed briefly below.

6.1.3.2 Assessment of Environmental and Social Significance

Assessment of the level of significance impact requires consideration of the impact level (i.e. magnitude of the environmental effect, its geographical scale and duration) in relation to the sensitivity of the key receptors and resources considered.

The overall significance is presented through a matrix of sensitivity of the resource receptor and the level of impact, as shown in **Table 6-1**.

Table 6-1: Significance Matrix for Environmental Impacts

Receptor Sensitivity	Impact Level		
	Low	Medium	High
Low value/sensitivity receptor or resource, impact disturbs degraded area or slightly disturbs area with value for conservation, causes small changes in species and diversity, within standards, small local change in human use and quality of life values over a short-term duration, reversible over short-term.	Negligible	Low	Medium
Medium value/sensitivity receptor or resource, Impact disturbs an area that has a value for conservation or causes change in species diversity. Impact important on a local or regional level, within standards, moderate change in human use and quality of life values at moderate level over a long-term duration, reversible over medium-term.	Low	Medium	High
High value/sensitivity receptor or resource, rare or endangered species or habitat impacted on a national or international level, exceeding standards, large permanent change in human use and quality of life values at a regional level, long-term or no reversible.	Medium	High	High

The impact assessment is based on four categories of impact significance level, as described in **Table 6-2**. These inform the level of mitigation that is considered appropriate to be applied for a given impact.

Table 6-2: Categories of Impact Significance

Significance Level	Definition
High	Impact is classified as high and can cause numerous effects. Major impacts affect an entire population or species in sufficient magnitude to cause a decline in abundance and /or change in distribution. Large permanent change in human use and quality of life values at a regional and national level. Fatality from an accident or occupational illness. Impacts cannot be managed or resolved by any mitigation measures.
Medium	Impact may result in changes that affect the value of resources and environment. Moderate impacts affect a portion of a population and may bring about a change in abundance and / or distribution but does not threaten integrity of population. Impact may affect moderate change in human use and quality of life values at a local and regional level over a long-term duration. Major injury or health effects (including Permanent Partial Disability). Mitigation measures are required to manage or reduce the potential impacts and monitoring measures are required to determine effectiveness of mitigation measures.
Low	Impact may result in changes in resources and environment but this change does not decrease value of these resources and environment. Minor impacts affect individuals within a population over a short period of time. Local change in human use and quality of life values over a short-term duration. Minor injury or health effects (Lost Time Injury). Impact can be managed and resolved by implementation of general mitigation measures.
Negligible	Impact has no effect.

Source: Adapted from Rossouw (2003) and Sippe (1999).

The degree of significance (categories as defined in **Table 6-2**) depends upon the level (i.e. magnitude, extent and duration) of impacts and the sensitivity of the resource value that they may impact. The criteria used to inform the significance ranking of impacts on a qualitative basis, are provided in **Table 6-3**.

Table 6-3: Criteria used to determine Impact Significance

Criteria	Detail
Extent	• **High –** Are of impact is beyond 5 km and impact extends to regional and national level. • **Medium -** Area of impact is beyond the project area but is in a limited area of 1 - 5 km. • **Low -** Area of impact is in the project area within a radius of 1 km.
Duration	• **Long Term** - Permanent impact**,** Impact will remain after well abandonment. Impact occurs in long-term duration (> 5 yr.). • **Medium** - Impact can be reversible overtime (1 – 5 yr.), period of impact occurrence is within the project period, Impact occurs over mid-term duration (1 – 5 yr.). • **Short term** - Impact can be quickly reversible (< 1 yr.), Period of impact occurrence is less than the project period, Impact occurs in short-term duration (< 1 yr.).
Magnitude	• **High –** Exceeds regulatory standards, changes the original structure of the environmental or social system or ecosystem. • **Medium –** Within regulatory standards, but changes some factors in the environmental or social system or ecosystem but does not change the structure. • **Low –** Within regulatory standards, with small changes in some factors for the environmental or social system or ecosystem but does not change the structure. • **Negligible –** no detectable impact on the environment or socio economic conditions. • **Positive –** Impact has a positive effect on the environment or socio economic conditions.
Receptor Sensitivity	• **High** – High value/sensitivity receptor or resource, rare or endangered species or habitat impacted on a national or international level, exceeding standards, large permanent change in human use and quality of life values at a regional level, long-term or no reversible. • **Medium** – Medium value/sensitivity receptor or resource, Impact disturbs an area that has a value for conservation or causes change in species diversity. Impact important on a local or regional level, within standards, moderate change in human use and quality of life values at moderate level over a long-term duration, reversible over medium-term. • **Low** – Low value/sensitivity receptor or resource, impact disturbs degraded area or slightly disturbs area with value for conservation, causes small changes in species and diversity, within standards, small local change in human use and quality of life values over a short-term duration, reversible over short-term.. • **Negligible** – no detectable sensitivity.

Source: Adapted from Nigel Rossouw (2003); Sippe (1999); and United Nations University (2007)

6.1.4 Identification of Management Measures

The first priority of environmental management is always to **prevent adverse impacts**, thereafter management measures with other objectives are considered. Environmental management measures can be varied and the measures themselves can have a variety of objectives.

World Bank guidelines for a best practice approach to the management of environmental and social impacts are presented in **Table 6-4**. Many of the recommendations set out in the design component are designed to meet the criterion for 'avoidance'.

Table 6-4: Primary objectives of mitigation measures for adverse environmental impacts.

First priority is avoidance of negative impacts; the objectives are listed in decreasing order of priority

Avoidance	▪ Avoiding activities that could result in adverse impacts. ▪ Avoiding resources or areas considered as sensitive.
Prevention	▪ Preventing the occurrence of negative environmental impacts and / or preventing such an occurrence having negative environmental impacts.
Preservation	▪ Preventing any future actions that might adversely affect an environmental resource. Typically achieved by extending legal protection to selected resources beyond the immediate needs of the project.
Minimisation	▪ Limiting or reducing the degree, extent, magnitude or duration of adverse impacts. This can be achieved by scaling down, relocating, redesigning elements of a project.
Rehabilitation	▪ Repairing or enhancing affected resources, such as natural habitats or water sources, particularly when previous development has resulted in significant resource degradation.
Restoration	▪ Restoring affected resources to an earlier (and possibly more stable and productive) state, typically 'background / pristine' condition.
Compensation	▪ Creation, enhancement or protection of the same type of resource at another suitable and acceptable location, compensating for lost resources.

Source: The World Bank. Environment Department. January 1999. Environmental Management Plans. Environmental Sourcebook Update. Number 25

For activities where the risk level is higher than low, management measures are required to prevent or mitigate the risk to an acceptable level. Prevention measures are put in place to prevent a hazard or event from occurring such as avoidance or reduction at source and pollution control equipment. Mitigation measures are put in place to avoid or minimise the actual impact of the event after it has occurred. This can include spill response plans, monitoring and offsets.

Measures to prevent or mitigate (reduce) the severity of potentially significant impacts will be developed and linked back to the related activities and included in the Environmental, Social and Health Management Plan (ESHMP). The ESHMP brings together the environmental, social and health management requirements needed to prevent or reduce potential impacts from activities and accidental events, and will form part of the ESHIA Report and company commitment to the project. The ESHMP is included in **Chapter 8**.

6.1.5 Residual Impact Significance

Following the identification of potential environmental and social impacts, their significance is assessed, taking into account those proposed mitigation measures already incorporated into the design of the project and, where appropriate, any further mitigation measures that are considered feasible and justified. Mitigation measures are applied to eliminate or reduce the extent, duration and or magnitude of a potential impact to an acceptable level. These remaining impacts are described as residual impacts.

One objective of the EIA is to understand the significance of these residual impacts that will remain after mitigation measures have been designed into the intended activity and if some form of monitoring or measurement might be justified.

6.1.6 Risk Determination for Unplanned Events

The significance of risk of unplanned events is determined by assessing the potential impact of an activity on the environment, social or health conditions and the likelihood of that risk occurring with effective management measures in place. The residual risk is an indication of the significance of an environmental, social or health impact and the probability of the event occurring, after application of management measures.

Where no meaningful measurable environmental, social or health impact can occur, a rating of negligible has been given. Where a positive impact has been identified a rating of positive impact has been given.

The probability of a specific event occurring can be determined either in terms of historical precedence or by calculation.

The potential Risk Ranking of an event occurring is determined according to the following themes:

- Environment (physical and ecological);
- Social;
- Health;

Impact Risk Ranking levels for each of these has been defined above.

The level of risk is identified using a matrix evaluating probability against impact severity; see Risk Ranking (**Table 6-5**). The risk level can be separated into three levels: low, medium, or high (**Table 6-6**). For each aspect identified a residual risk ranking will be defined.

If the risk is determined to be “medium” or “high”, it needs to be managed to reduce the frequency of occurrence or to mitigate any potential risks to achieve a risk that is low, or if it cannot be mitigated to a low level, to a level that is “As Low As Reasonably Possible” (ALARP). If the risk is determined to be “high” (i.e. unacceptable), specific actions must be developed to reduce the risk, which may involve a full Quantified Risk Assessment (QRA).

Table 6-5:Risk Assessment Matrix

	Significance	Increasing Probability				
Impact Level	Environmental, Social & Health	A	B	C	D	E
		Remote	Unlikely	Possible	Likely	Very Likely
		Never Heard of Incident in E&P Industry	Heard of Incident in E&P industry but not likely to occur during this project	Has Occurred once or twice in Company and may occur during this project but only under exceptional conditions	Has occurred frequently in company and could also occur during this project	Commonly occurs in the company and Is expected to occur during project
1	Positive	+	+	+	+	+
2	Negligible	Negligible				
3	Low impact		Low Risk			
4	Medium impact			Medium Risk		
5	High Impact					High Risk

Table 6-6: Risk Ranking

Risk Level	Definition
Low	Low level risk does not require additional management
Medium	The risk must be controlled to prevent increased risk
High	The risk must be managed/ reduced

6.2 Environmental, Social and Health Aspects For Drilling

The Screening summary (**Table 6-7**) and (**Table 6-8**) identifies Environmental, Social and Health Aspects that may occur as a result of planned project activities and unplanned events.

Each of the potential impacts was assessed qualitatively based on our screening methodology. All project activities were identified and potential impacts on the environment, social or health systems was defined.

Table 6-7: Screening Summary

ASPECTS	POTENTIALLY SIGNIFICANT	ACTIVITIES	POTENTIAL IMPACT
1. Environmental aspects			
1.1 Physical resources			
1.1.1 Topography	Yes	Installation of Infrastructure Road construction Camp site construction Well site construction Well abandonment and site restoration	Change in local topography
1.1.2 Air quality	Yes	Camp site construction, Well site construction Well abandonment and site restoration	Deterioration of Air Quality due to dust
		Drilling Well Testing Flaring	Hydrogen sulfide released
		Power Generation for Drilling and Flaring Well Testing and Flaring	Minor deterioration of local and regional air quality due to emission of pollutants such as NOx and SOx and CO.
		Transportation Road Construction and rehabilitation of Drill Site and Camp Site Construction Power Generation for Drilling Flaring Fugitive emissions	GHG Release contributing to climate change
1.1.3 Noise	Yes	Installation of infrastructure Drilling and infield operations Well Testing and Flaring	Behavioral disturbance to fauna
1.1.4 Heat	Yes	Flaring	Potential impact on local fauna
1.1.5 Light	Yes	Functional lighting on vehicles and drill rig, camp site and well site Flaring	Disturbance to Flora and Fauna
1.1.6 Geology	Yes	Drilling and fossil fuel extraction	Nature of rock/soil Stability of rock Potential for subsidence Transmissivity and hydraulic conductivity of rock Consumption of finite Natural

			Resources
1.1.7 Earthquake	Yes	Physical shifting of earth's surface	Potential physical disruption cause building collapse, blowouts, fires or spills, injury or death to personnel
1.1.8 Soil	Yes	Installation of Infrastructure Road construction Camp site construction Well site construction Well abandonment and site restoration	Soil Disturbance and Erosion
1.1.9 Surface water	Yes	Disposal of drill cuttings and sludge Disposal of sewage and grey water Potential for contaminated runoff from drill site.	Localized change in water quality and soil quality from chemical composition of drill fluids Disposal of effluents or contaminated surface runoff to the ground or directly into aquifers.
1.1.10 Hydrology	Yes	Installation of Infrastructure Road construction Camp site construction Well site construction Well abandonment and site restoration	Alteration of surface water hydrology by reducing interception, evaporation/ transpiration and infiltration
1.1.11 Groundwater	Yes	Drilling activities Chemical use Discharge of effluent	Impacts on groundwater chemistry/dynamics Possible contamination of groundwater
1.2 Biological resources			
1.2.1 Terrestrial Flora and Fauna	Yes	Vehicle Movements Rig Movement Installation of Infrastructure Road construction Camp site construction Well site construction Well abandonment and site restoration	Possible disturbance to and or loss of Flora and Fauna Possible destruction of habitat
1.2.2 Aquatic Flora and Fauna	Yes	Vehicle Movements Rig Movement Installation of Infrastructure Road construction Camp site construction Well site construction Well abandonment and site restoration	Possible disturbance to and or loss of aquatic flora and fauna
1.2.3 Biodiversity	Yes	Vehicle Movements Rig Movement Installation of Infrastructure Road construction Camp site construction Well site construction Well abandonment and site restoration Worker activities	Possible loss of biodiversity
1.2.4 Protected Areas	NO	Vehicle Movements Rig Movement Installation of Infrastructure Road construction Camp site construction Well site construction Well abandonment and site restoration Worker activities	Possible impact on protected areas

2.	Social Resources			
2.1	**Human use resources**			
2.1.1	Landuse	Yes	Installation of Infrastructure Road construction Camp site construction Well site construction Well abandonment and site restoration	Loss of agriculture potential Project operation effects on nearby land productivity Localized change in water quality Localized sediment deposition and disturbance to benthic habitats and associated biota.
2.1.2	Transportation	Yes	Transportation of equipment, personnel, granular fill, mud and cuttings, and waste	Increase in and disruption of local traffic Possible injury or death to personnel; and localized contamination of environment
2.1.3	Water	Yes	Water for construction exploration drilling and domestic use	Reduction of local community water supply
2.1.4	Power	Yes	Power for drilling operations and work camp	Increase or decrease of available power for local community
2.1.5	Waste management	Yes	**Waste Water Management** – Project operation effects on water quality from:	Potential impact to agriculture, aquaculture and fisheries Increased waste disposal overloading local infrastructure
			Drill site drainage	Localized change in water quality or contaminated soils from oil and grease
			Sewage and sullage	Localized nutrient enrichment and pollution of surrounding soil, surface water and ground water
			Infiltration	Infiltration from the cuttings and dirty water waste pit may deteriorate groundwater quality
			Solid Waste Management – Disposal of non-hazardous wastes from drilling activities Disposal of food and other kitchen wastes from camp site Disposal of Hazardous Solid Wastes Disposal of drill cuttings and sludge Loss of circulation	Contamination of water and soils and injury to fauna Attraction of fauna such as rats and birds. Nutrient enrichment of surrounding water and soils Contamination of water and soils and injury to fauna Localized change in water quality and soil quality from chemical composition of drill fluids Deterioration of shallow and deep groundwater quality.
2.1.6	Drainage and Flooding	Yes	Surface runoff from roads and camp site	Increased drainage potentially affecting roads and infrastructure
2.1.7	Agriculture and livestock	Yes	Installation of Infrastructure Road construction Camp site construction Well site	Possible loss of agriculture areas and livestock grazing areas

		construction Well abandonment and site restoration	
2.1.8 Indigenous fishery	Yes	Installation of Infrastructure Road construction Camp site construction Well site construction Well abandonment and site restoration Worker behaviour	Possible loss of fishing resources and areas.
2.1.9 Other aquaculture	Yes	Installation of Infrastructure Road construction Camp site construction Well site construction Well abandonment and site restoration	Possible loss of aquaculture areas and productivity

3. Quality of life resources			
3.1 Economic, Culture and Tourism			
3.1.1 Local economy	Yes	Employment, Buying-selling supplies, Spending of workers, Use of Local Business Continuity Services, Tax payment to local government. Purchase of Land	Potential increase in jobs and related income for local communities. Loss of agriculture potential Project operation effects on nearby land productivity Loss of employment for displaced workers that do not own land
3.1.2 Culture and tradition	Yes	The daily routine of employees, The arrival of migrant workers and foreign workers who may have different beliefs and cultures.	Possible conflict with local residents
3.1.3 Historical/ 3.1.4 Archaeological sites	Yes	Project construction potentially destroying historical and archaeological sites	Loss or damage to historical and archaeological sites
3.1.5 Recreation, Tourism and Aesthetics	Yes	Project construction and operation effects on tourism and recreation	Disturbance and reduction of tourism and recreational experience

4. Health Resources				
4.1 Public and Occupational Health				
4.1.1 Public health service	Yes	The arrival of migrant workers and foreign workers		Poor level of existing health care service being further stressed
4.1.2 Public health	Yes	Dust	Access/upgrade roads, Site construction, Transportation of granular fill, workers, equipment	Respiratory irritation Exacerbation of asthma
		Noise	Generator, Transportation, Construction Drilling	Hearing impairment for workers and Annoyance for public
		Non-hazardous waste	Waste disposal, Leaks/spills, Standing water	Food safety, gastroenteritis Increase in vector-borne diseases: malaria, typhus and dengue and others.
		Mud Chemicals and drilling waste	Mixing of drilling chemicals, Leak/spill of mud chemicals	Acute exposure such as skin irritation, inhalation exposure etc.
		Hazardous waste	Material contaminated with oil or chemicals, Lubricating and hydraulic oil, Drum and containers used for chemical transportation and storage	Acute exposure such as skin and eye irritation, inhalation exposure etc.
		Communicable diseases	Migration/influx of outside workers	Increased incidence and prevalence of HIV/AIDS, hepatitis Band C, syphilis, etc.
		Light and heat	Flaring	Heat exposure Nuisance light
		Flare emissions	Flaring	Increase in respiratory illnesses/diseases Exacerbation of asthma Disturbance psychological wellbeing H_2S Fatalities
4.1.3 Human resources (Occupational Health and Safety)	Yes	Project construction, operation and abandonment activities Drilling Fuel Storage and Flare testing Storage of chemicals and hazardous materials		The potential for workers to be injured or killed from construction, operations, abandonment or drilling activities.

Table 6-8: Unplanned Event Aspects for Drilling

Aspect	Activity	Potential Impact
Blowout	Drilling	Release of uncontrolled volumes of hydrocarbons, Fire, Explosion causing impact to the environment and possible injury or death to personnel.
Fire or Explosion (not associated with Blowout)	Fuel Storage	Possible explosion or fire of drilling rig or at campsite, or fuel storage area
Chemical, Fuel or Hazardous Waste/Materials Spill	Storage of chemicals, hazardous materials or waste	Potential risk of spills to the environment affecting air quality, soil quality, surface water, groundwater, biota and people
Transportation Accidents	Transportation of equipment, personnel, granular fill, mud and cuttings, and waste	Possible injury or death to personnel; and localized contamination of environment
Earthquakes	Physical shifting of earths surface	Potential physical disruption cause building collapse, blowouts, fires or spills, injury or death to personnel

The assessment of each aspect will be conducted during the EIA and SIA and will include the following components:

- Description of the source and characteristic of the potential impacts.
- Identification of receptors sensitive to potential impacts.
- Description and evaluation of potential impacts.
- Identification of management measures to reduce potential impacts.
- Determinations of the residual significance or risk after management measures are included.
- A summary assessment table with residual significant/risk rankings.

The study area for the environmental impact assessment includes the area within a 1 km and up to a 5 km radius of the project site(s). The study area for the social impact assessment includes the project stakeholders and communities near the project site(s). For the health impact assessment, workers employed for construction, drilling, testing and abandonment, as well as people who live in close proximity to the project site(s) are included in the assessment.

For each resource value a summary impact evaluation table will be provided as follows (**Table 6-9**):

Table 6-9: Example Impact Evaluation Table

Resource Value	**Impact Description**				
	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High
Residual Significance	Positive	Negligible	Low	Medium	High

6.3 Exploration Drilling Environmental Impact Assessment

5.9.1. Land/Habitat Disturbance

Land and habitat disturbance could happen as the result of clearance of site, construction of access roads, campsite and well site installation of rig and drilling equipment, and physical disturbance.

The estimated well site area will be 120 m by 180 to 200 m with buffer area; including the well site and nearby campsite for a total area of 24,000 m^2 per well site. This may vary slightly due to local topography. All short new access road will need to be constructed off of the existing MOGE road. The road will be constructed with a 6 m wide top and 1.5 m side slope for a total width of 9 m a height of approximately 20 to 30 cm before compaction with granular fill.

During the decommissioning phase, the potential for impacts associated with land/habitat disturbance will be of a lesser scale than during the construction phase as the decommissioning strategy will involve the site being restored to its original condition.

Impact Assessment

The potential impacts from land and habitat disturbance associated with the exploration drilling campaign are:

- Impact to Topography
- Soil Disturbance and Erosion
- Impact to Terrestrial Flora
- Impact to Terrestrial Fauna
- Impact to Surface Water Hydrology
- Impact to Water Quality and Aquatic Habitat

6.3.1.1 Impact to Topography

The construction area will be stripped of topsoil and the topsoil kept for the well site abandonment. The well site and adjacent accommodation campsite will be levelled and elevated by cut and fill methods and compacted using bulldozers, dump trucks, water trucks and graders. The compacted laterite pad will be 200 mm thick.

The source of impact from the site preparation is caused by soil excavation/filling and construction of access road/well pad activity. The project area mainly consists of paddy land between the agriculturally dominated communities and MOGE access road. The agriculture areas are used to grow mostly rice and beans/pulses.

The project will cause changes to the topography of the well site and surrounding areas. The effect will be limited to the construction areas and access road. The topography of the area within a 5-km radius of the exploration well site will be largely unaffected, because the construction areas for the well site and access road consist of only 0.1 % of the total area.

The well abandonment will follow normal industry practices and procedures, conforming to all internal PCMI regulations and MOGE requirements. The well site will be cleared of all equipment and cleaned up. The rig cellar will be broken down and removed; the well pipe will be cut 3 m below grade and capped with a steel plate before being backfilled with the rubble and soil. The concrete rig pad, other foundations and the water pit will be broken up and all material removed off site for disposal as normal building rubble. The surface of the well pad, consisting of compacted granular fill

will be broken up and the contours of the site restored to their original levels. The stripped topsoil will be placed over the area to restore to its original condition.

Without mitigation measures, the impact on topography from soil excavation/filling and construction of access road/well pad activity will be medium in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the impact significance to Topography is determined to be a **Low**.

The Significance Ranking of impacts to topography from soil excavation/filling and construction of access road/well pad activity is rated as Low (**Table 6-10**).

Table 6-10: Sigificance Ranking of impacts to topography

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from construction activities on topography can be mitigated through the use of the following measure:

- Limit construction activities to well sites and access roads only.
- Strip topsoil and keep for land rehabilitation
- Restore the site to its original condition on site abandonment.

Residual Significance

With these management measures, the extent and magnitude of impacts from a change to topography from soil excavation/filling and construction of access road/well pad activity will be reduced resulting in a residual significance ranked that is negligible.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.1.2 Soil Disturbance and Soil Erosion

General construction activities have the potential to result in adverse impacts on soil resources as a result of soil loss due to erosion. Sources of impact on soil properties during construction include soil excavation, land clearing, improvement/construction of access roads, and contamination such as

machine repairing and changing of lubricating oil. Impacts of accidental spills are discussed in **Section 6.6.4**.

The well pad area will be stripped of topsoil and levelled; the subsoil in the area will be covered with a compacted granular fill. If well testing indicates that the oil or gas reserves are not commercially viable to produce, the site will be restored to its original condition on site abandonment.

Without mitigation measures, drilling site might erode during construction phase due to runoff. Lower land might be consequently washed away by soil erosion and surrounded agricultural area might be affected.

Without mitigation measures, physical disturbance and soil erosion impacts from soil excavation, land clearing, improvement/construction of access roads, and contamination such as machine repairing and changing of lubricating oil are expected to be low in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the impact significance is determined to be low **impact** for environment.

The Significance Ranking of impacts from soil disturbance and soil erosion from soil excavation, land clearing, improvement/construction of access roads, and contamination such as machine repairing and changing of lubricating oil is rated as Low (**Table 6-11**).

Table 6-11: Sigificance Ranking of impacts to soil disturbance and soil erosion

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts to soils can be mitigated through the use of the following measures:

- Limit soil compaction only to well sites and access roads.
- Exposed site areas should be kept to a minimum during construction and completed areas should be hard surfaced or re-vegetated as soon as possible.
- Reduce erosion by preventing/reducing off-site sediment transport through the use of BMP's.
- Provide effective construction site run-off control and design.

Residual Significance

With these management measures, the magnitude of impacts from soil disturbance and erosion from soil excavation, land clearing, improvement/construction of access roads, and contamination such as machine repairing and changing of lubricating oil will be reduced, resulting in a residual significance ranking that is negligible.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.1.3 Impact to Terrestrial Flora

Sources of potential impact on flora in the construction phase include clearance of site, installation of rig and drilling equipment, constructing new access roads and physical disturbance. Soil compaction can inhibit root penetration and reduce water infiltration, which can increase runoff and erosion or cause ponding. These conditions limit or inhibit plant growth.

The well site area is an existing agricultural paddy area with limited natural terrestrial flora. As standard practice, PCMI will ensure that its staff and contractors will not cut trees or forage in the area surrounding the well sites during any phase of the project.

The impact to terrestrial flora from clearance of site, installation of rig and drilling equipment, constructing new access roads and physical disturbance will be local in extent, short-term in duration, reversible and of low-magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance ranking is determined to be negligible.

The Significance Ranking of impacts to terrestrial flora from clearance of site, installation of rig and drilling equipment, constructing new access roads and physical disturbance is rated as negligible (**Table 6-12**).

Table 6-12: Significance Ranking of impacts to terrestrial flora from clearance of site, installation of rig and drilling equipment, constructing new access roads and physical disturbance

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts to terrestrial flora can be mitigated through the use of the following measures:

- Remove vegetation in project areas only (roads, camp site, well site). Avoid cutting Riparian trees.
- Mark well sites clearly and prohibit vehicles from moving off site onto surrounding land.
- Mark trees to be cut prior to constructing well pads to prevent the cutting of other trees.
- Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to vegetation.

Residual Significance

With these management measures, the residual significance of impacts to terrestrial flora from clearance of site, installation of rig and drilling equipment, constructing new access roads and physical disturbance is determined to be Negligible.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.1.4 Impact to Terrestrial Fauna

Sources of impacts on fauna in the construction phase include clearance, installation of drilling equipment, access road construction, noise and human activity. Clearance activities could result in a direct loss of habitat, and increase in disturbance. Human activity causes disturbance to fauna.

The value of the study area as habitat is significantly affected by its current use as agriculture areas that are primarily used to grow rice and beans/pulses. Trees and vegetation are an important habitat for wildlife. Compared to the surrounding available habitats, the project area is small.

Human activity will be confined to the access road and well sites and will not constitute a new impact on the area, which is already regularly visited by people. Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to wildlife. In addition, hunting and trapping will be specifically prohibited and violations are grounds for termination of contract and dismissal. The potential impacts to fauna during construction include the following:

- Disorientation of least mobile animals
- Loss of forest ecosystem
- Trap hazards for animals
- Disturbance to animals
- Disoriented animals that are attracted to lights.
- Degradation of habitats

The impacts on fauna from clearance, installation of drilling equipment, access road construction, noise and human activity will be local in extent, short-term in duration, reversible and of low magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance is determined to be negligible.

The significance ranking of impacts to terrestrial fauna from clearance, installation of drilling equipment, access road construction, noise and human activity is rated as negligible (**Table 6-17**).

Table 6-13: Sigificance Ranking of impacts to terrestrial fauna from clearance, installation of drilling equipment, access road construction, noise and human activity

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High

Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts to terrestrial fauna can be mitigated through the use of the following measures:

- Mark trees to be cut prior to constructing well site, camp site and access road to prevent the cutting of other trees.
- Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to wildlife.
- Hunting and trapping will be specifically prohibited and any violations will be grounds for termination of contract and dismissal.
- Remove vegetation in road areas only.
- Mark well sites clearly and prohibit vehicles from moving off site onto surrounding land.

Residual Significance

With these management measures, the residual significance ranking of impacts to terrestrial fauna from clearance, installation of drilling equipment, access road construction, noise and human activity is determined to be negligible.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.1.5 Impact to Surface Water Hydrology

Impact Assessment

Vegetation removal, construction of well sites and access roads can alter surface water hydrology by reducing interception, evaporation/ transpiration and infiltration, which in turn can increase runoff and change local drainage patterns. Heavy rains can intensify changes in surface water hydrology; these changes are also enhanced on steep slopes.

Construction of the access roads, campsite and well sites for this project will result in some vegetation removal. The area of vegetation removal will be small and site preparation will be conducted on flat terrain. In addition, PCMI will install culverts under the access roads if required in order to maintain natural drainage. No changes in surface water hydrology are therefore expected.

Runoff calculation

The runoff from a single well site is calculated with **Equation 6-1**. In the project area the wettest month is September with a monthly rainfall of 129 mm. Therefore, runoff was calculated using rainfall intensity derived from a worst-case scenario of a month's equivalent of rain intensity in a ½-hr duration storm (129 mm/hr).

Runoff from the well site is calculated using **Equation 6-1**, which is valid for runoff areas not larger than 25 km^2.

$$Q = 0.278 x 10^{-6} CIA \qquad \textbf{Equation 6-1}$$

where: Q = runoff, m^3/second

A = area, m^2

I = rainfall density, mm/hour

C = runoff coefficient (**Table 6-14**)

Table 6-14: Runoff Coefficient of Various Catchment Areas

Land Use	Coefficient (C)	Surface	Coefficient (C)
Business		**Streets**	
- Downtown area	0.70-0.95	- Asphalt or concrete	0.70-0.95
- Neighbourhood areas	0.50-0.70	- Bricks	0.70-0.85
Residential		**Roofs**	0.75-0.95
- Single family areas	0.30-0.50	**Lawns (sandy soil)**	
- Multi unit, detached	0.40-0.60	- Flat with 2%slope	0.05-0.10
- Multi unit, attached	0.60-0.75	- 2-7% slope	0.10-0.15
- Suburban	0.25-0.40	- Over 7% slope	0.15-0.20
- Apartments	0.50-0.70	**Lawns (heavy soil)**	
Industrial		- Flat with 2% slope	0.13-0.17
- Light areas	0.50-0.80	- 2-7% slope	0.18-0.22
- Heavy areas	0.60-0.90	- Over 7% slope	0.25-0.35
Parks, cemeteries	0.10-0.25		
Playgrounds	0.20-0.35		
Railroad yard areas	0.20-0.35		
Unimproved areas	0.10-0.30		

Source: Kriangsak Udomsinrot (1994), Environmental engineer, Mitnarakanpim, Bangkok
Thongchai Pansawad (1995), Guideline for waste water treatment system and rainfall

Pre-Construction-Surface water drainage before the construction of a well site for the project can be calculated as follows:

Q (existing condition) = $(0.278x10^{-6})$ (0.17) (129) (24,000) m^3/s

= 228.25 m^3 for the ½ hr storm,

with the following parameters inserted into **Equation 6-1**:

A = well site area 14,400 m^2 and camp site area 6,400 m^2

I = 129 mm/h (using a monthly rainfall storm).

C = 0.17 for garden (heavy soil), flat with 2% slope (**Table 6-14**)

Therefore, the volume of runoff for an extreme ½ hour duration storm before the well pad is constructed will be 228.25 m^3 for a single well site.

Construction- Surface water drainage during construction of the project site can be calculated with **Equation 6-1** as for pre-construction with a runoff coefficient (C) of 0.30 for unimproved area (**Table 6-14**) as $(0.278x10^{-6})$ (0.30) (129) (24,000) (1800) m^3= 402.8 m^3.

Therefore, the volume of runoff for an extreme 1/2 hour duration storm during construction is projected to be 402.8 m^3 for the site.

Surface Water Runoff to Access Road

The overall landscape around the project well site is flat paddy agricultural land. The agriculture land was used to grow rice and beans/pulses.

All access roads will be 6-m wide. In consultation with and approval from MOGE the access roads will incorporate culverts to allow the flow of natural surface drainage and prevent any ponding of water around the existing MOGE access road.

Without mitigation measures, impact on hydrology will be local in extent and transient, reversible, short term and of medium magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance is determined to be a **Low**.

The Significance Ranking of impacts from vegetation removal, construction of well sites and access roads on surface water hydrology is rated as Low (**Table 6-15**).

Table 6-15: Sigificance Ranking of impacts to Surface Water Hydrology

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from runoff can be mitigated through the use of the following measures:

- Avoid construction of well sites and access roads in areas that may cause obstacles to water drainage.
- Construct water drainage lines (culverts) to maintain natural drainage. The required permission will be obtained from MOGE and all relevant agencies.
- Try to complete the construction of well sites within the dry season if possible.

Residual Significance

With these management measures, the magnitude of impacts from vegetation removal, construction of well sites and access roads to surface hydrology will be reduced resulting in a residual significance ranking that is negligible.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.1.6 Impact to Water Quality and Aquatic Habitat

Sources of impact on surface water quality from land and habitat disturbance are soil erosion in the construction area that might wash soil into surrounding surface water and contamination such as machine repairing and changing of lubricating oil. Impacts from accidental spills are discussed in **Section 6.6.4**.

Some erosion and soil loss are unavoidable during land-disturbing activities. While proper siting and design will help prevent areas prone to erosion from being developed, construction activities will invariably produce conditions where erosion may occur. However, the flat slope of the land and the timing of construction will limit downstream impacts.

Both runoff volume and suspended solids concentrations can increase during and after construction. For this project, the maximum runoff volume for an extreme rain event increases from 228.25 m^3 for pre-construction to 402.8 m^3 during construction (detailed calculation are provided under Surface Water Hydrology, **Section 6.3.1.5**). The typical suspended solids (SS) concentration from different areas is provided in **Table 6-16**.

Table 6-16: Typical Suspended Solids Concentration in Runoff

Source Area	Suspended Solids Concentration
Landscaped area	500 mg/L
Construction site	10,000 mg/L
Unpaved parking	250 mg/L
Detention pond water	10 mg/L

Source: Pitt and Clark. 2002[1]

The suspended runoff load from the project site before and during construction is outlined in **Table 6-17**. The overall suspended solids load during construction is substantially higher than before construction. Construction is expected to start on mid 2018 and last 2.5 months for the well site area. The Actual maximum annual rainfall will be well below the worst case of a maximum month's equivalent rainfall event of 129 mm/hr used the calculate runoff from the project well site.

The typical SS concentrations from different surfaces from **Table 6-16** are combined with the rainfall intensity of a ½-hr duration storm with a return period of 10 years to determine the maximum runoff load in **Table 6-17**.

Table 6-17: Suspended Solids (SS) Runoff from the well site

Period	Max. Runoff Volume (m^3)	SS Concentration (mg/L)	Max. SS Load (kg)
Pre-Construction	228.3	500	114
Construction	402.8	10,000	4,028

The calculations indicate that the runoff volume and levels of maximum suspended solids in runoff is potentially much higher during construction than before construction. It should be noted that the values calculated in **Table 6-17** are based on an extreme rainfall. The chance that this extreme event would happen within the construction window for this project is very small.

Any siltation from surface runoff generated during construction activities is unlikely to travel far. Sustained elevated turbidity levels from runoff can reduce transmission of sunlight, thus limiting photosynthesis. In turn, this can reduce the level of oxygen in the water. Organic matter introduced

[1] Pitt, R. and S. Clark. 2002. Emerging stormwater controls for critical areas. Pp. 104-136. In Wet weather flow in the urban watershed. Technology and Management. Field, R. and D. Sullivan. (Eds)

into a watercourse can lead to further deoxygenation as microorganisms decompose the organic matter and result in eutrophication. If oxygen levels fall below the natural DO variability in a system, flora phytoplankton, zooplankton and benthos diversity and abundance could decline.

Without mitigation measures, impacts to water quality and aquatic habitat are therefore expected to be local in extent, short-term in duration, reversible, and of medium magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance is determined to be Low.

The Significance Ranking of impacts to on surface water quality and aquatic biota from land and habitat disturbance is Low (**Table 6-18**).

Table 6-18: Sigificance Ranking of impacts to Surface Water Quality and Aquatic Biota

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts to water quality and aquatic biota can be mitigated through the use of the following measures:

- The proposed drill site and campsite will be orientated and designed to minimize areas requiring soil stabilization.
- Provide drip pans and absorbents to contain any spillage.
- Provide drainage and sediment traps around project area to reduce suspended particles in runoff from the well site and to contain minor oil spills.
- Avoid construction of the well pad and/or access road in areas where such construction obstructs water drainage.
- Prohibit workers from cleaning machines/equipment in/near a water source.
- Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.
- Provide a suitable storage area for construction materials (such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil).

Residual Significance

With these management measures, the magnitude of impacts to *surface water quality and aquatic biota from land and habitat disturbance* will be reduced which will result in a residual significance ranking that is **Negligible**.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.2 Vehicle and Drilling Rig Movements

This section details the impacts associated with the movement of vehicles and the drilling rig through all phases of the exploration drilling campaign. The construction phase of the project will see an increase in vehicle and heavy equipment activity that will then decrease during the operations phase.

Drilling Rig - PCMI plans to use a land rig for the drilling program. The estimated number of round trips for rig equipment is 175 trips (Based on previous onshore campaign by PCMI in 2015). The rig and equipment transportation route is via the Pathein – Monywa Highway Road to Kyangin and then to Myanaung. Then proceed to Well Site area via MOGE road starting from Mingone Junction. The distance from Yangon to Well Site is 418 Km for this route. The type of transportation for equipment is heavy truck with 1-2 day travel duration. The estimated number of round trips for drilling support equipment (Including casing, chemical and etc.) is 100 trips.

The personnel transportation route is via the Yangon – Hinthada Road. The distance from Yangon to the Well Site is 324 km. The type of transportation will include cars and mini bus with 8-10 hour travel duration. The estimated number of round trips for personnel is 100 trips.

Impact Assessment

The potential impacts from the movement of vehicles and drilling rigs associated with the exploration drilling campaign are:

- Disturbance leading to behavioural changes or displacement of fauna
- Disturbance to traffic
- Increased likelihood of incidents

6.3.2.1 Disturbance Leading to Behavioural Changes or Displacement of Fauna

The occurrence and intensity of disturbance is highly variable and depends on a range of factors relating to the animal and situation. Some behavioural disturbance may occur for short periods if fauna are present or near access road and project site.

Without mitigation measures, impacts to terrestrial fauna are therefore expected to be local in extent, short-term in duration, reversible, of low magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance is determined to be negligible.

The Significance Ranking of vehicle and drilling rig movement impacts to terrestrial fauna is rated as negligible (**Table 6-19**).

Table 6-19: Sigificance Ranking of impacts to Terrestrial Fauna from Vehicle and Drilling Rig Movement

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr

Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

6.3.2.2 Disturbance to traffic

The rig and crew mobilization and demobilization may cause disruption to local traffic. This is dealt with in the Social Impact Assessment in **Section 6.4.4**.

Management Measures

In order to minimize potential impacts to fauna from vehicle and rig movements associated with the project the following management measures will be adhered to:

- PCMI will conduct Road Hazard Assessment before transporting any large equipment.
- Vehicles will take direct routes where possible and avoid significant habitat areas.
- Construction vehicles will follow speed limits.
- Escort vehicles for wide load that have wide load signs and flashing warning lights.
- Follow local transportation laws and regulations.

Residual Significance

With these management measures, the residual significance of impacts from vehicle and rig movements to fauna is determined to be Negligible.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.3 Air Emissions

6.3.3.1 Dust Emissions

Vehicles driving on gravel/dirt roads during all project phases will disperse dust. Vehicles grind dust into fine particles lifted into the air by tire rotation and eddy air currents (Hesketh et al., 1983).

Dust dispersion can lead to a temporary deterioration in air quality by increasing TSP (Total Suspended Particulates) and PM_{10} (Particulate Matter <10 microns, units mg/m^3) concentrations.

During transportation of materials and equipment, site clearing including soil excavation/filling and construction of access road/well pad, well site, camp, sensitive receptors within a 2-km radius of the well sites may be affected by impacts to air quality. These receptors are mostly located in rural area and include:

- Village Households
- Pagodas, Monasteries
- Schools
- Fields (rice and crops oil seed: ground nuts, sesame etc.)

The sensitive receptors near the well site are shown in **Figure 6-2**. The closest sensitive receptor is Daung Kya village located 605 m from the well site.

Figure 6-2: Sensitive Receptors Near Well Site

Impact Assessment

During the construction phase, transport of materials and personnel, site preparation, excavation and movement of earth materials, contact of construction machinery with bare soil, and exposure of bare soil and soil piles to wind may generate fugitive dust.

Vehicles driving on laterite roads or off road will disperse dust: vehicles grind dust into finer particles, and tire rotation and eddy air currents lift particles into the air (Hesketh *et al.*, 1983). Dust dispersion will also be caused by filling and compaction during construction.

According to AP-42 of U.S.EPA (Compilation of Air Pollution Emissions Factors, 1977):

"The level of dust dispersion normally depends on working characteristic, soil humidity, wind speed, and construction period. On site construction with medium activities, 30% of silt and 50% of Precipitation Evaporation Index generates **1.2 tons/acre/month[2] of dust dispersion on average (or 15.8 kg / rai / day).** These particles **(greater than 10 micron)** will disperse following wind direction and will fall off in the **distance of 6-9 meters from construction site**".

[2] http://www.epa.gov/ttn/chief/old/ap42/3rd_edition/ ap42_3rdsup 1_7_aug 1977.pdf

Well site (well site and camp site construction)

There are no communities located within a radius of 500 m from the project well site. The closest sensitive receptor is Daung Kya village located 605 m away from well site. For particulate matter smaller than 10 microns, the dispersion distance could be greater than this, and the sensitive receptors are considered to be those within a 2 km radius of the well sites.

The emission rate (Q) and dust concentration (C) can be estimated as follows:

Emission Rate (Q)

The dust emission rate can be estimated according to **Equation 6-2**:

$$Q\ (mg/s) = \frac{15.8\ (kg/rai/d) * area\ (rai) * 10^6\ (mg/kg)}{24 * 60 * 60\ (s/d)} \qquad \textbf{Equation 6-2}$$

The well site covers an area of **24,000 m^2** for **well pad and campsite (120 x 200 m)**. In addition, the access road needs to be constructed.

On the basic of above equation, emission at source would be **2,743.1 mg/s**

Q = 2,743.1 mg/s, Area = 24,000 m^2 (**15 rai**)

Dust Concentration (C)

The dust concentration is estimated by using **Equation 6-3**:

$$C\ (mg/m^3) = \frac{Q\ (mg/s)}{d\ (m) * W\ (m/s) * M\ (m)} \qquad \textbf{Equation 6-3}$$

Where C = Dust Concentration (mg/m^3)
Q = Emissions at Source (mg/s)
d = Width (the smallest dimension is used for worst case scenario) (m)
W = Average maximum wind speed (m/s)
M = Mixing Height (m)

The mixing height data is not available yet in the Meteorology Department in Myanmar. Therefore, this measurement is adopted from the atmospheric simulation models(European Commssion, n.d.). The use of simple default values related to wind speed and stability class as in **Table 6-20**.

Table 6-20: Default Mixing Heights related to Wind Speed and Stability Class

Atmospheric Stability	Horizontal wind speed, m/s	Default Mixing Height, m
A very unstable	0.5-2	2000
B unstable	0.5-2	1500
C slightly unstable	2-10	1000
D neutral	3-10	750
E stable	2-5	300
F very stable	0.5-3	250
G extremely stable	0.5-1	250

Source: European Commission, n.d.

For this dust impact assessment, the **stable condition** is selected as the **worst case scenario.**

Q = 2,743.1 mg/s
d = 120 m
W= 2 m/s (stable wind)
M=300 m (stable wind)

Access road (constructed)

A short access road will be built off the existing MOGE road to access the well site. The access road constructed will be around 500 m with an entrance to the well site and a second access to the campsite. **Table 6-21** shows the distance and area required for the upgraded road length.

Table 6-21: The access road to be constructed for the well site

Off-road to well site(m)	d (m)	Area (m2)	Area (Rai)
500	9 (at base)	4,500	2.81

Table 6-22 shows the dust construction emitted from the one well site using the equations **Equation 6-2** and **Equation 6-3**.

Table 6-22: Dust Concentration from Well Site associated Road Construction (one well-site)

Location		Area (m^2)	Area (rai)	Q (mg/s)	d (m)	C (µg/m^3)	Ambient PM-10 (µ g/m^3)*
Well	1 Well site	24,000	13	2,743.1	120	38.1	**(89-91)**
Drive way (between Off-road and the well site)							
Access road (constructed and upgraded)	Off-road leading to well site	4,500	2.8	512.0	9	94.8	**(89-91)**

* Ambient PM-10 concentrations are 24hr average baseline values measured at the total (8) locations in the whole proposed project area. The findings are more detailed in ambient air baseline section.

The dust concentration resulting from the well site and access road construction is added to the ambient concentration. **The highest combined dust concentration** would be during **upgrading of the access roads for the well site** (with a wind parallel to the road and driveway): In actual situation, road construction would be carried out section by section. Therefore, it could not emit all dust emission at the same time.

Without mitigation measures the impacts to air quality from nuisance dust are expected to be local in extent, short-term in duration, reversible and of high magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance is determined to be Medium.

The Significance Ranking of impacts to air quality from nuisance dust is rated as medium (**Table 6-23**).

Table 6-23: Sigificance Ranking of impacts to Air Quality from Nuisance Dust

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr

Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

In general, the potential impact is estimated for a worst case scenario; in reality vehicles and equipment will only be used intermittently. Therefore, the emissions will be less than presented above.

Based on the ranking, nuisance dust from the construction phase is considered as medium. Dust emissions from the construction activities are expected to potentially deteriorate the existing status of air quality around the project area especially during the dry season and when winds blow from the construction site to nearby communities.

The impacts would be short-term and limited to localized areas. But, if there were no mitigation measures, dust emissions can cause nuisance close to the construction sites, so would potentially affect construction workers, villagers and the environment.

Management Measures

Potential impacts from dust dispersion can be mitigated by application of the following measures:

- Minimize land clearance to a minimum especially during the drier months.
- Reduce air emissions by regular maintenance.
- Limit vehicle speed (approximately a speed limit of 30 km/hr) especially on unpaved roads during dry conditions.
- Cover trucks transporting materials with tarpaulins or plastic to prevent any loose material from blowing away and also to prevent dust dispersion.
- Cover construction materials.
- Spray water on roads twice a day to keep dust down.
- Clean tires of the vehicles before leaving site if needed.
- Practice correct storage and usage of covers and/or control equipment (water suppression, bag house, or cyclone) in handling of materials such as conveyors and bins to prevent nuisance dust emissions.
- Re-vegetate disturbed areas as soon as practicable to limit exposed soil areas.
- Provide personal protective equipment (masks and gloves) to exposed field workers.
- Use vehicles with dust flaps.

Residual Significance

With these management measures, the magnitude of impacts to air quality from nuisance dust will be reduced resulting in a residual significance that is Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.3.2 Hydrogen Sulphide

Gas produced from the wells is constantly analysed for its composition and for the presence of hydrogen sulphide (H_2S). Hydrogen sulfide is a colorless, flammable, highly toxic gas. US Occupational Safety and Health Administration's (OSHA) occupational standard in the workplace is 10 ppm (8hr. TWA (time weighted average) and 15ppm (15min. STEL (short term exposure limit)); NIOSH IDLH (immediately dangerous to life or health) = 100 ppm. The potential for H_2S is a possibility but unlikely.

H_2S detection and safety equipment is standard issue (see **Section 4.10.3**). PCMI's emergency response plan (ERP) includes an H_2S Contingency Plan. Furthermore, the drilling contractors will have their own H2S Contingency Plan.

Without mitigation measures, hydrogen sulphide impacts during drilling and well testing will be local in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance is determined to be Low.

The Significance Ranking of impacts from hydrogen sulphide release is rated as low (**Table 6-24**).

Table 6-24: Sigificance Ranking of impacts from Hydrogen Sulphide

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Standard mitigation measures to reduce impacts from hydrogen sulphide release will be implemented:

- Install H_2S sensors at the flow line.
- If H_2S levels exceed 10 ppm in the gas stream, implement appropriate safety zones.
- All crew are instructed and rehearsed in H_2S procedures.

Residual Significance

With these management measures, the magnitude of impacts from hydrogen sulphide release will be reduced resulting in a residual significance ranking that is Negligible.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.3.3 Air Pollutants

Air pollutants come from various sources: fugitives and exhausts, fuel combustion, gas and oil processing, evaporation, flaring, waste incineration, refrigerators and freezers, vaporization from drilling muds, etc.

Potential concerns are:

- personnel safety
- global greenhouse effect
- ozone depletion
- fire hazards

Gaseous emissions may not deteriorate local air quality, but may contribute to the global problems of greenhouse warming and ozone depletion. The primary gaseous emission concerns are hydrocarbons, nitrogen oxides, sulphur oxides and carbon monoxide, and the contribution they will make to onshore levels of those gases or to existing problems, e.g., photochemical smog. Mercury vapour, sulphur dioxide and carbon monoxide in confined space present serious personnel health threats, while combustible gases may constitute fire hazards.

Impact Assessment

Fuel use for construction activities causes emission of pollutants. Emissions include CO, CO_2, NO_X and SO_2. Potential impacts of these and engine emissions are summarized in **Table 6-25**.

Table 6-25: Potential Impacts of Combustion Emissions

Emission Species	Environmental Impact
CO	Contributes indirectly to climate change by enhancing low-level of ozone formation.
CO_2	A GHG. Contributes to climate change.
NO_X	Contributes to the formation of acidic species that can be deposited by wet and dry processes, impacting aquatic and terrestrial ecosystems.
SO_2	Contributes to the formation of acidic species that can be deposited by wet and dry processes, impacting aquatic and terrestrial ecosystems.
CH_4	A GHG. Contributes to climate change. Reactant of ozone. Impact on respiratory system and circulatory system of living creature
N_2O	A GHG. Contributes to climate change.

Based on compilation of air pollution emission factors established by the U.S. Environmental Protection Agency (EPA), air pollutants generated from diesel oil combustion will consist of carbon monoxide, nitrogen dioxide, sulphur dioxide, and methane. The major contributor of air pollutants will be the diesel generators on site during drilling and from flaring. Estimated carbon dioxide emissions are discussed under Greenhouse Gases in **Section 6.3.3.4** below.

Drilling Rig Diesel Generators

Diesel generators will be used as a source of power supply for drilling. The generators will operate 24 hr/day throughout a drilling period of 90 days for both well sites.

Based on compilation of air pollution emission factors established by the U.S. Environmental Protection Agency (EPA), air pollutants generated from diesel oil combustion of 8 m^3/day for the Land Drilling Rig.

This will consist of carbon monoxide, nitrogen dioxide, sulphur dioxide, and methane at estimated concentrations shown in **Table 6-26**.

The total emission values are a worst case scenario for 2 drilling wells. The rig is powered by 4 diesel driven generator sets and each rated 400KVA to supply the rig site with power.

Table 6-26: Air pollution emissions from Drilling

Air Pollutant	Emission Factor (kg/TJ)	Emission of Air Pollutant (tonne/day	Total Emission (tonnes)
Drilling Rig Century Generator and Camp Site – (8 m^3/day/well), 90 days for 2 wells			
Nitrogen Oxides (NO_x)	1,896	0.552	**49.7**
Sulphur Oxides (SO_x)	126	0.037	**3.3**
Carbon Monoxide (CO)	410	0.119	**10.71**

Sources: US.EPA, "Compilation of Air Pollution Emission Factors, Volume 1, Stationary Point and Area Sources", Fifth Edition, January 1995; http://www.epa.gov/ttn/chief/ap42/ch03/bgdocs/b03s03.pdf.

Emissions during Well Testing Phase

Diesel generators will be used as a source of power supply for testing. The generators will operate 24 hr/day throughout a testing period of 30 days for both wells. The maximum flow during a DST test generally never exceeds 10 mmscfgd. Thus a worst case scenario flaring is a sustained flow rate of 10 mmscfgd for 7 days per well.

Based on compilation of air pollution emission factors established by the U.S. Environmental Protection Agency (EPA), air pollutants generated from diesel oil combustion will consist of carbon monoxide, nitrogen dioxide, sulphur dioxide, and methane at estimated concentrations shown in **Table 6-27**. Estimated carbon dioxide emissions are discussed under Greenhouse Gases below.

Table 6-27: Estimated Total Air Pollutant Emissions for Well Testing Phase

Air Pollutants – Fuel Use	Emission Factor (kg/TJ)	Emission of Air Pollutant (tonne/day/well)	Total Emission (tonnes)
350-KVA Camp Site Generator (1.5 m^3/day/well) – 30 days for both wells			
Nitrogen Oxides (NO_x)	1,896	0.103	3.1**
Sulphur Oxides (SO_x)	126	0.007	0.2**
Carbon Monoxide (CO)	410	0.022	0.7**
Air Pollutants – Flaring	**Emission Factor (lb/10^6 Btu)**	**Emission of Air Pollutant (lb/day)**	**Total Emission (tonnes)***
Flaring max 10 mmscfgd or 10 x 10^9 BTU/day/well – 7 d/well for 2 wells			
Carbon Monoxide (CO)	0.37	3700	23.5
Total Hydrocarbons**	0.14	1400	8.9
Nitrogen Oxides (NO_x)	0.068	680	4.3

Sources: US.EPA, "Compilation of Air Pollution Emission Factors, Volume 1, Stationary Point and Area Sources", Fifth Edition, January1995; http://www.epa.gov/ttn/chief/ap42/ch03/bgdocs/b03s03.pdf; http://www.eppo.go.th/ref/UNIT-OIL.html.
Note: Density of diesel oil is 0.8397 kg/L for calculation, IEA (2004), Densities of Oil Product, Energy Statics Working Group Meeting; Net Calorific Values is 43.33 TJ/Gg for calculation, IEA (2009), CO_2 Emission From Fuel Combustion, Documentation For Beyond 2020 Files

Without mitigation measures, the impact from air pollutants will be local in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance is determined to be Low.

The Significance Ranking of impacts from air pollutants is ranked Low (**Table 6-28**).

Table 6-28: Sigificance Ranking of impacts from Air Pollutants

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from air pollutants can be mitigated through the use of the following measures:

- Energy conservation measures will be taken into account during rig selection.
- Process control to minimize flaring.
- Diesel used in vessels will have a low sulphur.
- Reporting of atmospheric emissions as per PCMI requirements.
- Maintain scheduled maintenance program.

Residual Significance

With these management measures, the magnitude of impacts from air pollutants will be reduced resulting in a residual significance ranking that is Negligible.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.3.4 GHG Emissions

The potential sources of deterioration of air quality are fuel combustion from:

- Vehicle Emissions
- Well Testing
- Diesel Generators (Drilling Rig and Camp site)

The sensitive receptors for greenhouse gas emissions are the same as those listed for dust emissions.

Impact Assessment

The GHG emissions are estimated following the Tier 1 approach of IPCC (2006). Full details of the calculations are shown in **Appendix 6.** GHG emissions are estimated using emission factors and global warming potentials for the three main greenhouse gases (CO_2, CH_4 and N_2O). The estimated GHG emissions for the project is shown in **Table 6-29**.

Total greenhouse gas emissions during for the project (2 exploration wells) amounts to a worst case maximum of 19,945.7 tonnes eq CO2. The latest CO2 release of Myanmar was 212.49 $MtCO_2e$ in

2014 (CAIT, 2018)[3], the total GHG releases from the project are almost insignificant (approximately 0.009%), and therefore will not significantly impact the environment.

Table 6-29: Estimated Total GHG Emissions

Project Phase	Activity	One Time CO_2 Release (ton CO_2)
Site Preparation	Granular Fill Transport	9.2
Drilling	Drilling rig mobilization / demobilization	187.2
	Equipment and Supplies	107.0
	Heavy equipment use	3,898.6
	Generator to power drilling rig and camp site	5,713.0
Testing Activity	Generator to power beam pump	121.7
	Flaring	9,632.5
Abandonment and Restoration	Heavy Equipment and transportation.	276.5
Total per well		**19,945.7**

Without mitigation measures, the impact from greenhouse gas emissions during drilling are considered to be a global issue, local in extent, short-term in duration, reversible and of low magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance is determined to be Medium.

The Significance Ranking of impacts from GHG emissions is medium (**Table 6-30**).

Table 6-30: Sigificance Ranking of impacts from GHG Emissions

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

[3] CAIT Climate Data for Myanmar, Accessed Feb 14th from http://cait.wri.org/profile/Myanmar

Management Measures

Impacts from GHG emissions can be mitigated through the use of the following measures:

- Ensure all machinery and vehicles are properly maintained and serviced as per maintenance schedule recommended by manufacturer.
- Maintain road going vehicles to ensure that fuel use is efficient and emissions are within acceptable limits.
- Instruct drivers on the benefits of driving practices that reduce the risk of accidents, fuel consumption and dust generation.
- Turn off all vehicles and equipment when not in use as well as prohibit vehicles from idling.
- To maximize energy efficiency and design facilities to minimize energy use.
- Operating flare to control odor and visible smoke emissions (no visible black smoke).
- Locate flare at a safe distance from local communities and the workforce including workforce accommodation units.
- Implementation of burner maintenance and replacement, programs to ensure continuous maximum flare efficiency.
- Metering flare gas.
- Keep installation and functioning of flare gas system safe according to the good engineering practice.
- Ensure flare system has efficient combustion.
- Maintain pilot flame at the flare tip to ensure that flame is not extinguished by strong wind.
- Verify the operation's flaring system.
- Minimize the duration and rate of flaring as much as possible.

Residual Significance

With these management measures, the residual significance from GHG emissions is determined to be Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.4 Noise

This section assesses the potential impacts of noise from the exploration drilling campaign to sensitive receptors. The level of noise from project activities that is audible to a receptor (received level) will depend on the following:

- Background (ambient) noise.
- Noise level generated by an activity at the source (source level).
- The distance the receptor is from the noise source (range), and the level of transmission loss between the noise source and the receptor.
- The hearing threshold and frequency sensitivity of the receptor.

Noise will be generated during all project stages by vehicles, generators, equipment and drilling rig operations at levels shown in **Table 6-31**.

Table 6-31: Noise Level from Construction and Drilling Equipment

Source	Maximum dB (A) at source	Number of Sources at one time
Bulldozer	85	1
Backhoe	80	1
Grader	85	1
Compactor	82	1
Heavy trucks (dump trucks)	88	1
Water truck (Lmax truck)	84	1
Jack-hammer	80	1
Drilling Rig (auger)	85	1
Generator (for drilling & testing)	81	2

Source: US Federal Highway Administration, US Department of Transportation, 2008; reference distance 50 ft (15.24 m); (http://ops.fhwa.dot.gov/wz/workshops/accessible/Schexnayder_paper.htm)

Impact Assessment

The impact assessment for noise from project activities evaluates impacts to fauna during the different phases of the project. Noise is expected to be greatest during construction and commissioning due to the higher number of vehicle movements and heavy machinery use. During the drilling phase of the project, noise sources will include the drilling rig, generators and occasional vehicle movements.

Noise associated with decommissioning is expected to result primarily from the operation of the heavy machinery required to decommission the facilities and remove infrastructure. Noise impacts are anticipated to be similar to those from construction and commissioning activities. A decommissioning plan will be developed at the time of project decommissioning which will assess noise impacts of associated activities in more detail.

Like humans, the effect of noise on wildlife is highly varied and is dependent on the noise intensity, its frequency, and its duration; the sensitivity of the species or individual affected; and the environment in which the noise is perceived. Sounds exceeding 55 dB are known to cause physiological and behaviour changes in terrestrial fauna (Checker, 1980) and diminishes habitat value and disrupts terrestrial fauna activity (e.g. injury, energy loss, decreased food intake, habitat avoidance, and reproductive loss). Unusual, loud, and/or intermittent noise will generally startle and stress most species of wildlife, although they may quickly get used to continuous noise. They may avoid the area for varying lengths of time; once the noise ceases they will return. The area around the well sites provides habitat for many animals and birds temporarily disturbed by the noise of this operation.

Increased stress and/or movement during a critical period such as nesting or birthing will generally cause greater adverse effects to wildlife than the same stress outside of such critical times. If nesting birds leave the nest for even a short period of time, their nesting success may be reduced; if they abandon the nest, that nesting attempt will fail.

6.3.4.1 Construction

There will be a temporary increase in traffic levels and operation of heavy equipment, which will cause an increase in the noise levels and an increase in disturbance. This will have an impact on the surrounding wildlife (mainly birds), as they will tend to avoid the area.

Noise levels at various distances from these sources were calculated using **Equation 6-4**:

$$L_r = L_w - 20*Log_{10}(D/D_0) \qquad \text{Equation 6-4}$$

Where L_r = Sound level at distance D (dB(A))

L_w = Sound level at source D_0 (dB(A))

D = Distance from point source (m)

D_0 = Reference distance where the source noise emission level was measured

(Source: http://www.fhwa.dot.gov/environment/noise/highway/hcn03.htm)

The total noise level from several construction sources is calculated using **Equation 6-5**:

$$Lp_{Total} = 10 * Log_{10}(\sum_{i=1}^{n} 10^{Li/10}) \quad \textbf{Equation 6-5}$$

Where $L_{p\ total}$ = Noise level from n sources
n = Number of sources
Li = Noise level from ith source, dB (A)

Not all construction equipment will be operating at the same time. Using data from **Table 6-31** for the three noisiest construction machines (dump truck, grader and bulldozer), the total construction noise is

$Leq_{(Total)}=10\ Log\ [(2)(10^{85/10}) + (1)(10^{88/10})] = 91.0dB(A)$ at 50 feet from noise source

The nuisance noise during construction activities is calculated using **Equation 6-6**.

Nuisance Noise = Specific Noise Level- Background Noise Level **Equation 6-6**

Construction noise levels at sensitive receptors at 500 m and 1 km using **Equation 6-4** are 60.68 and 54.65 dB (A), respectively. The average ambient noise levels measured for the villages in IOR-7 was 51.6 dB (A). The construction noise levels are combined with ambient noise levels using **Equation 6-5** into a specific noise level. The specific noise levels at the sensitive receptors at a range of 500 m and 1km are 61.64 and 57.63 dB(A), respectively.

The estimated noise levels present an absolute worst-case condition. Not all equipment is likely to operate at the same time. In addition, the surrounding trees and other vegetation and the topography are expected to lead to a far more rapid attenuation of noise. Construction activities are expected to last approximately 2.5 months; noise levels at the sensitive receptors will return to baseline levels upon cessation of construction activities.

The nuisance noise level does not exceed the nuisance noise standard of 10 dB (A).

6.3.4.2 Drilling

The compounded noise level will be generated during drilling operations will last for 90 days.

During drilling operations, the highest compounded noise level at the site is expected from the drilling rig and two generators working simultaneously. Using **Equation 6-5**, the compounded noise level is:

$Leq_{(Total)} = 10\ Log\ [(2)\ (10^{81/10}) + (1)\ (10^{85/10})] = 87.5$ dB (A) at 50 feet from noise source

Drilling activities will last 90 day at the site (for both wells). Noise levels have been calculated for the sensitive receptors in the vicinity of the well sites at 500 m and 1 km using **Equation 6-4** to generate the worst-case scenario for exposure. Drilling noise levels at sensitive receptors within 500 m radius is 57.18 dB (A). Drilling noise levels at sensitive receptors within 1 km radius is 51.16 dB (A). The drilling noise levels are combined with ambient noise levels using **Equation 6-5** into a specific noise level.

The specific noise level at the sensitive receptors within 500 m is 59.09 dB (A). The specific noise level at the sensitive receptors within 1 km is 56.23 dB (A). The specific noise level at all well sites does not exceed the ambient noise standard of 70 dB (A).

The nuisance noise levels from the well sites at sensitive receptors at 500 m and 1km are 7.49 and 4.63 dB (A), respectively. The nuisance level at all well site not exceeds the nuisance noise level of 10 dB (A).

The estimated noise levels present an absolute worst-case condition: the surrounding trees and other vegetation and the topography will lead to a far more rapid attenuation. Drilling activities are expected to last approximately 90 days for both wells; noise levels will return to previous levels upon cessation of drilling activities.

On the well site itself, all workers will be issued with standard safety equipment, including ear protectors, and their use will be strictly enforced where required by regulations in areas with high levels of noise and vibration. This is the standard industry practice on all rigs and part of the routine health and safety procedures.

6.3.4.3 Well Testing (Flaring)

During well testing (15 days/well), the flare and use of a generator may contribute to increased noise levels, however, at the flaring rate of 10 mmscfgd at the well site, noise during testing is not expected to be a significant source beyond about 500 m. The flare stack will be horizontal burner directed to an earth bermed flare pit to ensure the safety of workers at the well site. The earth bermed flare pit will shield the flaring and limit noise emissions during flaring. Also flaring will be planned for day light hours only and will be limited in duration.

Without mitigation measures, impacts from noise to sensitive receptors are expected to be local in extent, short-term in duration, reversible, of low magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance ranking is determined to be negligible.

The Significance Ranking of impacts from Noise to sensitive receptors is rated as negligible (**Table 6-32**).

Table 6-32: Sigificance Ranking of impacts from Noise to Sensitive Receptors

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from noise can be mitigated through the use of the following mitigation measures:

- Vehicles and rig transportation will avoid sensitive environmental areas.
- Construction activities and Vehicle/rig movements will be restricted to daylight hours.
- Limit vegetation removal to a minimum.
- Schedule operation of noisy construction equipment at different times.
- Ensure use of mufflers on diesel/gas driven machinery.

- Use low noise equipment.
- Ensure all machinery and vehicles are properly maintained and serviced as per maintenance schedule recommended by manufacturer.
- Turn equipment off when not in use.
- Use enclosures when possible to contain noise on site.
- Implement transportation plan.
- Materials should be lowered when practical and not dropped.
- Verify the operation's flaring system.
- Minimize the duration and rate of flaring as much as possible.

Residual Significance

With these management measures, the residual significance from the impact of noise to sensitive receptors is negligible.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.5 Light

Project components of the exploration program are to be artificially lit to varying extents during all phases of the project, therefore generating light spill. Light emissions will occur from vehicles, drill rig, well site and campsite. Site preparation and abandonment will be carried out in daylight. Hence, light impacts will not be relevant during these project phases. Drilling will be conducted on a 24-hour basis. Lighting on the site will be kept to a minimum and directed so that, consistent with safety and security, as little as possible falls outside the pad area and should be partly or fully hidden by scattered trees, thickets and topography.

Artificial light can disrupt biological processes that rely on natural light for visual cues. Terrestrial fauna that are known to be sensitive to light and may be disorientated, attracted to or repelled by light spill including mammals, reptiles and birds. The amount of light spill emanating from project activities will vary according to the number of light sources, wavelength and intensity of light sources, location of and/or placement of fittings and the method of light switching (rapid or gradual turning on of light sources).

This section discusses the impacts of light spill on ecological receptors identified within or adjacent to the project area.

Light Sources

Sources of artificial light for project will include:

- Functional lighting on vehicles and drill rig, camp site and well site
- Flaring

Functional Lighting

Functional lighting is required on vehicles, drill rigs, campsite and well site at levels that provide a safe working environment for personnel. Lighting typically consists of bright white lights, used in accordance with safety requirements. Working lights will be directed into the site so that impacts from working lights will be minimized off-site.

Flaring

If drilling results indicate the presence of sufficient petroleum hydrocarbons, well testing will be performed. Flaring during well testing will constitute a potentially significant light source. The flare stack will be horizontal burner directed to an earth bermed flare pit to ensure the safety of workers at

the well site. The earth bermed flare pit will shield and limit light emissions during flaring. Also flaring will be planned for day light hours only and will be limited in duration.

Impact Assessment

Fauna that use visual cues for orientation, navigation, or other purposes may be disoriented by, attracted to, or repelled by artificial light sources. Potential impacts from artificial lighting associated with the project are:

- Disturbance to fauna
- Disruption to flora

6.3.5.1 Disturbance to Terrestrial Fauna

Drilling will occur 24 hours per day for 90 days per well. Lighting on the site at night will be kept to a minimum and directed so that as little as possible falls outside the confines of the pad, consistent with safety and security.

Any impacts from light on wildlife will be limited to the immediate vicinity of the well sites. Animals that are disturbed will avoid the area during the period of occupation. Insects will be attracted to the lights, which is likely to provide an easy food source for birds and other wildlife species. The area is an agricultural area but does have migratory bird pass through the area. The drilling will be completed in the dry season, so impacts to migratory birds will be limited. The closest biodiversity sensitive receptor is the Htu In Peatland located 3.6 km away from the well site as shown in **Figure 6-3**.

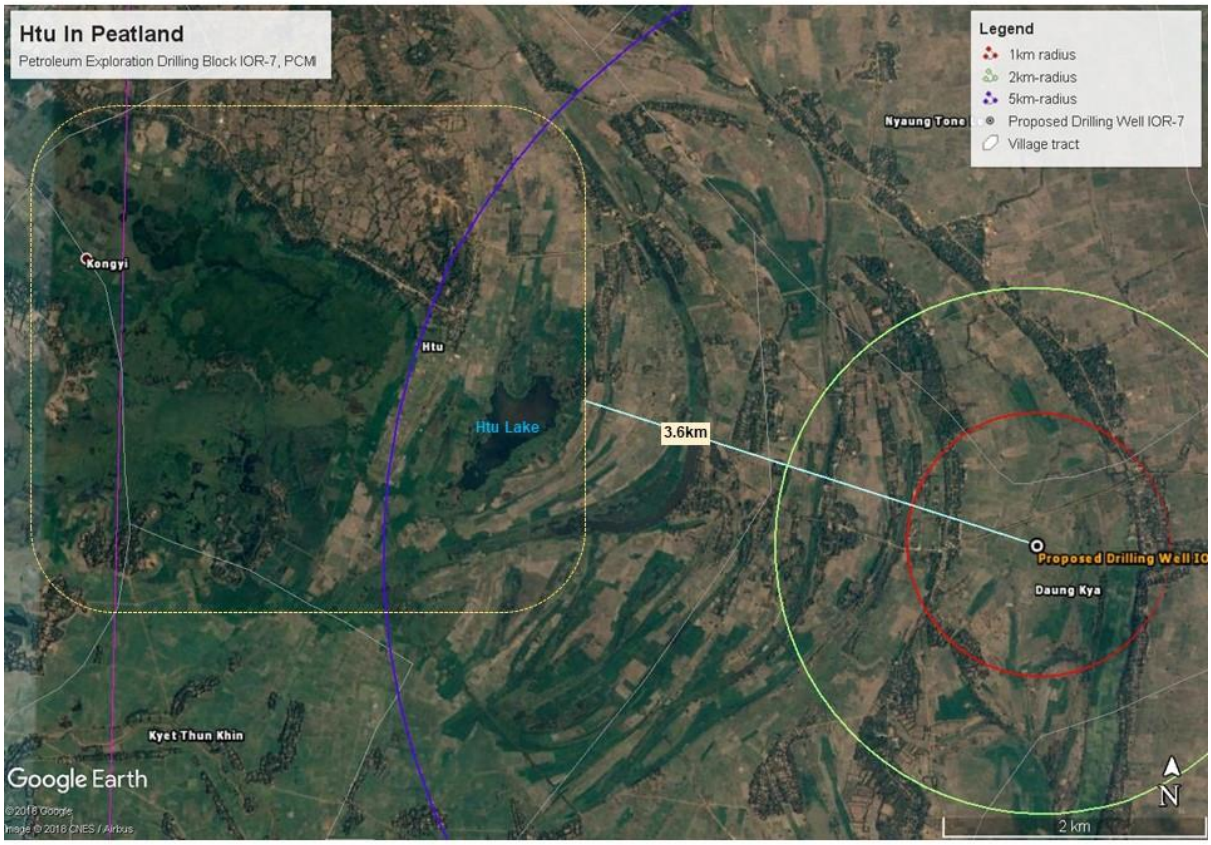


Figure 6-3: Htu In Peatland Distanc from Wellsite

Without mitigation measures, impacts to terrestrial fauna from light emissions occurring from vehicles, drill rig, well site, campsite and flaring are expected to be local in extent, short-term in duration, reversible, of low magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance is determined to be negligible.

The Significance Ranking of impacts to terrestrial fauna from light emissions is rated as negligible (**Table 6-33**).

Table 6-33: Sigificance Ranking of impacts to terrestrial fauna from light emissions

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from light on terrestrial fauna can be mitigated through the use of the following mitigation measures:

- Keep night lighting to a minimum, consistent with safety and security.
- Direct lighting to the inside of the well sites.
- Clear vegetation around the flare stack and build earth bermed flare pit.

Residual Significance

With these management measures, the residual significance ranking of impacts to terrestrial fauna from light is determined to be negligible.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.5.2 Flaring Disturbance to Terrestrial Flora

Flaring during well testing will cause light and smoke. The light and smoke may have an impact on crop productivity around the well sites. Vegetation within this radius may be displaced but this safety zone will prevent fire spreading to nearby fields. The value of the well sites as habitat is significantly affected by its current use as agriculture areas are used to grow beans/pulses, peanuts and sesame, rice, corn and vegetables and continued human activity.

Without mitigation measures, the light and smoke impacts from flaring to terrestrial flora and fauna are expected to be local in extent, short-term in duration, reversible, of low magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance is determined to be negligible.

The Significance Ranking of light and smoke impacts from flaring to terrestrial flora and fauna is ranked as negligible (**Table 6-34**).

Table 6-34: Sigificance Ranking of impacts to terrestrial flora and fauna from flaring light and smoke

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from light on terrestrial flora can be mitigated through the use of the following mitigation measures:

- Drill Rig located in area distant to sensitive receptors.
- Keep night lighting to a minimum, consistent with safety and security.
- Direct lighting to the inside of the well sites.
- Clear vegetation around the flare stack and build earth bermed flare pit.

Residual Risk

With these management measures, the Residual Significance ranking of light and smoke impacts from flaring to terrestrial flora and fauna is ranked as negligible.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.6 Heat

Heat can disrupt terrestrial fauna within the project area. This section discusses the impacts of heat on terrestrial fauna within or adjacent to the project area.

Impact Assessment

The volume of gas to be flared from the wells in an LTP test is expected to be a maximum of 10 mm scfgd per well. The recommended safe distance for heat radiation was calculated from the API equation (**Equation 6-7**):

$$D = \sqrt{\frac{F * Q}{4 * \pi * K}}$$ **Equation 6-7**

Where

D is minimum distance in feet from midpoint of flame to the object;

F is fraction of radiated heat (0.2 for methane API RP 521)

Q is total heat content (BTU/hr) – 10 mmscfgd ÷ 24 hr/d * 1000 BTU/scf

K is allowable radiation (BTU/hr-sqft)

The calculated safe distances are provided in **Table 6-35**.

Table 6-35: Safe Distance from Flare

Exposure	F	Q	K	D	
				ft	m
Continuous exposure with no protection	0.2	416,666,667	500	115	35.1
Continuous exposure with minor discomfort	0.2	416,666,667	1000	81	24.8
Emergency access – several minutes	0.2	416,666,667	1500	66	20.3

The flare stack will be directed to an onsite earth bermed flare pit. Furthermore, a constant fire watch will be posted during flaring and testing operations to specifically watch this area and ensure that in the event of any fire the operation is immediately shut down and the ground fire extinguished before it can spread. This follows the standard operational procedure when testing a well. Heat is therefore not expected to affect wildlife off site. The closest biodiversity sensitive receptor is the Htu In Peatland located 3.6 km away from the well site and will not be affected by heat.

Without mitigation measures, impacts of heat on terrestrial fauna are expected to be local in extent, short-term in duration, reversible, of low magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance is determined to be negligible.

The Significance Ranking of impacts from heat to terrestrial flora and fauna is rated as low (**Table 6-36**).

Table 6-36: Sigificance Ranking of the impacts of heat on terrestrial flora and fauna

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High

Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from heat can be mitigated through the use of the following measures:

- Clear vegetation around the flare stack and build earth bermed flare pit.
- Minimize flare rate and duration.
- Post constant fire watch during flaring operations.
- Maintain safety distance between flare stack and well site facilities and adjacent crops.

Residual Significance

With these management measures, the residual significance of impacts from heat on terrestrial fauna is determined to be negligible.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.7 Liquid Waste

Liquid wastes will be generated during all stages of the exploration drilling campaign in varying quantities and contain both hazardous and non-hazardous materials. Liquid wastes discussed in this section are:

- Sewage and sludge
- Drill site drainage
- Infiltration

The nearest water receptors are the community water pond, small peat land area and the Seloatma Stream located within 1 km of the well site.

Impact Assessment

6.3.7.1 Sewage and Sludge

Sewage and sludge (grey water generated from domestic processes such as dish washing, laundry and showers) will be generated at the campsite and well site. The disposal of sewage and sludge will be managed in accordance with PETRONAS Waste Management Standards and Waste Management Plan.

The wastewater and sewage will be collected in a concrete-lined closed sewage tank with a capacity of 8 m^3 (8,000 litres) and equipped with degreasers to reduce the organic load. It is estimated that some 3-4 m^3 (3,000 to 4,000 litres) of combined sewage and wastewater will be produced each day during maximum manned operations. The sites grey water to be discharged to an infiltration field if site conditions allow for the proper installation of an infiltration field. Tanker trucks as required will vacuum out the settled sludge in the septic tank and the contents sent by the waste transporter to the DOWA licensed waste treatment site.

Without mitigation measures, impact on from sewage and sludge on soil, surface and ground water resources will be local in extent and transient, short term in duration, reversible and of low magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance ranking is determined to be negligible.

The Significance Ranking of impacts from sewage and sludge on soil, surface and ground water is ranked as negligible (**Table 6-37**).

Table 6-37: Sigificance Ranking of impacts from sewage and sludge on soil, surface and ground water

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from sewage and sludge liquid waste can be mitigated through the use of the following measures:

- Install 1-2 concrete lined septic tanks at the well site for holding & treating sewage. Grey water to be discharged to infiltration field and away from community water supplies.

Residual Significance

With these management measures, the residual significance from impacts from sewage and sludge on soil, surface and ground water is ranked as negligible.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.7.2 Drill Site Drainage

The well pad and camp pad have drainage which is derived from rainwater and wash down water that may contain minor quantities of oil, grease and detergents if present on the site. A perimeter drainage system will be constructed around the levelled area to direct runoff into one waste pit. This pit will measuring approximately 35 m by 25 m by 4 m deep with a volume of 6,000 m^3. The pit will be lined with a high-density polyethylene (HDPE) 2mm thick impermeable geomembrane liner to form an impermeable barrier. The contaminated runoff water from well site will drain only to the waste pit. The dirty water collected in the waste pit will be treated onsite by DOWA.

Calculation of surface water drainage from a well site after construction is subdivided based on the various surfaces. Drainage calculated from each distinct area is outlined in **Table 6-38**.

Table 6-38: Runoff Distribution from Well Site and Capacity of Receiving Areas

Areas	Project Site Areas	Catchment Area (A)	Runoff Coefficient (C)	Runoff (Q) for extreme ½ hr storm	Receiving Area
Well Site					
Rig Pad	Rig Pad: Drilling Rig, Mud Tanks and Pumps, Cement Units, Generators, Solid Control Equipment (reinforced concrete pad)	20x20 m = 400 m^2	0.95	24.5 m^3	Waste pit Capacity 6,000 m^3/pit
	Waste Pit (plastic lined)	40 m x 30 m = 1,200 m^2	1	77.5 m^3	
Well Pad and Camp Pad	Well Pad Pipe Storage, Work Shops, Offices	14,400m^2 (well pad) –400 m^2 (rig pad) – 1200 m^2 (waste pit) = 12,800 m^2	0.35	289.2 m^3	Waste pit Capacity 6,000 m^3/pit
	Accommodation camp (compacted fill)	80 m x 120 m = 9,600 m^2	0.35	144.6	Off site through drainage system with weir and oil trap

The uncontaminated runoff water from the well pad and camp pad area will discharge to a drainage system surrounding the area passing with an off site flow rate of 144.6 m^3 for the extreme ½ hr storm. Runoff after campsite construction is greater than runoff prior to construction; the compacted granular fill will inhibit infiltration compared to pre-construction conditions.

The contaminated runoff water from rig pad and shaker area will drain only to designated waste pit (capacity 6,000 m^3). The runoff from the rig pad and well pad combined with rain falling on the waste pit for a ½-hr duration storm totals 391.2m^3. The waste pit has an actual holding capacity of 6,000m^3. The waste pit can therefore contain much more rainfall than the rainfall intensity of a ½-hr duration storm a month's equivalent rainfall in one hour. In the unlikely event that the waste pit should become full and overflow, tanker trucks are prepared to drain rainwater from the pit. This can be stored for later use as mix water, or if contaminated, will be disposed of at approved disposal site.

Runoff containing certain chemicals or drill fluid additives can cause water quality deterioration by increasing nutrient and/or organic matter loads (which can lead to eutrophication of water bodies from organic matter decomposition by micro-organisms), and by introducing toxic material into the water bodies. The potential for impacts from silt in runoff from the well site is minimal once the construction is complete; the suspended solid load following construction is practically identical to the pre-construction load.

On site fuel will be stored in steel tanks that sit on the higher ground and will be completely surrounded with a bund to contain any spillage. The bund will be 300 mm high around the entire fuel storage area. The site will have spill kits available to be used if any accidental fuel spill happens during operations. PCMI has an oil spill contingency plan if there is any accidental release.

These measures will create a zero-discharge well site and should ensure there is no release of contaminated water from the well sites. In the event of a spill, spill kits provided on site will be used to remove and contain the spill immediately. Any contaminated water will be collected in the waste pit through a drainage system around the project site. The dirty water collected in the waste pit will be treated onsite by DOWA.

Without mitigation measures, impact from drill site drainage on soil, surface and ground water resources will be local in extent, short-term in duration, reversible and of low magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance is determined to be negligible.

The Significance Ranking of impacts from drill site drainage on soil, surface and ground water resources is rated as negligible (**Table 6-39**).

Table 6-39: Sigificance Ranking of impacts from drill site drainage on soil, surface and ground water

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from runoff can be mitigated through the use of the following measures:

- Prohibit workers from cleaning machines/equipment nearby public water source.
- Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.
- Provide a suitable storage area for construction materials (such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil).
- Construct one lined waste pit for potentially contaminated runoff and spills (6,000 m^3), surrounded by 0.2 m high bund that will help prevent run-off into the environment. Monitor and transport waste to prevent any overflow from waste pit.
- On site fuel will be stored in steel tanks that sit on the higher ground and will be completely surrounded with a bund to contain any spillage. The bund will be 300 mm high around the entire fuel storage area.
- Construct drainage system (that includes a series of oil traps) around well site including the concrete rig pad, mud tanks and pumps, cement units, generators and solid control equipment to divert any spills into the waste pit.
- Contaminated drainage from site, machinery spaces or bunded areas will be contained.
- If the oil-in-water content specification is not met, the contaminated water will be stored in suitable containers and transported for treatment and/or disposal at DOWA waste management facility

- Extracted hydrocarbons from oil-in water separator systems will be stored in suitable containers and transported for treatment and/or disposal at DOWA waste management facility

Residual Significance

With these management measures, the residual significance of impacts from drill site drainage soil, surface and ground water resources is determined to be negligible.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.7.3 Infiltration

Infiltration is the process by which water on the ground surface enters the soil. The septic tanks will use a sub-irrigation infiltration field to treat the grey water from the project site. This field will be installed in areas of stable soils that are nearly level, well drained, and permeable, with enough separation between the drain field and the groundwater table or other receiving waters. Infiltration is also possible from the waste pit.

The waste pit will measuring approximately 35 m by 25 m by 4 m deep with a volume of 6,000 m^3. The pit will be lined with a high-density polyethylene (HDPE) 2mm thick impermeable geomembrane liner to form an impermeable barrier. The contaminated runoff water from well site will drain only to the waste pit. The pit will be surrounded by 0.2 m high bund that will help prevent run-off into the environment.

Without mitigation measures the impacts to groundwater quality from infiltration are expected to be local in extent, potentially long-term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance is ranked as Low.

The Significance Ranking of impacts from the cuttings and dirty water waste pit to groundwater quality is rated as low (**Table 6-40**).

Table 6-40: Sigificance Ranking of impacts from the cuttings and dirty water waste pit to groundwater quality

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts to groundwater from infiltration from cuttings and dirty water waste pit can be mitigated through the use of the following measures:

- Install an impervious HDPE geomembrane liner in the cuttings and dirty water waste pit. Monitor liner for tears or leaks during installation and operations.
- Infiltration (sub-irrigation) field is properly designed and installed in accordance with local regulations and guidance to prevent any hazard to public health or contamination of land, surface or groundwater;
- Infiltration (sub-irrigation) field installed in areas of stable soils that are nearly level, well drained, and permeable, with enough separation between the drain field and the groundwater table or other receiving waters.
- Infiltration field to be kept well maintained to allow effective operation;

Residual Significance

With these management measures, the duration and magnitude of impacts will be reduced resulting in a residual significance to possible impacts to groundwater from infiltration from the cuttings and dirty water waste pit to be ranked as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.8 Solid Waste

Impact Assessment

Solid wastes will be generated during all phases of the project. Solid wastes produced will consist of both hazardous and nonhazardous materials. For all solid wastes, a policy of reduce, reuse and recycle will be implemented, where possible, across all phases of the project.

Management of solid waste will be undertaken by PCMI in accordance with PETRONAS standards. For each solid waste type generated the most appropriate method of management will be determined and documented in a Waste Management Plan. Solid wastes to be produced during exploration drilling campaign will consist of:

- Non-hazardous waste.
  - General non-hazardous wastes.
  - Food and kitchen wastes.
- Hazardous waste.
  - General hazardous wastes.
  - Drill Cuttings and Fluids.
  - Naturally Occurring Radioactive Material.

6.3.8.1 Non-Hazardous Solid Waste

Types of waste and potential impact caused are summarised in **Table 6-41**.

Table 6-41: Types of Solid Waste and Potential Impacts

Waste Type	Potential Impacts
Food Waste	• Odour • Attraction of pests and disease vectors
Paper and plastic packaging, rags, plastic, glass	• Fire hazard • Wind-blown litter • Fouling of surface water
Metal and plastic drums, sacks and bags	• Fire hazard • Wind-blown litter • Fouling of surface water • Contamination of soil and water
Wooden packaging	• Fire hazard • Debris hazard
Scrap Metal	• Contamination of soil and water • Public Safety • Debris hazard

6.3.8.1.1 General Non-Hazardous Wastes

General non-hazardous waste will be generated from the drill site, campsite and vehicles during all phases of the project. General non-hazardous wastes may include scrap metal, packaging, wood, cardboard, paper and empty containers. Improper handling and disposal of non-hazardous materials may cause adverse effects by materials spills or (as in the case of domestic wastes) being carried away by wind, vectors, etc. Burning some types of innocuous-looking waste types (especially plastics) may create toxic tar or even extremely toxic dioxin. Depending on their pathway, the end result would be air, soil, groundwater, and freshwater life contamination.

General waste will be separated on-site to facilitate recycling. Domestic and general waste should be segregated and stored using suitability labelled containers to ensure safe collection segregation and handling of all waste streams generated. This waste will be stored in appropriate containers to be transported off site for recycling, reuse, treatment and/or disposal.

It is estimated that the well site will generate between 1 and 10 tonnes of "domestic" waste and 1 to 40 tonnes of "industrial" waste per month. It is estimated that the accommodation campsite will generate between 1 and 4 tonnes of "domestic" waste per month.

All solid general waste will be sent for recycling or disposal to at the DOWA Waste Management Facility.

Without mitigation measures, impact from non-hazardous waste on soil and water will be local in extent and transient, reversible, short term in duration and of medium magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance is determined to be a **minor impact** for environment.

The Significance Ranking of impacts from general non-hazardous solid waste on Air, Soil, Groundwater and flora and fauna is rated as Low (**Table 6-42**).

Table 6-42: Sigificance Ranking of impacts from Non-Hazardous Waste on Air, Soil, Water and Flora and Fuana

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km

Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from general non-hazardous waste contamination can be mitigated through the use of the following measures:

- Tenders for supply and construction contractors will require waste reduction at the source.
- A PCMI Waste Management Plan for this drilling campaign will be developed.
- Domestic and general waste to be segregated and stored using suitability labeled.
- Food scraps and other kitchen wastes will be segregated and transferred to waste disposal facilities.
- Cooking oils and greases from the kitchen will be collected and transported to waste disposal facilities.
- All non-hazardous solid general waste will be sent for recycling or disposal to at the DOWA Waste Management Facility.

Residual Significance

With these management measures, the magnitude of impacts will be reduced resulting in a residual significance of impact from general non-hazardous waste to Air, Soil, Groundwater and Flora and Fauna that is ranked as negligible.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.8.2 Hazardous Solid Waste

Impact Assessment

The well site will generate a low volume of hazardous waste throughout all project phases including:

- Excess or spent chemicals.
- Paints and paint cans.
- Biological waste from medical facilities.
- Oil contaminated materials (e.g. sorbents, filters and rags).
- Waste oils.
- Drums and containers used for oil or chemical transportation and storage;
- Batteries.
- Fluorescent light tubes.

The well site and accommodation campsite combined will generate a low volume of hazardous waste, estimated to be between 2 and 5 tonnes per month. The drilling contractor is to ensure appropriate

and safe storage until this waste is picked up by the waste transporter and taken to the DOWA Waste Management Facility.

Without mitigation measures, impact from hazardous waste on soil and water resources will be local in extent and transient, reversible, long term in duration and of medium magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact significance considerations the significance is ranked as Medium.

The Significance Ranking of impacts from hazardous waste to soil, water resources and flora and fauna is rated as Medium (**Table 6-43**).

Table 6-43: Sigificance Ranking of impacts from Hazardous Waste to Soil, Water Resources and Flora and Fauna

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from general hazardous waste contamination can be mitigated through the use of the following measures:

- Hazardous wastes materials will be handled and stored in accordance with the corresponding MSDS.
- General non-hazardous solid wastes will be managed in accordance with accepted international standards.
- Tenders for supply and construction contractors will require waste reduction at the source.
- A PCMI Waste Management Plan for this drilling campaign will be developed.
- Waste will be segregated at source into recyclable and non-recyclable wastes, where a net environmental benefit is likely, and stored in clearly marked containers for transport to DOWA waste disposal site.
- Hazardous wastes will be transported for disposal at a DOWA waste facility

Residual Significance

With these management measures, the duration and magnitude of impacts will be reduced resulting in a residual significance ranking from the impact of hazardous waste to Air, Soil, Groundwater and Flora and Fauna as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.9 Drill Cuttings and Fluids

6.3.9.1 Drill Cuttings and Sludge

Impact Assessment

Water-based muds contain bentonite, caustic soda, caustic potash, soda ash polymers, scale inhibitors, drilling lubricants and, occasionally, oxygen scavengers and biocides. The company plans to use potassium chloride (KCl) water based mud (WBM) for the drilling. The drilling fluids that are used for the well will be returned to the surface from the annulus of the drill with rock cuttings, and may also contain small quantities of other fluids, such as hydrocarbons and produced water.

A portion of the mud will be attached to the cuttings (the separation system is efficient but cannot remove all the mud from the cuttings). At the end of drilling the surface hole, fresh water-based mud held in the rig storage tanks will need treatment and disposal.

Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil. In the case of production, and after drilling the cuttings burial site would be compacted and used as land for other purposes. Drilling mud would be dewatered and treated before disposal into drill cutting pits. The dewatering unit will reduce the solids in the water and treated to disposal. DOWA shall be treating the fluids onsite to disposal level as per IFC 2007 regulations.

The cuttings and fluids contain potassium chloride, which are saline and residual hydrocarbons. The possible entry of saline and hydrocarbon contaminated fluids into the soil and ground water may affect the growth of agricultural crops and be potentially toxic to terrestrial and aquatic flora and fauna. The cuttings and fluids may also contain heavy metals, which may possibly contaminate soils and affect the growth of agricultural crops.

The influent water is separated from the water based mud and the held in the cuttings pit. The cuttings generated is expected to be 2000 -3000 m^3 per well. The water-based mud generated is expected to be 1000-2000 m^3 per well. The process water from the cuttings pit will be treated onsite by DOWA. The treated water will be monitored to ensure it meets IFC and Myanmar National Emission guidelines before being discharged from the site. Sludge from the onsite wastewater treatment process and the hazardous brine water that is resulting from the onsite treatment will be removed from the site and disposed and treated at the DOWA waste disposal area.

Without mitigation measures, impact from drill cuttings and sludge on soil, water, and flora and fauna will be local in extent and transient, reversible, medium term duration and of medium magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance is determined to be Medium.

The Risk Ranking of impacts from drill cuttings and sludge on soil, water, and flora and fauna disposal is rated as low (**Table 6-44**).

Table 6-44: Sigificance Ranking of impacts to from drill cuttings and sludge on soil, water, and flora and fauna

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from drilling waste contamination can be mitigated through the use of the following measures:

- Drill cuttings and adhered fluids will not be discharged to surrounding area.
- All drilling activities will be conducted in accordance with approved Environment Management Plan.
- Volume of cuttings and fluids discharged will be minimised through use of solids control equipment.
- Use non-hazardous water-based mud system. Inform MOGE in case of change in mud chemicals.
- Store all chemicals in secured storage area with impervious (cement or plastic sheet) floor and bund wall. Handle all chemicals according to its MSDS.
- Provide spill clean up kits and training for designated rapid response teams to clean up any spills. In the event of oil or chemical spill, implement spill response plan. Handle all chemicals according to its MSDS.
- Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil.
- Implement transportation plan.

Residual Significance

With these management measures, impact magnitude will be reduced resulting in a residual significance of impacts from drill cuttings and sludge on soil, water, and flora and fauna that is ranked as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.9.2 Lost Circulation

Once the well is spudded, the mud circulates in an essentially closed system. The practice of casing sections of the well with steel tubing, cemented in place as it is drilled, will prevent significant losses of mud to the formation and prevent groundwater contamination.

In the event of lost circulation, mud may be released into the surrounding formations via fractures. As lost circulation normally occurs in the reservoir section, which is much deeper than the surface aquifers, mud is not likely to impact aquifers. In addition, the mud system to be used is a water-based mud (WBM) that is the least toxic to the environment.

If mud loss should occur, a series of steps will be taken to seal the well bore as follows:

- Pump in Lost Circulation Material (LCM) such as mica;
- If this does not work, try to drill through it with water and LCM;
- If this does not work, the well will be plugged with cement and re-drilled.

Without mitigation measures the impacts to groundwater quality from loss of circulation mud are expected to be local in extent, potentially long-term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture with limited conservation value; the sensitivity of the receptor or resource is rated low. Given these impact criteria considerations the significance is determined to be medium.

The Risk Ranking of impacts to groundwater quality from loss of circulation mud is rated as Medium (**Table 6-45**).

Table 6-45: Sigificance Ranking of impacts to

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts to groundwater from lost circulation can be mitigated through the use of the following measures:

- Case sections of the well with steel tubing.
- Cement steel casing in place.

Residual Significance

With these management measures, the impact magnitude will be reduced resulting in a residual significance of impacts to groundwater quality from loss of circulation mud that is ranked as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.3.9.3 Naturally Occurring Radioactive Materials

No produced formation water is expected for the exploration drilling campaign. Produced water can contain small quantities of naturally occurring radioactive materials (NORMS). Under certain conditions (high salinity, together with the presence of sulphates and/or carbonates, calcium, barium and strontium) NORMS can become bound to scale deposits in production wells, pipelines and process equipment. Maintenance of wells, pipelines and process pipework or equipment may require the disposal of scale if it has built up as a solid. However, since no produced formation water is expected and the exploration wells will be drilled over a short time frame (90 days) the potential for scale deposition containing NORMS to build up has been assessed as **negligible**.

6.4 Exploration Drilling Social Impact Assessment

The purpose of a social impact assessment is to study the potential impacts from the project that might affect social issues. The social impact assessment in this report will therefore assess impacts from the project to human use values and quality of life issues.

6.4.1 Social Aspects

Preliminary impact screening and scoping of social issues identified social aspects in **Table 6-46** for detailed impact assessment.

These preliminary scoping results were used to design of the socio-economic surveys and focus group meetings as a part of the consultation with communities in and around the project area that might be affected by the project activities.

Table 6-46: Social Aspects

Social Aspects	Road &Site Construction	Exploration Drilling & Testing	Restoration and Abandonment
Change in Land Use	✓	✓	✓
Traffic	✓	✓	✓
Water Use	✓	✓	✓
Power Use	✓	✓	✓
Water Drainage	✓	✓	✓
Wastewater	✓	✓	✓
Waste Disposal	✓	✓	✓
Tourism and Recreational experience	✓	✓	✓
Employment & Income	✓	✓	✓
Labour In-migration	✓	✓	✓
Historical, Archaeological & Cultural Resources	✓	✓	✓

6.4.2 Criteria and Method for Social Impact Assessment

Project information is used to assess the environmental impact on social issues. The impacts can be divided into 2 categories:

1) Positive Impact (+): The project activities increase the human use values and quality of life values or bring something desirable to group/community.

2) Negative Impact (-): The project activities decrease the human use values and quality of life values or bring unwanted things to group/community.

Impact factors considered include magnitude, extent, duration, reversibility, and resource sensitivity in determining significance of impact.

The assessment of potential socio-economic impacts is based on quantitative and qualitative data and professional judgment.

Additional factors include consideration of changes in the value of assets that households depend upon for their livelihoods, manageability of the change and potential for it to lead to further changes beyond the control of the project, and whether the effects are acute or chronic. The significance ranking of the potential social impact is ranked as positive, negligible, low, medium or high negative as defined in **Section 6.1.3.2**.

The assessment of each aspect includes the following components:

- Description of the source and characteristic of the potential impacts.
- Identification of receptors sensitive to potential impacts.
- Description and evaluation of potential impacts.
- Identification of management measures to reduce potential impacts.
- Determinations of the residual significance after management measures are included.
- An aspect summary assessment table.

6.4.3 Change in Land Use

Impact Assessment

The project area consists of agricultural paddy land with nearby agriculturally dominated communities and an existing MOGE access road.

The main project activity that affects land use is the well pad, campsite and access road construction as well as the topsoil storage area. All land needed for the project has been acquired by PCMI. The well pad and work camp area will be built adjacent to each other. The well site area for the well pad and camp pad will be 120 x 200 m for a total the land area of 24,000 m^2 that will be disturbed. The well site is located next to the existing MOGE road; therefore a short access road will be built to access the well site and campsite areas.

The well site and adjacent accommodation campsite areas will be cleared of topsoil and then levelled and elevated by cut and fill methods and compacted using bulldozers, dump trucks, water trucks and graders. The compacted granular pad will be 150 to 200 centimeters thick. In the event that the results of the well testing conclude that the wells are non-commercial, the well site, campsite and roads will be restored to its original state.

The landowners of the well site and access road were compensated with land purchase price and crop compensation. Of the villagers interviewed, 28% had received compensation from project developments. All of the respondents (100%) who had received compensation were satisfied with the compensation they had received.

The purchase of the land provided a significant financial benefit to landowners. While this land will be temporarily lost from agriculture production. Project operations too may degrade the nearby land and reduce agriculture productivity in those areas (i.e. dust, flares, drainage previously discussed). If hydrocarbon resources are not found the land will be restored to its original state. The impacts from changes in land use to human use values and quality of life values will be local in extent, short term in duration, of medium magnitude. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium.

Given the short-term impact of this aspect and its return to its original state, it is determined to be a positive benefit as a result of the financial benefit to land owners and the community.

The significance of impacts from changes in land use to human use values and quality of life values is ranked as Positive (**Table 6-47**).

Table 6-47: Sigificance Ranking of impacts from changes in land use to human use values and quality of life values

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from construction activities on land use can be mitigated through the use of the following measures:

- Transparent and fair compensation to land owners and users.
- Ensure all permissions are obtained from landowners and local authorities. Provide summary to MOGE.
- Notify surrounding landowners 2 weeks before on location and time of project activities.
- Restoration of land to its original state within 6 months of project completion.

Residual Significance

With these management measures, the residual significance of impacts from changes in land use to human use values and quality of life values will result in a positive financial benefit.

Residual Significance	Positive	Negligible	Low	Medium	High

6.4.4 Traffic

Impact Assessment

Transportation of equipment, people and services will increase traffic volume in the local area of the planned project and may disrupt of community traffic. Transportation during drilling consists of rig mobilization, transport of workers and supplies, transport of industrial water supply and drilling support equipment (Including casing, chemical and etc.).

Transport of the rig and associated equipment to the proposed project area will be by trucks and trailers travelling in convoys The estimated number of round trips for rig equipment is 175 trips (Based on previous onshore campaign by PCMI in 2015). The rig and equipment transportation route is via the Pathein – Monywa Highway Road to Kyangin and then to Myanaung. Then proceed to Well Site area via MOGE road starting from Mingone Junction. The distance from Yangon to Well Site is

418 Km for this route. The type of transportation for equipment is heavy truck with 1-2 day travel duration.

The transportation route for materials and chemicals to the well site is via the Pathein – Monywa Highway Road to Kyangin and then to Myanaung. Then proceed to Well Site area via MOGE road starting from Mingone Junction. The distance from Yangon to Well Site is 418 Km for this route. The type of transportation for equipment is heavy truck with 1-2 day travel duration. The estimated number of round trips for drilling support equipment (Including casing, chemical and etc.) is 100 trips. RHA (Route Hazard Assessment was conducted for transportation of materials and crew from Yangon to the Well site.

The personnel transportation route is via the Yangon – Hinthada Road. The distance from Yangon to the Well Site is 324 km. The type of transportation will include cars and mini bus with 8-10 hour travel duration. The estimated number of round trips for personnel is 100 trips.

The impact of transportation of the project affects the people that use the same route used for the project and around the project area. There will be no restrictions on movement of the local population along the Highway during drilling.

The impacts from increased traffic and traffic disruption to human use and quality of life values will be local in extent, short-term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium. As a result of these impact criteria considerations, significance is ranked as medium.

The Significance of increased traffic and traffic disruption on human use and quality of life values is ranked as medium (**Table 6-48**).

Table 6-48: Sigificance Ranking of impacts from traffic to human use values and quality of life values

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from construction activities on traffic can be mitigated through the use of the following measures:

- Post and enforce speed limit (follow traffic law on highway and community area, 30km/hr on unsealed road).
- Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.

- Consult with local authority before major movement.
- Restrict/ avoid movement of heavy equipment during rush hours.
- Provide traffic signs or flags at junction of access roads and main roads.
- Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.
- Obtain approval from MOGE and appropriate government offices (Forestry Department if forestry land is crossed) before constructing, upgrading or reroute access roads.
- Strictly enforce training programs to reduce transport incident cases by its contractors.
- Restore any damage to roads that is caused by contractors or Company.
- Restrict local traffic on PCMI private access road.
- Ensure all vehicles are left hand drive.

Residual Significance

With these management measures, the magnitude of impacts will be reduced resulting in a residual significance of impacts from increased traffic and traffic disruption on human use and quality of life values that is ranked as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.4.5 Water Use

Impact Assessment

During the construction phase, water use will consist of water for dust suppression and cleaning and potable water for workers. The civil works campsite will be built near the well site construction zone. The camp will include a minimum one (1) Shower per ten men, one toilet per fifteen men and one washbasin per fifteen men. The construction dining unit shall have minimum seating capacity for 20 men at any time. All Camp equipment will be maintained in good condition, clean and has access to a Camp Maintenance Repair man on short notice. The temporary construction sewer pits must be constructed 100 meters from the campsite. The construction of accommodation in the work camp will be in compliance with Requirements of the IFC Guidance on Workers' Accommodation (August 2009).

Access to and availability of water is an important issue to all communities in the Regional Study Area. Community water wells are a critical piece of local infrastructure, and access to water to support domestic and farming requirement is critical.

Maximum daily usage is expected to be 10.4 m^3 per day during drilling (80L/person/day for maximum crew of 120) when the camp is accommodating a full crew. Potable water will be supplied by two deep tube well installed at the campsite. If tube type wells are not successful or water not suitable, water will be sourced and transported by tanker from near by water source as approved by the Local Authorities. Local authorities will be consulted before water hauling. All potable water for showering washing will be put through a filter system with black light and chlorine injection to prevent disease.

It is estimated that a total of 6000 m^3 of industrial grade fresh (non-potable) water will be required during the drilling operation (to be used as makeup water for the drilling mud, cement mixing and losses). Water will be supplied to each well site from two deep tube wells at the well site. If tube type wells are not successful or water supply rate not suitable, water will be sourced and transported by tanker from near by water source. Local authorities will be consulted prior water hauling begins.

The industrial water will be stored on the well site in an in clean water ground storage pit 30 m x 15 m x 4 m deep for a maximum capacity of 1,800 m^3.

The drilling water will be supplied from new water wells to be installed in well pad area (if available). In addition, treated water from the mud cleaning system will be recycled and used to supplement the water required to make up the drilling mud.

All drinking water will be sourced from local retail suppliers. The maximum demand from the operation, estimated to be 200 litres per day, will have a beneficial impact on the local sales of bottled drinking water.

The impacts from water use to human use and quality of life values will be local in extent, medium-term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium. As a result of these impact criteria considerations, significance is ranked as medium.

The Significance of water use on human use and quality of life values is ranked as medium (**Table 6-49**).

Table 6-49: Sigificance Ranking of impacts from water use to human use and quality of life values

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from construction activities on water use will be mitigated through the use of the following measures:

- Obtain local approval for drilling a ground water well.
- PCMI to drill their own ground water wells on site.
- Consult local community leaders and township authorities before water hauling (if required).
- Potable water and industrial water, if taken by tube wells or tanker from nearby reservoirs/rivers, should not affect the availability of water to locals.

With these mitigation measures, the likelihood of impacts from water use is minimized during construction.

Residual Significance

With these management measures, the impact magnitude and duration will be reduced resulting in a residual significance of impacts from water us to human use values and quality of life values that is ranked as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.4.6 Power Use

Impacts Assessment

All power for drilling operations and work camp will be supplied by Project-supplied diesel powered generators. No public power utilities will be required at the drilling site.

No power-use impacts will occur from power use by the project. The camp's 10 KVA diesel-fuelled generators will provide all power for the campsite. Expected fuel consumption is 1.5 m^3 per day during full accommodation. On-site fuel storage capacity will consist of one 25 m^3 tank. Estimated total fuel usage is about 180 m^3 (based on 90 days of drilling and 30 days of well testing).

The impacts from power use to human use and quality of life values will be negligible. Nearby communities are not affected. As a result of these impact criteria considerations, significance is ranked as negligible.

The Significance of power use on human use and quality of life values is ranked as negligible (**Table 6-50**).

Table 6-50: Sigificance Ranking of impacts from power use on human use and quality of life values

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

To prevent and or mitigate power use activities from having any social impacts, the following measures will be implemented:

- Purchase and install diesel-powered generators to supply all project power related needs.

Residual Significance

With these management measures, the residual significance of impacts from power use to human use values and quality of life values is ranked as negligible.

Residual Significance	Positive	Negligible	Low	Medium	High

6.4.7 Water Drainage

Impact Assessment

Surface runoff from roads and campsite will result in increased drainage potentially affecting roads and infrastructure. Vegetation removal, construction of well sites and access roads can alter surface water hydrology by reducing interception, evaporation/ transpiration and infiltration, which in turn can increases runoff and change in local drainage patterns. Heavy rains can intensify changes in surface water hydrology and cause changes in drainage.

Agriculture and water sources around project well sites could be affected from water drainage during construction of the well sites. However, a civil engineering contractor will be hired to survey and upgrade the road. The contracted civil engineer will determine and recommend if culverts or additional ditches are necessary to manage surface water runoff. Local authorities and local landowners will also be consulted to address their requirements for any culverts or ditching to be installed at any point along the road. If culverts are required or requested, the size of culvert to install will depend on the civil engineer's recommendation and/or local authority's recommendation. Generally, culverts in this area are 60 cm in diameter, made of reinforced concrete and purchased prefabricated.

The waste pit will measuring approximately 35 m by 25 m by 4 m deep with a volume of 6,000 m^3. The pit will be lined with a high-density polyethylene (HDPE) 2mm thick impermeable geomembrane liner to form an impermeable barrier. The contaminated runoff water from well site will drain only to the waste pit. The pit will be surrounded by 0.2 m high bund that will help prevent run-off into the environment.

The impacts from surface hydrology and drainage caused by construction of well sites and access roads to human use and quality of life will be local in extent, transient, reversible, short term in duration and of low magnitude. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium. As a result of these impact criteria considerations, significance is ranked as Low.

The Significance Ranking of impacts from surface hydrology and drainage caused by construction of well sites and access roads to human use and quality of life is ranked as Low (**Table 6-51**).

Table 6-51: Significance Ranking of impacts from surface hydrology and drainage caused by construction of well sites and access roads to human use and quality of life

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High

Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from drainage can be mitigated through the use of the following measures:

- Obtain approval from MOGE and appropriate government offices (Forestry Department if forestry land is crossed) before constructing, upgrading or reroute access roads.
- Follow civil engineer's recommendation on well site and access road construction design.
- Avoid construction of well sites and access roads in areas that may cause obstacles to water drainage.
- Water drainage lines (culverts) will be constructed to maintain natural drainage. The required permission will be obtained from all relevant agencies.

Residual Significance

With these management measures, the residual significance of impacts from surface hydrology and drainage caused by construction of well sites and access roads to human use and quality of life is ranked as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.4.8 Wastewater

Impact Assessment

Project operation may affect water quality and has the potential to impact agriculture. Most households are engaged in agriculture. The main agriculture crop in this area is rice (56%), with Beans/Pulses the next most common crop (38%). Corn, sesame and vegetables are also grown in the area.

Accidental release of drill cuttings and drilling mud, spills, overflow of the cuttings and waste pit could affect soil quality and vegetation (agriculture), surface water quality and aquatic biota (aquaculture). Wastewater released from the sites could result in impacts on agriculture crops and river fishing. The nearest water receptors are the community water pond, small peat land area and the Seloatma Stream located within 1 km of the well site.

Impacts on soil, surface water quality, vegetation and aquatic biota from accidental spills are discussed **Section 6.6.4**.

The impacts from wastewater on water quality and its affect on human use and quality of life will be local in extent, short term in duration, reversible and of low magnitude. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium. As a result of these impact criteria considerations, significance is ranked as Low.

The Significance Ranking of impacts from wastewater on water quality and its affect on human use and quality of life is ranked as Low (**Table 6-52**).

Table 6-52: Significance Ranking of impacts from wastewater on water quality and its affect on human use and quality of life

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts of wastewater on agriculture and aquaculture/fisheries can be mitigated through the use of the following measures:

- Avoid construction of the well pads and/or access roads in areas where this would obstruct water drainage.
- Prohibit workers from cleaning machines/equipment in/near a public water source.
- Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.
- Use non-hazardous water-based mud and synthetic based mud system. Inform MOGE in case of change in mud chemicals or type of mud.
- Fuel storage tanks to be surrounded by bund wall.
- Construct drainage system around concrete rig pad and mud tanks to divert any spills into waste pit.
- Monitor level of cuttings and dirty water in waste pit.
- Isolate any area(s) that might be contaminated from non-contaminated areas. Provide water drainage system around the contaminated area for collecting water into the sump pit or for treatment.
- Construct oil traps along perimeter drainage ditch to prevent any spills from flowing off site.
- Store all chemicals in secured storage area with impervious (cement or plastic sheet) floor and bund wall. Handle all chemicals according to their MSDS.
- Use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious surfaces (i.e. on tarpaulin sheet).
- Provide spill cleanup kits and training for designated rapid response teams to clean up any spills.
- In the event of oil or chemical spill, implement spill response plan.
- Install septic tanks for holding sewage and grey water.

- Pump septic tank fluids to DOWA sewage treatment plant on a regular basis to prevent overflow.

Residual Significance

With these management measures, the residual significance of impacts from wastewater on water quality and its affect on human use and quality of life will be ranked as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.4.9 Waste Management and Disposal

Impact Assessment

Disposal of waste in project area may overload local disposal infrastructure. Waste from the construction phase consists of: domestic waste, such as food scraps, plastic packaging, paper, cardboard, tin cans and glass, and industrial waste, such as wooden cases, large glass containers, metal items, plastic and metal drums and containers, plastic and cardboard packaging.

General waste will be separated on-site to facilitate recycling. Domestic and general waste should be segregated and stored using suitability labelled containers to ensure safe collection segregation and handling of all waste streams generated. This waste will be stored in appropriate containers to be transported off site for recycling, reuse, treatment and/or disposal. It is estimated that the well site will generate between 1 and 10 tonnes of "domestic" waste and 1 to 40 tonnes of "industrial" waste per month. It is estimated that the accommodation campsite will generate between 1 and 4 tonnes of "domestic" waste per month. All solid general waste will be sent for recycling or disposal to at the DOWA Waste Management Facility.

The well site and accommodation campsite combined will generate a low volume of hazardous waste, estimated to be between 2 and 5 tonnes per month. The drilling contractor is to ensure appropriate and safe storage until this waste is picked up by the waste transporter and taken to the DOWA Waste Management Facility.

All materials brought onto the well site and accommodation campsite will be logged and the relevant supplier or contractor will identify all sources of potential toxic waste. Equipment or materials containing heavy metals, such as batteries, will be identified and a special container designated for their disposal as waste. All used chemical and lubricant containers will be collected in separate containers.

The impacts from waste management and disposal and its affect on human use and quality of life will be local in extent, medium term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of impacts from waste management and disposal and its affect on human use and quality of life is ranked as Medium (**Table 6-53**).

Table 6-53: Significance Ranking of impacts from waste management and disposal and its affect on human use and quality of life

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km

Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from activities required for waste management can be mitigated through the use of the following measures:

- Provide septic tank for sewage.
- Ensure treatment and disposal according to accepted international standard. Keep waste manifest.
- Enforce "Good Housekeeping" practices.
- Segregate and store waste in appropriate, secure properly labelled containers.
- Dispose of waste in labelled containers for possible recycling.
- Implement requirements for waste management and related laws.
- Store hazardous waste in appropriately designed areas and safe containers that are suitable for transporting/transferring.
- Always check and record the type(s) and amount of waste generated.
- Provide Waste Manifest System.

Residual Significance

With these management measures, the magnitude and duration of impacts will be reduced resulting in a residual significance of impacts from waste management and disposal and its affect on human use and quality of life that is ranked as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.4.10 Tourism and Recreational Experience

Impact Assessment

Project operation effects on tourism and recreation may reduce the tourism and recreational experience.

As this area is a restricted area, little tourism and recreation currently exists. The project well sites will not directly affect tourism and recreation through either land use changes. The main potential impacts would be increased traffic activity on major corridors that has been ranked as a Low Residual Risk.

The impacts from project effects impact on tourism and recreation experience and its affect on human use and quality of life will be local in extent, short term in duration, reversible and of low magnitude. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium. As a result of these impact criteria considerations, significance is ranked as Low.

The Significance Ranking of impacts from project effects impact on tourism and recreation experience and its affect on human use and quality of life is ranked as Low (**Table 6-54**).

Table 6-54: Sigificance Ranking of impacts to from project effects impact on tourism and recreation experience and its affect on human use and quality of life

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from project activities on tourism and recreation can be mitigated through the use of the transportation mitigation measures:

- Post and enforce speed limit (follow traffic law on highway and community area, 30km/hr on unsealed road). Consult with local authority before major movement.
- Consult with local authority before major movement.
- Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.
- Restrict/ avoid movement of heavy equipment during rush hours.
- Provide traffic signs or flags at junction of access roads and main roads.
- Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.
- Obtain approval from MOGE and appropriate government offices (Forestry Department if forestry land is crossed) before constructing, upgrading or reroute access roads.
- Strictly enforce training programs to reduce transport incident cases by its contractors.
- Restore any damage to roads if caused by contractor or company.
- Restrict local traffic on PCMI private access road.
- When project complete, promptly (within 6 months) restore land to its original state.

Residual Significance

With these management measures, the residual significance of impacts from project effects impact on tourism and recreation experience and its affect on human use and quality of life values will result in a positive financial benefit.

Residual Significance	Positive	Negligible	Low	Medium	High

6.4.11 Employment and Income

Impact Assessment

Project employment and business opportunities will increase jobs and related income for local communities.

During construction, 60 – 80 workers will be employed and supplies (such as laterite, selected fill material, fuel, water) and services (accommodation, waste management) will be required. The composition of the crew will depend on actual contracting companies, most of which will be Myanmar subsidiaries of international companies. An onsite camp will be developed for workers.

During drilling, around 100-120 workers will be employed and supplies (such as fuel and water) and services (accommodation, waste management) will be required. Most of the workers are expected to be experienced drillers and rig crews, not locally available.

IEM surveyed 111 households in this region. Results indicated 25% of respondents earned between 1,00,001-2,000,000 Kyats; 24% earning above 5,000,000 kyats; and 20% earning between 3,000,000 – 5,000,000 kyats:

Of those interviewed, 54% considered oil and gas drilling to be important to the community. When asked what positive impacts from the project did they anticipate, the Villagers response included: increased employment (32%), increased annual income (34%), and improved living infrastucture (21%).

PCMI has a policy to encourage the hiring of local staff and contractors. Advance meetings with local authorities on approaches to hiring will help PCMI design hiring to maximise the positive effects and limit the loss of labour availability to local businesses at critical times (i.e. harvest).

The impacts from employment and income from the project and its affect on human use and quality of life will be local in extent, short term in duration, reversible and of low magnitude but positive. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium. As a result of these impact criteria considerations, significance is ranked as Positive.

The Significance Ranking of impacts from employment and income from the project and its affect on human use and quality of life is ranked as Positive (**Table 6-55**).

Table 6-55: Sigificance Ranking of impacts to employment and income from the project and its affect on human use and quality of life

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km

Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from project activities on the socio-economy are positive and can be further enhanced by the following measures:

- Meet with local authorities to discuss and design local employment hiring to limit impacts on local businesses and key agricultural seasons.
- Employ qualified local workers.
- Purchase local supplies and services, whenever possible.
- Host a pre-project local community awareness program with communities to facilitate awareness of opportunities and benefits.
- Terms of contract for recruitment of manpower in these companies needs to include emphasis on hiring locals, especially for unskilled and semi-skilled workforce.

Residual Significance

With these management measures, the residual significance of impacts from impacts to employment and income from the project and its affect on human use and quality of life will be a positive.

Residual Significance	Positive	Negligible	Low	Medium	High

6.4.12 Labour In-Migration

Impact Assessment

In-migration of labour and social interaction may result in conflict between workers from other regions and local communities.

During construction, 60 – 80 workers will be employed and supplies (such as granular fill, fuel, water) and services (accommodation, waste management) will be required. The composition of the crew will depend on actual contracting companies, most of which will be Myanmar subsidiaries of international companies. An onsite camp will be developed for workers.

During drilling, around 100-120 workers will be employed and supplies (such as fuel and water) and services (accommodation, waste management) will be required. Most of the workers are expected to be experienced drillers and rig crews, not locally available.

The baseline household survey showed that:

- 92% felt that larger projects (including oil and gas and infrastructure projects) had not affected labour availability for traditional businesses

- 75% are not concerned about worker in migration, 22% of the participants are a little worried, while 3% are very worried.
- 47% were unaware of negative impacts, while 26% are concerned about health, and 18% are concerned about possible environmental pollution.

The receptors of impact from the project are:

- businesses that trade and provide services near the project area and people who live in the surrounding area. The project would provide opportunities for additional work and business.
- businesses and trade who lose access to employees and contractors during the construction phase.
- vulnerable social and ethnic groups who are exposed to migrant project employees and contractors. The surveys indicated that Groups of possible concern are children (45%), women (39%) and unskilled workers / religious minorities (1%).

PCMI has a policy to encourage the hiring of local staff and contractors. Hiring local provides opportunities for local communities while reducing increased levels of migrant worker interaction. Advance meetings with local authorities on approaches to hiring will help PCMI design hiring to maximise the positive effects and limit the loss of labour availability to local businesses at critical times (i.e. harvest).

Pre-project awareness programs with migrant workers on local community, social and ethnic group sensitivities will help create increased understanding and, where advisable, limit interactions during project construction.

The impacts from labour in-migration and its affect on human use and quality of life will be local in extent, short term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium.

The Significance Ranking of impacts from labour in-migration and its affect on human use and quality of life is ranked as Medium (**Table 6-56**).

Table 6-56: Sigificance Ranking of impacts from labour in-migration and its affect on human use and quality of life

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from project activities on employment and income can be further enhanced by the following measures:

- Meet with local authorities to discuss and design local employment hiring to limit impacts on local businesses and key agricultural seasons.
- Employ qualified local workers.
- Purchase local supplies and services, whenever possible.
- Host a pre-project local community awareness program with migrant workers to facilitate sensitivity and limit interactions, where advisable, between migrant workers and local communities.
- Restrict workers to within project boundaries and do not allow local interaction within the communities.

Residual Significance

With these management measures, the residual significance of impacts from labour in-migration and its affect on human use and quality of life will be ranked as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.4.13 Historical, Archaeological and Cultural Resources

Impacts Assessment

Potential impacts to the local historical, archaeological and cultural resources during the construction phase include possible damage or demolition of historical buildings or archaeological sites during construction of the access roads, camp site and well sites. The Historical, Archaeological and Cultural Resources site assessment and the Myanaung GAD confirmed that no sites are located within the project area and there is no regional historical office in Myanaung Township. Of the households surveyed, 94% of them don't know of important cultural, historic and religious sites around their community. Villagers felt that local cultural, historic and religious sites are not adequately protected (89%).

The well site land is currently paddy agricultural field and no cultural or historic site was identified in the site assessment. Therefore, construction activities will not disrupt any culturally important activities or cause any damage to the archaeological resources. However, there is a very small chance that unknown and prehistoric communities existed in the area and additional artefacts may be recovered during construction of the well sites and access roads. If any artefact is found, then work will be stopped and PCMI will inform the Myanaung GAD for further action before proceeding with operations.

The impacts on local historical, archaeological and cultural resources during the construction and its affect on human use and quality of life will be local in extent, long term in duration, reversible and of low magnitude. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated low. As a result of these impact criteria considerations, significance is ranked as low.

The Significance Ranking of impacts on local historical, archaeological and cultural resources during the construction and its affect on human use and quality of life is ranked as Low.

Table 6-57: Sigificance Ranking of impacts to local historical, archaeological and cultural resources during the construction and its affect on human use and quality of life

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

Impacts from construction activities on historical, archaeological and cultural resources can be mitigated through the use of the following measures:

- Watch for artefacts during site construction and inform the Local Authorities before commencement of drilling.
- Report to the Myanaung GAD if any archaeological evidence is discovered at the well sites or access roads. Through consultation, a plan to proceed will be developed.
- If artefacts are found during the construction phase, PCMI will inform the responsible local office immediately.
- Consult with local authorities to identify culturally important festivals and plan transportation, construction and drilling activities to avoid impact.
- Review any records for site-specific location.
- Monitor earthworks during construction using qualified/trained inspector.

Residual Significance

With these management measures, the duration of impacts will be reduced resulting in a residual significance of impacts on local historical, archaeological and cultural resources during the construction and its affect on human use and quality of life will be ranked as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.5 Exploration Drilling Health Impact Assessment

The HIA assesses the significance of potential health impacts on the community around the well site, and on occupational health. The Risk Ranking of impacts is considered from various factors such as type of threat, environmental factor, health status, impact on medical services and livelihood.

Health impacts for key issues, which are obtained from the screening procedure, are assessed.

The Health Impact Assessment (HIA) for this hydrocarbon development project is carried out following the methodology outlined at the beginning of **Chapter 6**.

This follows the same sequence that is used for both environmental and social impact assessments. In addition potential factors for determining scope and type of health impact include: hazardous chemicals or health threats, environment, factors of exposure, health impact, impacts on medical services and impacts on society and lifestyle. Details are shown in **Table 6-58**.

Table 6-58: Factors for Determining Scope and Type of Health Impact

Factor	Detail
Hazardous Chemicals or Health Threats	• Chemicals: heavy metals, toxic organic compounds. • Physical: noise and vibration • Biological: virus, bacteria. • Ergonomic: lifting of heavy material and inappropriate posture • Psychological: stress, annoyance, and nuisance • Social: lack of community relationship
Environment	• Change of environment quality: water quality, air quality • Change of utilization or acquiring resources: water use • Physical: noise, dust, radius, vibration
Factors of Exposure	• Exposure pathway: mouth or skin • Risk group: workers or people around the project area
Health Impact	• Death rate • Injury rate from infectious diseases or non-infectious diseases, acute or chronic effect • Rate of emotional impact, stress • Injuries and accidents • Impacts on next generation • Impacts on high-risk groups • Stimulate or enhance the severity of the disease • Cumulative impacts
Impacts on Medical Services	• Overall increase in demand for health care • Demand for special health care • Changes of existing medical services
Impacts on Society and Lifestyle	• Impacts on income, employment, and socio-economics • Impacts on local income, industrial sector and local agriculture • Impacts on migration and settlement • Impacts on environmental health • Impacts on society, culture, and lifestyle. • Impacts on education • Impact on social support network • Benefits to health from project operation

Stakeholder participation through meetings with local communities and relevant agencies is an integral part of the HIA process: it provides local communities and relevant agencies an opportunity to participate and provide their comments before project implementation.

The aim of screening and scoping was to identify and prioritize health-related issues and areas of concern considered most important. The study area boundary for the HIA varies based on the issues being examined:

Area Scoping

- Occupational health impacts will be limited to the well sites, worker camp and transportation activities.
- Assessment on community health impacts will be initially determined within a 1-km radius boundary of the well sites. This is in line with the ESHIA, where communities within a 1-km radius are considered as sensitive receptors.
- Transportation impacts on communities will be studied along local transportation routes in the project area within 5 km of the well site.

Project activities may affect the health of communities and workers. Project activities in each phase, such as the transportation of equipment/machines during construction phase, rig mobilization, installation, drilling phase, well testing and well abandonment, may cause acute or chronic impact to the health of workers and communities. However, the duration of each activity is short. For the well site and both wells, the construction phase is 2.5 months, the drilling phase is 90 days, well testing is 30 days and well abandonment and site restoration is 30 days. The total estimated time is about 10.5 months.

Project scoping identifies project activities with the potential to impact health from various factors: type of threat (chemical, physical, biological); environment; factors of exposure (population at risk, worker and public exposure); type and nature of impact (acute/chronic, direct/indirect, cumulative); and impact on medical services, socio-economics, and livelihood. The potential health aspects identified for each project phase are presented in **Table 6-59**.

Table 6-59: Health Aspects by Project Phase

Health Aspects	Site Construction	Exploration Drilling & Testing	Restoration and Abandonment
Dust	✓	✓	✓
Noise	✓	✓	✓
Accidents	✓	✓	✓
Non-Hazardous Waste	✓	✓	✓
Hazardous Waste	✓	✓	✓
Mud Chemicals and Drilling Waste		✓	
Communicable Diseases	✓	✓	✓
Light and Heat	✓	✓	✓
Flare Emissions		✓	

The health impact assessment for this project considers:

- Project information and environment setting (**Chapter 4** and **Chapter 5**) that include health profiles, attitude surveys and sensitive groups.
- Assessment and rating of health impacts. The Health Impact Assessment for this project uses a Risk Assessment Matrix considering the probability and severity of the health impact.
- Probability score is assigned by considering past data and calculating the probability based on existing information on health threats.
- Severity rating is assigned by evaluating the Risk Ranking of possible heath impacts, either by an assessment of the impact or considering a worst-case scenario.
- The Risk Ranking rating of health impacts is determined using the probability and severity of a particular health impact in the health matrix. If the Risk Ranking of risk is rated as medium, suitable management or mitigation measures must be set to minimize impacts. If the significance of risk is rated as high, specific mitigation measures must be adopted to reduce the impacts to an acceptable level.

Potential health aspects are assessed below. The assessment of each aspect includes the following components:

- Description of the source and characteristic of the potential impacts.
- Identification of receptors sensitive to potential impacts.
- Description and evaluation of potential impacts.
- Identification of management measures to reduce potential impacts.
- A determination of the residual significance after management measures is included.
- An aspect summary assessment table.

6.5.1 Dust

Impact Assessment

During the construction phase, new access roads and the well site will be constructed, while some sections of roads will be upgraded. Granular fill transport and construction activities may increase dust concentrations in air. The types of equipment used during construction include ten wheel dump trucks, graders, rollers and water trucks. The construction time will be 2.5 months for the well site.

The potential health effects of dust are closely related to particle size. Particle sizes are normally measured in microns, and the size range of airborne particles is typically from less than 0.1 microns up to about 500 microns, or half a millimetre. Human health effects of airborne dust are mainly associated with particles less than about 10 microns in size (PM_{10}), which are small enough to be inhaled. Nuisance effects can be caused by particles of any size, but are most commonly associated with those larger than 20 microns.

Many forms of dust are considered to be biologically inert, and hence the primary effects on people relate to our sense of aesthetics. There can also be minor health effects, such as eye irritation, when the dust is airborne. Indirect stress-related health effects could also arise, especially if dust problems are allowed to persist for an unreasonable length of time.

Some nuisance dust may have the potential to cause other types of health effects because of the presence of specific biologically active materials. For instance, some mineral dusts contain quantities of quartz, which can cause the lung disease known as silicosis when persistent at high concentrations. Other dusts may contain significant amounts of toxic metals such as mercury or lead.

There is also the potential for contamination of roof-collected water supplies. Dusty conditions can also affect people's ability to enjoy their outdoor environment. For most people, a major effect of a dust nuisance problem is annoyance at the increased requirement for cleaning.

Airborne dust can have effects on visibility, although dust is usually less regionally significant. Visibility effects from dust are usually only a concern in the immediate vicinity of a specific source. Visibility effects are largely a matter of aesthetics. However, it should also be recognised that visibility is one of the main ways by which people commonly judge air quality. Loss of visibility is also a safety concern under extreme conditions, especially for road traffic.

Dust may result in respiratory irritation of construction workers and respiratory irritation and worsen asthma of people living nearby. Dust levels during construction were evaluated in **Section 6.3.3.1**. Baseline levels of TSPM did not meet the WHO guideline in all villages. Dust calculations in **Section 6.3.3.1** indicate that construction of access roads to well sites could increase dust levels further beyond the ambient air standard. The ambient air standard is set to protect public health.

The health impacts from dust will be local in extent, short term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of health impacts from dust is ranked as Medium (**Table 6-60**).

Table 6-60: Sigificance Ranking of health impacts from dust

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

PCMI will implement the following mitigation measures to reduce dust dispersion:

- Spray water on un-surfaced access roads of project transportation route during dry conditions at least twice a day (morning and afternoon).
- Post speed limits on project access route and limit vehicle speed to 30 km/h on un-surfaced roads.
- Use vehicles with dust flaps.
- Cover loose dry loads.

Residual Significance

With the implementation of management measures, the magnitude of impacts will be reduced resulting in a residual significance of health impacts from dust being ranked low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.5.2 Noise

Impact Assessment

During the construction and rehabilitation phase, noise will primarily be generated from project vehicles for transportation of granular fill, workers, construction equipment, generators and the drilling rig. During the drilling phase, noise will primarily be generated from the drilling rig and generators.

Construction is expected to result in nuisance noise at some communities but is not expected to exceed the ambient noise standard (See **Section 6.3.4.1**).

Transport of road fill and the drilling rig will be on local roads. Heavy trucks are expected to emit noise levels of 88 dB (A) at 50 ft. from the source. Houses are located approximately 50 m away from the road. Using **Equation 6-5**, the noise calculated for these houses is approximately 77.7dB (A). The impact however takes place only during the time the truck passes the house. Ambient noise standards do not apply for this type of noise.

Noise levels from construction equipment do not exceed the 90 dB (A) noise standard in the workplace for an 8-hr exposure time. However, a combination of several construction machines could result in a compounded noise level 91 dB (A), exceeding the workplace standard.

The noise levels estimated at communities assumed a worst-case scenario of hemispherical spreading with no attenuation from the surrounding area. However, the presence of trees, vegetation, and the topography will attenuate the noise levels.

Drilling is expected to result in nuisance noise at some communities but not exceed the ambient noise standard (See **Section 6.3.4.2**).

Noise levels from drilling equipment and generators do not exceed the 90 dB (A) noise standard in the workplace for an 8-hr exposure time. In addition, the compounded noise level of the drilling rig and two generators. (87.5 dB (A), does not exceed the workplace standard).

The health impacts from noise will be local in extent, short term in duration, reversible and of low magnitude. The impact disturbs an area currently used for agriculture located within 1 km of local communities; the sensitivity of the receptor or resource is rated medium. As a result of these impact criteria considerations, significance is ranked as Low.

The Significance Ranking of health impacts from noise is ranked as Low (**Table 6-61**).

Table 6-61: Sigificance Ranking of the Health Impacts from Noise

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr

Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

PCMI will implement the following mitigation measures to reduce noise impacts:

- Limit vegetation removal to a minimum.
- Schedule operation of noisy construction equipment at different times.
- Ensure use of mufflers on diesel/gas driven machinery and vehicles.
- Ensure all machinery and vehicles are properly maintained and serviced as per maintenance schedule recommended by manufacturer.
- Provide earplugs to drilling workers.
- Select drill site locations at safe distances from nearest community (a minimum of 500 m).
- Should complaints over noise be received, consideration will be given to the provision of noise barriers.

Residual Significance

With the implementation of management measures, the residual significance ranking of the health impacts from Noise is Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.5.3 Non-Hazardous Waste

Impact Assessment

Non-hazardous wastes during drilling include food waste, paper, plastic and wooden packaging, rags, glass, metal and plastic drums, sacks, and scrap metal. General waste will be separated on-site to facilitate recycling. Domestic and general waste should be segregated and stored using suitability labelled containers to ensure safe collection segregation and handling of all waste streams generated. This waste will be stored in appropriate containers to be transported off site for recycling, reuse, treatment and/or disposal. It is estimated that the well site will generate between 1 and 10 tonnes of "domestic" waste and 1 to 40 tonnes of "industrial" waste per month. It is estimated that the accommodation campsite will generate between 1 and 4 tonnes of "domestic" waste per month. All solid general waste will be sent for recycling or disposal to at the DOWA Waste Management Facility.

Solid wastes may impact physical health, mental health, and quality of life: for example, food remains cause foul smell, unpleasant ambience, act as a fire hazard and provide habitat for disease carriers including bacteria, flies and rats. This increases the chance of bringing diseases to local people. Myanmar is a tropical country prone to vector borne disease outbreaks, such as gastrointestinal

diseases and dengue and malaria. In 2016, over 36,749 cases were reported as malaria by Basic Health Staff reporting.[4] Dengue and dengue haemorrhagic fever cases have seasonal epidemics; it is a leading cause of morbidity in Myanmar with 24,700 cases report in 2013.[5] Due to inadequate facilities, the number illnesses due to lack of water supply and sanitation in Myanmar for 2013 are as follows: 49,799 reported cases of diarrhea, 77,964 cases of Gastritis and Duodenitis. Statistics indicate that the situation of communicable vector-borne disease in the project districts is a public health concern.

The health impacts from non-hazardous waste will be local in extent, medium term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of health impacts from non-hazardous waste is ranked as Medium (**Table 6-62).**

Table 6-62: Sigificance Ranking of Health Impacts from Non-Hazardous Waste

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

PCMI will implement the following mitigation measures to reduce impacts from non-hazardous waste:

- Provide septic tank for domestic sewage.
- Ensure treatment and disposal according to accepted international standard.
- Keep waste manifest.
- Enforce "Good Housekeeping" practices.
- Segregate non-hazardous and hazardous waste, store each type of waste in closed containers and make sure all containers are clearly labeled.

[4] Public Health Statistics (2014 - 2016), Ministry of Health and Sport, 2017

[5] Annual Hospital Statistics Report 2013, Department of Public Health in collaboration with Department of Medical Services

- Dispose of waste in labelled containers for possible recycling.
- Implement requirements for waste management and related laws.
- Store hazardous waste in appropriate and safe containers that are suitable for transporting/transferring.
- Always check and record the type(s) and amount of waste generated.

Residual Significance

With the implementation of management measures, the magnitude and duration of impacts will be reduced resulting in a residual significance of the health impacts from non-hazardous waste being ranked as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.5.4 Mud, Chemicals and Drilling Waste

Impact Assessment

The Drilling Program for this project will use water-based drilling mud.

All components of the drilling mud are classified as non-hazardous with the exception of eight chemicals: Soda Ash (sodium carbonate), Caustic Soda (sodium hydroxide), Break-Free NW, Calcium Carbonate, Glutaraldehyde, HYDRO-BUFF, HYDRO-CAP L and OX-SCAV. The available workplace standards are shown in **Table 6-63**.

Table 6-63: Permissible Exposure Limits (PEL) over 8-hour TWA

Chemicals	Permissible Exposure Limit (8-hr TWA)	PPE Requirements
Soda Ash (sodium carbonate)	The following materials had no OELs on our records	**RESPIRATOR** In case of inadequate ventilation wear respiratory protection **EYE** Safety glasses with side shields; or Chemical goggles **HANDS/FEET** Neoprene gloves.Wear chemical protective gloves, eg. PVC. **OTHER** Eyewash unit
Caustic Soda (sodium hydroxide),	2 mg/m^3 (WEL-TWA, respirable dust)	**RESPIRATOR** (APF = 50) Any air-purifying, full-face piece respirator with an N100, R100, or P100 filter **EYE** Chemical goggles **HANDS/FEET** DO NOT handle directly. Wear gloves and use scoop / tongs / tools. Elbow length PVC gloves. **OTHER** Overalls, P.V.C. apron, Eyewash unit
Break-Free NW	50 mg/m^3 (WELs)	**RESPIRATOR** Type A Filter of sufficient capacity **EYE** Safety glasses with side shields; or as required, - Chemical goggles. **HANDS/FEET** Neoprene gloves.Wear chemical protective gloves, eg. PVC.

		OTHER Overalls, P.V.C. apron.
Calcium Carbonate	4 mg/m^3 (WEL-TWA, respirable dust)	**RESPIRATOR** Particulate **EYE** Safety glasses with side shields; or Chemical goggles **HANDS/FEET** Wear chemical protective gloves **OTHER** Overalls, Eyewash unit
Glutaraldehyde	0.2 mg/m^3 (WEL-TWA)	**RESPIRATOR** Type A Filter of sufficient capacity **EYE** Chemical goggles. **HANDS/FEET** Elbow length PVC gloves. When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots. **OTHER** Overalls, P.V.C. apron
HYDRO-BUFF	7.5 mg/m3 (AUS-TWA)	**RESPIRATOR** Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant **EYE** Chemical goggles. Full face shield may be required for supplementary but never for primary protection of eyes **HANDS/FEET** Wear chemical protective gloves, eg. PVC. Wear safety footwear or safety gumboots, eg. Rubber. When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots. **OTHER** Overalls, PVC Apron, Eyewash unit
HYDRO-CAP L	The following materials had no OELs on our records	**RESPIRATOR** Type A Filter of sufficient capacity **EYE** Safety glasses with side shields, Chemical goggles. **HANDS/FEET** Barrier cream, Nitrile gloves / Polyethylene gloves, Safety footwear. **OTHER** Overalls, Eyewash unit
OX-SCAV	10 mg/m3 (AUS-TWA - ammonium bisulfite dust) 5.2 mg/m3 (AUS-TWA -sulfur dioxide)	**RESPIRATOR** Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant **EYE** Safety glasses with side shields, Chemical goggles. **HANDS/FEET** Wear chemical protective gloves, Wear safety footwear. **OTHER** Overalls, Barrier cream, Eyewash unit.

Source: 1. MSDS

Mud chemicals and drilling waste may impact community health should spillage contaminate soil, surface water or groundwater. Health may be impacted by accumulation of contaminants in the body if contaminated water is consumed and may cause irritation if used for bathing and washing. Local communities in the vicinity of the project site, particularly people who use and consume local water resources are potentially at risk. In addition, the public is concerned about chemicals and drilling waste.

Potential exposure to chemicals under normal conditions is limited to workers within the well site boundary. Workers can be exposed to the chemicals through the following exposure routes: inhalation, dermal or eye contact, and ingestion. However, accidental spills (including during transport) and leaks may release chemicals and drilling waste into the environment and impact nearby community health or contaminate their water and land resources.

Impacts from mud chemicals and drilling can have minor health effects, which are reversible e.g. skin irritation, food poisoning for occupational health; and for community health, extent of health effect limited to rare individual cases within worker and/or local community.

The health impacts from mud chemicals and drilling waste will be local in extent, medium term in duration, reversible and of medium magnitude. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of health impacts from mud chemicals and drilling waste is ranked as Medium (**Table 6-64**).

Table 6-64: Sigificance Ranking of health impacts from mud chemicals and drilling waste

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

PCMI will implement the following mitigation measures to reduce impacts from mud chemicals and drilling waste:

- Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil.
- Use non-hazardous water-based mud system. Inform MOGE in case of change in mud chemicals.
- Construct drainage system around concrete rig pad, mud tanks and pumps, cement units, generators and solid control equipment to divert any spills into the waste pit.
- Store all chemicals in secured storage area with impervious (cement or plastic sheet) floor and bund wall. Handle all chemicals according to its MSDS.
- Provide spill clean up kits and training for designated rapid response teams to clean up any spills.

- In the event of chemical spill, implement spill response plan.
- Implement transportation plan.
- Cement steel casing in place.
- Implement awareness training on the hazards of the chemicals.
- Enforce use of PPE, such as dust masks or respirators, gloves, overalls, and eye glasses.
- Handle chemicals only in well-ventilated and controlled areas.

Residual Significance

With the implementation of management measures, the magnitude and duration of impacts will be reduced resulting in a residual significance of the health impacts from mud chemicals and drilling waste being ranked as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.5.5 Hazardous Chemicals and Waste

Impact Assessment

Drilling activities will generate a low volume of hazardous waste including lubricating and hydraulic oil, rags and other materials contaminated with chemicals, and drums and containers used for chemical transportation and storage. The well site and accommodation campsite combined will generate a low volume of hazardous waste, estimated to be between 2 and 5 tonnes per month. The drilling contractor is to ensure appropriate and safe storage until this waste is picked up by the waste transporter and taken to the DOWA Waste Management Facility.

Community health may be impacted through spills and subsequent contamination of soil, surface and groundwater resources. Consumption of such water may result in bioaccumulation of contaminants and various health impairments. Bathing and washing in it may cause skin irritation. Indirect public health impacts could occur through soil contamination by oils, chemicals and the bioaccumulation of heavy metals impacting crop yields and food quality. Worker health is affected in similar ways. Because workers are closer to and handle hazardous waste, the likelihood of exposure is higher of workers than for the public.

Any spills on the drill pad would be directed into the waste pit. An oil trap will prevent oil from flowing into the waste pit. The site will have spill kits available to be used if any accidental spill happens during operations. The mud chemicals are all dry powder so spill or leakage is low, spill kits will be used for any oil or liquid spills.

Impacts from hazardous chemicals and waste may affect both occupational health and community health, and are considered to be local in Extent, of medium term duration, reversible over time, and of medium magnitude. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of health impacts from hazardous chemicals and waste is ranked as Medium (**Table 6-65**).

Table 6-65: Sigificance Ranking of impacts from hazardous chemicals and waste

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

PCMI will implement the following mitigation measures to reduce impacts from hazardous waste:

- Segregate and store hazardous chemicals and waste in appropriate, labelled and safe containers that are suitable for transporting/transferring. Containers having hazardous waste must be kept in safe areas.
- All hazardous waste will be collected in skips ready for treatment and disposal and sent directly to DOWA waste disposal facility.
- Provide Manifest System for transportation of hazardous waste to treatment area or disposal area.
- Always check and record the type(s) and amount of hazardous waste generated.

Residual Significance

With the implementation of management measures, the magnitude and duration of impacts will be reduced resulting in a residual significance of the health impacts from hazardous chemicals and waste including materials contaminated with oil or chemicals, lubricating and hydraulic oil, drum and containers used for chemical transportation and storage being ranked as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.5.6 Communicable Diseases

Impact Assessment

Drilling activities will require 100 to 120 workers. Because these are specialized positions, most of these workers will temporarily move into the area. Experiences from other parts of the world have shown that oil and gas development activities introduced or increased incidence of communicable diseases, such as HIV/AIDS and malaria, in communities where these projects are located. Although the PCMI project is not a large-scale development, the influx of outside workers could contribute to proliferation of communicable diseases in local communities.

The structures at the project well sites can conceivably contribute to vector-borne diseases such as malaria, dengue by providing breeding grounds for mosquitoes if they are not properly maintained. These structures include a perimeter drainage trench and an intermediate drainage trench and the high-density polyethylene (HDPE) 2 mm thick impermeable geomembrane lined waste pit. Unhygienic practices in the work place may also promote spread of gastrointestinal diseases amongst project employees.

The potential health impacts from an influx of workers could contribute to proliferation of communicable diseases in local communities and the work force.

National statistics on HIV/AIDS are provided in **Table 6-66**. Detailed information on HIV/AIDS is limited.

Table 6-66: National HIV/AIDS Statistics[6]

Number of people living with HIV	230 000 [200 000 - 260 000]
Adults aged 15 to 49 prevalence rate	0.8 [0.6 - 0.9]
Adults aged 15 and up living with HIV	220 000 [190 000 - 250 000]
Women aged 15 and up living with HIV	81 000 [71 000 - 91 000]

In 2016, over 36,749 cases were reported as malaria by Basic Health Staff reporting.[7] Dengue and dengue haemorrhagic fever cases have seasonal epidemics; it is a leading cause of morbidity in Myanmar with 24,700 cases report in 2013.[8] Due to inadequate facilities, the number illnesses due to lack of water supply and sanitation in Myanmar for 2013 are as follows: 49,799 reported cases of diarrhea, 77,964 cases of Gastritis and Duodenitis. Statistics indicate that the situation of communicable vector-borne disease in the project districts is a public health concern. Most surveyed respondents claimed to have slept under a mosquito net the previous night.

Impacts from communicable disease may affect both occupational health and community health, and are considered to be local in extent, medium term duration, reversible over time, and of medium magnitude. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium. As a result of these impact criteria considerations, significance is ranked as Medium.

[6] UNAIDS Myanmar Statistics, 2016. Accessed on Feb 15th from http://www.unaids.org/en/regionscountries/countries/myanmar

[7] Public Health Statistics (2014 - 2016), Ministry of Health and Sport, 2017

[8] Annual Hospital Statistics Report 2013, Department of Public Health in collaboration with Department of Medical Services

The Significance Ranking of health Impacts from communicable disease is ranked as Medium (**Table 6-67**).

Table 6-67: Sigificance Ranking of Impacts from Communicable Disease

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

PCMI will implement the following mitigation measures to reduce the spread of communicable diseases:

- Implement mitigation measures listed for non-hazardous waste (**Section 6.5.3**).
- Clearing of overgrowth in perimeter.
- Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil.
- Keep waste manifest.
- Drainage and removal of waste from waste pit upon completion of drilling.
- Health screening of workers before employment.
- On-site health clinic (drilling operations) and referral system during all of project operations with external health agencies to ensure timely diagnosis and treatment of workers' illness and injury.
- Maximize hiring of qualified local workers to reduce reliance on outside labour and increase local employment.
- Do not allow workers to enter communities near the drill site.
- Provide awareness to workers on preventive measures for the prevention of communicable and local diseases.

Residual Significance

With the implementation of management measures, the magnitude and duration of impacts will be reduced resulting in a residual significance of the health Impacts from communicable disease that is ranked as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.5.7 Light and Heat

Impact Assessment

Testing will be conducted for those exploration wells showing promising hydrocarbon presence. During the well testing process (15 days/well), flaring will create high temperatures near the flare. Flaring during well testing will constitute a potentially significant light source where gas will be burnt off via a flare stack. The flare stack will be a horizontal flare directed into a protected flare pit to ensure the safety of workers at the well site and to reduce heat / light radiation. The nearest community is expected to be located more than 500m away (for all the proposed well sites); thus, impact from light and heat from the flare stack will be minimal.

Residents close to the well testing sites will be affected from flaring, mainly through disturbance of psychological wellbeing and annoyance if the flare is visible. However the flare will not be an issue if hydrocarbons are not found, and if found the testing phase will last only 15 days per well.

Workers could however be affected by heat from the flare. An assessment of heat impacts was done in **Section 6.3.6**. According to **Table 6-35** the safe distance for continuous exposure without protection is 35 m.

Health impacts from light and heat are considered to be local in extent, of short-term duration, reversible over time, and of medium magnitude. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium. As a result of these impact criteria considerations, significance is ranked as Medium.

The Significance Ranking of health impacts from light and heat is ranked as Medium (**Table 6-68**).

Table 6-68: Sigificance Ranking of Health Impacts from Light and Heat

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

PCMI will implement the following mitigation measures to reduce light and heat impacts:

- Post constant fire watch during flaring operations.
- Maintain safety distance between flare stack and well site facilities and adjacent crops.
- Implement PCMI's Emergency Response Plan including specific management procedures to mitigate the impacts if a fire occurs.
- Install fire extinguishers, alarms and windsocks (to be audible and visible from whole site).

- Heat impacts from the flare stack will be minimised by having a protected flare pit.
- Maintain a safe distance from nearest sensitive receptor.

Residual Significance

With the implementation of management measures, the residual significance of the health impacts from light and heat are ranked as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.5.8 Flare Emissions

Impact Assessment

Pollutants emitted from the flare include Carbon dioxide, Hydrocarbons and Nitrogen oxides. These pollutants may affect the respiratory system, circulatory system and central nervous system, depending on the concentration of pollutants and period of contact. Evaluation of the rate of emission of air pollutants caused by flaring in the well testing phase found greenhouse gas emissions from the activities of well testing phase is 9,632.5 tons of carbon dioxide equivalent per year of primary greenhouse gases (GHGs) (e.g. carbon dioxide CO_2 and methane CH_4) and varying amounts of other pollutants such as carbon monoxide (CO), oxides of nitrogen (NO_X) and sulphur (SO_X), volatile organic compounds (VOCs), and particulate matter (PM) will be released to the atmosphere during the drilling programme. This volume is considered low and not expected to have adverse health effect for the people who live around project site. The well testing process is short term (15 days/well).

Health impacts from flare emissions are considered to be local in extent, of short-term duration, reversible, and of Low magnitude. The impact disturbs an area currently used for agriculture; income levels are low and infrastructure is not well developed; the sensitivity of the receptor or resource is rated medium. As a result of these impact criteria considerations, significance is ranked as Low.

The Significance Ranking of health impacts from flare emissions is ranked as Low (**Table 6-69**).

Table 6-69: Sigificance Ranking of Health Impacts from Flare Emissions

	Level and Type of Impact				
	1	2	3	4	5
Impact Criteria	Positive	Negligible	Low	Medium	High
Extent			< 1 km	1 - 5 km	> 5 km
Duration			0 - 1 yr	1 - 5 yr	> 5 yr
Magnitude	Positive	Negligible	Low	Medium	High
Receptor Sensitivity	Positive	Negligible	Low	Medium	High
Significance	Positive	Negligible	Low	Medium	High

Management Measures

PCMI will implement the following mitigation measures to reduce impacts from flare emissions:

- Ensure flare system has efficient combustion.
- Clear vegetation around the flare stack and build earth bermed flare pit.
- Maintain pilot flame at the flare tip to ensure that flame is not extinguished by strong wind.
- H_2S detection and safety equipment is standard issue. PCMI's emergency response plan (ERP) includes an H_2S Contingency Plan. Furthermore, the drilling contractor will have their own H_2S Contingency Plan.
- Standard mitigation measures to reduce impacts from hydrogen sulphide release during well testing will be implemented:
    - Install H_2S sensors at the flow line.
    - If H_2S levels exceed 10 ppm in the gas stream, implement appropriate safety zones.
    - The initial flow of hydrocarbons to surface will be timed to coincide with daylight hours.
- Staff trained in H_2S procedures.

Residual Significance

With the implementation of management measures, the magnitude of impacts will be reduced resulting in a residual significance of the health impacts from flare emissions being ranked as Medium.

Residual Significance	Positive	Negligible	Low	Medium	High

6.6 Exploration Drilling Unplanned Events Impact Assessment

6.6.1 Criteria and Method for Unplanned Events Impact Assessment

The impacts associated with unplanned events during implementation of the PCMI Exploration Drilling Project are evaluated by determining the likelihood (or probability) of an event occurring, and the significance of the event on the environment, social, and health. Assessment of the level of significance impact requires consideration of the impact level (i.e. magnitude of the environmental effect, its geographical scale and duration) in relation to the sensitivity of the key receptors and resources considered. The significance of possible impact and probability of the event occurring allows us to provide a Risk Ranking.

Unplanned Events Considered

For the PCMI Exploration Drilling Project, the unplanned events considered were:

(1) Blowout (with subsequent fire and/or explosion);
(2) Fire or Explosion (not Associated with Blowout);
(3) Chemical or Hazardous Waste/Materials Spill
(4) Transportation Accidents;
(5) Thunderstorms; and
(6) Earthquakes.

These unplanned events will be assessed by determining possible causes, likely receptors affected, probability and Risk Rankings of the events. Residual risks will be evaluated after management measures are defined.

If the risk is determined to be "High", it is considered to be intolerable and must be reduced. If the risk is determined to be medium, risk reduction measures need to be implemented to reduce the frequency of occurrence or to mitigate any Risk Rankings to achieve a risk which is "As Low As Reasonably Possible" (ALARP). If the risk is determined to be "Low", the activity must be managed for continuous improvement.

The following table lists potential unplanned events affecting this exploration drilling program and identifies the aspects by project phase.

Table 6-70: Unplanned Event Aspects by Project Phase

Health Aspects	Site Construction	Exploration Drilling & Testing	Restoration and Abandonment
Blowout (with subsequent fire and/or explosion)		✓	
Fire or Explosion (not associated with Blowout)	✓	✓	✓
Chemical or Hazardous Waste/Material Spill	✓	✓	✓
Transportation Accidents	✓	✓	✓
Earthquakes	✓	✓	✓

The assessment of each aspect includes the following components:

- Description of the source and characteristic of the potential impacts.
- Identification of receptors sensitive to potential impacts.
- Description and evaluation of potential impacts.
- Identification of management measures to reduce potential impacts.
- A determination of the residual risk after management measures is included.

- An aspect summary assessment table.

6.6.2 Blowout (with subsequent Fire and/or Explosion)

Impact Assessment

Blowouts during exploration drilling and testing have an inherent risk of fire due to the flammability of hydrocarbon gas when mixed with air. The main risk is to the health and safety of the concessionaire's employees and contractors (People) working at the well site at the time of any incident and damage to equipment and structures (Assets).

A kick is an uncontrolled flow of formation fluids into the borehole and a blowout is the uncontrolled release at the surface. Not all kicks involve hydrocarbons; commonly they involve fresh or salty water. A kick can be controlled in the first instance by increasing the specific gravity of the drilling mud, which increases the effective pressure exerted by the mud on the formation, or by shutting in the well at the surface and increasing the mud weight. The ultimate response to a kick is to close the blow-out preventer (BOP) valve (pipe rams) to completely shut-in the well.

A blowout only occurs if all of the measures taken to control a kick fail and the pressure cannot be contained by the BOPs or the well casing ruptures. The most common cause of a blowout is that the well encounters unexpectedly high formation pressures or there is a rapid loss of the drilling mud into fractures or caverns in the formation. In areas where previous wells have already been drilled, the maximum formation pressures and depths of any over-pressured zones or lost circulation zones have been determined. The well plan is designed based on this information and ensures that the BOPs are sized to contain the pressure and the casing is positioned to establish control. Thus, there are numerous control systems, plans and procedures that have to fail in order for a blowout to occur. Nevertheless, they do occur and are a constant hazard that every well faces. Consequently, all drilling operations are planned taking into account the blowout risk and all personnel are trained and experienced in the procedures needed to control a kick and prevent a blowout.

Maximum pressure for the planned wells is expected to not exceed 5,500psi. PCMI will use a 10,000 psi rated BOP.

The BOP is tested and certified as per API standards to 10,000 psi before installation. Once the BOP stack is installed it is pressure tested to API specification (API RP 53) to 10,000 psi. Once in service, PCMI's standard operation procedures require the BOP to be tested every 2 weeks which is more stringent than API specification. Also, every time a connection is made (i.e. wellhead connection) the BOP must be pressure tested again as per API specification. The BOP unit will have a separate generator which will supply power to generate pressure in the accumulator to ensure the BOP operates at all times.

If a blowout contains hydrocarbons, these have the potential to mix with the air, providing oxygen, and a spark can cause the mixture to ignite. As the fluids flowing from the well will be under significant pressure, the result will be a 'jet' of flame that will shoot out in the direction of any holes in the well head (usually this is directed vertically).

The impact of a blowout will depend on the amount of hydrocarbons flowing from the well and their pressure. Thermal radiation of 8.5 kW/m^2 can result in pain after about 8 seconds exposure and second-degree burns after about 20 seconds of exposure. A blowout could have the potential to create a significant hazard to anyone without protective clothing. Even if a fire does not ignite, the released gas can lead to suffocation or poisoning. Thus, the first response to any blowout is to evacuate personnel to a safe distance before planning commences for containment and well control. With the exception of the personnel on site, the nearest people to any of the sites must be greater than 350 feet (about 100 meters). Therefore there is no immediate hazard to the local population in the unlikely event a blowout should occur, allowing time for evacuation in a severe situation.

Although standard precautions are taken on all wells drilled to prevent, control or contain a blowout, blowouts do occur, but rarely.

An escape of large quantities of gas could result in notable reduction in local air quality causing a temporary stress to those exposed. Natural gas can cause headaches, nausea and dizziness in a high concentration when inhaled.

Small leaks of gas will not be toxic and any irritation would be minor to workers. In addition, a blowout is very likely to cause damage to equipment and injuries to drill rig workers.

Liquid hydrocarbon impacts in the event of Blowout, would lead to contamination of soil and groundwater, and also surface water.

The frequency of a blowout is very low at 4.4×10^{-4} blowouts per well drilled worldwide (E&P, 2010), or 4.9 $x10^{-4}$ (SENES Consultants, 2016) and much lower for wells drilled into normal formations i.e. not known to have high-pressure gas. The likelihood of its occurrence is considered "Occasional/Rare" which relates to B Unlikely in our Risk Matrix.

The significance of a blowout considering its magnitude of the environmental effect, its geographical scale and duration in relation to the sensitivity of the key receptors and resources is considered to be high. The significance of possible impact and probability of the event occurring allows us to provide a Risk Ranking of Medium.

Table 6-71: Risk Assessment Matrix for Blowouts

	Significance	Increasing Probability				
Impact Level	Environmental, Social & Health	A	B	C	D	E
		Remote	Unlikely	Possible	Likely	Very Likely
		Never Heard of Incident in E&P Industry	Heard of Incident in E&P industry but not likely to occur during this project	Has Occurred once or twice in Company and may occur during this project but only under exceptional conditions	Has occurred frequently in company and could also occur during this project	Commonly occurs in the company and Is expected to occur during project
1	Positive	+	+	+	+	+
2	Negligible	Negligible				
3	Low impact		Low Risk			
4	Medium impact			Medium Risk		
5	High Impact					High Risk

Management Measures

PCMI's Emergency Response Plan sets out the specific management procedures to be implemented to mitigate the impact if a blowout/explosion occurs. This ERP defines the procedures that are to be used in the event of a well control emergency occurring in their exploration drilling program.

A full set of preventative measures will be in place to reduce the risk significance of a blowout occurring, including:

- Careful planning of drilling operation.
- Examination of existing seismic lines and nearby wells to identify shallow gas hazards.
- Drilling and Well Control Standard Operating Procedures and extensive HSE Management System procedures and operational controls in place.
- Internal hazardous operations reviews and "Table Top drilling" exercises to test procedures and individual personnel performances against the drilling plan.
- Select proper drill fluid formulation, provide well kill fluids/systems, loss control and weighting agents.
- Very careful monitoring of down hole conditions and mud returns.
- Use of appropriate, high quality materials in well construction (casing and cement grades).
- Provide a blowout preventer (BOP) stack that is sized appropriately in proportion to the maximum formation pressure; and test as per procedures.
- Provide of a high-pressure water-spray dousing system around the wellhead, solids removal chokes and flare stack.
- PCMI's Emergency Response Plan.
- PCMI's HSE Integrated Management System Procedures and operational controls will be in place to prevent a blowout/explosion.
- PCMI BOCP in place prior to spudding.

Residual Risk

With the implementation of management measures, the residual risk from a Blowout is ranked as Low.

Residual Risk	Positive	Negligible	Low	Medium	High

6.6.3 Fire or Explosion (not Associated with Blowout)

Impact Assessment

Potential sources of fire other than from a release of hydrocarbons from the well include the burning of garbage, discarded cigarettes, the presence of diesel fuel on site and the flare during testing. Burning of garbage will be prohibited and smoking will be restricted to safe areas. Diesel is not easily ignited as flash point of diesel is in the range of 40 to 100 ^{0}C which is above the normal room temperature, so the likelihood of a fire occurring is unlikely. Furthermore, the lower explosive limit (LEL) of diesel fuel is 0.6 percent that equals of the concentration of approximately 6,000 ppm. It is unlikely that a fuel spill would cause this concentration to ignite and explode when it occurs in an open area, such as PCMI's well site.

Incident statistics for the onshore oil and gas sector are general and not specific for onshore oil wells, similar to PCMI's proposed project. For instance, statistics for all oil and gas workers in the United States indicated that there were 120 fatalities in 2015 and 89 fatalities in 2016 for the entire Mining, quarrying, and oil and gas extraction industry. The rate of fatal injury is 10.1 per 100,000 full-time equivalent workers (FTEs)[9]. The probability of a fire or explosion is Unlikely (B).

[9]US Labour Statistics. Accessed on Feb 15th from https://www.bls.gov/news.release/cfoi.t04.htm

A fire or explosion may result in multiple on-site fatalities. Therefore, the significance of a *fire or explosion not associated with a blowout* considering its magnitude of the environmental effect, its geographical scale and duration in relation to the sensitivity of the key receptors and resources is considered to be high. The significance of possible impact and probability of the event occurring allows us to provide a Risk Ranking of Medium (**Table 6-72**).

Table 6-72: Risk Assessment Matrix for Fire or Explosion

	Significance	Increasing Probability				
Impact Level	Environmental, Social & Health	A	B	C	D	E
		Remote	Unlikely	Possible	Likely	Very Likely
		Never Heard of Incident in E&P Industry	Heard of Incident in E&P industry but not likely to occur during this project	Has Occurred once or twice in Company and may occur during this project but only under exceptional conditions	Has occurred frequently in company and could also occur during this project	Commonly occurs in the company and Is expected to occur during project
1	Positive	+	+	+	+	+
2	Negligible	Negligible				
3	Low impact		Low Risk			
4	Medium impact			Medium Risk		
5	High Impact					High Risk

Should a fire occur, there are numerous fire extinguishers on site, and staffs are trained in their use, so any fire from these sources would quickly be brought under control. In an event of a major fire, PCMI would alert and cooperate with the local fire brigades.

Management Measures

Fires will be managed under existing emergency plans. The risk significance of fire will be reduced by using the following mitigation measures:

- PCMI's HSE Integrated Management System Procedures and operational controls to prevent a fire/explosion.
- PCMI's Emergency Response Plan including specific management procedures to mitigate the impacts if a fire/explosion occurs.
- Install fire extinguishers, alarms and windsocks (to be audible and visible from whole site).
- Pre-arranged call out support from local fire brigades.

Residual Risk

With the implementation of management measures, the residual risk from a Fire or Explosion not associated with a blowout is ranked as Low.

Residual Risk	Positive	Negligible	Low	Medium	High

6.6.4 Hydrocarbon, Chemical or Hazardous Waste/Materials Spill

Hydrocarbon, chemicals and hazardous waste materials present potential risk of spills to the environment and spillage could affect air quality, soil quality, surface water, groundwater, biota and people. The quantity of the hazardous chemicals that will be used at well site is minimal; therefore, the impact on the environment in the case of a spill would be limited in area and likely to be transitory.

6.6.4.1 Hydrocarbon Spill

Impact Assessment

The potential impacts from spills of fuel or lubricant oils area:

- Decline in groundwater quality
- Temporary localized decline in surface water quality and aquatic biota
- Temporary localized decline in soil quality
- Temporary minor toxicity to flora and fauna

6.6.4.1.1 Hydrocarbon Spills Impacting Groundwater

On site fuel will be stored in steel tanks that sit on the higher ground on a lined platform and will be completely surrounded with a bund to contain any spillage. The bund will be 300 mm high around the entire fuel storage area. The site will have spill kits available to be used if any accidental fuel spill happens during operations. PCMI has an oil spill contingency plan if there is any accidental release.

The areas of the well pad where oil, lubricants and drilling mud may spill are isolated by a drainage system designed to drain all run-off on the rig pad into the waste pit. The waste pit is lined with a high-density polyethylene (HDPE) 2 mm thick impermeable geomembrane liner to form an impermeable barrier.

These measures should ensure that there is no accidental release of hydrocarbons into the groundwater. In the event of a spill, spill kits provided on site will be used to remove and contain the spill immediately. Any contaminated water will be collected in the waste pit through a drainage system around the project site.

The groundwater table in the project area is very deep (except near seasonal drainage areas and watercourses. However, shallow unconfined aquifer may be tapped as water source in certain villages, so the severity of impact depends on the location of well site to community wells.

6.6.4.1.2 Hydrocarbon Spills Impacting Surface Water Quality and Aquatic Biota

The areas of the well pad where oil and lubricants may spill are isolated by an intermediate drainage system designed to drain all rainwater run-off on site into the waste pit, this is lined with a high density polyethylene (HDPE) 2mm thick impermeable geomembrane liner to form an impermeable barrier. An oil trap will prevent oil from flowing into the waste pit.

On site fuel will be stored in steel tanks that sit on the higher ground and will be completely surrounded with a bund to contain any spillage. The bund will be 300 mm high around the entire fuel storage area. On site separated emulsion-condensate will be stored in separate tanks placed within the intermediate drainage system. These measures should ensure there is no release of contaminated water to the area outside the site. The site will have spill kits available to be used if any accidental fuel spill happens during operations. PCMI has an oil spill contingency plan if there is any accidental release.

These measures should ensure there is no release of contaminated water to the area outside the site. In the event of a spill, spill kits provided on site will be used to remove and contain the spill immediately. Any contaminated water will be collected in the waste pit through a drainage system around the project site. This will be disposed of as hazardous waste.

6.6.4.1.3 Hydrocarbon Spills Impacting Soils, Flora and Fauna

Fuel spills can increase soil toxicity and/or decrease soil fertility and impact flora and fauna. The site will have spill kits available to be used if any accidental fuel spill happens during operations. PCMI has an oil spill contingency plan if there is any accidental release.

Fuel spills may occur during fuelling of vehicles or tanks at the drilling site, or because of leaks from the fuel storage tank at the drilling site. All spills will be cleaned up immediately with the spill kits on site that include shovels, absorbents (sand) and steel containers. At the end of the project, all oily wastes classified as hazardous will be transported and disposed in at DOWA.

Fuelling during drilling operations will be conducted within the prepared site. The oil traps on each side of the location will ensure that any spills are contained within the site and do not contaminate any soil surrounding the location.

6.6.4.2 Mud and Chemical Spills

Mud and chemical spills from storage and handling could happen during all phases of the exploration campaign.

Impact Assessment

The potential impacts from mud and chemicals are:

- Decline in groundwater quality
- Temporary localized decline in surface water quality and aquatic biota
- Temporary localized decline in soil quality
- Temporary minor toxicity to flora and fauna

6.6.4.2.1 Mud and Chemical Spill Impacting Groundwater

Only a limited amount of hazardous material is to be held at the project site and only during drilling. The mud chemicals are all delivered and stored on site as dry powder. All components of the drilling mud are classified as non-hazardous with the exception of eight chemicals: Soda Ash (sodium carbonate), Caustic Soda (sodium hydroxide), Break-Free NW, Calcium Carbonate, Glutaraldehyde, HYDRO-BUFF, HYDRO-CAP L and OX-SCAV. The Concentrations of these chemicals used in the drilling mud are however non-toxic. Concentrations of these chemicals used in the drilling mud are however non-toxic. Environmental toxicity information is provided in **Table-6-73**.

Mud chemicals shall be stored in a covered and concreted warehouse before transportation to the drilling site. The warehouse shall be in YANGON. Once transported to site, the chemicals shall be stored on an impermeable geo-membrane based area with in a bunded area. Most of the chemicals are dry powdered chemicals, hence the chemicals shall be covered with tarpoline at site to protect from rainwater. The geomembrane lined chemical storage area will be 10 m by 10 m.

Other storage areas such as parts, equipment and repair shops will be contained in converted portable 40 foot containers. These containers will sit on concrete blocks. Workshop for vehicles maintenance will be in a bunded area fitted with oil trap/separator to stop oil spills. The site will have spill kits available to be used if any accidental spill happens during operations. The mud chemicals are all dry powder so spill or leakage is low, spill kits will be used for any oil or liquid spills.

These measures should ensure that there is no accidental release into the groundwater. In the event of a spill, spill kits provided on site will be used to remove and contain the spill immediately. Any contaminated water will be collected in the waste pit through a drainage system around the project site.

6.6.4.2.2 Mud and Chemical Spill Impacting Surface Water and Aquatic Biota

For this exploration drilling program, PCMI will drill the exploration well with Water Based Mud (WBM). The well site facilities used to mix and hold the mud are made from steel and constructed according to industry standards. Drilling mud would be dewatered and treated before disposal into drill cutting pits. The dewatering unit will reduce the solids in the water and treated to disposal. DOWA shall be treating the fluids onsite to disposal level as per IFC 2007 regulations.

The areas of the well pad where oil, lubricants and drilling mud may spill are isolated by a drainage system designed to drain all rainwater run-off on site into the waste pit, a high density polyethylene (HDPE) 2mm thick impermeable geomembrane liner to form an impermeable barrier. An oil trap will prevent oil from flowing into the sump pit. Most of the chemicals are dry powdered chemicals, hence the chemicals shall be covered with tarpoline at site to protect from rainwater. The geomembrane lined chemical storage area will be 10 m by 10 m. Any spills will be immediately cleaned up using the spill kits provided on site.

Accidental spills may deteriorate surface water quality and aquatic biota. Some chemicals from drilling operation may be toxic to aquatic biota and cause eutrophication or dissolved oxygen depletion of water bodies (**Table-6-73**). Containment measures are installed at the well sites to ensure that there is no release of spilt material off-site. These measures include: drainage systems around the rig and areas of the well pad where oil, lubricants and drilling mud may spill, waste pit sufficient in size to contain any spills and storm rainfall event.

Table-6-73: Environmental Characteristics of Components in the Drilling Fluids

Chemical Compound	Biota Affected	Toxicity
Caustic Soda (sodium hydroxide)	Fish	Fish LC50 (96h): 43mg/l2
Soda Ash (sodium carbonate)	N/A	Not acutely toxic to fish, mollusks, nematodes, phytoplankton, zooplankton
Break-Free NW	Invertebrate, algae / plankton	No data for BREAK-FREE NW. N-BUT ANOL has the following: Toxicity Fish: LD100(24)1.4g/L,LC50(96)1.91g/L Toxicity invertebrate: cell mult. inhib.8-650mg/L Effects on algae and plankton: cell mult. inhib.100-875mg/L
Calcium Carbonate	N/A	No data for CaCO3 F, M & C.
Glutaraldehyde	N/A	Marine Pollutant:Not Determined Glutaraldehyde is not expected to bioconcentrate in the food chain. In water glutaraldehyde undergoes moderate biodegradation to produce glutamic acid.
HYDRO-BUFF	Fish / Algae	Prevent, by any means available, spillage from entering drains or water courses. DO NOT discharge into sewer or waterways. Fish LC50 (96 h): Oncorrhynchus 150 mg/l[SEP] Daphnia LC50 (24 h): 120-140 mg/l[SEP] Algae NOEC (192 h): 0.75-0.97 mg/l[SEP]
HYDRO-CAP L	Fish	Acute (daphnia magna) LC50: 0.16 mg/l[SEP]Acute (adult cyprinus carpio) LC50: 91 mg/l[SEP]Acute (juvenile cyprinus carpio) LC50: 70 mg/l [Baroid]
OX-SCAV	Fish / invertebrate	Toxicity Fish: LC50(96)>12.5mg/L[SEP]Toxicity invertebrate: LC50(48)802-2241ppm

Source: [1]Ecotox: http://cfpub.epa.gov/ecotox/help.cfm?sub=about, [2]MSDS, [3]http://www.pesticideinfo.org/List_ChemicalsAlpha.jsp

6.6.4.2.3 Mud and Chemical Spill Impacting Soil

With the necessary drainage isolation, capture systems, protected storage in place, together with good housekeeping, the risk of contaminants release into the soil around the site is minimal. The mud chemicals held on site are largely non-toxic and biodegradable, limiting both the severity and the duration of any impact.

6.6.4.2.4 Mud and Chemical Spill Impacting Terrestrial Flora and Fauna

The containment systems chemicals and drilling mud are comprehensive and the likelihood of any of these substances reaching terrestrial flora and fauna off-site is unlikely. A complete list of the mud chemical properties and environmental toxicity is provided in **Table-6-73**. The mud chemicals held

on site are largely non-toxic and biodegradable, limiting both the severity and the duration of any impact from an on-site spill. Hazardous chemicals are segregated from the main chemicals and kept in appropriate containers during drilling. Spills during transportation however have the potential to affect soils and surface water quality and thus terrestrial flora and fauna.

6.6.4.3 Mud, Chemical and Hydrocarbon Spill Risk Assessment

Without mitigation measures, the probability of a Hydrocarbon, chemicals and hazardous waste materials spill to the environment affecting air quality, soil quality, surface water, groundwater, biota and people impact occurring is determined to be Possible (C).

The value of the study area as habitat is significantly affected by its current use as agriculture areas are used to grow beans/pulses, peanuts and sesame, rice, corn, vegetables and continued human activity. However, the impact could be important on a local level; therefore the significance of a hydrocarbon, chemical or hazardous waste/materials spill considering its magnitude of the environmental effect, its geographical scale and duration in relation to the sensitivity of the key receptors and resources is considered to be medium. The significance of possible impact and probability of the event occurring allows us to provide a Risk Ranking of Medium (**Table 6-74**).

Table 6-74:Risk Assessment Matrix for Hydrocarbon, Chemical or Hazardous Waste/Materials

	Significance	Increasing Probability				
Impact Level	Environmental, Social & Health	A	B	C	D	E
		Remote	Unlikely	Possible	Likely	Very Likely
		Never Heard of Incident in E&P Industry	Heard of Incident in E&P industry but not likely to occur during this project	Has Occurred once or twice in Company and may occur during this project but only under exceptional conditions	Has occurred frequently in company and could also occur during this project	Commonly occurs in the company and Is expected to occur during project
1	Positive	+	+	+	+	+
2	Negligible	Negligible				
3	Low impact		Low Risk			
4	Medium impact			Medium Risk		
5	High Impact					High Risk

The impact of a hydrocarbon, chemical or hazardous waste/materials spill will be reduced by using the following mitigation measures:

- Chemicals, Hydrocarbons and hazardous materials or waste will be securely stored and use governed by safe operating procedures.
- Spill containment and recovery equipment will be available near storage areas.
- Procedures for response to Chemicals, Hydrocarbons and hazardous materials or waste spills will be included in PCMI's ERP.
- MSDS Sheets will be posted in areas where Chemicals, Hydrocarbons and hazardous materials or waste is stored and with the ESH Officer.

- Construct one lined waste pit for potentially contaminated runoff and spills (6,000 m^3), surrounded by 0.2 m high bund that will help prevent run-off into the environment. Monitor and transport waste to prevent any overflow from waste pit.
- Construct drainage system around well sites and concrete rig pad which mud tanks, shakers, generators and fuel tanks sit on to divert any spills into the waste pit.
- Use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious floor (e.g. tarpaulin sheet).
- Provide drip pans and absorbents to contain any spillage.
- Provide spill cleanup kits and training for designated rapid response teams to clean up any spills. In the event of oil or chemical spill, implement ERP.
- Prohibit workers from cleaning machines/equipment in/near a public water source.
- Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.
- Maintain oil traps along perimeter drainage ditch to prevent any spills from flowing off site.
- Isolate any area(s) that might be contaminated from non-contaminated areas. The ground of areas where possible contamination occurs will be covered with plastic sheet.
- Store Chemicals, Hydrocarbons and hazardous materials or waste storage tanks on concrete rig pad. The storage unit will be surrounded by a bund wall that is able to contain 110-120% of the capacity of the tanking case of spill.
- Transport produced emulsion-condensate to a DOWA wastewater treatment facility using dedicated tanker trucks.
- The use of chemicals will be avoided through appropriate design where practicable.
- During the procurement process, chemicals will be evaluated for environmental, safety, technical, and commercial performance. As far as practicable, least hazardous chemicals will be selected.
- Procedures for response to chemical spills will be included in PCMI's ERP.
- Use non-hazardous water-based mud system. Inform MOGE in case of change in mud chemicals.
- Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil.
- Implement transportation plan.

PCMI's Emergency Response Plan will set out the management procedures to be put in place to mitigate the impact if a spill occurs.

Residual Risk

With the implementation of management measures, the residual risk from a hydrocarbon, chemical or hazardous waste/materials spill is ranked as Low.

Residual Risk	Positive	Negligible	Low	Medium	High

6.6.5 Transportation Accidents

Transportation accidents associated with PCMI's project may occur during transportation of equipment, personnel, granular fill, mud and cuttings, and waste.

PCMI plans to use a land rig for the drilling program. The estimated number of round trips for rig equipment is 175 trips (Based on previous onshore campaign by PCMI in 2015). The rig and equipment transportation route is via the Pathain – Mon Ywar Highway Road. The distance from Yangon to Well Site is 330 Km for this route. The type of transportation for equipment is heavy truck

with 1-2 day travel duration. The estimated number of round trips for drilling support equipment (Including casing, chemical and etc.) is 100 trips.

The personnel transportation route is via the Yangon – Hinthada Road way. The distance from Yangon to the Well Site is 300 km. The type of transportation will include cars and mini bus with 8-10 hour travel duration. The estimated number of round trips for personnel is 100 trips.

No data on accidents is available for the area. However, this part of the county has a relatively small number of vehicles (including motorcycles) per capita. The probability of these impact occurring are ranked as Possible C.

The significance of transportation accidents considering its magnitude of the environmental effect, its geographical scale and duration in relation to the sensitivity of the key receptors and resources is considered to be high. The significance of possible impact and probability of the event occurring allows us to provide a Risk Ranking of Medium (**Table 6-75**).

Table 6-75:Risk Assessment Matrix for Transportation Accidents

	Significance	Increasing Probability				
Impact Level	Environmental, Social & Health	A	B	C	D	E
		Remote	Unlikely	Possible	Likely	Very Likely
		Never Heard of Incident in E&P Industry	Heard of Incident in E&P industry but not likely to occur during this project	Has Occurred once or twice in Company and may occur during this project but only under exceptional conditions	Has occurred frequently in company and could also occur during this project	Commonly occurs in the company and Is expected to occur during project
1	Positive	+	+	+	+	+
2	Negligible	Negligible				
3	Low impact		Low Risk			
4	Medium impact			Medium Risk		
5	High Impact					High Risk

The risk significance of a transportation accident will be reduced by using the following management measures:

- HSE Integrated Management System Procedures.
- Limit the speed of project vehicles, according to the road condition (on unpaved road to 30 km/h).
- Maintain construction equipment and vehicles to regulatory standards.
- Conducting RHA (Road Hazard Assessment for identified roads and implement JHA)
- Notify the local authority on the oversized load and put a escort in front of this convoy with horn and hazard lights.
- Consult with community leaders on plan and transportation route before movement of large equipment.
- Restrict/ avoid movement of heavy equipment during rush hours from 07.30 to 08.30 am and 3.30 to 4.30 pm.
- Provide traffic signs or flags at junction of access road and main road.
- Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.
- Strictly enforce training programs to reduce transport and drilling incidents by its contractors.
- Restore any damage to roads caused by project vehicles.
- Implement emergency response training, fire training and response drills.
- Install adequate fire extinguishers around the well sites.
- Test safety devices as determined appropriate.
- Provide PPE to workers on site.
- Provide medic, First Aid kits and First Aid trained personnel at drilling site.
- Restrict smoking to controlled areas.
- Prohibit trespassers from entering the construction site.
- Referral system with external medical facilities for serious injuries or emergencies.

Residual Risk

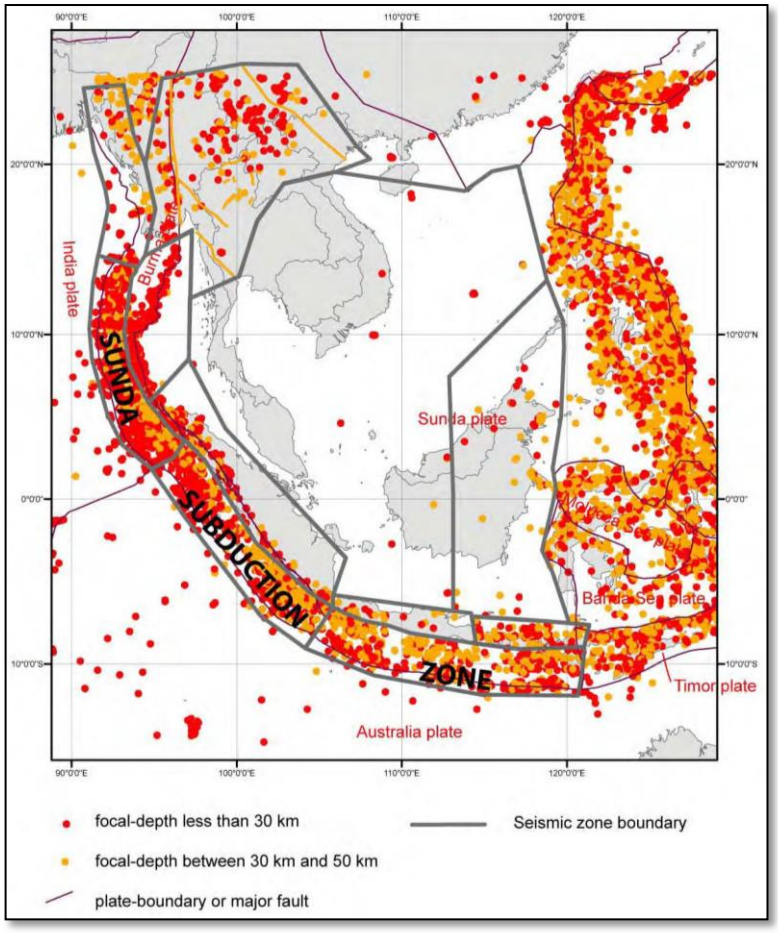
With the implementation of management measures, the residual risk from Transportation Accidents is ranked as Low.

Residual Significance	Positive	Negligible	Low	Medium	High

6.6.6 Earthquakes

Central Lowlands in the vicinity of IOR-7 have potential to thrust, and contains transpressional active faults such as Chauk-Tangyitaung and Gwecho faults. IOR-7 is located at 35km east of Arakan-Yoma mountain range and 100km west of Sagiang fault.

A map of earthquakes in the SE Asian region is shown in **Figure 6-4**.



Source: USGS, 2007

Figure 6-4: Map of Earthquakes with Shallow-Focus Epicentre for Period 1965-2005

An earthquake could result in environmental, social and health impacts. The worst-case scenario would be similar to a blowout, fire or explosion.

As earthquakes are possible in the region but rare, their frequency has been rated as "Unlikely"**.**

The significance of earthquake related accidents considering its magnitude of the environmental effect, its geographical scale and duration in relation to the sensitivity of the key receptors and resources is considered to be high. The significance of possible impact and probability of the event occurring allows us to provide a Risk Ranking of Medium (**Table 6-76**).

Table 6-76:Risk Assessment Matrix for Earthquakes

	Significance	Increasing Probability				
Impact Level	Environmental, Social & Health	A	B	C	D	E
		Remote	Unlikely	Possible	Likely	Very Likely
		Never Heard of Incident in E&P Industry	Heard of Incident in E&P industry but not likely to occur during this project	Has Occurred once or twice in Company and may occur during this project but only under exceptional conditions	Has occurred frequently in company and could also occur during this project	Commonly occurs in the company and Is expected to occur during project
1	Positive	+	+	+	+	+
2	Negligible	Negligible				
3	Low impact		Low Risk			
4	Medium impact			Medium Risk		
5	High Impact					High Risk

Management Measures

Although earthquakes cannot be directly mitigated, the effects on operations can be managed through design and management measures as follows:

- Implement PCMI's Earthquakes: Evacuation Plan and Emergency Response Plan.
- Proper training and safety procedures will be the main preventative measures to reduce the potential risk.
- In the unlikely event an accident should occur, the Emergency Response Plan would be implemented, which includes evacuation of personnel during severe circumstances.

Residual Risk

With the implementation of management measures, the residual risk from earthquakes is ranked as Low.

Residual Risk	Positive	Negligible	Low	Medium	High

6.7 Summary of Residual Significance/Risk Rankings from Exploration Drilling

The residual risk rankings of the impact assessment of the Exploration Drilling unplanned events on environmental, social, health and unplanned aspects are summarized below in **Table 6-77** to **Table 6-80**.

Table 6-77: Environmental Aspects Residual Significance Rankings

Aspect	Activity	Potential Impact	Residual Significance				
			Pos	No	L	M	H
Land & Habitat Disturbance	Installation of Infrastructure Road construction Camp site construction Well site Construction Well abandonment and site restoration	Disturbance to local topography					
		Soil Disturbance and Erosion					
		Disturbance to local Terrestrial Flora					
		Disturbance to local terrestrial fauna					
		Alteration of surface water hydrology by reducing interception, evaporation/ transpiration and infiltration					
		Localized change in water quality and aquatic habitat					
Vehicle and Rig Movements	Vehicle and Rig Movements	Impacts to terrestrial fauna from vehicle and drilling movement					
Air Emissions	Installation of infrastructure	Deterioration of Air Quality due to dust					
	Drilling Well Testing Flaring	Hydrogen sulphide released					
	Power Generation for Drilling and Flaring Well Testing and Flaring	Minor deterioration of local and regional air quality due to emission of pollutants such as NOx and SOx and CO.					
	Transportation Road Construction and rehabilitation of Drill Site and Camp Site Construction Power Generation for Drilling Flaring Fugitive emissions	GHG Release contributing to climate change					

Aspect	Activity	Potential Impact	Residual Significance				
			Pos	No	L	M	H
Noise	Installation of infrastructure Drilling and infield operations Well Testing and Flaring	Behavioral disturbance to fauna					
Artificial Light	Functional lighting on vehicles and drill rig, camp site and well site Flaring	Potential impact on terrestrial fauna					
		Potential impact on terrestrial flora					
Heat	Flaring	Potential impact on local fauna					
Liquid Waste	Drill site drainage	Localized change in water quality or contaminated soils from oil and grease					
	Sewage and sulllage	Localized nutrient enrichment and pollution of surrounding soil, surface water and ground water					
	Infiltration	Infiltration from the cuttings and dirty water waste pit may deteriorate groundwater quality					
Solid Waste	Disposal of non-hazardous wastes from drilling activities	Contamination of water and soils and injury to fauna					
	Disposal of Hazardous Solid Wastes	Contamination of water and soils and injury to fauna					
Drill Cuttings and Fluids	Disposal of drill cuttings and sludge	Localized change in water quality and soil quality from chemical composition of drill fluids					
	Loss of circulation	Deterioration of shallow and deep groundwater					

Table 6-78: Social Aspects Residual Significance Rankings

Aspect	Activity	Potential Impact	Residual Significance				
			Pos	No	L	M	H
Change in Land Use	Purchase of land for access roads, drill and camp site	Loss of agriculture potential Project operation effects on nearby land productivity Loss of employment for displaced workers that do not own land					
Traffic	Transportation of equipment, people and services	Increase in and disruption of local traffic					
Water Use	Water for construction exploration drilling and domestic use	Reduction of local community water supply					
Power Use	Power for drilling operations and work camp	Increase or decrease of available power for local community					
Water Drainage	Surface runoff from roads and camp site	Increased drainage potentially affecting roads and infrastructure					
Wastewater	Project operation effects on water quality	Potential impact to agriculture, aquaculture and fisheries					
Waste Disposal	Disposal of waste in project area	Increased waste disposal overloading local infrastructure					
Tourism and Recreational experience	Project construction and operation effects on tourism and recreation	Disturbance and reduction of tourism and recreational experience					
Employment & Income	Employment & income for nearby communities	Potential increase in jobs and related income for local communities					
Labour In-migration	In-migration of labour and social interaction	Potential conflict between workers from other regions and local communities					
Historical, Archeological & Cultural Resources	Project construction potentially destroying historical and archaeological sites	Loss or damage to historical and archeological sites					

Table 6-79: Health Aspects Residual Significance Rankings

Aspect	Activity	Potential Impact	Residual Significance				
			Pos	No	L	M	H
Dust	Access/upgrade roads, Site construction, Transportation of granular fill, workers, equipment	Respiratory irritation Exacerbation of asthma					
Noise	Generator, Transportation, Construction Drilling	Hearing impairment for workers and Annoyance for public					
Non-hazardous waste	Waste disposal, Leaks/spills, Standing water	Food safety, gastroenteritis Increase in vector-borne diseases: malaria, typhus and dengue and others.					
Mud Chemicals and drilling waste	Mixing of drilling chemicals, Leak/spill of mud chemicals	Acute exposure such as skin irritation, inhalation exposure etc.					
Hazardous Chemicals and waste	Material contaminated with oil or chemicals, Lubricating and hydraulic oil, Drum and containers used for chemical transportation and storage	Acute exposure such as skin and eye irritation, inhalation exposure etc.					
Communicable diseases	Migration/influx of outside workers	Increased incidence and prevalence of HIV/AIDS, hepatitis Band C, syphilis, etc.					
Light and heat	Flaring	Heat exposure Nuisance light					
Flare emissions	Flaring	Increase in respiratory illnesses/diseases Exacerbation of asthma Disturbance psychological wellbeing H2S Fatalities					

Table 6-80: Unplanned Events Residual Risk Rankings

Aspect	Activity	Potential Impact	Residual Risk				
			Pos	Neg	L	M	H
Blowout	Drilling	Release of uncontrolled volumes of hydrocarbons Fire Explosion					
Fire or Explosion (not associated with Blowout)	Fuel Storage Flare Testing	Possible explosion or fire of drilling rig or at campsite, or fuel storage area					
Hydrocarbon Chemical or Hazardous Waste/Materials Spill	Storage of chemicals, hazardous materials or waste	Potential risk of spills to the environment affecting air quality, soil quality, surface water, groundwater, biota and people					
Transportation Accidents	Transportation of equipment, personnel, granular fill, mud and cuttings, and waste	Possible injury or death to personnel; and localized contamination of environment					
Earthquakes	Physical shifting of earths surface	Potential physical disruption cause building collapse, blowouts, fires or spills					

Note: S - Significance: 1 Positive, 2 Negligible, 3 Low Impact, 4 Medium Impact, 5 High Impact
P - Probability: A – Remote, B – Unlikely, C – Possible, D – Likely, E – Very Likely

6.8 Conclusion

All environmental issues are ranked as negligible or low and can be managed to minimize potential impacts. There are two social issues that are ranked as positive, including Change in Land Use and Employment and Income. The residual significance of other social issues are ranked as negligible or low. Water use needs for the drilling program could potentially impact community water resource supplies. While PCMI plans to drill separate water wells for its needs, this could impact nearby community water supplies, if it is from the same source. This potential issue needs to be carefully planned to ensure adequate water resources are available for the project that does not impact the local community.

Two health issues have a medium residual significance ranking including Hazardous Chemicals and Drilling Waste as well as Flare Emissions. A specific waste management plan needs to be prepared to ensure that all wastes are managed to international standards.

Unplanned Events are all ranked as having a low residual risk. To achieve this specific management procedures and training need to be implemented. Drug testing too is recommended, as this is a known issue in the region.

To mitigate the potential for a blowout, a BOP needs to be installed and tested. Drilling procedures need to be carefully implemented. The risk of fire and related explosions requires that regular monitoring and inspection measures are in place, as well as fire extinguishers strategically placed to minimize any damage should a fire occur.

This region has had earthquakes in the past and design considerations need to be taken to minimize the impact of an earthquake should it occur. Site-specific emergency response procedures for all unplanned events need to be in place and training conducted for all staff as appropriate prior to the start of the exploration drilling program.

Recommendations:

The following recommendations are provided:

- Implement recommended stakeholder engagement program at least one month before site construction.
- Prepare a site specific emergency response plan.
- Conduct recommended training program prior to project initiation.
- Evaluate water resource potential to ensure it does not impact local community.
- Identify, cleanup and restore any legacy well sites located within the block.
- Adopt and implement the ESHMP provided in **Chapter 8**.

7. CUMULATIVE IMPACTS

The objective of the cumulative impact assessment is to identify those environmental, social or health aspects that may not on their own constitute a significant impact but when combined with impacts from past, present or reasonably foreseeable future activities associated with this and/or other projects, result in a larger and more significant impact(s).

The screening of planned and unplanned project related activities to identify potential environmental, social, health aspects assisted to highlight potential areas where cumulative impacts could possibly occur. These areas include: Community and Occupational Health; Agriculture; Transportation; Flora and Fauna (including aquatic); Ground Water Quality; Surface Water Quality, Soil, and Air Quality. The key activities potentially causing these cumulative effects include: hazardous and non-hazardous waste; wastewater; road and site construction; traffic, and unplanned events (blowout, fire and explosion, chemical/hazardous materials spill).

From the impact analysis of the environmental, social, health and unplanned events and the determination of the residual risk, it is concluded that the management measures defined for each aspect will prevent cumulative effects from occurring for this planned exploration drilling project. The ESHIA Management Plan too outlines monitoring measures that will ensure that mitigation measures are effective and that any change or impact to the environment is detected.

8. ENVIRONMENTAL, SOCIAL AND HEALTH MANAGEMENT PLAN (ESHMP)

8.1 Introduction

This environmental, social and health management plan has been developed to prevent, minimize and monitor potential environmental, social and health impacts associated with PCMI's planned exploration drilling program.

For each project activity, management measures have been defined to prevent and/or reduce the likelihood or magnitude of impacts and/or to limit the extent of an impact if one does occur. The proposed management measures will take into account applicable policies, guidelines, regulations, industry best practices, expert judgment, design techniques, and operational control. Monitoring measures too have been defined to determine if there are changes to the environment and to ensure that mitigation measures are effective.

The following hierarchy of control will be used to identify appropriate management measures:

- Eliminate the risk by removing the hazard.
- Substitute of a hazard with a less hazardous one.
- Prevention of potential events.
- Control the magnitude of an impact.
- Mitigation of the impact of an event on the environment e.g. (bunding for potential hydrocarbon spills).
- Monitoring environmental change and mitigation effectiveness.
- Emergency response and contingency planning to enable recovery from the impact of an event.
- Public consultation and disclosure.

8.2 Scope Of This Document

The purpose of this ESHMP is to provide ESH management actions, monitoring requirements and roles and responsibilities for ensuring that this drilling program is implemented in a sustainable manner.

In particular, the ESHMP will provide:

- Project Description by Project phase (pre-construction, construction, operation, decommissioning, closure and post-closure);
- Project's Environmental, Socio-economic and, where relevant, Health Policies and Commitments, legal requirements and institutional arrangements;
- Summary of Impacts and Mitigation Measures;
- Overall budget for implementation of the EMP;
- Management and Monitoring Sub-Plans by Project phase (pre-construction, construction, operation, decommissioning, closure and post-closure); the Management and Monitoring Sub-

Plans will address relevant environmental and social management and monitoring issues such as but not limited to;

- noise, vibrations,
- waste, hazardous waste,
- wastewater and storm water,
- air quality,
- odor,
- chemicals,
- water quality,
- erosion and sedimentation, biodiversity,
- occupational and community health and safety,
- cultural heritage,
- employment and training, and
- emergency response.

8.3 Project Description

Myanmar's Ministry of Energy has announced and awarded onshore blocks IOR-7 to PETRONAS Carigali Myanmar Inc. ('PCMI') to explore, appraise, and develop the oil/gas fields within the blocks.

IOR-7 lies within the Ayeyarwady Region. The total area of this block is 95 sq. mile or 246 sq. km.

The IOR-7 Block is under an Improved Petroleum Recovery Contract (IPR) that consists of acquiring 300 km line 3D Land seismic data acquisition and drilling of 2 exploration wells within the stipulated 3 years period. The 3D seismic survey operations have been completed. Therefore, this ESHIA covers the planned exploration-drilling program.
International Environmental Management Co. Ltd. (IEM) and local partner Environmental Quality Management Co. Ltd. (EQM) have been contracted by PCMI to prepare an environmental, social, and health impact assessment report (ESHIA) for the proposed Block IOR-7 exploration drilling project ("the Project").

Based on the results of the seismic program, PCMI will then plan to drill 2 wells in the IOR-7 block. PCMI's exploration drilling program in Block IOR-7 includes the following activities:

1. Construction and Installation
2. Exploration Drilling
3. Well Testing (If any)
4. Shut-in Well, Well Abandonment, and Site Recovery

Geologically IOR-7 block is situated near the southern edge of Pyay Embayment. In the MOGE geological map it is named as Shwepyitha area. Shwepyitha Oil & Gas field was discovered in 1967. There are some 70 wells drilled, 93.5 KM line of Gravity data and 255 KM line of 2D seismic data existing in the block. It is known to be a Middle Miocene Sandstone Oil play. The deepest well drilled is SPT#1 which was TD at 11,540 ft. The field achieved its peak production of 1250 BOPD in 1991. Shwepyitha field is still currently in production. It is producing 143 BBL of Oil and 0.786 MMSCF of Gas from 14 producing wells. Topographically the block is generally flat and mostly cultivated with paddy plant and it's the main source of income for the people in this area.

8.4 Environmental Management of PCMI

PCMI is committed to ensuring that its business operates in an environmentally responsible manner. The company recognises that it must conduct its operations in a safe and environmentally responsible manner consistent with established industry best practices. For the construction and exploration drilling program, PCMI makes the following commitments:

- Ensure drilling contractor operates in compliance with all relevant PCMI Corporate and Myanmar government policies, laws and regulations:
- Maintain manifests for all wastes (solids, liquids) and continue to identify methods to reduce such wastes where practicable;
- Ensure emissions result in air quality meeting International Environmental Conventions/Protocols/Agreement for Ambient Air Quality standards;
- Minimize particulate emissions to prevent harm to people and the environment;
- Account for all industrial and domestic waste and dispose of these wastes in an environmentally appropriate manner;
- Prevent spills and loss of potential contaminants to soil, groundwater and streams;
- Restore the environment impacted by the Company to a condition appropriate to its use or remediation “in-kind”;
- Define recovery procedures for all potential incident scenarios;
- Ensure efficient energy use and conservation;
- Where possible, provide local employment, training and skill upgrading to the local workforce;
- Ensure all contractors and subcontractors adhere to HSE policy guidelines and procedures; and
- Maintain up-to-date management and monitoring objectives.

8.4.1 Environmental Management of Contractors

Contractors will be required to provide specific procedures to meet the criteria described in this report. Procedures will be required to cover the following areas:

- Health and Hygiene;
- HSE Training, Drills and Exercises;
- Reporting of Occupational Accident / Incident and Unsafe Act and/or Conditions;
- HSE Reviews and Audits;
- Hazardous Materials Handling and Personal Protective Equipment (PPE);
- Emergency Procedures and Contingency Plans;
- Worker Codes of Conduct; and
- Transportation Policies and Procedures.

8.4.2 Roles and Responsibilities

For the effective implementation of PCMI HSE Management System, the HSE roles, responsibilities and accountabilities of managing environmental, social and health issues are outlined below with the onsite roles and responsibilities shown in **Table 8-1**.

Head (Myanmar Asset)

(1) Head shall have the responsibility and accountability for the implementation of HSE Management System within Myanmar Asset.

(2) He/she is responsible and accountable for the provision of adequate resources, including competent personnel, to implement the arrangements specified in the HSE Management System within Myanmar Asset.

(3) In the execution of HSE-critical activities, he/she is responsible and accountable for the conduct of the required HSE risk assessment, including the identification and implementation of HSE controls, such that harm to people, environment, asset and reputation are eliminated and/or minimised.

(4) He/she is responsible and accountable for ensuring the technical and operational integrity of facilities and equipment that PCMI design, procure, fabricate, install, acquire, operate and maintain; including facilities and equipment used by Contractors engaged in work for the Company.

(5) He/she, in turn, delegate the responsibility for the implementation of the HSE Management System in their respective Myanmar Asset, including agreed HSE objectives, plans and targets to the respective Senior Managers/Managers within Myanmar Asset.

(6) In addition, the Head (Myanmar Asset) shall also meet the HSE roles, responsibilities and accountabilities as specified in their respective Position Description.

Senior Managers – Well, Exploration

(1) Senior Managers shall have the responsibility and accountability for the implementation of HSE Management System within Myanmar Asset.

(2) They are responsible and accountable for the provision of adequate resources, including competent personnel, to implement the arrangements specified in the HSE Management System within Myanmar Asset.

(3) In the execution of HSE-critical activities, they are responsible and accountable for the conduct of the required HSE risk assessment, including the identification and implementation of HSE controls, such that harm to people, environment, asset and reputation are eliminated and/or minimised.

(4) They are responsible and accountable for ensuring the technical and operational integrity of facilities and equipment that PCMI design, procure, fabricate, install, acquire, operate and maintain; including facilities and equipment used by Contractors engaged in work for the Company.

(5) They, in turn, delegate the responsibility for the implementation of the HSE Management System in their respective Country and/or Department, including agreed HSE objectives, plan and targets to the respective Managers within Myanmar Asset.

(6) In addition, the Senior Managers – Well, Exploration shall also meet the HSE roles, responsibilities and accountabilities as specified in their respective Position Description.

Senior Managers/Managers – Human Resources, Procurement, Finance, and Other Support Functions

(1) Senior Managers/Managers shall have the responsibility and accountability for the implementation of HSE Management System within Myanmar Asset.

(2) They are responsible and accountable for the provision of adequate resources, including competent personnel, to implement the arrangements specified in the HSE Management System within Myanmar Asset.

(3) They, in turn, delegate the responsibility for the implementation of the HSE Management System in their respective Myanmar operation, including agreed HSE objectives, plans and targets to the respective Managers within Myanmar Asset.

(4) They are responsible for providing advice on the respective functional areas (e.g. competency, legal compliance, procurement, finance, etc.) to support the effective implementation of the HSE Management System throughout PCMI operations.

(5) In addition, the Managers – Human Resources, Procurement, Finance, and Other Support Functions shall also meet the HSE roles, responsibilities and accountabilities as specified in their respective Position Description.

Managers – Production, Maintenance & Engineering Department and Sub-surface Department

(1) Senior Managers/Managers shall have the responsibility and accountability for the implementation of HSE Management System within their respective operational areas.

(2) They are responsible and accountable for the provision of adequate resources, including competent personnel, to implement the arrangements specified in the HSE Management System within their respective operational areas.

(3) In the execution of HSE-critical activities, they are responsible and accountable for the conduct of the required HSE risk assessment, including the identification and implementation of HSE controls, such that harm to people, environment, asset and reputation are eliminated and/or minimised.

(4) They are responsible and accountable for ensuring the technical and operational integrity of facilities and equipment within the respective operational areas, through reliability analysis and execution of required maintenance activities.

(5) They, in turn, delegate the responsibility for the implementation of the HSE Management System in their respective operational areas, including agreed HSE objectives, plans and targets to the respective Senior Managers/Managers within their respective operational areas.

(6) In addition, the Senior Managers/Managers – Production, Maintenance, Petroleum Engineering and Reliability Engineering shall also meet the HSE roles, responsibilities and accountabilities as specified in their respective Position Description.

Company Site Representative

(1) Company Site Representatives shall have the responsibility and accountability for the implementation of HSE Management System, including the associated procedures and guidelines, within their respective facility/worksite.

(2) They are responsible for ensuring that employees and Contractors personnel under their supervision are fully competent to carry out tasks allocated to them, including emergency response preparedness capabilities.

(3) In the execution of HSE-critical activities, they are responsible and accountable for the conduct of the required HSE risk assessment, including the identification and implementation of HSE controls, such that harm to people, environment, asset and reputation are eliminated and/or minimised.

(4) They are responsible and accountable for ensuring the technical and operational integrity of facilities and equipment within the respective facility/worksite, through execution of required maintenance activities.

(5) They, in turn, delegate the responsibility for the implementation of the HSE Management System in their respective facility/worksite, including agreed HSE objectives, plan and target to the respective Supervisors and/or Team Leaders within the facility/worksite.

(6) In addition, Company Site Representatives shall also meet the HSE roles, responsibilities and accountabilities as specified in their respective Position Description.

Senior Manager/ Manager (Health, Safety and Environment – HSE)

(1) HSE Senior Manager shall have the responsibility and accountability in driving the implementation of HSE Management System within his respective facility/area of responsibility.

(2) He is responsible and accountable for providing the required advice on HSE, towards attaining full compliance to the requirement of the HSE Management System within his respective facility/area of responsibility.

(3) He is responsible for engagement/contact on HSE matters with regulatory authorities and industry associations within his respective facility/area of responsibility.

(4) He is responsible for maintaining an HSE assurance program, including for Contractors, to support the effective implementation of the HSE Management System within facility/area of responsibility.

(5) He is responsible for maintaining an effective crisis management and emergency response capabilities within facility/area of responsibility.

(6) In addition, the Senior Managers/Managers, Health, Safety and Environment (HSE) shall also meet the HSE roles, responsibilities and accountabilities as specified in their respective Position Description.

HSE Liaison/Focal Person

(1) HSE Liaison/Focal Person is an employee in line departments appointed to coordinate HSE matters for their respective Department. The appointment of HSE Liaison/Focal Person shall be made in writing by the respective Head (Myanmar Operation)/Senior Manager.

(2) HSE Liaison/Focal Person should be responsible for the followings:

a) Disseminating HSE information within the respective Department;

b) Coordinating the provision of HSE advice to Department;

c) Tracking to closure the implementation of HSE Recommended Action Items (HSERAI) for the Department;

d) Tracking the implementation of HSE trainings for the Department;

e) Compiling and submitting HSE performance reports (e.g. incident report, man-hours); and

f) Coordinating and/or conducting HSE briefing to new staff and transferees within the Department.

Daily Site Operations / Tool box Meetings

The Person-in-Charge of all facility/worksite shall conduct daily site operations meeting to discuss daily planned activities, as well as sharing of HSE-related information, e.g. incidents, unsafe acts and unsafe conditions, lesson learnt, etc. Emphasis shall be given to potential impact of hazardous activities, including concurrent activities, such that harm to people, environment, asset and reputation are eliminated and/or minimised.

Table 8-1:Onsite Roles and Responsibilities

Position	Role	Responsibilities	Specific Tasks
Drilling Site Manager	Management commitment	Promote commitment to HSE and Waste Management Procedure (WMP) among all staff and contractors	• Ensure HSE and WMP is on Management agenda and discussed where appropriate at weekly Operations meeting Guidance for efficient disposal
Third Party Consultant	Auditing	Ensure HSE and WMP is implemented property	• Conduct HSE and WMP auditing as part of ESHMP
HSE Focal (Safety Officer)	Responsibility for HSE Monitoring and Reporting	• Ensure HSE and WMP is implemented property • Oversee implementation of HSE and WMP • HSE and WMP Education	• Educating on site staffs, visitor and contractors. • Track waste being disposed • Arrange for disposal and prepare datasheet. • Ensure that segregated waste is disposed of as described in this manual. • Audit waste disposal facilities every 6 months • Identify waste in terms of categories • Update the nature and quantity of waste disposal data. • Finding ways to get more storage space and to utilize recycle methods • Report monthly as part ESHMP
Drilling Safety Officer	Monitoring and Reporting	• Oil/ diesel waste • Chemical waste • Scheduled waste	• Making sure that all chemicals come to the site with correct MSDS. • Making sure that all expired chemicals and unidentified chemicals are not in the site. • Report monthly as part of ESHMP
Drilling Medical Officer	Monitoring and Reporting	Medical waste	• Track waste being disposed • Arrange for disposal • The safe disposal of sanitary products • Inspect disposal facilities every 6 months • Report monthly as part of ESHMP
Drilling Supervisor	Supervision & Control	Non-hazardous waste Waste	• Keep clean camp and disposing site. • Fixing time for emptying or rubbish bins and collection of disposed materials. • Record all non-hazardous waste before dispose. • Safe disposal of waste at approved disposal site. • No buring at site. • Report monthly as part of ESHMP
Drilling Material & Logistics Coordinator	Monitoring and Reporting	Identifying and tracking	• Completion of required transfer notes/ waste manifest/ waste consignment notes. • Keeping accurate records of skip contents for the cargo. • Safe packing and transportation of hazardous waste when required. • Ensuring items sent from site/ Yangon is correct and liaison with relevant parties in the event of unidentified items. • Making sure that all chemicals come to the site with correct MSDS.

Position	Role	Responsibilities	Specific Tasks
Catering Camp Boss	Contractor	Follow HSE and WMP for site related works	• Keep clean camp and disposing site. • Record canteen waste and remove all kitchen waste daily from site. • Report weekly as part of EMS
Representative	Contractor	Follow HSE and WMP for site related works	• Ensure that all received items are correct as mentioned in the cargo manifest. • Keep all cargo manifests as record for auditor. • Ensuring that follow the instruction in waste disposing.
Representative	Recycle/ Re-User (third party)	Follow HSE and WMP for related works	• Ensure that all received items are correct as mentioned in the cargo manifest. • Keep all cargo manifests (copy) as record for auditor. • Ensuring that follow the instruction in waste recycling/ reusing

8.4.3 Training Requirements

The following training is required for this project.

HSE Induction

All new employees and transferees, including Contractors, shall be given a formal induction of the facility/worksite, including familiarisation with emergency procedures.

Pre-Mobilisation The key HSE requirements and/or deliverables during the pre-mobilisation phase shall include, amongst others, the followings:

Training and review of standard Work Procedures/Work Instructions, incorporating the identified HSE controls will be conducted prior to project start up.

A training program for HSE requirements and/or deliverables during this phase (e.g. HSE Plan, HSE Training, Emergency Response Plan, etc.) shall be implemented accordingly, as specified in the contract.

Mobilisation A seminar will be provided to review all HSE requirements and/or deliverables during the mobilisation phase shall include, amongst others, the following:

(1) Communication of HSE Plan, including HSE Key Performance Indicators and Target;
(2) Verification of personnel competencies, including HSE training; and
(3) Personnel screening for drug and alcohol, in accordance with PETRONAS Carigali Drug and Alcohol Policy.

Additionally, as part of the mobilization, an audit should be carried out to verify conformance to HSE requirements as specified in the contract.

Training shall be conducted to ensure personnel are aware of the existence of procedures and work instructions, understand their applicability and are competent to apply their requirements.

8.4.4 Standards and Regulations

HSE Legislation, International Convention and Protocol

All relevant HSE legislations and applicable international conventions and protocols shall be fully complied with throughout PCMI operations. Where PCMI HSE standards are more stringent, the requirement of the Company HSE standards shall apply.

Line management shall ensure that HSE Legal Register, incorporating all relevant provisions, shall be developed and maintained for PCMI's Facilities and/or Work Locations, including offices.

For Contractors' facilities, full compliance to legislative requirements shall be demonstrated, either through HSE Legal Register or equivalent.

The **HSE Legal Register** shall indicate the status of compliance, including detailed information on compliance, for all applicable provisions. For cases of non-compliance, if any, detail information of the non-compliance as well as proposed action plans to ultimately attain compliance, shall also be documented accordingly.

Verifications

Compliance to the above expectations may be demonstrated by the following documentations:

(1) Availability and comprehensiveness of HSE Legal Register, or equivalent (for Contractors);
(2) Records of work practices conform to legal requirements;
(3) Relevant HSE monitoring reports/records e.g. records on Noise Monitoring programme, equipment certificate, Environmental Monitoring Reports, etc.; and
(4) Minutes of HSE Meetings.

8.5 Summary of Environmental, Social and Health Mitigation & Monitoring Measures

During the environmental impact assessment, a number of potentially significant impacts were identified. In some cases, even though the impacts were of low significance, mitigation measures were provided as part of PCMI's environmental management guidelines. This section outlines the mitigation measures that are to be employed to reduce the likelihood of impacts and/or to limit the extent of impact if one does occur. In addition, environmental monitoring measures will be undertaken to assess whether the mitigation measures are effective and if performance meets EIA commitments; these are outlined in the next section.

8.5.1 General Mitigation Measures for Project Operation

Table 8-2 shows the general mitigation measures for project operation.

Table 8-2: General Mitigation Measures for Project Operation

General Measures
1 . Mitigation and monitoring measures set forth in this document must be incorporated into contractual agreements for all contractors, including: design, construction, and operation in order to obtain practical and effective execution of the project.
2. Report compliance with these mitigation and monitoring measures to MOGE in congruence with schedule.
3. Provide stakeholder relation plans to explain the project description before starting (at least 15 days prior), including schedule for construction and drilling periods, mitigation and monitoring measures for affected communities located near the project area.
4. Operator must set up a contact point to receive any complaints from the stakeholder regarding its exploration activities. Further, the Operator must provide assistance and rectify the cause of such complaints as determined appropriate, as soon as possible.
5. If impacts and/or damages result from project activities, the Operator must implement all necessary measures to mitigate these impacts and/or damages as soon as possible.
6. MOGE will investigate complaints lodged by people living in the surrounding area concerning any disturbance by project activities, or any damage of public infrastructure resulting from project operations. The Operator will inform the public within 30 days if the investigation proves that the Operator did not comply with mitigation and monitoring measures.
7. During the project period, if archaeological finds or fossils are encountered in the project area, the project team must stop all activities immediately and report the findings to the appropriate government office, e.g. Local Archeological Department, Fossil Research Center and Geological Museum within 7 days of the discovery. In addition, the project team must cooperate with the government agencies in an effort to verify the findings in the project area. If it is proven that these findings are archaeological finds or fossils, the Operator must follow the regulations strictly.
8.Should the Operator wish to make changes to the exploration activities, or change the methodology of operations, or conduct the activities significantly different from what was proposed in the EIA; details regarding the changes, along with revised assessment and appropriate mitigation and monitoring measures in accordance with such change(s) will be submitted to the MOGE for approval before commencing.
9. The Operator will start operations only when the Operator has received the necessary approval, permit or agreement from the landowner or responsible agency. Moreover, the Operator will improve or construct access roads when approved by the authorized local government agencies and/or landowner. All activities will operate under the control of MOGE.

8.5.2 Environmental, Social, and Health Impacts and Mitigation Measures

A summary of EHS impact and mitigation measures for the onshore exploration drilling and well testing are shown **Table 8-3.**

Table 8-3: Summary of Environmental, Social and Health Drilling Impacts and Mitigation Measures

Environmental Aspect

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
Land & Habitat Disturbance	Installation of Infrastructure Road construction Camp site construction Well site construction Well abandonment and site restoration	Disturbance to local topography	• Limit construction activities to well sites and access roads only. • Strip topsoil and keep for land rehabilitation • Restore the site to its original condition on site abandonment.
		Soil Disturbance and Erosion	• Limit soil compaction only to well sites and access roads. • Exposed site areas should be kept to a minimum during construction and completed areas should be hard surfaced or re-vegetated as soon as possible. • Reduce erosion by preventing/reducing off-site sediment transport through the use of BMP's. • Provide effective construction site run-off control and design.
		Disturbance to local Terrestrial Flora	• Remove vegetation in project areas only (roads, camp site, well site). Avoid cutting Riparian trees. • Mark well sites clearly and prohibit vehicles from moving off site onto surrounding land. • Mark trees to be cut prior to constructing well pads to prevent the cutting of other trees. • Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to vegetation.
		Disturbance to local terrestrial fauna	• Mark trees to be cut prior to constructing well site, camp site and access road to prevent the cutting of other trees. • Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to wildlife. • Hunting and trapping will be specifically prohibited and any violations will be grounds for termination of contract and dismissal. • Remove vegetation in road areas only. • Mark well sites clearly and prohibit vehicles from moving off site onto surrounding land. •

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
Land & Habitat Disturbance (Cont.)	Camp site construction Well site construction Well abandonment and site restoration (Cont.)	Alteration of surface water hydrology by reducing interception, evaporation/ transpiration and infiltration	• Avoid construction of well sites and access roads in areas that may cause obstacles to water drainage. • Construct water drainage lines (culverts) to maintain natural drainage. The required permission will be obtained from MOGE and all relevant agencies. • Try to complete the construction of well sites within the dry season if possible.
		Localized change in water quality Localized sediment deposition and disturbance to benthic habitats and associated biota.	• The proposed drill site and campsite will be orientated and designed to minimize areas requiring soil stabilization. • Provide drip pans and absorbents to contain any spillage. • Provide drainage and sediment traps around project area to reduce suspended particles in runoff from the well site and to contain minor oil spills. • Avoid construction of the well pad and/or access road in areas where such construction obstructs water drainage. • Prohibit workers from cleaning machines/equipment in/near a water source. • Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources. • Provide a suitable storage area for construction materials (such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil).
Vehicle and Rig Movements	Vehicle Movements Rig Movement	Disturbance to traffic	• PCMI will conduct Road Hazard Assessment before transporting any large equipment. • Vehicles will take direct routes where possible and avoid significant habitat areas. • Construction vehicles will follow speed limits. • Escort vehicles for wide load that have wide load signs and flashing warning lights. • Follow local transportation laws and regulations.

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
Air Emissions	Installation of infrastructure	Deterioration of Air Quality due to dust	• Minimize land clearance to a minimum especially during the drier months. • Reduce air emissions by regular maintenance. • Limit vehicle speed (approximately a speed limit of 30 km/hr) especially on unpaved roads during dry conditions. • Cover trucks transporting materials with tarpaulins or plastic to prevent any loose material from blowing away and also to prevent dust dispersion. • Cover construction materials. • Spray water on roads twice a day to keep dust down. • Clean tires of the vehicles before leaving site if needed. • Practice correct storage and usage of covers and/or control equipment (water suppression, bag house, or cyclone) in handling of materials such as conveyors and bins to prevent nuisance dust emissions. • Re-vegetate disturbed areas as soon as practicable to limit exposed soil areas. • Provide personal protective equipment (masks and gloves) to exposed field workers. • Use vehicles with dust flaps.
	Drilling Well Testing Flaring	Hydrogen sulphide released	• Install H2S sensors at the flow line. • If H2S levels exceed 10 ppm in the gas stream, implement appropriate safety zones. • All crew are instructed and rehearsed in H2S procedures.
	Power Generation for Drilling and Flaring Well Testing and Flaring	Minor deterioration of local and regional air quality due to emission of pollutants such as NOx and SOx and CO.	• Energy conservation measures will be taken into account during rig selection. • Process control to minimize flaring. • Diesel used in vessels will have a low sulphur. • Reporting of atmospheric emissions as per PCMI requirements. • Maintain scheduled maintenance program.

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
Air Emissions (Cont.)	Transportation Road Construction and rehabilitation of Drill Site and Camp Site Construction Power Generation for Drilling Flaring Fugitive emissions	GHG Release contributing to climate change	• Ensure all machinery and vehicles are properly maintained and serviced as per maintenance schedule recommended by manufacturer. • Maintain road going vehicles to ensure that fuel use is efficient and emissions are within acceptable limits. • Instruct drivers on the benefits of driving practices that reduce the risk of accidents, fuel consumption and dust generation. • Turn off all vehicles and equipment when not in use as well as prohibit vehicles from idling. • To maximize energy efficiency and design facilities to minimize energy use. • Operating flare to control odor and visible smoke emissions (no visible black smoke). • Locate flare at a safe distance from local communities and the workforce including workforce accommodation units. • Implementation of burner maintenance and replacement, programs to ensure continuous maximum flare efficiency. • Metering flare gas. • Keep installation and functioning of flare gas system safe according to the good engineering practice. • Ensure flare system has efficient combustion. • Maintain pilot flame at the flare tip to ensure that flame is not extinguished by strong wind. • Verify the operation's flaring system. • Minimize the duration and rate of flaring as much as possible.
Noise	Road Construction Camp Site Construction Well Site Construction Rig Mobilization Drilling Well Testing and Flaring Rig demobilization Abandonment and Site Restoration	Behavioral disturbance to fauna	• Vehicles and rig transportation will avoid sensitive environmental areas. • Construction activities and Vehicle/rig movements will be restricted to daylight hours. • Limit vegetation removal to a minimum. • Schedule operation of noisy construction equipment at different times. • Ensure use of mufflers on diesel/gas driven machinery. • Use low noise equipment. • Ensure all machinery and vehicles are properly maintained and serviced as per maintenance schedule recommended by manufacturer. • Turn equipment off when not in use. • Use enclosures when possible to contain noise on site. • Implement transportation plan. • Materials should be lowered when practical and not dropped. • Verify the operation's flaring system. • Minimize the duration and rate of flaring as much as possible.

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
Artificial Light	Functional lighting on vehicles and drill rig, camp site and well site Flaring	Potential impact on terrestrial fauna	• Keep night lighting to a minimum, consistent with safety and security. • Direct lighting to the inside of the well sites. • Clear vegetation around the flare stack and build earth bermed flare pit.
		Potential impact on terrestrial flora	• Drill Rig located in area distant to sensitive receptors. • Keep night lighting to a minimum, consistent with safety and security. • Direct lighting to the inside of the well sites. • Clear vegetation around the flare stack and build earth bermed flare pit.
Heat	Flaring	Potential impact on local fauna	• Clear vegetation around the flare stack and build earth bermed flare pit. • Minimize flare rate and duration. • Post constant fire watch during flaring operations. • Maintain safety distance between flare stack and well site facilities and adjacent crops.
Liquid Waste	Drill site drainage	Localized change in water quality or contaminated soils from oil and grease	• Prohibit workers from cleaning machines/equipment nearby public water source. • Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources. • Provide a suitable storage area for construction materials (such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil). • Construct one lined waste pit for potentially contaminated runoff and spills (6,000 m^3), surrounded by 0.2 m high bund that will help prevent run-off into the environment. Monitor and transport waste to prevent any overflow from waste pit. • On site fuel will be stored in steel tanks that sit on the higher ground and will be completely surrounded with a bund to contain any spillage. The bund will be 300 mm high around the entire fuel storage area. • Construct drainage system (that includes a series of oil traps) around well site including the concrete rig pad, mud tanks and pumps, cement units, generators and solid control equipment to divert any spills into the waste pit. • Contaminated drainage from site, machinery spaces or bunded areas will be contained. • If the oil-in-water content specification is not met, the contaminated water will be stored in suitable containers and transported for treatment and/or disposal at DOWA waste management facility • Extracted hydrocarbons from oil-in water separator systems will be stored in suitable containers and transported for treatment and/or disposal at DOWA waste management facility

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
Liquid Waste (Cont.)	Sewage and sludge	Localized nutrient enrichment and pollution of surrounding soil, surface water and ground water	• Install 1-2 concrete lined septic tanks at the well site for holding & treating sewage. Grey water to be discharged to infiltration field and away from community water supplies.
	Infiltration from the waste pit and sub-irrigation field	Deterioration of shallow Groundwater	• Install an impervious HDPE geomembrane liner in the cuttings and dirty water waste pit. Monitor liner for tears or leaks during installation and operations. • Infiltration (sub-irrigation) field is properly designed and installed in accordance with local regulations and guidance to prevent any hazard to public health or contamination of land, surface or groundwater; • Infiltration (sub-irrigation) field installed in areas of stable soils that are nearly level, well drained, and permeable, with enough separation between the drain field and the groundwater table or other receiving waters. • Infiltration field to be kept well maintained to allow effective operation;
Solid Waste	Non-hazardous solid waste	Contamination of water and soils and injury to fauna	• Tenders for supply and construction contractors will require waste reduction at the source. • A PCMI Waste Management Plan for this drilling campaign will be developed. • Domestic and general waste to be segregated and stored using suitability labeled. • Food scraps and other kitchen wastes will be segregated and transferred to waste disposal facilities. • Cooking oils and greases from the kitchen will be collected and transported to waste disposal facilities. • All non-hazardous solid general waste will be sent for recycling or disposal to at the DOWA Waste Management Facility.
	Hazardous Solid Waste	Contamination of water and soils and injury to fauna	• Hazardous wastes materials will be handled and stored in accordance with the corresponding MSDS. • General non-hazardous solid wastes will be managed in accordance with accepted international standards. • Tenders for supply and construction contractors will require waste reduction at the source. • A PCMI Waste Management Plan for this drilling campaign will be developed. • Waste will be segregated at source into recyclable and non-recyclable wastes, where a net environmental benefit is likely, and stored in clearly marked containers for transport to DOWA waste disposal site. • Hazardous wastes will be transported for disposal at a DOWA waste facility

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
Drill Cuttings and Sludge	Disposal of drill cuttings and sludge	Localized change in water quality and soil quality from chemical composition of drill fluids	• Drill cuttings and adhered fluids will not be discharged to surrounding area. • All drilling activities will be conducted in accordance with approved Environment Management Plan. • Volume of cuttings and fluids discharged will be minimized through use of solids control equipment. • Use non-hazardous water-based mud system. Inform MOGE in case of change in mud chemicals. • Store all chemicals in secured storage area with impervious (cement or plastic sheet) floor and bund wall. Handle all chemicals according to its MSDS. • Provide spill clean up kits and training for designated rapid response teams to clean up any spills. In the event of oil or chemical spill, implement spill response plan. Handle all chemicals according to its MSDS. • Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil. • Implement transportation plan.
	Loss of circulation	Deterioration of shallow and deep Groundwater	• Case sections of the well with steel tubing. • Cement steel casing in place.

Social Aspects

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
Change in Land Use	Purchase of land for access roads, drill and camp site	• Loss of agriculture potential • Project operation effects on nearby land productivity • Loss of employment for displaced workers that do not own land	• Transparent and fair compensation to land owners and users. • Ensure all permissions are obtained from landowners and local authorities. Provide summary to MOGE. • Notify surrounding landowners 2 weeks before on location and time of project activities. • Restoration of land to its original state within 6 months of project completion.
Traffic	Transportation of equipment, people and services	Increase in and disruption of local traffic	• Post and enforce speed limit (follow traffic law on highway and community area, 30km/hr on unsealed road). • Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights. • Consult with local authority before major movement. • Restrict/ avoid movement of heavy equipment during rush hours. • Provide traffic signs or flags at junction of access roads and main roads. • Investigate any complaints and handle appropriately. Keep records of complaints and follow-up. • Obtain approval from MOGE and appropriate government offices (Forestry Department if forestry land is crossed) before constructing, upgrading or reroute access roads. • Strictly enforce training programs to reduce transport incident cases by its contractors. • Restore any damage to roads that is caused by contractors or Company. • Restrict local traffic on PCMI private access road. • Ensure all vehicles are left hand drive.

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
Water Use	Water for construction exploration drilling and domestic use	Reduction of local community water supply	• Obtain local approval for drilling a ground water well. • PCMI to drill their own ground water wells on site. • Consult local community leaders and township authorities before water hauling (if required). • Potable water and industrial water, if taken by tube wells or tanker from nearby reservoirs/rivers, should not affect the availability of water to locals.
Power Use	Power for drilling operations and work camp	Increase or decrease of available power for local community	• Purchase and install diesel-powered generators to supply all project power related needs.
Water Drainage	Surface runoff from roads and camp site	Increased drainage potentially affecting roads and infrastructure	• Obtain approval from MOGE and appropriate government offices (Forestry Department if forestry land is crossed) before constructing, upgrading or reroute access roads. • Follow civil engineer's recommendation on well site and access road construction design. • Avoid construction of well sites and access roads in areas that may cause obstacles to water drainage. • Water drainage lines (culverts) will be constructed to maintain natural drainage. The required permission will be obtained from all relevant agencies.
Wastewater	Project operation effects on water quality	Potential impact to agriculture, aquaculture and fisheries	• Avoid construction of the well pads and/or access roads in areas where this would obstruct water drainage. • Prohibit workers from cleaning machines/equipment in/near a public water source. • Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources. • Use non-hazardous water-based mud and synthetic based mud system. Inform MOGE in case of change in mud chemicals or type of mud. • Fuel storage tanks to be surrounded by bund wall. • Construct drainage system around concrete rig pad and mud tanks to divert any spills into waste pit. • Monitor level of cuttings and dirty water in waste pit. • Isolate any area(s) that might be contaminated from non-contaminated areas. Provide water drainage system around the contaminated area for collecting water into the sump pit or for treatment. • Construct oil traps along perimeter drainage ditch to prevent any spills from flowing

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
			off site. • Store all chemicals in secured storage area with impervious (cement or plastic sheet) floor and bund wall. Handle all chemicals according to their MSDS. • Use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious surfaces (i.e. on tarpaulin sheet). • Provide spill cleanup kits and training for designated rapid response teams to clean up any spills. • In the event of oil or chemical spill, implement spill response plan. • Install septic tanks for holding sewage and grey water. • Pump septic tank fluids to DOWA sewage treatment plant on a regular basis to prevent overflow.
Waste Disposal	Disposal of waste in project area	Increased waste disposal overloading local infrastructure	• Provide septic tank for sewage. • Ensure treatment and disposal according to accepted international standard. Keep waste manifest. • Enforce “Good Housekeeping” practices. • Segregate and store waste in appropriate, secure properly labelled containers. • Dispose of waste in labelled containers for possible recycling. • Implement requirements for waste management and related laws. • Store hazardous waste in appropriately designed areas and safe containers that are suitable for transporting/transferring. • Always check and record the type(s) and amount of waste generated. • Provide Waste Manifest System.
Tourism and Recreational experience	Project construction and operation effects on tourism and recreation	Disturbance and reduction of tourism and recreational experience	• Post and enforce speed limit (follow traffic law on highway and community area, 30km/hr on unsealed road). Consult with local authority before major movement. • Consult with local authority before major movement. • Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights. • Restrict/ avoid movement of heavy equipment during rush hours. • Provide traffic signs or flags at junction of access roads and main roads. • Investigate any complaints and handle appropriately. Keep records of complaints and follow-up. • Obtain approval from MOGE and appropriate government offices (Forestry Department if forestry land is crossed) before constructing, upgrading or reroute access roads. • Strictly enforce training programs to reduce transport incident cases by its

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
			contractors. • Restore any damage to roads if caused by contractor or company. • Restrict local traffic on PCMI private access road. • When project complete, promptly (within 6 months) restore land to its original state.
Employment & Income	Employment & income for nearby communities	Potential increase in jobs and related income for local communities	• Meet with local authorities to discuss and design local employment hiring to limit impacts on local businesses and key agricultural seasons. • Employ qualified local workers. • Purchase local supplies and services, whenever possible. • Host a pre-project local community awareness program with communities to facilitate awareness of opportunities and benefits. • Terms of contract for recruitment of manpower in these companies needs to include emphasis on hiring locals, especially for unskilled and semi-skilled workforce.
Labour In-migration	In-migration of labour and social interaction	Potential conflict between workers from other regions and local communities	• Meet with local authorities to discuss and design local employment hiring to limit impacts on local businesses and key agricultural seasons. • Employ qualified local workers. • Purchase local supplies and services, whenever possible. • Host a pre-project local community awareness program with migrant workers to facilitate sensitivity and limit interactions, where advisable, between migrant workers and local communities. • Restrict workers to within project boundaries and do not allow local interaction within the communities.

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
Historical, Archeological & Cultural Resources	Project construction potentially destroying historical and archaeological sites	Loss or damage to historical and archeological sites	• Watch for artefacts during site construction and inform the Local Authorities before commencement of drilling. • Report to the Myanaung GAD if any archaeological evidence is discovered at the well sites or access roads. Through consultation, a plan to proceed will be developed. • If artefacts are found during the construction phase, PCMI will inform the responsible local office immediately. • Consult with local authorities to identify culturally important festivals and plan transportation, construction and drilling activities to avoid impact. • Review any records for site-specific location. • Monitor earthworks during construction using qualified/trained inspector.

Occupational Health/Public Health

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
Dust	• Access/upgrade roads, • Site construction, • Transportation of granular fill, workers, equipment	• Respiratory irritation • Exacerbation of asthma	• Spray water on un-surfaced access roads of project transportation route during dry conditions at least twice a day (morning and afternoon). • Post speed limits on project access route and limit vehicle speed to 30 km/h on un-surfaced roads. • Use vehicles with dust flaps. • Cover loose dry loads.
Noise	• Generator, Transportation, Construction • Drilling	Hearing impairment for workers and Annoyance for public	• Limit vegetation removal to a minimum. • Schedule operation of noisy construction equipment at different times. • Ensure use of mufflers on diesel/gas driven machinery and vehicles. • Ensure all machinery and vehicles are properly maintained and serviced as per maintenance schedule recommended by manufacturer. • Provide earplugs to drilling workers. • Select drill site locations at safe distances from nearest community (a minimum of 500 m). • Should complaints over noise be received, consideration will be given to the provision of noise barriers.
Non-hazardous waste	• Waste disposal, Leaks/spills, • Standing water	• Food safety, gastroenteritis • Increase in vector-borne diseases: malaria, typhus and dengue and others.	• Provide septic tank for domestic sewage. • Ensure treatment and disposal according to accepted international standard. • Keep waste manifest. • Enforce “Good Housekeeping” practices. • Segregate non-hazardous and hazardous waste, store each type of waste in closed containers and make sure all containers are clearly labeled. • Dispose of waste in labelled containers for possible recycling. • Implement requirements for waste management and related laws. • Store hazardous waste in appropriate and safe containers that are suitable for transporting/transferring. • Always check and record the type(s) and amount of waste generated.
Mud Chemicals and drilling waste	• Mixing of drilling chemicals, • Leak/spill of mud chemicals	Acute exposure such as skin irritation, inhalation exposure etc.	• Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil. • Use non-hazardous water-based mud system. Inform MOGE in case of change in mud

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
			chemicals. • Construct drainage system around concrete rig pad, mud tanks and pumps, cement units, generators and solid control equipment to divert any spills into the waste pit. • Store all chemicals in secured storage area with impervious (cement or plastic sheet) floor and bund wall. Handle all chemicals according to its MSDS. • Provide spill clean up kits and training for designated rapid response teams to clean up any spills. • In the event of chemical spill, implement spill response plan. • Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil. • Implement transportation plan. • Cement steel casing in place. • Implement awareness training on the hazards of the chemicals. • Enforce use of PPE, such as dust masks or respirators, gloves, overalls, and eye glasses. • Handle chemicals only in well-ventilated and controlled areas.
Hazardous waste	• Material contaminated with oil or chemicals, • Lubricating and hydraulic oil, • Drum and containers used for chemical transportation and storage	Acute exposure such as skin and eye irritation, inhalation exposure etc.	• Segregate and store hazardous chemicals and waste in appropriate, labelled and safe containers that are suitable for transporting/transferring. Containers having hazardous waste must be kept in safe areas. • All hazardous waste will be collected in skips ready for treatment and disposal and sent directly to DOWA waste disposal facility. • Provide Manifest System for transportation of hazardous waste to treatment area or disposal area. • Always check and record the type(s) and amount of hazardous waste generated.
Communicable diseases	• Migration/influx of outside workers	Increased incidence and prevalence of HIV/AIDS, hepatitis Band C, syphilis, etc.	• Implement mitigation measures listed for non-hazardous waste (Section 6.5.3). • Clearing of overgrowth in perimeter. • Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil.

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
			• Keep waste manifest. • Drainage and removal of waste from waste pit upon completion of drilling. • Health screening of workers before employment. • On-site health clinic (drilling operations) and referral system during all of project operations with external health agencies to ensure timely diagnosis and treatment of workers' illness and injury. • Maximize hiring of qualified local workers to reduce reliance on outside labour and increase local employment. • Do not allow workers to enter communities near the drill site. • Provide awareness to workers on preventive measures for the prevention of communicable and local diseases.
Light and heat	• Flaring	Heat exposure Nuisance light	• Post constant fire watch during flaring operations. • Maintain safety distance between flare stack and well site facilities and adjacent crops. • Implement PCMI's Emergency Response Plan including specific management procedures to mitigate the impacts if a fire occurs. • Install fire extinguishers, alarms and windsocks (to be audible and visible from whole site). • Heat impacts from the flare stack will be minimized by having a protected flare pit. • Maintain a safe distance from nearest sensitive receptor.

Flare emissions	• Flaring	Increase in respiratory illnesses/diseases
		Exacerbation of asthma
		Disturbance psychological wellbeing
			• Ensure flare system has efficient combustion.
			• Clear vegetation around the flare stack and build earth bermed flare pit.
			• Maintain pilot flame at the flare tip to ensure that flame is not extinguished by strong wind.
			• H2S detection and safety equipment is standard issue. PCMI's emergency response plan (ERP) includes an H2S Contingency Plan. Furthermore, the drilling contractor will have their own H2S Contingency Plan.
			• Standard mitigation measures to reduce impacts from hydrogen sulphide release during well testing will be implemented:
			  ○ Install H2S sensors at the flow line.
			  ○ If H2S levels exceed 10 ppm in the gas stream, implement appropriate safety zones.
			  ○ The initial flow of hydrocarbons to surface will be timed to coincide with daylight hours.
			• Staff trained in H2S procedures.

Unplanned Events

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
Blowout	Drilling	• Release of uncontrolled volumes of hydrocarbons • Fire • Explosion	• Careful planning of drilling operation. • Examination of existing seismic lines and nearby wells to identify shallow gas hazards. • Drilling and Well Control Standard Operating Procedures and extensive HSE Management System procedures and operational controls in place. • Internal hazardous operations reviews and "Table Top drilling" exercises to test procedures and individual personnel performances against the drilling plan. • Select proper drill fluid formulation, provide well kill fluids/systems, loss control and weighting agents. • Very careful monitoring of down hole conditions and mud returns. • Use of appropriate, high quality materials in well construction (casing and cement grades). • Provide a blowout preventer (BOP) stack that is sized appropriately in proportion to the maximum formation pressure; and test as per procedures. • Provide of a high-pressure water-spray dousing system around the wellhead, solids removal chokes and flare stack. • PCMI's Emergency Response Plan. • PCMI's HSE Integrated Management System Procedures and operational controls will be in place to prevent a blowout/explosion. • PCMI BOCP in place prior to spudding.
Fire or Explosion (not associated with Blowout)	Fuel Storage Flare Testing Burning Garbage	Possible explosion or fire of drilling rig or at campsite, or fuel storage area	• PCMI's HSE Integrated Management System Procedures and operational controls to prevent a fire/explosion. • PCMI's Emergency Response Plan including specific management procedures to mitigate the impacts if a fire/explosion occurs. • Install fire extinguishers, alarms and windsocks (to be audible and visible from whole site). • Pre-arranged call out support from local fire brigades.
Fuel, Chemical or Hazardous Waste/Materials Spill	Storage of Fuel, chemicals, hazardous materials or waste	Potential risk of spills to the environment affecting air quality, soil quality, surface water, groundwater, biota	• Chemicals, Hydrocarbons and hazardous materials or waste will be securely stored and use governed by safe operating procedures. • Spill containment and recovery equipment will be available near storage areas. • Procedures for response to Chemicals, Hydrocarbons and hazardous materials or waste spills will be included in PCMI's ERP. • MSDS Sheets will be posted in areas where Chemicals, Hydrocarbons and hazardous materials or waste is stored and with the ESH Officer.

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
		and people	• Construct one lined waste pit for potentially contaminated runoff and spills (6,000 m^3), surrounded by 0.2 m high bund that will help prevent run-off into the environment. Monitor and transport waste to prevent any overflow from waste pit. • Construct drainage system around well sites and concrete rig pad which mud tanks, shakers, generators and fuel tanks sit on to divert any spills into the waste pit. • Use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious floor (e.g. tarpaulin sheet). • Provide drip pans and absorbents to contain any spillage. • Provide spill cleanup kits and training for designated rapid response teams to clean up any spills. In the event of oil or chemical spill, implement ERP. • Prohibit workers from cleaning machines/equipment in/near a public water source. • Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources. • Maintain oil traps along perimeter drainage ditch to prevent any spills from flowing off site. • Isolate any area(s) that might be contaminated from non-contaminated areas. The ground of areas where possible contamination occurs will be covered with plastic sheet. • Store Chemicals, Hydrocarbons and hazardous materials or waste storage tanks on concrete rig pad. The storage unit will be surrounded by a bund wall that is 300 mm high and able to contain liquid chemicals in case of spill. • Transport produced emulsion-condensate to a DOWA wastewater treatment facility using dedicated tanker trucks. • The use of chemicals will be avoided through appropriate design where practicable. • During the procurement process, chemicals will be evaluated for environmental, safety, technical, and commercial performance. As far as practicable, least hazardous chemicals will be selected. • Procedures for response to chemical spills will be included in PCMI's ERP. • Use non-hazardous water-based mud system. Inform MOGE in case of change in mud chemicals. • Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil. • Implement transportation plan.

Aspect	Activity	Potential Impact	Prevention/Mitigation Measure
Transportation Accidents	Transportation of equipment, personnel, granular fill, mud and cuttings, and waste	Possible injury or death to personnel; and localized contamination of environment	• HSE Integrated Management System Procedures. • Limit the speed of project vehicles, according to the road condition (on unpaved road to 30 km/h). • Maintain construction equipment and vehicles to regulatory standards. • Conducting RHA (Road Hazard Assessment for identified roads and implement JHA) • Notify the local authority on the oversized load and put a escort in front of this convoy with horn and hazard lights. • Consult with community leaders on plan and transportation route before movement of large equipment. • Restrict/ avoid movement of heavy equipment during rush hours from 07.30 to 08.30 am and 3.30 to 4.30 pm. • Provide traffic signs or flags at junction of access road and main road. • Investigate any complaints and handle appropriately. Keep records of complaints and follow-up. • Strictly enforce training programs to reduce transport and drilling incidents by its contractors. • Restore any damage to roads caused by project vehicles. • Implement emergency response training, fire training and response drills. • Install adequate fire extinguishers around the well sites. • Test safety devices as determined appropriate. • Provide PPE to workers on site. • Provide medic, First Aid kits and First Aid trained personnel at drilling site. • Restrict smoking to controlled areas. • Prohibit trespassers from entering the construction site. • Referral system with external medical facilities for serious injuries or emergencies.
Earthquakes	Physical shifting of earths surface	Potential physical disruption cause building collapse, blowouts, fires or spills	• Implement PCMI's Earthquakes: Evacuation Plan and Emergency Response Plan. • Proper training and safety procedures will be the main preventative measures to reduce the potential risk. • In the unlikely event an accident should occur, the Emergency Response Plan would be implemented, which includes evacuation of personnel during severe circumstances.

8.5.3 Environmental, Social, and Health Impacts and Monitoring Measures

A summary of EHS impact and monitoring measures for the onshore exploration drilling and well testing are shown in **Table 8-4**.

Table 8-4: Environmental, Social, and Health Monitoring Measures

Factors	Index	Procedure	Proposed Duration and Frequency of Monitoring	Location
Air Quality	• TSP • PM-10 • NOx, • SOx, • CO	Method • Following the WHO guideline (updated 2005) and the National Ambient Air Quality Standards (NAAQS, set by U.S. Environmental Protection Agency USEPA, 1990)	**Duration:** 1 days continuously **Frequency:** • Once during construction and drilling phase • As within 1 km of a community regular monitoring will be required. • In case of any complaint regarding air quality, an additional air quality measurement may be conducted in response to specific complaints (if necessary)	Nearest sensitive receptor or downwind of complaint area (if necessary)
Noise	• L_{eq}24 hr. • L_{max} • L_{dn} • Nuisance noise	Method • Measure background noise level, residual noise level, specific noise level and calculation of noise using a Type 1 or 2 sound level meters meeting all appropriate IEC standards • Following the Guidelines for Community Noise, World Health Organization (WHO), 1999	**Duration:** 1 days continuously **Frequency:** • Once during construction and drilling phase • As within 1 km of a community regular monitoring will be required • In case of a complaint regarding noise from project site, an additional noise measurement may be conducted (if necessary)	100 meter from Drill Rig

Factors	Index	Procedure	Proposed Duration and Frequency of Monitoring	Location
Soil	Physical parameters: • pH • Soil texture • Salinity • Conductivity • Temperature • Cl^- Chemical Parameters: • Petroleum Hydrocarbons • Benzene • Toluene • Ethyl benzene • Total xylene • Metals: As, Cd and Cd-compound, Cr^{6+}, Pb, Hg, Ni, Se, Ba, Cu, Zn, Fe, Mn and Mn-compound	Method • Follow U.S. EPA Analytical Method per parameter • Compare results to Soil Quality Standards, Notification of the National Environmental Board No. 25, B.E. 2547 (2004), published in the Royal Government Gazette, Vol. 121 special part 119D, dated October 20, B.E. 2547 (2004)	• Once after project completion	Project site At the spillage or leakage areas
Surface water	Physical parameters: • pH • Conductivity • Temperature • SS • TDS • Salinity Chemical Parameters: • DO • BOD • TPH and Oil and Grease • Cl, SO_4 • Metals: As, Cd, Total Cr, Pb, Total Hg, Ni, Se, Ba, Cu, Zn, Fe, Mn Biological parameters: • TCB	Method • Analytical Methods followed to Standard Methods for the Examination of Water and Wastewater, recommended by APHA-AWWA-WEF • Compare to EPA's National Recommended Water Quality Criteria and standards from Notification of the National Environmental Quality No.8, B.E. 2537 (1994)	• Regular intervals (monthly or quarterly) • In an event of spillage and leakage	• At the same surface water sampling station before having project (Baseline) • Water sources which are potentially affected (in case of spillage of leakage)

Factors	Index	Procedure	Proposed Duration and Frequency of Monitoring	Location
Groundwater	Physical parameters: • pH • Conductivity • Temperature • TDS • Salinity Chemical Parameters: • TPH and Oil and Grease • Benzene • Toluene • Ethyl benzene • Total xylene • Cl, SO_4 • Metals : As, Cd, Total Cr, Pb, Hg, Ni,Se, Ba, Cu, Zn, Fe, Mn	Method • Analytical Methods followed to Standard Methods for the Examination of Water and Wastewater, recommended by APHA-AWWA-WEF • Compare to Standards from Notification of Ministry of Natural Resources and Environment B.E. 2551 (2008)	• Regular intervals (monthly or quarterly) • In event of spillage and leakage	• Nearest groundwater well or just off well pad area • Area of possible spill
Cuttings from drilling (in case of further using cuttings)	Cuttings from surface section • pH • Conductivity • Salinity • Cl^- Cuttings from middle and reservoir section • pH • Conductivity • Salinity • Cl^- • Soluble Threshold Limit Concentration (STLC) • Total Threshold Limit Concentration (TTLC)	Method • Soil quality standards for habitat and agriculture and other purposes from Notification of the National Environmental Board No. 25, B.E. 2547 (2004), published in the Royal Government Gazette, Vol. 121 special part 119D, dated October 20, B.E. 2547 (2004) • STLC and TTLC are analyzed by Waste Extraction Test Method and Leaching Test Method[1] and also classify that analyzed cuttings sample is non-hazardous waste or hazardous waste by using an analysis method Number of Samples • At least 2 samples per section of drilling	• During exploration drilling • Upon Completion of Drilling before mixing / burial disposal in waste pit.	• Exploration drilling well

Factors	Index	Procedure	Proposed Duration and Frequency of Monitoring	Location
Chemical use for drilling	• Type of chemical • Volume of use	• Daily record type of chemicals and volume used	• Daily and report after drilling is completed	• Project area
Hazardous and Non-hazardous waste	• Manifest Disposal and Tracking Report	• Track waste volume by type and disposal location daily	• All phases	• At all project locations
Social	• Complaint • Monitoring and solving	• Record complaint • Monitor, investigate and implement suitable solutions	• All phases	• Project area, community around project area, and transportation route
Occupational health and safety	• Accidental statistics • cause of accidents • Mitigation measures	• Record accidents or near misses generated during construction by identifying cause(s) and severity of impact(s), as well as operated mitigation measures • Conduct summary report for accident investigation	• All phases	• Project area, community around project area and transportation route
Audit of Management Measure Implementation	• Audit of Management Measures	• Conduct Audit of management measure implementation	• Once after project completion	• At all project locations
Post Project Opinion Survey	• Opinion Survey of Communities near project area	• Post project opinion survey to determine community attitude toward the project	• Post Project	• Nearby community

1 = Extracted by using Waste Extraction Test Method and Leaching Test Method and also classify that analyzed cuttings is non-hazardous waste or hazardous waste by using analysis method and standard values

8.6 Management and Monitoring Sub-Plans

Management and monitoring sub-plans are provided in this section for key parameters that may be significantly impacted by the proposed project, including:

- Waste Management Plan
- Water Management Plan
- Soil Management Plan
- Air Quality Management Plan
- Noise Management Plan
- Biodiversity Action Plan
- Cultural Heritage Management Plan
- Community Consultation and Grievance Mechanism
- Emergency Response Plan
- Land Acquisition Procedure

Management actions are defined to prevent or mitigate potential issues from occurring and monitoring will provide:

(1) Data on waste-stream emissions to ensure an ongoing assessment of operating standards and to measure performance against established requirements (objectives, targets, and performance criteria).
(2) Data on the environment to measure changes from the original environmental conditions.

The baseline survey reported in this EIA provided information on the relevant chemical, biological and social environment before start-up of operations. Follow-up monitoring will be done to determine any possible changes as a result of the proposed PCMI Exploration Drilling Project.

Discharges and emissions from the proposed project are monitored to determine compliance with regulations and/or company standards.

Monitoring therefore includes ambient monitoring of the environment and monitoring of discharges.

An independent monitor will be in the field for the duration of project activities. The monitor too will audit compliance with guidelines, regulations and mitigation measures. Monitoring measures for the construction, drilling, and abandonment are outlined in the following plans.

8.7 Waste Management Plan

8.7.1 Objectives

This WMP is designed for use in all activities associated with this drilling project.

The target users of this Plan are the drilling field personnel (drilling storage, camp, etc.), who will be responsible for the actual handling and management of wastes generated from project activities.

This Plan applies to all sectors and activities related to the drilling operations for Block IOR-7, throughout all operations and includes:

- collection, handling and temporary storage of wastes; and
- management and transportation to treatment/disposal of the waste at authorized facilities.

The main objective of this Plan is to define the management procedures of the waste produced during the activities performed in Block IOR-7, Myanmar, in compliance with the national and international standards and guidelines presented in the following sections.

8.7.2 Legal Requirements

The section provides a description of the legal framework relevant to the management of the wastes produced during drilling activities.

8.7.2.1 International Conventions And Agreements

Basel Convention: The Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was adopted on 22nd March 1989 by the Conference of Plenipotentiaries in Basel, Switzerland. The overarching objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes. The provisions of the Convention center around the following principal aims:

- the reduction of hazardous waste generation and the promotion of environmentally sound management of hazardous wastes, wherever the place of disposal;
- the restriction of transboundary movements of hazardous wastes except where it is perceived to be in accordance with the principles of environmentally sound management;
- a regulatory system applying to cases where transboundary movements are permissible.

8.7.2.2 Myanmar Laws And Regulations

The Ministry of Natural Resources and Environmental Conservation is the main institutional body responsible for setting a framework for waste management at the national level. Similarly, all major cities across Myanmar are administrated by City Development Committees that are responsible for providing municipal waste management services.

8.7.2.3 Existing Policy And Regulations

Existing Laws and Regulations are as follows:

National Level

- The Constitution of the Republic of the Union of Myanmar (2008);
- National Government Policy (1994);
- Environmental Conversation Law (March, 2012);
- Environmental Conservation Rules (June 2014);
- Environmental Impact Assessment procedures (Dec, 2015);
- National Environmental Quality (Emission) Guideline (2015);
- Hazardous Waste Notification (Draft 2016);
- Factories Act (1951) ;
- Public Health Law (1972);

Yangon

- The Yangon Civil Development Law (2013);
- The City of Yangon Development Law (1990);
- The Underground Water Act (1930);
- The Water Power Act (1927);
- The City of Yangon Municipal Act (1922);
- The Yangon Water-work Act (1885).

In addition, City and Township Development Committees promulgated the solid waste disposal and collection by-law providing the legal basis at the local level. For the Ayeyarwady Region Regional Level, there is the "Ayeyarwady Region Municipal Act" which is concerned with the whole region. For each township, there are local by-laws specific to town. These by-laws are based on the township level situation. Thus the by-laws are different between each township.

MONREC has established environmental quality standards, the National Environmental Quality Standard [Legal Reference: ECL 2012 (Article 2c) and EQS 2016]. ECD / MONREC have indicated that the discharge standards shown in **Table 8-5** below would be applicable for Onshore Oil and Gas activities. These are in accordance with international standards.

Table 8-5: Myanmar Discharge Standards Applicable to Onshore Oil and Gas activities

Guideline	Standard
Drilling fluids and cuttings	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines
Produced sand	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines
Produced water	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines for discharge to surface waters or to land: – Total hydrocarbon content 10 mg/L – pH 6-9 – Biochemical oxygen demand 25 mg/L – Chemical oxygen demand 125 mg/L – Total suspended solids 35 mg/L – Phenols 0.5 mg/L – Sulfides 1 mg/L – Heavy metals (total)a 5 mg/L – Chlorides 600 mg/L (average), 1,200 mg/L maximum
Hydrotest water	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines for discharge to surface waters or to land, apply standards specified for Produced Water
Completion and well work- over fluids	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines

	For discharge to surface waters or to land: – Total hydrocarbon content 10 mg/L – pH 6-9
Storm water drainage	Storm water runoff should be treated through an oil / water separation system able to achieve oil and grease concentration of 10 mg/L
Cooling water	The effluent should result in a temperature increase of no more than 3°C at edge of the zone where initial mixing and dilution take place; where the zone is not defined, use 100 m from point of discharge
Sewage	Treatment as per General EHS Guidelines, including discharge requirements
Air emissions	Treatment as per General EHS Guidelines Emission concentrations as per General EHS Guidelines, and: – Hydrogen sulfide 5 mg/Nm^3

a Heavy metals include: Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, Vanadium and Zinc

8.7.2.4 Standards And Guidelines

The following Standards and Guidelines are to be considered:

- ISO 14001:2015, Environmental Management Systems - Requirements with Guidance for use;
- International Finance Corporation (IFC), General Environmental, Health, and Safety General Guide-lines, 2007;
- International Finance Corporation (IFC) Environmental, Health, And Safety Guidelines For Onshore Oil And Gas Development, 2017;

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP).

Table 8-6: Applicable IFC EHS Guidelines

Environmental topic	Applicable EHS Guidelines
Wastewater and Liquid effluent quality	Section 1.3 provides guidelines applied for projects that have either direct or indirect discharge of process wastewater or wastewater from utility operations. Section 1.3 provides guidelines for treatment approaches of process wastewater and wastewater from utility operations. These Guidelines include the following key recommendations: • points of discharge, rate of discharge, chemical use, dispersion and environmental risk should be considered in a disposal plan; • discharges should be planned away from environmentally sensitive areas, with specific attention to high water tables, vulnerable aquifers, wetlands, and community receptors, including water wells and intakes.
Waste management	Section 1.6 provides guidelines for projects/facilities that generate, store, or handle any quantity of industrial hazardous or not hazardous waste. Section 1.6 provides appropriate guidelines for hazardous waste storage, transport, treatment and disposal, in order to prevent harm to health, safety and environment. These Guidelines include the following key recommendations: • waste management should be addressed through a Waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring; • in addition to the implementation of waste prevention strategies, the total amount of waste may be significantly reduced through the implementation of recycling plans; • if waste materials are still generated after the implementation of feasible waste prevention, reduction, reuse, recovery and recycling measures, waste materials should be treated and disposed and all measures should be taken to avoid potential impacts to human health and the environment.

8.7.3 Waste Management Principles

The Drilling Contractor will be responsible for waste management during the drilling program, and will be required to be in compliance with the local legislation and Environmental, Social an Health Management and Monitoring Plan (ESHMP). PCMI will regularly conduct inspections and audits during operations to ensure compliance to contract requirements. .

8.7.3.1 General Waste Management Principles

The following guidance applies to the management of nonhazardous and hazardous waste. Waste management should be addressed through a Waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring.

IFC (2007) notes that Facilities that generate and store wastes should practice the following:

- Establishing waste management priorities at the outset of activities based on an understanding of potential Environmental, Health, and Safety (EHS) risks and impacts and considering waste generation and its consequences.
- Establishing a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes.
- Avoiding or minimizing the generation waste materials, as far as practicable.
- Where waste generation cannot be avoided but has been minimized, recovering and reusing waste.
- Where waste cannot be recovered or reused, treating, destroying, and disposing of it in an environ-mentally sound manner.

The waste management hierarchy below considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes:

- prevention (don't generate waste);
- reduction (generate less waste by better management and by material substitution);
- reuse (reuse in its original form);
- recovery (extract material or energy from a waste);
- recycle (recycle and reprocess the waste to incorporate it into a new product or new use);
- disposal (mitigate the hazard through treatment, relocate the waste to another location).

Efforts should be made to eliminate, reduce or recycle wastes at all times, in line with the waste hierarchy. At a minimum, the waste materials should be segregated into non-hazardous and hazardous wastes for consideration for reuse, recycling, or disposal.

Waste management planning should establish a clear strategy for wastes that will be generated including options for waste elimination, reduction or recycling or treatment and disposal, before any wastes are generated.

8.7.3.2 Waste Management And Minimisation Plan

Waste minimization practices are to be applied to all types of waste. In addition, the conservation of re-sources (energy, water, gas, and fuel) will be addressed. The waste minimization plan is one part in the overall programme of responsible waste management.

8.7.3.3 Training

All contractor personnel will be trained on the PCMI Waste Management Plan, so they can become familiar with the reporting procedures and the entities involved in the management of the wastes derived by the drilling activities. Training of personnel will take place at the following frequency:

- New Personnel will be initially trained to ensure familiarity with the Waste Management Plan prior to beginning their job assignments (applicable to all shift changes);
- Specific training will be provided for the management of hazardous wastes;
- Refresher training will be conducted whenever there are inadequacies in management of waste (classification, storage, handing) or when deviations from the Waste Management Plan are observed.

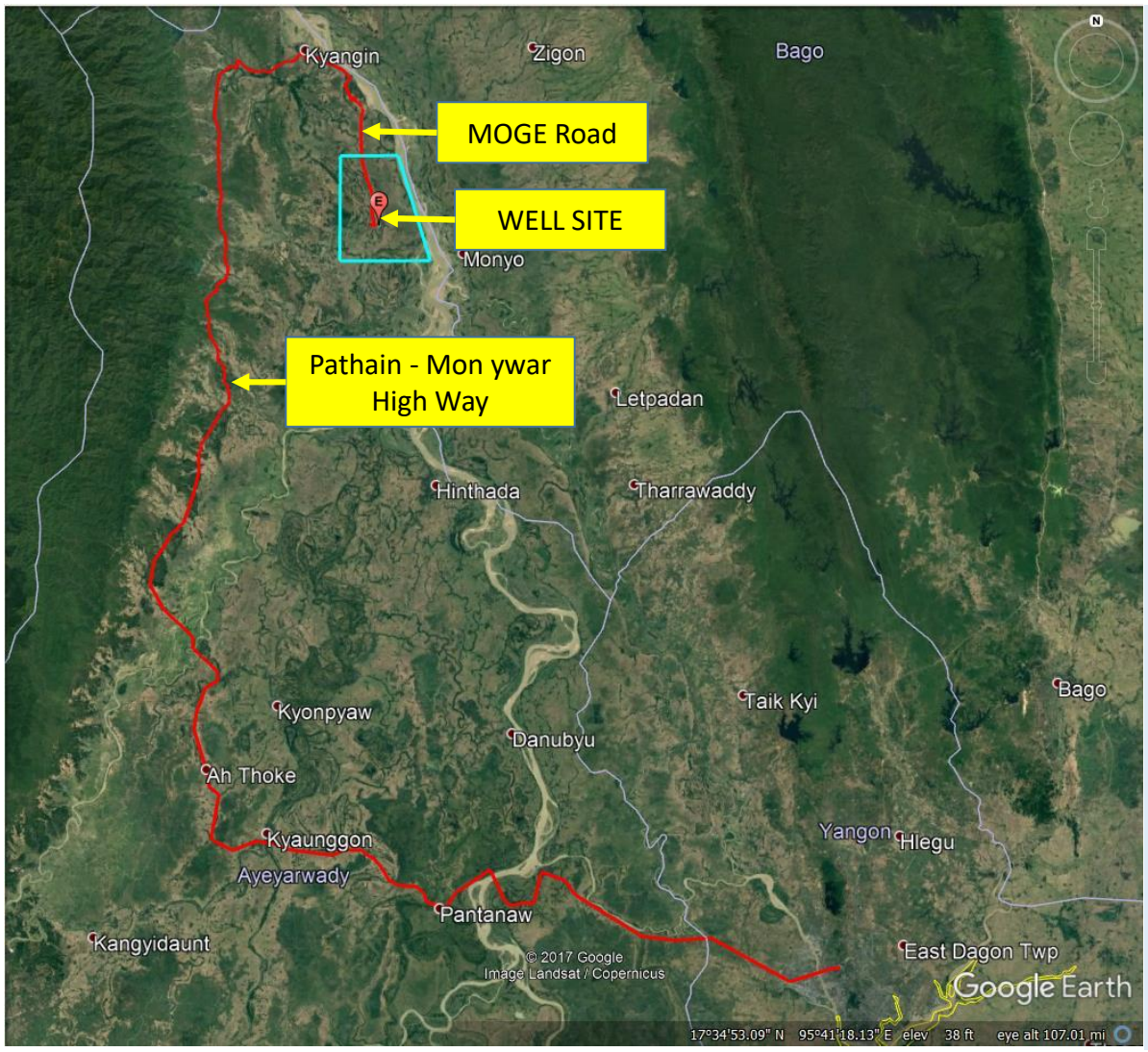
8.7.3.4 Due Diligence

Steps toward the establishment of due diligence includes:

- Regular performance of environmental audits or inspections
- The establishment of periodic exercising of contingency plans
- Knowledge and compliance with applicable legislation
- Employee/contractor training
- Establishing and maintaining codes and operating procedures, and
- Maintaining detailed records and inventories

8.7.4 Overview Maps and Site Layout

On-site and Off-site transportation of waste should be conducted so as to prevent or minimize spills, re-leases, and exposures to employees and the public. All waste containers designated for off-site shipment should be secured and labeled with the contents and associated hazards, be properly loaded on the transport vehicles before leaving the site, and be accompanied by a shipping paper (i.e., manifest) that describes the load and its associated hazards, consistent with the guidance on the Transport of Hazardous Materials. The waste transportation route is shown in **Table 8-1**. The distance from Yangon to Well Site is 418 Km for this route. The route is via Pathein – Monywa Highway road to Kyangin and then to Myanaung. Then proceed to Well Site area via MOGE road starting from Mingone Junction.



Source: PCMI 2018

Figure 8-1: Drilling Waste Transportation Route

8.7.5 Management Actions

Liquid Waste

- Prohibit workers from cleaning machines/equipment nearby public water source.
- Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.
- Provide a suitable storage area for construction materials (such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil).
- Construct one lined waste pit for potentially contaminated runoff and spills (6,000 m^3), surrounded by 0.2 m high bund that will help prevent run-off into the environment. Monitor and transport waste to prevent any overflow from waste pit.

- On site fuel will be stored in steel tanks that sit on the higher ground and will be completely surrounded with a bund to contain any spillage. The bund will be 300 mm high around the entire fuel storage area.
- Construct drainage system (that includes a series of oil traps) around well site including the concrete rig pad, mud tanks and pumps, cement units, generators and solid control equipment to divert any spills into the waste pit.
- Contaminated drainage from site, machinery spaces or bunded areas will be contained.
- If the oil-in-water content specification is not met, the contaminated water will be stored in suitable containers and transported for treatment and/or disposal at DOWA waste management facility
- Extracted hydrocarbons from oil-in water separator systems will be stored in suitable containers and transported for treatment and/or disposal at DOWA waste management facility
- Install 1-2 concrete lined septic tanks at the well site for holding & treating sewage. Grey water to be discharged to infiltration field and away from community water supplies.

Non-hazardous Solid Waste

- Tenders for supply and construction contractors will require waste reduction at the source.
- A PCMI Waste Management Plan for this drilling campaign will be developed.
- Domestic and general waste to be segregated and stored using suitability labeled.
- Food scraps and other kitchen wastes will be segregated and transferred to waste disposal facilities.
- Cooking oils and greases from the kitchen will be collected and transported to waste disposal facilities.
- All non-hazardous solid general waste will be sent for recycling or disposal to at the DOWA Waste Management Facility.

Hazardous Solid Waste

- Hazardous wastes materials will be handled and stored in accordance with the corresponding MSDS.
- General non-hazardous solid wastes will be managed in accordance with accepted international standards.
- Tenders for supply and construction contractors will require waste reduction at the source.
- A PCMI Waste Management Plan for this drilling campaign will be developed.
- Waste will be segregated at source into recyclable and non-recyclable wastes, where a net environmental benefit is likely, and stored in clearly marked containers for transport to DOWA waste disposal site.
- Hazardous wastes will be transported for disposal at a DOWA waste facility

Drill Cuttings and sludge

- Drill cuttings and adhered fluids will not be discharged to surrounding area.
- All drilling activities will be conducted in accordance with approved Environment Management Plan.
- Volume of cuttings and fluids discharged will be minimized through use of solids control equipment.
- Use non-hazardous water-based mud system. Inform MOGE in case of change in mud chemicals.
- Store all chemicals in secured storage area with impervious (cement or plastic sheet) floor and bund wall. Handle all chemicals according to its MSDS.
- Provide spill clean up kits and training for designated rapid response teams to clean up any spills. In the event of oil or chemical spill, implement spill response plan. Handle all chemicals according to its MSDS.

- Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil.
- Implement transportation plan.

Loss of Circulation

- Case sections of the well with steel tubing.
- Cement steel casing in place.

8.7.5.1 Summary Of Waste Inventories

A summary listing of wastes generated by this proposed project is provided in **Table 8-7**.

Should the well encounter technical difficulties that require contingency wells to be drilled, additional waste will be generated (drilling mud and cuttings, domestic waste, industrial waste, hazardous waste and sewage and grey water).

Table 8-7: Waste Inventory

Waste Type	Estimated Quantity	Proposed Disposal Contractor	Disposal Plan
Drill cuttings and attached WBM	~430 m^3	Treated / Separated on Site by DOWA	• Water Separated from the Mud and Cuttings and treated on Site. • Drill Cuttings disposed of in a dilution land burial process.
Water-based mud	1000-2000 m^3/well	Treated / Separated on Site by DOWA and residues sent to Waste Management Facility - DOWA	• Stored in mud storage tanks • Liquids treated on site and WBM residues send to DOWA Landfill. • In case of the well is actually abandoned rather than completed as a producer, some of this mud will be used to make the kill weight spacer between the cement plugs
Brine Water & Sludge	50 m^3	Waste Management Facility - DOWA	• Water Treatment Sludge and Brine Water Disposed at Dowa Facility for treatment and final disposal
Unused chemicals	N/A	Licensed chemical supplier or Waste Management Facility - DOWA	• Returned to supplier or kept for future drilling campaigns.
Domestic waste	1 – 10 tonnes/month well site 1 – 4 tonnes/month camp site	Waste Management Facility - DOWA	• Landfill • Incinerated
Industrial waste (scrap metal, plastic, paper, wood, glass etc.)	1 – 40 tonnes/month	Waste Management Facility - DOWA	• Recyclable or reusable materials to be sold or donated. • Other non-recyclable or reusable waste goes to licensed landfill
Hazardous waste	2 – 5 tonnes/month	Waste Management Facility - DOWA	• Landfill • Incinerator
Sewage & grey water	3 – 4 m^3/day	Treated On Site	• Septic tank. • Treated in on-site bio-digester or infiltration field
Septic Sludge & Black Water	4 m^3 at end of project	Waste Management Facility - DOWA	• Disposed at Dowa and Landfilled
Fluids produced from the separators during testing	0 – 7.95 m^3/day/well	Waste Management Facility - DOWA	• Gas Flared • Separated Fluids disposed at Dowa and Landfilled

8.7.6 Monitoring Plans

Factors	Index	Procedure	Proposed Duration and Frequency of Monitoring	Location
Cuttings from drilling (in case of further using cuttings)	Cuttings from surface section • pH • Conductivity • Salinity • Cl^- Cuttings from middle and reservoir section • pH • Conductivity • Salinity • Cl^- • Soluble Threshold Limit Concentration (STLC) • Total Threshold Limit Concentration (TTLC)	Method • Soil quality standards for habitat and agriculture and other purposes from Notification of the National Environmental Board No. 25, B.E. 2547 (2004), published in the Royal Government Gazette, Vol. 121 special part 119D, dated October 20, B.E. 2547 (2004) • STLC and TTLC are analyzed by Waste Extraction Test Method and Leaching Test Method[1] and also classify that analyzed cuttings sample is non-hazardous waste or hazardous waste by using an analysis method Number of Samples • At least 2 samples per section of drilling	• During exploration drilling • Upon Completion of Drilling before mixing / burial disposal in waste pit.	• Exploration drilling well
Chemical use for drilling	• Type of chemical • Volume of use	• Daily record type of chemicals and volume used	• Daily and report after drilling is completed	• Project area
Hazardous and Non-hazardous waste	• Manifest Disposal and Tracking Report	• Track waste volume by type and disposal location daily	• All phases	• At all project locations
Produced Water	Physical parameters: • pH • Conductivity • Temperature • SS • TDS • Salinity Chemical Parameters: • DO • BOD • TPH and Oil and Grease • Cl, SO4 • Metals: As, Cd, Total Cr, Pb, Total Hg, Ni, Se, Ba, Cu, Zn, Fe, Mn	• Daily record volume	• All phases	• At discharge point

8.7.7 Implementation Schedule

8.7.7.1 Mud And Cuttings

Prior to disposal, each batch of drilling waste will be analysed to determine if it is hazardous and to obtain specifications required by the contractor.

8.7.7.2 Hazardous And Non-Hazardous Waste

A Manifest System of all waste leaving the site will be maintained and licensed contractors will track the waste to its point of disposal.

The Waste Register will be reviewed and verified on a weekly basis.

8.7.8 Projected Budgets and Responsibilities

8.7.8.1 Budget

USD 75,000

8.7.8.2 Responsibilities

Roles and responsibilities for the involved parties are reported in the following Section.

Prior to waste management collection, transportation and disposal, DOWA will conduct laboratory analytic tests on an amount of sampled wastes to correctly establish waste classification; other complementary information can be collected from Material Safety Data Sheets and process knowledge. This will assist to ensure that proper storage and handling procedures are in place.

DOWA Waste Manifest System

Slip A – Waste Generator Copy (Confirm waste collection)
Slip B – Transportation Company (Office Use)
Slip C – Transportation Company to waste Generator (Delivery approved)
Slip D - Waste services Company copy (office use) (Record of waste Transport)
Slip E – Waste services Company to Waste Generator (Treatment approved)

See Waste Management Plan Appendix C – DOWA Waste Manifest System

Drilling Contractor (Producers of waste): issue five (5) copies of the Waste Manifest (SLIP A-E in carbon copies) reporting the following:

- date and number of issuance;
- issuer name and signature (drilling manager name & signature);
- waste generator company name , transportation company (DOWA or a third party company) and waste service company (DOWA);
- waste classification:
- kind: hazardous, non hazardous, others,
- name: identification of the waste (e.g. plastic, glass, wood, etc …),
- quantity: description of waste amount or waste weight estimation,
- style of packing: description of containers,
- remark: actual weight waste from DOWA,

- waste classification code is to be assigned by DOWA,
- Request the transportation company signature for all the waste manifest copies;
- keep the first copy (SLIP A);
- deliver the second copy (SLIP B) to the transporter company;
- deliver the third copy (SLIP C) to the Drilling Contractor HSE Manager, who is the custodian of the documentation;
- deliver the fourth (SLIP D) to the waste transport company and;
- the fifth (SLIP E) copies to Drilling Contractor HSE Manager to confirm that treatment of waste has been completed.

Drilling Contractor HSE Manager:

- is primarily responsible for ensuring implementation of the Waste Management Plan throughout the area of collection;
- checks to ensure chemically and physically incompatible wastes are not mixed at the site temporary storage area;
- keep the third copy of the Waste Manifest (SLIP C) filled in and signed by the Transporter (DOWA or third party company);
- keeps the fifth (SLIP E) copy to confirm waste has been treated by DOWA
- receives a monthly summary for the waste disposed, checks it and sends to PCMI HSE Manager.

Transporter (DOWA or third party company):

- delivers the wastes to the waste service company (DOWA) and cross checks the data reported on the Waste Manifest from PCMI with the DOWA;
- the wastes are weighed by DOWA, the waste amount in reported in the “remark” space and waste code and customer code are filled in by DOWA representative:
- delivers the SLIP D to Transporter office and SLIP E to PCMI to confirm waste has been treated.
- the waste service company (DOWA) signs E

DOWA Representative:

- verify that the waste is correctly labeled before transferring it to the authorized treatment/disposal facilities;
- avoid any overloading of vehicles with waste and ensure cleanliness of vehicles leaving the site;
- ensure the vehicles collecting the waste from site are decontaminated and clean;
- checks to ensure chemically and physically incompatible wastes are not mixed;
- weigh the wastes and confirm the exact amount, the waste code, the customer code and signs and dates the SLIPS C, D and E;
- SLIP D is kept by DOWA and SLIP E comes back in original copy to Drilling Contractor by email;
- DOWA will also provide the details of the final disposal for the waste and will attach the waste tracking form to the original copy of the SLIP E;
- prepare and submit monthly summary to the Drilling Contractor providing the following information:
  - types of waste recycled, treated or stored,
  - area/location of treatment, recycling or storage,
  - quantity of waste treated, recycled or stored (weight),
  - date of waste treated, recycled or stored,
  - Area/location of waste generation.

8.8 Water Management Plan

8.8.1 Objectives

The Water Management Plan will have the following objectives:

- Monitor water use: the Plan will set procedures for estimating water used by the project, identifying activities that use this resource, and following a reporting procedure for registering volumes of water used;
- Minimise water use: the Plan will provide a series of measures to be considered for minimising the use of water;
- Log water suppliers: the supply, the volume and the type of water provided will be identified and registered in the Plan.
- Monitor surface water quality
- Monitor ground water quality

8.8.2 Legal Requirements

Myanmar applicable legislation and regulation regarding the water resources include:

- The Constitution of the Republic of the Union of Myanmar (2008);
- Myanmar Environmental Conservation Laws (2012);
- Environmental Conservation Rules (2014);
- National Environmental Quality (Emission) Guideline (2015);
- Public Health Law (1972);
- The Prevention and Control of Communicable Disease Law (1995);
- Fresh Water Fisheries Law (1991 Section 40);
- The Underground Water Act (1930);
- Conservation of Rivers, Creeks and Water Resources Law, 2006 (Section 24 (b), 21(a)(b), 19, 11(a) (b));
- The Prevention of Danger of Hazardous Chemical and related Substances Law, 2013 (Section 16,17,23,27

MONREC has established environmental quality standards, the National Environmental Quality Standard [Legal Reference: ECL 2012 (Article 2c) and EQS 2016]. ECD / MONREC have indicated that the discharge standards shown in **Table 8-8** below would be applicable for Onshore Oil and Gas activities. These are in accordance with international standards.

Table 8-8: Myanmar Discharge Standards Applicable to Onshore Oil and Gas activities

Guideline	Standard
Drilling fluids and cuttings	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines
Produced water	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines for discharge to surface waters or to land: – Total hydrocarbon content 10 mg/L – pH 6-9 – Biochemical oxygen demand 25 mg/L – Chemical oxygen demand 125 mg/L – Total suspended solids 35 mg/L – Phenols 0.5 mg/L – Sulfides 1 mg/L – Heavy metals (total)a 5 mg/L – Chlorides 600 mg/L (average), 1,200 mg/L maximum

Hydrotest water	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines for discharge to surface waters or to land, apply standards specified for Produced Water
Completion and well work- over fluids	Treatment and disposal in accordance with applicable standards provided in the General EHS Guidelines For discharge to surface waters or to land: – Total hydrocarbon content 10 mg/L – pH 6-9
Storm water drainage	Storm water runoff should be treated through an oil / water separation system able to achieve oil and grease concentration of 10 mg/L
Cooling water	The effluent should result in a temperature increase of no more than 3°C at edge of the zone where initial mixing and dilution take place; where the zone is not defined, use 100 m from point of discharge
Sewage	Treatment as per General EHS Guidelines, including discharge requirements

a Heavy metals include: Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, Vanadium and Zinc

The IFC General EHS Guidelines considered relevant to the project are:

- General EHS Guidelines
  - Section 1.3 – Wastewater and Ambient Water Quality
  - Section 1.6 – Waste Management
- Onshore Oil and Gas Development Guidelines

Table 8-9: Applicable IFC EHS Guidelines

Environmental topic	Applicable EHS Guidelines
Wastewater and Liquid effluent quality	Section 1.3 provides guidelines applied for projects that have either direct or indirect discharge of process wastewater or wastewater from utility operations. Section 1.3 provides guidelines for treatment approaches of process wastewater and wastewater from utility operations. These Guidelines include the following key recommendations: • points of discharge, rate of discharge, chemical use, dispersion and environmental risk should be considered in a disposal plan; • discharges should be planned away from environmentally sensitive areas, with specific attention to high water tables, vulnerable aquifers, wetlands, and community receptors, including water wells and intakes.
Onshore Oil and Gas Development	The EHS Guidelines for Onshore Oil and Gas Development include information relevant to exploration drilling These Guidelines include the following key recommendations regarding wastewater / effluent discharges: • Separate drainage systems for drainage water from process areas that could be contaminated with oil (closed drains) and drainage water from non-process areas (open drains) should be available; • Equipment and vehicle wash waters should be directed to the closed drainage system; • Oily water from drip trays and liquid slugs from process equipment should be routed to the closed drainage system

8.8.3 Overview Maps and Site Layout

The water resources in the area include a community water pond, a small peat land and a stream as shown in **Figure 8-2**.

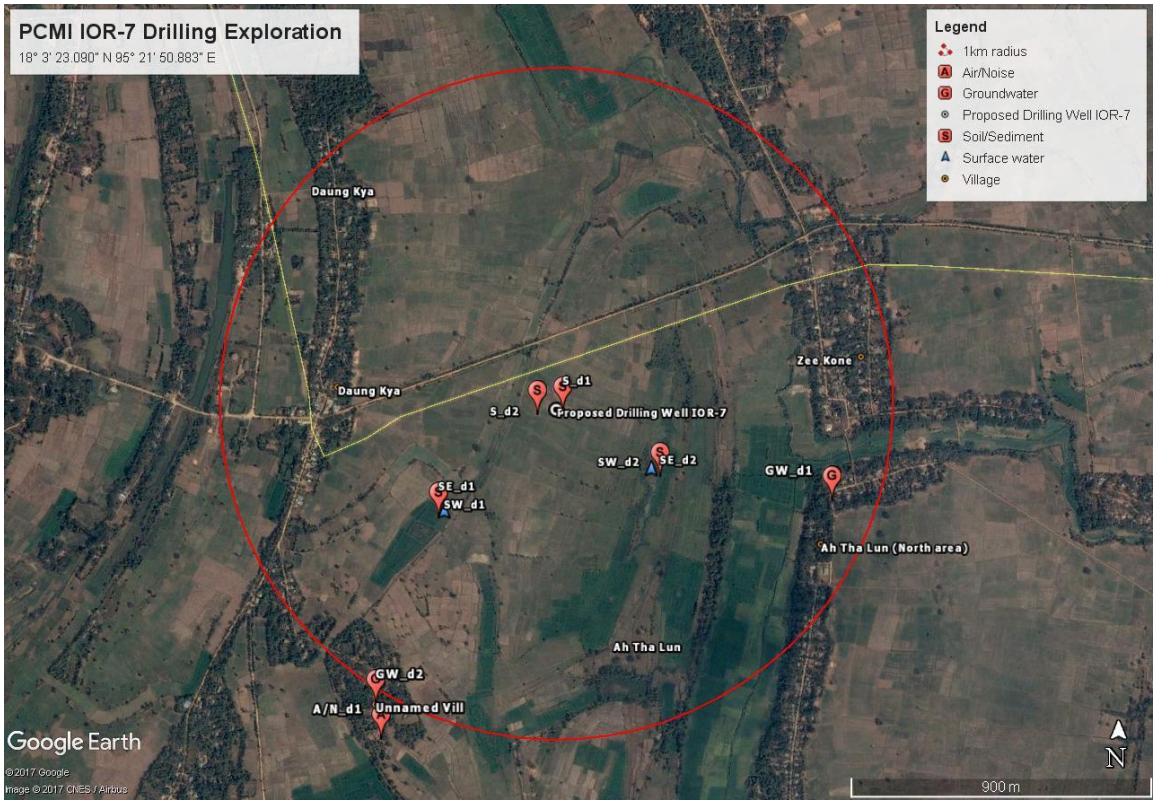


Figure 8-2: Water Management Overview Map

8.8.4 Management Actions

Prevent Alteration of Surface Water Hydrology

- Avoid construction of well sites and access roads in areas that may cause obstacles to water drainage.
- Construct water drainage lines (culverts) to maintain natural drainage. The required permission will be obtained from MOGE and all relevant agencies.
- Try to complete the construction of well sites within the dry season if possible.

Prevent Localized Change in Water Quality

- The proposed drill site and campsite will be orientated and designed to minimize areas requiring soil stabilization.
- Provide drip pans and absorbents to contain any spillage.
- Provide drainage and sediment traps around project area to reduce suspended particles in runoff from the well site and to contain minor oil spills.
- Avoid construction of the well pad and/or access road in areas where such construction obstructs water drainage.
- Prohibit workers from cleaning machines/equipment in/near a water source.

- Provide a suitable storage area for construction materials (such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil).
- Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.
- Construct one lined waste pit for potentially contaminated runoff and spills (6,000 m^3), surrounded by 0.2 m high bund that will help prevent run-off into the environment. Monitor and transport waste to prevent any overflow from waste pit.
- On site fuel will be stored in steel tanks that sit on the higher ground and will be completely surrounded with a bund to contain any spillage. The bund will be 300 mm high around the entire fuel storage area.
- Construct drainage system (that includes a series of oil traps) around well site including the concrete rig pad, mud tanks and pumps, cement units, generators and solid control equipment to divert any spills into the waste pit.
- If the oil-in-water content specification is not met, the contaminated water will be stored in suitable containers and transported for treatment and/or disposal at DOWA waste management facility
- Extracted hydrocarbons from oil-in water separator systems will be stored in suitable containers and transported for treatment and/or disposal at DOWA waste management facility
- Use non-hazardous water-based mud and synthetic based mud system. Inform MOGE in case of change in mud chemicals or type of mud.
- Monitor level of cuttings and dirty water in waste pit.
- Isolate any area(s) that might be contaminated from non-contaminated areas. Provide water drainage system around the contaminated area for collecting water into the sump pit or for treatment.
- Store all chemicals in secured storage area with impervious (cement or plastic sheet) floor and bund wall. Handle all chemicals according to their MSDS.
- Use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious surfaces (i.e. on tarpaulin sheet).
- Install septic tanks for holding sewage and grey water.
- Pump septic tank fluids to DOWA sewage treatment plant on a regular basis to prevent overflow.
- Drill cuttings and adhered fluids will not be discharged to surrounding area.
- All drilling activities will be conducted in accordance with approved Environment Management Plan.
- Volume of cuttings and fluids discharged will be minimized through use of solids control equipment.
- Use non-hazardous water-based mud system. Inform MOGE in case of change in mud chemicals.
- Store all chemicals in secured storage area with impervious (cement or plastic sheet) floor and bund wall. Handle all chemicals according to its MSDS.
- Provide spill clean up kits and training for designated rapid response teams to clean up any spills. In the event of oil or chemical spill, implement spill response plan. Handle all chemicals according to its MSDS.
- Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil.

- Implement transportation plan.

Impacts to Water Drainage from Surface runoff from roads and campsite

- Obtain approval from MOGE and appropriate government offices (Forestry Department if forestry land is crossed) before constructing, upgrading or reroute access roads.
- Follow civil engineer's recommendation on well site and access road construction design.
- Avoid construction of well sites and access roads in areas that may cause obstacles to water drainage.
- Water drainage lines (culverts) will be constructed to maintain natural drainage. The required permission will be obtained from all relevant agencies.

Prevent Deterioration of Ground Water

- Install an impervious HDPE geomembrane liner in the cuttings and dirty water waste pit. Monitor liner for tears or leaks during installation and operations.
- Case sections of the well with steel tubing.
- Cement steel casing in place.
- Infiltration (sub-irrigation) field is properly designed and installed in accordance with local regulations and guidance to prevent any hazard to public health or contamination of land, surface or groundwater;
- Infiltration (sub-irrigation) field installed in areas of stable soils that are nearly level, well drained, and permeable, with enough separation between the drain field and the groundwater table or other receiving waters.
- Infiltration field to be kept well maintained to allow effective operation;

Prevent Reduction of Local Community Water Supply

- Obtain local approval for drilling a ground water well.
- PCMI to drill their own ground water wells on site.
- Consult local community leaders and township authorities before water hauling (if required).
- Potable water and industrial water, if taken by tube wells or tanker from nearby reservoirs/rivers, should not affect the availability of water to locals.

8.8.5 Monitoring Plans

8.8.5.1 Surface Water

Monitoring of surface water in the immediate vicinity of the drill site or campsite will be conducted at appropriate intervals (monthly or quarterly) during exploration drilling to monitor any adverse changes to surface water quality. This is particularly important if the well sites are located in close proximity to areas where there are beneficial uses of surface water. However, in the event of spillage or leakage, potentially affected watercourses will be sampled and analysed for the substance spilt.

Parameters	Analytical Method	Monitoring Schedule	Location
Physical parameters: • pH • Conductivity • Temperature • SS • TDS • Salinity	Method • Analytical Methods followed to Standard Methods for the Examination of Water and Wastewater, recommended by APHA-AWWA-WEF	• Regular intervals (monthly or quarterly) • In an event of spillage and leakage	• At the same surface water sampling station before having project (Baseline) • Water sources which are

Chemical Parameters: • DO • BOD • TPH and Oil and Grease • Cl, SO_4 • Metals: As, Cd, Total Cr, Pb, Total Hg, Ni, Se, Ba, Cu, Zn, Fe, Mn Biological parameters: • TCB	• Compare to EPA's National Recommended Water Quality Criteria and standards from Notification of the National Environmental Quality No.8, B.E. 2537 (1994)		potentially affected (in case of spillage of leakage)

8.8.5.2 Groundwater

Monitoring of groundwater in the immediate vicinity of the sites will be conducted at regular intervals (monthly or quarterly) during exploration drilling to monitor any adverse changes to groundwater quality. In addition, groundwater will be sampled in the event of spillage or leakage.

Parameters	Analytical Method	Monitoring Schedule	Location
Physical parameters: • pH • Conductivity • Temperature • TDS • Salinity Chemical Parameters: • TPH and Oil and Grease • Benzene • Toluene • Ethyl benzene • Total xylene • Cl, SO_4 • Metals : As, Cd, Total Cr, Pb, Hg, Ni,Se, Ba, Cu, Zn, Fe, Mn	Method • Analytical Methods followed to Standard Methods for the Examination of Water and Wastewater, recommended by APHA-AWWA-WEF • Compare to Standards from Notification of Ministry of Natural Resources and Environment B.E. 2551 (2008)	• Regular intervals (monthly or quarterly) • In event of spillage and leakage	• Nearest groundwater well or just off well pad area • Area of possible spill

8.8.6 Implementation Schedule

The monitoring activities will be performed as mentioned in the tables above.

Monitoring of surface and groundwater in the immediate vicinity of the sites will be conducted at regular intervals (monthly or quarterly) during exploration drilling to monitor any adverse changes to surface or ground water quality. However, in the event of spillage or leakage, potentially affected groundwater or watercourses will be sampled and analysed for substance spilt.

8.8.7 Projected Budgets and Responsibilities

Budget
USD 15,000

Responsibilities

- Drilling Contractor;
- Drilling Contractor HSE Manager.
- PCMI Manager, Health, Safety and Environment (HSE)

8.9 Soil Management Plan

8.9.1 Objectives

Construction and operation activities will be managed to prevent soil contamination or erosion.

8.9.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- The Constitution of the Republic of the Union of Myanmar (2008);
- Myanmar Environmental Conservation Laws (2012);
- Environmental Conservation Rules (2014);
- National Environmental Quality (Emission) Guideline (2015);
- The Farmland Law and Farmland Rules (2012 - Section 30).

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). They are designed to provide relevant industry background and technical information. This information supports actions aimed at avoiding, minimizing, and controlling EHS impacts during the construction, operation, and decommissioning phase of a project or facility. The IFC guidelines regarding waste management are applicable to protecting soil quality (Environmental Health and Social Guidelines, IFC 2007).

Table 8-10: Applicable IFC EHS Guidelines

Environmental topic	Applicable EHS Guidelines
Waste management	Section 1.6 provides guidelines for projects/facilities that generate, store, or handle any quantity of industrial hazardous or not hazardous waste. Section 1.6 provides appropriate guidelines for hazardous waste storage, transport, treatment and disposal, in order to prevent harm to health, safety and environment. These Guidelines include the following key recommendations: • waste management should be addressed through a Waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring; • in addition to the implementation of waste prevention strategies, the total amount of waste may be significantly reduced through the implementation of recycling plans; • if waste materials are still generated after the implementation of feasible waste prevention, reduction, reuse, recovery and recycling measures, waste materials should be treated and disposed and all measures should be taken to avoid potential impacts to human health and the environment.

8.9.3 Overview Maps and Site Layout

The area is dominated by agricultural area and some small peat land areas as shown in **Figure 8-3**.

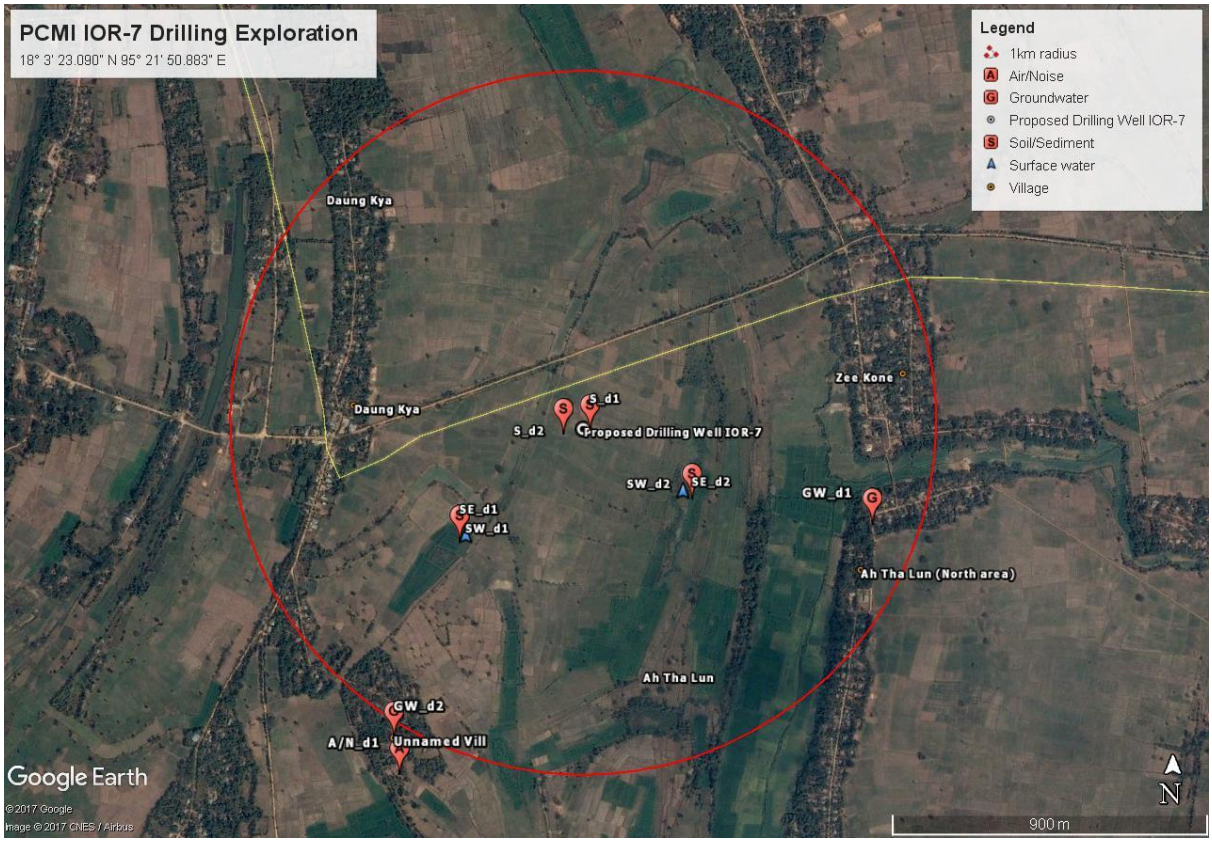


Figure 8-3: Soil & Land Overview Map

8.9.4 Management Actions

Prevent Soil Disturbance and Erosion

- Limit soil compaction only to well sites and access roads.
- Exposed site areas should be kept to a minimum during construction and completed areas should be hard surfaced or re-vegetated as soon as possible.
- Reduce erosion by preventing/reducing off-site sediment transport through the use of BMP's.
- Provide effective construction site run-off control and design.

Prevent Deterioration of Local Soil Quality

- Prohibit workers from cleaning machines/equipment nearby public water source.
- Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.
- Provide a suitable storage area for construction materials (such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil).
- Construct one lined waste pit for potentially contaminated runoff and spills (6,000 m3), surrounded by 0.2 m high bund that will help prevent run-off into the environment. Monitor and transport waste to prevent any overflow from waste pit.

- On site fuel will be stored in steel tanks that sit on the higher ground and will be completely surrounded with a bund to contain any spillage. The bund will be 300 mm high around the entire fuel storage area.
- Construct drainage system (that includes a series of oil traps) around well site including the concrete rig pad, mud tanks and pumps, cement units, generators and solid control equipment to divert any spills into the waste pit.
- Contaminated drainage from site, machinery spaces or bunded areas will be contained.
- If the oil-in-water content specification is not met, the contaminated water will be stored in suitable containers and transported for treatment and/or disposal at DOWA waste management facility
- Extracted hydrocarbons from oil-in water separator systems will be stored in suitable containers and transported for treatment and/or disposal at DOWA waste management facility

Prevent Contamination of Soils

- Hazardous wastes materials will be handled and stored in accordance with the corresponding MSDS.
- General non-hazardous solid wastes will be managed in accordance with accepted international standards.
- Tenders for supply and construction contractors will require waste reduction at the source.
- A PCMI Waste Management Plan for this drilling campaign will be developed.
- Waste will be segregated at source into recyclable and non-recyclable wastes, where a net environmental benefit is likely, and stored in clearly marked containers for transport to DOWA waste disposal site.
- Hazardous wastes will be transported for disposal at a DOWA waste facility
- Drill cuttings and adhered fluids will not be discharged to surrounding area.
- All drilling activities will be conducted in accordance with approved Environment Management Plan.
- Volume of cuttings and fluids discharged will be minimized through use of solids control equipment.
- Use non-hazardous water-based mud system. Inform MOGE in case of change in mud chemicals.
- Store all chemicals in secured storage area with impervious (cement or plastic sheet) floor and bund wall. Handle all chemicals according to its MSDS.
- Provide spill clean up kits and training for designated rapid response teams to clean up any spills. In the event of oil or chemical spill, implement spill response plan. Handle all chemicals according to its MSDS.
- Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil.
- Implement transportation plan.

8.9.5 Monitoring Plans

Under normal circumstances there is no pathway for contaminants to reach soils off-site. However, soils will be sampled once within one month after well shut-in or as determined appropriate. In addition, soils will be sampled in the event of spillage or leakage.

Soil	Physical parameters: · pH · Soil texture · Salinity · Conductivity · Temperature · Cl^- Chemical Parameters: · Petroleum Hydrocarbons · Benzene · Toluene · Ethyl benzene · Total xylene · Metals:As, Cd and Cd-compound, Cr^{6+}, Pb, Hg, Ni, Se, Ba, Cu, Zn, Fe, Mn and Mn-compound	Method · Follow U.S. EPA Analytical Method per parameter · Compare results to Soil Quality Standards, Notification of the National Environmental Board No. 25, B.E. 2547 (2004), published in the Royal Government Gazette, Vol. 121 special part 119D, dated October 20, B.E. 2547 (2004)	· Once after project completion	Project site At the spillage or leakage areas

8.9.6 Implementation Schedule

Under normal circumstances there is no pathway for contaminants to reach soils off-site. However, soils will be sampled once within one month after well shut-in or as determined appropriate. In addition, soils will be sampled in the event of spillage or leakage.

8.9.7 Projected Budgets and Responsibilities

Budget

USD 15,000

Responsibilities

- Drilling Contractor;
- Drilling Contractor HSE Manager.
- PCMI Manager, Health, Safety and Environment (HSE)

8.10 Air Quality Management Plan

8.10.1 Objectives

Monitor air quality to ensure compliance with national and international air quality standards

8.10.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- The Constitution of the Republic of the Union of Myanmar (2008);
- Myanmar Environmental Conservation Laws, (2012);
- Environmental Conservation Rules (2014);
- National Environmental Quality (Emission) Guideline (2015).

MONREC has established environmental quality standards, the National Environmental Quality Standard with Treatment as per General EHS Guidelines Emission concentrations as per General EHS Guidelines, and specifically Hydrogen sulfide below 5 mg/Nm^3.

International air quality standards are set by the *IFC Environmental, Health, and Safety Guidelines for Air Emissions and Ambient Air Quality* published on 2007, which refers to the WHO Air Quality Guidelines[1].

Table 8-11: IFC/WHO Air Quality Standards

Parameter	Averaging Time	Concentration (µg/m^3)	Notes
Nitrogen dioxides (NO2)	Annual	40	
	1-hour	200	
Photochemical Oxidants: Ozone (O_3)	8-hour daily maximum	100	
Particulate Matter (PM10)	Annual	20	
	24-hours	50	
Particulate Matter (PM2.5)	Annual	10	
	24-hours	25	
Sulphur Dioxide (SO2)	24-hours	20	
	10 minute	500	
Carbon Monoxide (CO)	1-hour	30 (mg/m3)	Carbon monoxide was not included in the WHO Air Quality Guidelines 2005. As a result, the 2000 WHO guidelines per European Air Quality Guideline for CO remain in effect.
	8-hours	10 (mg/m3)	
Benzene	Annual	5	European directive 2008/50/EC

[1] WHO Air Quality Guidelines are available at http://www.who.int/en

The WHO has established the following air quality criteria to be considered when selecting substances (or pollutant indicators) to be included in an air quality monitoring network:

- The selection of the substances shall be based on the current air pollution issues potentially affecting the area, and on those expected for the future.
- The substances shall be measured extensively, or the extent of monitoring shall be increased due to emerging concerns (for example: PM_{10} and $PM_{2.5}$).
- Only substances for which quality assurance and control procedures exist or are being developed shall be included.

8.10.3 Overview Maps and Site Layout

The sensitive receptors near the site for air quality are the local communities and agricultural area within 1 km of the well site as shown in **Figure 8-4**.

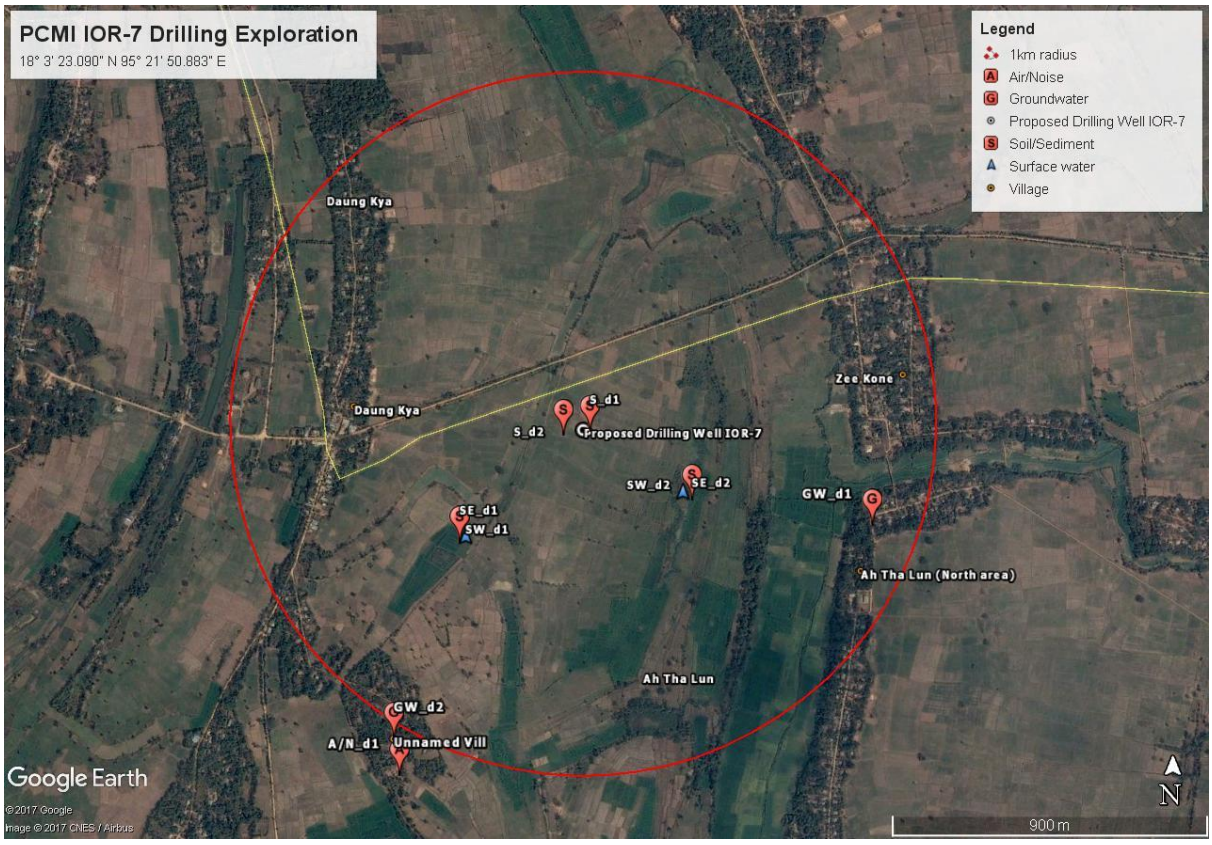


Figure 8-4: Air Quality Overview Map

8.10.4 Management Actions

Prevent Deterioration of Air Quality Due to Dust

- Minimize land clearance to a minimum especially during the drier months.
- Reduce air emissions by regular maintenance.
- Limit vehicle speed (approximately a speed limit of 30 km/hr) especially on unpaved roads during dry conditions.

- Cover trucks transporting materials with tarpaulins or plastic to prevent any loose material from blowing away and also to prevent dust dispersion.
- Cover construction materials.
- Spray water on roads twice a day to keep dust down.
- Clean tires of the vehicles before leaving site if needed.
- Practice correct storage and usage of covers and/or control equipment (water suppression, bag house, or cyclone) in handling of materials such as conveyors and bins to prevent nuisance dust emissions.
- Re-vegetate disturbed areas as soon as practicable to limit exposed soil areas.
- Provide personal protective equipment (masks and gloves) to exposed field workers.
- Use vehicles with dust flaps.

Manage Hydrogen Sulphide

- Install H2S sensors at the flow line.
- If H2S levels exceed 10 ppm in the gas stream, implement appropriate safety zones.
- All crew are instructed and rehearsed in H2S procedures.

Prevent Minor Deterioration of Local and Regional Air Quality

- Energy conservation measures will be taken into account during rig selection.
- Process control to minimize flaring.
- Diesel used in vessels will have a low sulphur.
- Reporting of atmospheric emissions as per PCMI requirements.
- Maintain scheduled maintenance program.

Manage GHG Release Contributing to Climate Change

- Ensure all machinery and vehicles are properly maintained and serviced as per maintenance schedule recommended by manufacturer.
- Maintain road going vehicles to ensure that fuel use is efficient and emissions are within acceptable limits.
- Instruct drivers on the benefits of driving practices that reduce the risk of accidents, fuel consumption and dust generation.
- Turn off all vehicles and equipment when not in use as well as prohibit vehicles from idling.
- To maximize energy efficiency and design facilities to minimize energy use.
- Operating flare to control odor and visible smoke emissions (no visible black smoke).
- Locate flare at a safe distance from local communities and the workforce including workforce accommodation units.
- Implementation of burner maintenance and replacement, programs to ensure continuous maximum flare efficiency.
- Metering flare gas.
- Keep installation and functioning of flare gas system safe according to the good engineering practice.
- Ensure flare system has efficient combustion.
- Maintain pilot flame at the flare tip to ensure that flame is not extinguished by strong wind.
- Verify the operation's flaring system.
- Minimize the duration and rate of flaring as much as possible.

8.10.5 Monitoring Plans

Factors	Index	Procedure	**Proposed Duration and Frequency of Monitoring**	Location
Air Quality	• TSP • PM-10 • NOx, • SOx, • CO	Method • Following the WHO guideline (updated 2005) and the National Ambient Air Quality Standards (NAAQS, set by U.S. Environmental Protection Agency USEPA, 1990)	**Duration:** 1 days continuously **Frequency:** • Once during construction and drilling phase • As within 1 km of a community regular monitoring will be required • In case of any complaint regarding air quality, an additional air quality measurement may be conducted in response to specific complaints (if necessary)	Nearest sensitive receptor or downwind of complaint area (if necessary)

8.10.6 Implementation Schedule

Air quality monitoring will be conducted once during construction and drilling phase. If communities are located in close proximity to drilling sites, regular monitoring (instead of once) of air emissions may be necessary during drilling and construction. In addition, if complaints are received, an additional air quality monitoring may be conducted in response to specific complaints. Air quality monitoring will be conducted at the same location previously measured during the baseline survey and/or at the location of the complaint. The monitoring shall be conducted as defined by the Myanmar standards and or international guidelines. The parameters measured will be NOx, SOx, CO, TSP, PM10 and other parameters as specified and agreed by the COMPANY.

8.10.7 Projected Budgets and Responsibilities

Budget

USD 6,000

Responsibilities

- Drilling Contractor;
- Drilling Contractor HSE Manager.
- PCMI Manager, Health, Safety and Environment (HSE)

8.11 Noise Management Plan

8.11.1 Objectives

To minimize noise disturbance to fauna.

8.11.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- The Constitution of the Republic of the Union of Myanmar (2008);
- Myanmar Environmental Conservation Laws, 2012
- Environmental Conservation Rules, 2014
- National Environmental Quality (Emission) Guideline (2015)

The management and mitigation measures of the Plan are aligned with the IFC guidelines detailed here below.

In the absence of relevant national laws, the Project will comply with international standards. The IFC General EHS Guidelines considered relevant to the project are:

- General EHS Guidelines
    - Section 1.7 – Noise and Vibration Emissions

Table 8-12: Applicable IFC EHS Guidelines

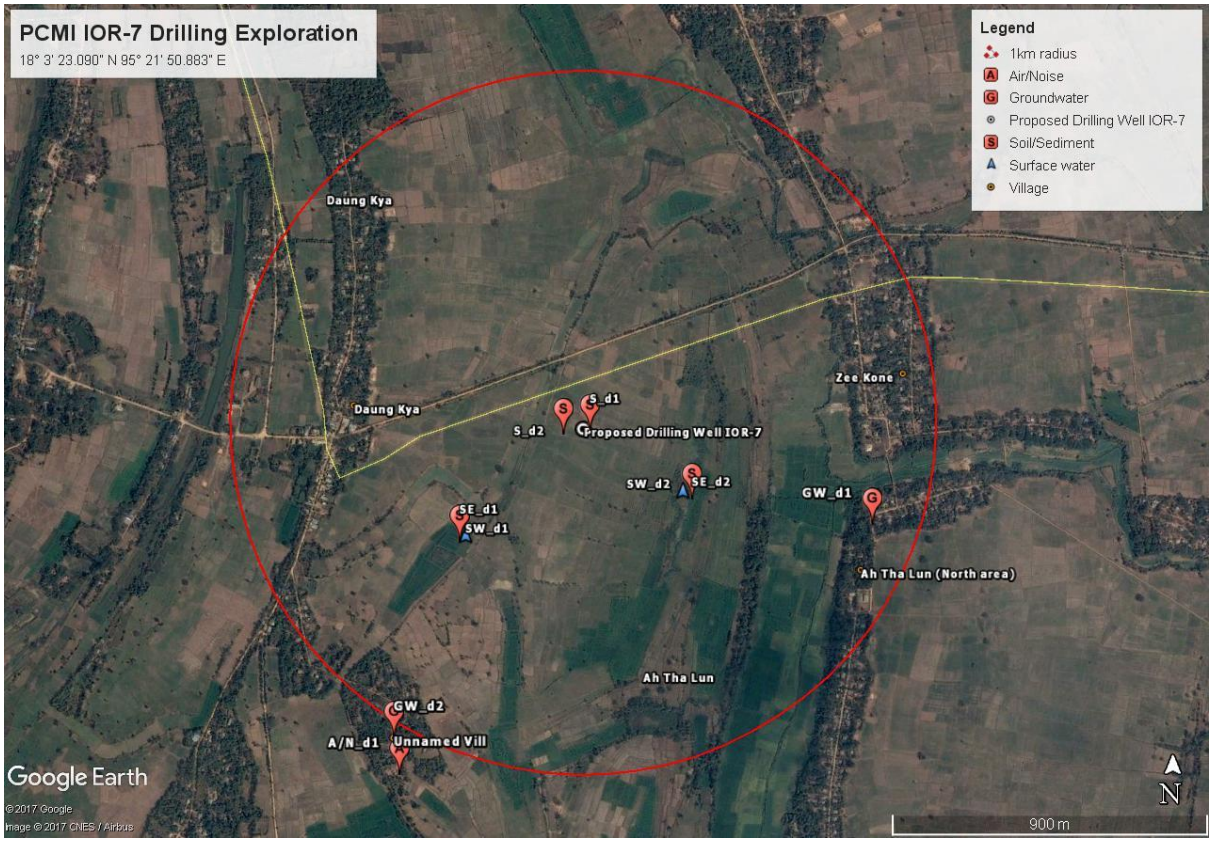
Environmental topic	Applicable EHS Guidelines
Noise and vibration emissions	Section 1.7 provides standards for daytime and night time noise emissions (for residential and industrial environments, WHO 1999) and recommends that noise prevention and mitigation measures are implemented with regard to predicted noise levels at sensitive receptors. Noise monitoring may be carried out for the purpose of establishing the existing ambient noise levels in the area of the proposed project or for verifying emission noise levels during project execution. A key priority should be the implementation of noise control measures at source; the selected methods will depend on the source type and the proximity of sensitive receptors, and can include: equipment selection, acoustic enclosures, vibration isolation, traffic route selection, other.

Noise pollution is not currently regulated at national level; hence international guidelines (e.g., IFC) shall be applied to the Project. The noise limits established by the World Bank Group/International Finance Corporation (IFC) for residential areas are the following [2]:

- **55 dBA during daytime** (daytime hours 07:00 to 22:00).
- **45 dBA during night-time** (night-time hours 22:00 to 07:00).

[2] IFC doesn't discriminate between temporary and permanent Project operations. Conservatively, in consideration of the survey period and all associated activities, it is considered that the IFC threshold levels for the daytime and for the nighttime would be appropriate for the entire project phase.

8.11.3 Overview Maps and Site Layout



8.11.4 Management Actions

- Vehicles and rig transportation will avoid sensitive environmental areas.
- Construction activities and Vehicle/rig movements will be restricted to daylight hours.
- Limit vegetation removal to a minimum.
- Schedule operation of noisy construction equipment at different times.
- Ensure use of mufflers on diesel/gas driven machinery.
- Use low noise equipment.
- Ensure all machinery and vehicles are properly maintained and serviced as per maintenance schedule recommended by manufacturer.
- Turn equipment off when not in use.
- Use enclosures when possible to contain noise on site.
- Implement transportation plan.
- Materials should be lowered when practical and not dropped.
- Verify the operation's flaring system.
- Minimize the duration and rate of flaring as much as possible.

8.11.5 Monitoring Plans

Noise will be measured once during drilling phase to monitor noise level generated from drilling activities. If communities are located in close proximity to drilling sites, regular monitoring (instead of once) of noise may be necessary during drilling and construction. In addition, if complaints are received, an additional noise measurement may be conducted in response to specific complaints. Noise levels (24 hour Leq) will be monitored at the same location previously measured during the baseline survey and/or at the location of the complaint. If monitoring indicates noise levels over the WHO standards (70 dB (A)) at the receptor as a result of drilling, specific mitigation measures will be implemented. The noise levels will be measured as defined by the Myanmar or international standards.

Factors	Index	Procedure	Proposed Duration and Frequency of Monitoring	Location
Noise	• L_{eq}24 hr. • L_{max} • L_{dn} • Nuisance noise	Method • Measure background noise level, residual noise level, specific noise level and calculation of noise using a Type 1 or 2 sound level meters meeting all appropriate IEC standards • Following the Guidelines for Community Noise, World Health Organization (WHO), 1999	**Duration:** 1 days continuously **Frequency:** • Once during construction and drilling phase • As within 1 km of a community regular monitoring will be required • In case of a complaint regarding noise from project site, an additional noise measurement may be conducted (if necessary)	Nearest sensitive receptor

8.11.6 Implementation Schedule

The monitoring activities will be performed as mentioned in the tables above.

The Plan shall be revised before project activities start, in order to guarantee the compliance with Myanmar laws.

8.11.7 Projected Budgets and Responsibilities

Budget

USD $3,000

Responsibilities

- Drilling Contractor;
- Drilling Contractor HSE Manager.
- PCMI Manager, Health, Safety and Environment (HSE)

8.12 Biodiversity Action Plan

8.12.1 Objectives

The objective is to protect and conserve biodiversity, maintain ecosystem services, and sustainably managing living natural resources that are fundamental to sustainable development within the project area.

8.12.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- The Constitution of the Republic of the Union of Myanmar (2008);
- National Environmental Quality (Emission) Guideline (2015);
- Fresh Water Fisheries Law, 1991 (Section 40);
- Forest Law (1992 - Section 12);
- Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law (1994);
- The Farmland Law (2012 - Section 30).

The IFC General EHS Guidelines for air quality, noise, waste management and wastewater are relevant for biodiversity protection.

The International Finance Corporation (IFC) has developed a series of Performance Standards that aim at protecting the environment. Performance Standard 6 "recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development". The requirements set out in this Performance Standard have been guided by the Convention on Biological Diversity, which defines biodiversity as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems" (IFC, October 2012).

The guidance notes accompanying Performance Standard 6 indicate that in situations where there is the potential of significant negative impacts to biodiversity the project proponent should develop a Biodiversity Action Plan (BAP), to guide its activities so as to protect the natural environment.

8.12.3 Overview Maps and Site Layout

The area is a known migratory bird area, however the drilling will be completed in the dry season, so impacts to migratory birds will be limited. The closest biodiversity sensitive receptor is the Htu In Peatland located 3.6 km away from the well site as shown in **Figure 8-5**.

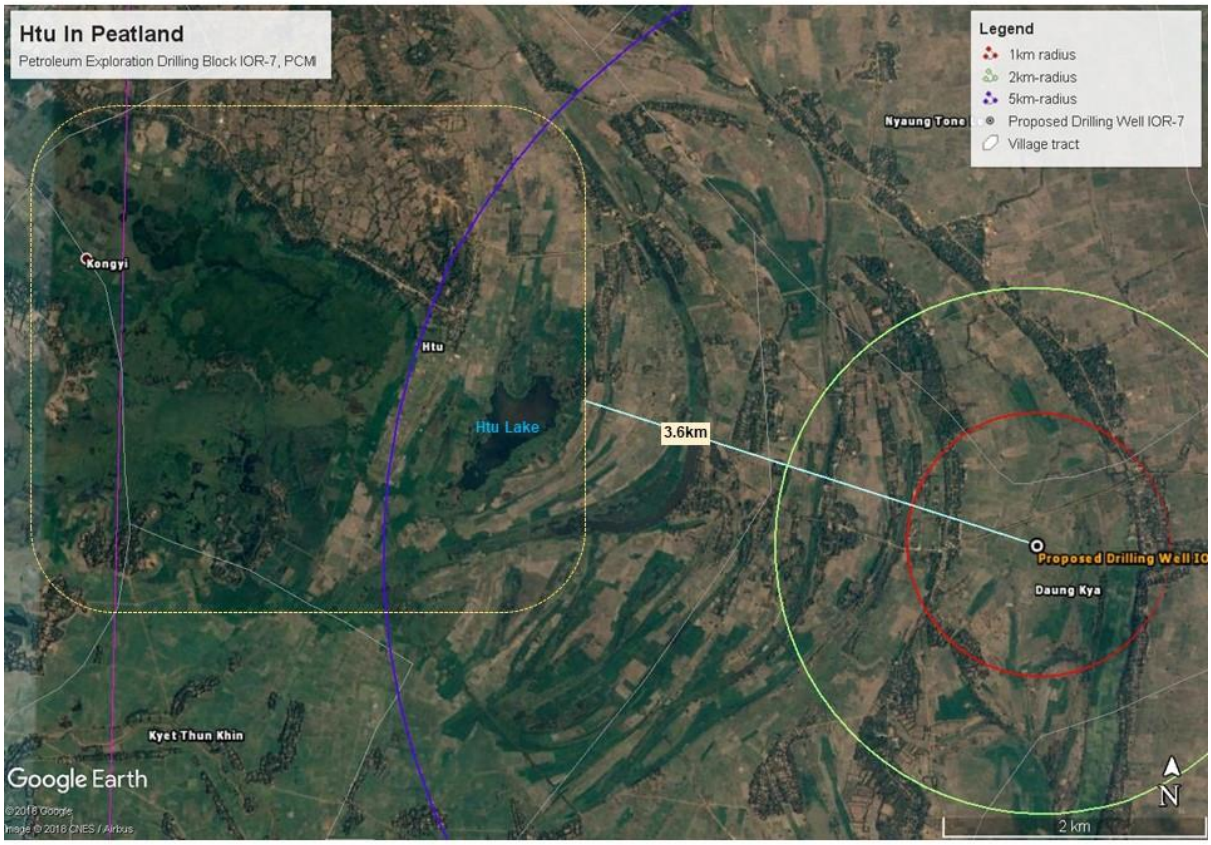


Figure 8-5: Htu In Peat land Distance from Well site

8.12.4 Management Actions

PCMI's actions for conservation of biodiversity in the project area can be divided into three categories: actions already foreseen in the ESHIA, new conservation-related activities specific to Protected Areas or Natural Forest habitat, and general actions on biodiversity conservation.

Conservation Actions already foreseen in the ESHIA:

- any sensitive area identified (natural or critical habitat) and located around the camp site, drill site, or access roads (e.g. sensitive vegetation, water wells) will be marked with pegs and tape to ensure that these will remain untouched;
- re-vegetation (i.e. sowing native herbaceous species and/or planting native shrubs/trees) on bare soil with natural or semi-natural vegetation will reduce the spread of alien species;
- to avoid the introduction of alien species, both flora and fauna;
- to avoid hunting and wild resources consumption;
- using fences with fine mesh will limit the probability of crossing and access to the camp site, drill site, or access roads by small vertebrates (e.g. amphibians, reptiles and small carnivores);
- in order to mitigate light pollution on wildlife and to preserve the view of the night sky, artificial lighting (e.g. in the camp site, drill site, or access roads) will be limited in compliance with best practices;
- development of measures for control of surface water quality to avoid potential contamination from wastes, fuels, chemicals able to modify the characteristics of the water and influence the water usage by biodiversity;
- design and construction of all facilities outside the flooding hazard zones;

- removal, storage and restoration of disturbed soils;
- planning of project facilities in order to avoid/minimize sensitive areas, to avoid erosion and sediment runoff, to minimize site clearance;
- works to be undertaken outside the bird breeding season;
- waste disposal areas shall be fenced to minimize any interaction with local fauna;
- careful driving will minimize the likelihood of injuring fauna;
- noise sources shall be fitted with mufflers or housing to restrict noise levels.
- all equipment shall be properly maintained to minimize emissions;
- application of the Waste Management Plan and Emergency Management Plan in case of oil spill scenario;
- Remove vegetation in road areas only.
- Mark well sites clearly and prohibit vehicles from moving off site onto surrounding land.
- Drill Rig located in area distant to sensitive receptors.
- Keep night lighting to a minimum, consistent with safety and security.
- Direct lighting to the inside of the well sites.
- Clear vegetation around the flare stack and build earth bermed flare pit.
- Minimize flare rate and duration.
- Post constant fire watch during flaring operations.
- Maintain safety distance between flare stack and well site facilities and adjacent crops.
- Mark trees to be cut prior to constructing well site, camp site and access road to prevent the cutting of other trees.
- Contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to wildlife.
- Hunting and trapping will be specifically prohibited and any violations will be grounds for termination of contract and dismissal.
- do not cut trees of a diameter greater than local regulation permit (in absence of regulation, greater than 20cm); leave in place smaller vegetation, topsoil, root stock, seeds and endangered or protected species used by local communities for commercial or subsistence use;
- avoid clearing and disturbance in all areas of native vegetation;
- avoid removal of mature tree cover;
- ensure proper storage and handling of all fuels or other hazardous substance
- harassment or collection of any wildlife species by project personnel will not be allowed. Crews will be advised of this as part of their induction. Crews will be encouraged to report any observations of wildlife;
- avoid disturbance to any natural or manmade surface water impoundments. Discuss with community the opportunity to enhance water storage of any manmade surface water impoundments to take advantage of the presence of heavy equipment. Care would have to be exercised to ensure this activity did not harm any wildlife resident in a nearby water body or productive adjacent habitats.

New conservation-related activities specific to Protected Areas or Natural Forest habitat:

- protect the natural areas (protected areas or area of ecological interest) by Company or Contractors' Personnel: all personnel will receive appropriate training about the importance of biodiversity conservation and the importance of respecting and avoiding disturbance to habitats/flora/fauna;
- train Company and Contractor Personnel on the types of sensitive flora and fauna that need to be protected near the areas;
- carry out periodical review of the operations in the sites to review potential negative impacts to biodiversity and implement appropriate corrective actions. Update and enhance BAP as needed based on the mitigation and monitoring program;

- noise and dust control, speed limit and installation of warning signs will promote adaptation of species to disturbance factor of moving traffic;
- Sedimentation ponds fencing in order to avoid potential death of animals (drowning).

New general BAP actions:

- informative meeting for Local Communities on Conservation. PCMI will organize this meeting for awareness raising for local residents on the need for conservation. Handout materials will be made available and other communities close to natural area affected by the project. Age-appropriate materials on conservation will be made available to local schools.

8.12.5 Monitoring Plans

The development of flora and fauna monitoring campaign will provide a record of the variability in species occurrence, abundance and distribution throughout the Project activities in the most sensitive habitats identified within the area of influence of the Project.

The monitoring activities will not be conducted over the entire concession, but they will focus on that area evaluated as significant in terms of biodiversity resources that could possibly be influenced by the drill site, campsite or access roads.

The campaign will include commonly surveyed taxa that will allow any trends/patterns in regards to their biological parameters to be identified. In case detailed information about flora and fauna species of the Project area are available, the campaign will also focus on the main taxonomic groups identified.

The following biology-related features will be monitored as part of the Plan:

- flora;
- terrestrial and aquatic fauna (birds, small and large mammals, amphibians, invertebrates and reptiles);
- habitat mapping;
- protected areas.

Table 8-13: Environmental Monitoring

Receptor	*Monitoring Task*	*Monitoring locations*	*Monitoring Parameter*	*Timing*
Flora (The main receptors are area of ecological interest)	Avoid the loss of vegetation especially for species of priority importance Ecological supervision Review and audit of mitigation activities to ensure satisfactory implementation of mitigation measures	Areas of ecological interest (e.g. protected areas, natural habitats) in proximity of the camp site, drill site and access roads Area of direct interference (camp site, drill site and access roads)	Parameters to be monitored are: • Qualitative as well as species presence • Quantitative as well as occurrence, frequency, abundance, percentage cover	Before start of project During the project activities
Fauna (Birds, large mammals, small mammals, reptiles, amphibians)	Avoid the loss of biodiversity in the areas affected by the project and in the area of influence. Ecological supervision Review and audit of mitigation activities to ensure satisfactory implementation of mitigation measures	Areas of ecological interest in proximity of the camp site, drill site and access roads Area of direct interference (camp site, drill site and access roads)	Parameters to be monitored are: • Qualitative as well as species presence • Quantitative as well as occurrence, frequency, abundance, percentage cover	Before start of project During the project activities

8.12.6 Implementation Schedule

The monitoring activities will be performed as mentioned in the tables above. The Plan shall be revised before project activities start, in order to guarantee the compliance with Myanmar laws.

8.12.7 Projected Budgets and Responsibilities

Budget

USD $1,000

Responsibilities

- Drilling Contractor;
- Drilling Contractor HSE Manager.
- PCMI Manager, Health, Safety and Environment (HSE)

8.13 Cultural Heritage Management Plan

8.13.1 Objectives

The Cultural Heritage Management and Monitoring Plan will have the objective of avoiding potential damage to cultural resources within 5 km of the project area.

8.13.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- The Constitution of the Republic of the Union of Myanmar (2008);
- The Myanmar Investment Law (2016);
- Myanmar Environmental Conservation Laws (2012);
- Environmental Conservation Rules (2014);
- National Environmental Quality (Emission) Guideline (2015);
- The Protection and Prevention of Antique Objective Law, 2015 (Section 12);
- The Protection and Prevention of Ancient Monument Law, 2015 (Section 12, 20(f) (c), 15(c));
- The Protection and Prevention of Cultural Heritage Area, 2015 (Section 20, 23, 29(b)).

The Plan has been developed following PCMI's standards and will consider all the relevant IFC EHS guidelines. Consistent with the convention concerning the Protection of the World Cultural and Natural Heritage, IFC Performance Standard 8: Cultural Heritage aims to ensure that projects protect cultural heritage in the course of their activities, support its preservation and promote the equitable sharing of benefits from the use of cultural heritage. IFC Performance Standard 8 requires that projects:

- protect cultural heritage by ensuring that internationally recognized practices for the protection, field-based study, and documentation of cultural heritage are implemented. Where relevant this includes the retention of a competent professional to assist in the identification and protection of cultural heritage;
- develop provisions for managing chance finds, requiring any chance find to be undisturbed until an assessment by competent professional is complete and management actions are identified;
- consult with affected communities to identify cultural heritage of importance and to incorporate their views into the decision making process. This shall involve national and local regulatory agencies;
- allow continued access to cultural heritage sites by affected communities within living memory for long-standing cultural purposes;
- avoid impacts to or where not feasible minimize (negative impacts) or restore in situ the functionality of replicable cultural heritage;
- do not remove any non-replicable cultural heritage unless the following criteria are met namely, that – there are no technically or financially feasible alternatives; the overall benefit of the project outweigh the anticipated cultural heritage loss from removal; and the removal of cultural heritage is conducted using the best available techniques;
- shall not remove, significantly alter, or damage critical cultural heritage. In exceptional circumstances where impacts are unavoidable, the Project will use a process of Informed Consultation and Participation (ICP);

8.13.3 Overview Maps and Site Layout

The cultural heritage assessment determined that since the area is a disturbed area of agricultural paddy land there are no archeological or historic areas near the project area. There are no known archeological or historic areas in Myanaung Township. The closest cultural heritage areas are the local temples in the nearby villages as shown in **Figure 8-6**.

Figure 8-6: Cultural Heritage Overview Map

8.13.4 Management Actions

Avoidance of cultural heritage resources is the preferred mitigation method. Marking and protection of cultural heritage sites with temporary barriers such as a bright coloured plastic or mesh wire fence with highly visible flagging or tape is recommended. Marking of areas of high archaeological potential for avoidance in wet conditions is also recommended.

Management of cultural heritage resources foresees:

- Myanmar authority engagement strategy to: 1) further evaluation of sites and the use of intrusive and non-intrusive methods, 2) development of a chance finds procedure, 3) developing site-specific mitigation approaches for any archaeological sites found, and 4) archaeological rescue;
- community consultation strategy to: 1) inform local stakeholders of Project activities, 2) understand site boundaries, user access, timing of use, and schedule of special events, 3) consider relocation of unavoidable evidences with cultural heritage value, 4) provide feedback to Project about community concerns, 5) plan alternative access if necessary, and 6) develop site-specific mitigation approaches;

- project activity timing restrictions in the following situations: 1) in very wet conditions over areas of high archaeological potential or near sites sensitive to vibration, 2) following a chance find;
- chance finds procedures to be implemented throughout the Project activities. This includes: 1) arrangement of on-call archaeologists prior to contract to handle an archaeological rescue if required at a chance find, 2) monitoring of Project activities by a professional archaeologist, 3) cessation of work in the vicinity of any new archaeological discovery, and 4) consultation with relevant authorities.

The following mitigation measures and controls will be implemented:

- Watch for artefacts during site construction and inform the Local Authorities before commencement of drilling.
- Report to the Myanaung GAD if any archaeological evidence is discovered at the well sites or access roads. Through consultation, a plan to proceed will be developed.
- If artefacts are found during the construction phase, PCMI will inform the responsible local office immediately.
- Consult with local authorities to identify culturally important festivals and plan transportation, construction and drilling activities to avoid impact.
- Review any records for site-specific location.
- Monitor earthworks during construction using qualified/trained inspector.

8.13.5 Monitoring Plans

The cultural Heritage management Plan and monitoring program, includes:

- pre-survey and recording of the condition and structural integrity of sites with above-ground components that lie within 50 m of the camp site, access road and drill site.
- follow-up protection or architectural reinforcement at sites found to be at risk from project activities;
- periodic monitoring of site conditions throughout the life of the Project.
- If sites are discovered to be at risk from project activities, they shall be monitored daily during the project activities.

Monitoring to include:

- a photographic documentation of each of the cultural resources within each site at risk;
- GPS coordinates for each of the cultural resources built within each site;
- a brief description of any visible changes to the cultural resources in comparison with previous quarterly monitoring reports;

In conclusion, an outline of the monitoring programmes proposed for the Project, is presented below in **Table 8-14**.

Table 8-14: Environmental monitoring

Receptor	*Monitoring Task*	*Monitoring locations*	*Monitoring Parameter*	*Timing*
CH sites	Monitor appearance of CH resources: survey and recording of the condition and structural integrity of sites with above-ground components.	Area of direct interference (camp site, drill site, access roads)	Presence of CH resources	if sites found
CH sites	Review and audit of mitigation activities to ensure satisfactory implementation of mitigation measures	Area of direct interference (camp site, drill site, access roads)	Completion of required reporting, including: • reporting of ground disturbing activities • Reporting on findings • Completion of induction training • Implementation of all additional measures, such as signage, fencing, structural bracing & conservation • 100% of cultural heritage related grievances and cultural heritage issues raised through community consultation addressed	if sites found

8.13.6 Implementation Schedule

The monitoring activities will be performed as mentioned in the table above. The Plan will be designed to guarantee compliance with Myanmar laws.

8.13.7 Projected Budgets and Responsibilities

Budgets

USD $1,000

Responsibilities

- Drilling Contractor;
- Drilling Contractor HSE Manager.
- PCMI Manager, Health, Safety and Environment (HSE)

8.14 Community Consultation & Grievance Mechanism

8.14.1 Objectives

Prior to both the initiation of construction of drill site, campsite or drilling activities, as part of the ongoing stakeholder consultation and engagement plan, PCMI will undertake to implement a Grievance Mechanism. This will include the following objectives:

- Appoint a community liaison officer;
- Engagement with communities
- Dissemination of Information;
- Monitor Feedback and Community Attitudes, and
- Implement a Grievance Mechanism

8.14.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- The Constitution of the Republic of the Union of Myanmar (2008);
- The Myanmar Investment Law (2016);
- Myanmar Environmental Conservation Laws (2012);
- Environmental Conservation Rules (2014);
- Draft Administrative Instruction of Environmental Impact Assessment Procedure (2015);
- Draft Environmental Impact Assessment Guidelines for Onshore and Offshore Oil and Gas Developments (December 2015);
- Draft Guideline on Public Participation in Myanmar's EIA Processes (2017);
- National Environmental Quality (Emission) Guideline (2015);
- Public Health Law (1972);
- The Prevention and Control of Communicable Disease Law (1995);
- The Control of Smoking and Consumption of Tobacco Product Law, 2006 (Section 9);
- The Farmland Law and Farmland Rules, 2012 (Section 30);
- The Prevention of Danger of Hazardous Chemical and related Substances Law, 2013 (Section 16,17,23,27).

The management and mitigation measures of the Plan are aligned with the IFC guidelines detailed here below.

IFC Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts.

Performance Standard 1 underscores the importance of managing environmental and social performance throughout the life of a project. An effective Environmental and Social Management System (ESMS) is a dynamic and continuous process initiated and supported by management, and involves engagement between the client, its workers, local communities directly affected by the project (the Affected Communities) and, where appropriate, other stakeholders.

8.14.3 Overview Maps and Site Layout

The study area includes local communities within a 1-km radius of the well site (for all phases of the project).

Figure 8-7: Community Consultation Overview Map

8.14.4 Management Actions

Prevent Hearing Impairment For Workers And Annoyance For Public from Noise

- Limit vegetation removal to a minimum.

Change in Land Use - Purchase of land for access roads, drill and campsite

- Transparent and fair compensation to land owners and users.
- Ensure all permissions are obtained from landowners and local authorities. Provide summary to MOGE.
- Notify surrounding landowners 2 weeks before on location and time of project activities.
- Restoration of land to its original state within 6 months of project completion.

Traffic - Transportation of equipment, people and services

- PCMI will conduct Road Hazard Assessment before transporting any large equipment.
- Vehicles will take direct routes where possible and avoid significant habitat areas.
- Construction vehicles will follow speed limits.
- Escort vehicles for wide load that have wide load signs and flashing warning lights.

- Follow local transportation laws and regulations.
- Post and enforce speed limit (follow traffic law on highway and community area, 30km/hr on unsealed road).
- Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.
- Consult with local authority before major movement.
- Restrict/ avoid movement of heavy equipment during rush hours.
- Provide traffic signs or flags at junction of access roads and main roads.
- Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.
- Obtain approval from MOGE and appropriate government offices (Forestry Department if forestry land is crossed) before constructing, upgrading or reroute access roads.
- Strictly enforce training programs to reduce transport incident cases by its contractors.
- Restore any damage to roads that is caused by contractors or Company.
- Restrict local traffic on PCMI private access road.
- Ensure all vehicles are left hand drive.

Power Use - Power for drilling operations and work camp

- Purchase and install diesel-powered generators to supply all project power related needs.

Tourism and Recreational experience - Project construction and operation effects on tourism and recreation

- Post and enforce speed limit (follow traffic law on highway and community area, 30km/hr on unsealed road). Consult with local authority before major movement.
- Consult with local authority before major movement.
- Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.
- Restrict/ avoid movement of heavy equipment during rush hours.
- Provide traffic signs or flags at junction of access roads and main roads.
- Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.
- Obtain approval from MOGE and appropriate government offices (Forestry Department if forestry land is crossed) before constructing, upgrading or reroute access roads.
- Strictly enforce training programs to reduce transport incident cases by its contractors.
- Restore any damage to roads if caused by contractor or company.
- Restrict local traffic on PCMI private access road.
- When project complete, promptly (within 6 months) restore land to its original state.

Employment & Income - Employment & income for nearby communities

- Meet with local authorities to discuss and design local employment hiring to limit impacts on local businesses and key agricultural seasons.
- Employ qualified local workers.
- Purchase local supplies and services, whenever possible.
- Host a pre-project local community awareness program with communities to facilitate awareness of opportunities and benefits.
- Terms of contract for recruitment of manpower in these companies needs to include emphasis on hiring locals, especially for unskilled and semi-skilled workforce.

Labour In-migration - In-migration of labour and social interaction

- Meet with local authorities to discuss and design local employment hiring to limit impacts on local businesses and key agricultural seasons.

- Employ qualified local workers.
- Purchase local supplies and services, whenever possible.
- Host a pre-project local community awareness program with migrant workers to facilitate sensitivity and limit interactions, where advisable, between migrant workers and local communities.
- Restrict workers to within project boundaries and do not allow local interaction within the communities.

Waste DisposalDisposal of waste in project area - Increased waste disposal overloading local infrastructure

- Provide septic tank for sewage.
- Ensure treatment and disposal according to accepted international standard. Keep waste manifest.
- Enforce "Good Housekeeping" practices.
- Segregate and store waste in appropriate, secure properly labelled containers.
- Dispose of waste in labelled containers for possible recycling.
- Implement requirements for waste management and related laws.
- Store hazardous waste in appropriately designed areas and safe containers that are suitable for transporting/transferring.
- Always check and record the type(s) and amount of waste generated.
- Provide Waste Manifest System.

8.14.5 On-going Consultation & Grievance Mechanism

8.14.5.1 Appoint a Community Liaison Officer

To facilitate information exchange a community liaison officer will be appointed. The local village leader could possibly fulfill this role. Villages near project activities must be advised 2 weeks in advance of project initiation.

8.14.5.2 Engagement With Communities

Engagement with local communities that may be impacted by PCMI business activities shall be conducted to create awareness on Company's operations, including the associated HSE controls and recovery measures. Where there are legislative requirements to conduct such engagements, these requirements shall be fully complied with. To facilitate information exchange a community liaison officer will be appointed. The local village leader could possibly fulfill this role. Villages near project activities must be advised 2 weeks in advance of project initiation.

8.14.5.3 Dissemination Of Information

The objective of these activities is to distribute information to affected stakeholders and communities within the project area. A combination of communication methods will be used to ensure the target groups within the project area are reminded and aware of the proposed plans. PCMI will periodically inform the local authorities the project plans throughout all phases of the project.

Before project commencement, the Local Authority will be formally notified of the upcoming project. A meeting with the village heads will be conducted at least 2 weeks before project launch. This meeting will be used to inform the community leaders of transportation routes, drilling operations and potential disturbances from these activities. The meeting will also introduce key staff members and ensure contact details are exchanged. The community leaders will be asked to relay the information to their communities.

8.14.5.4 Feedback And Community Attitudes

PCMI understands the importance of listening to stakeholder concerns and addressing any valid issues to maintain good relations and demonstrate respect for the neighbouring communities in which it operates.

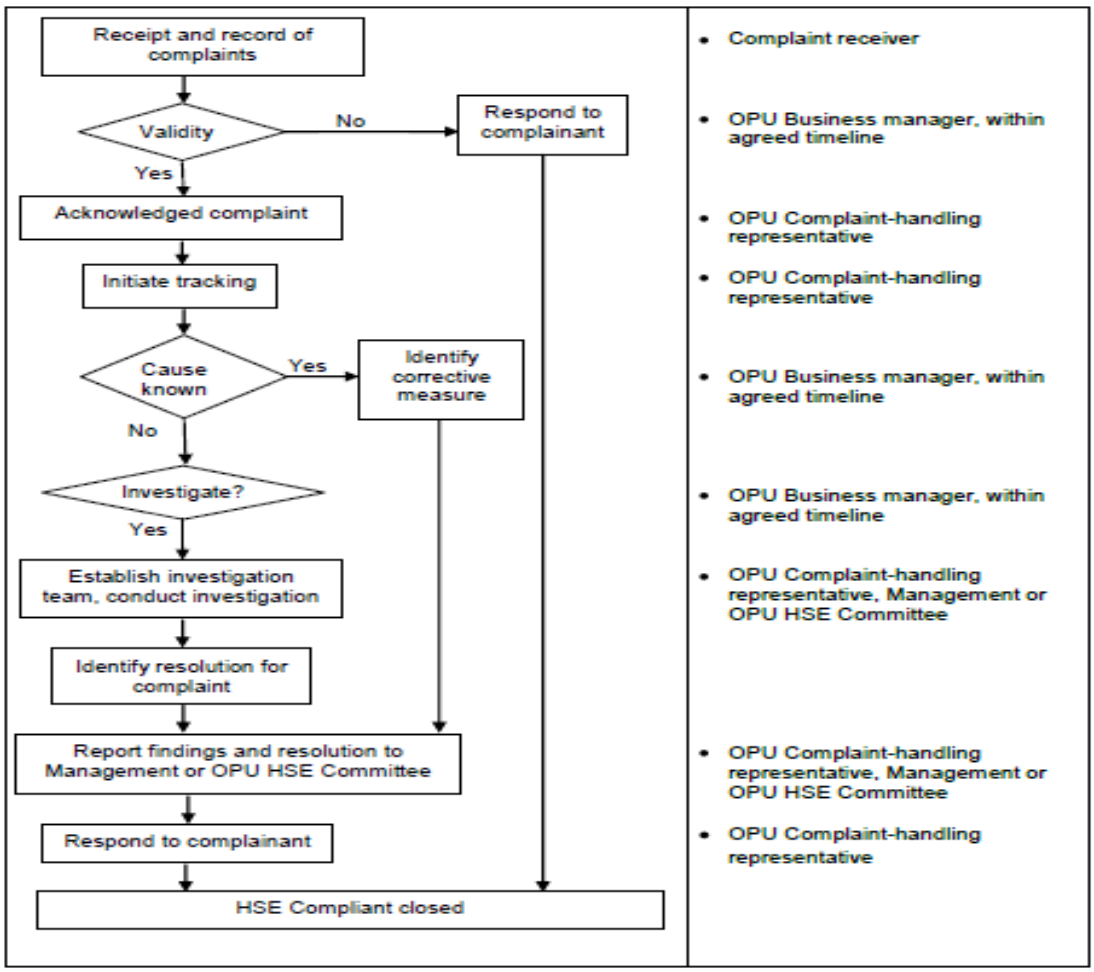
Implement Grievance Response Mechanism

The following techniques and mechanisms will be utilized to ensure effective feedback to any community grievances raised.

All HSE Grievances will be processed immediately and according to the HSE Stakeholder Complaint Procedure. Access to complaint-handling process should be free-of-charge to the complaintant. All Complaintants should be treated courteously and be kept informed of the progress of their complaint, being addressed in an equitable, objective and unbiased manner through the complaint-handling process.

The flow of activities in HSE Complaint process is shown in **Figure 8-8** below.

Figure 8-8: HSE Complaint Process Flow



8.14.6 Monitoring Plans

Factors	Index	Procedure	Proposed Duration and Frequency of Monitoring	Location
Social	• Complaint • Monitoring and solving	• Record complaint • Monitor, investigate and implement suitable solutions	• All phases	• Project area, community around project area, and transportation route
Post Project Opinion Survey	• Opinion Survey of Communities near project area	• Post project opinion survey to determine community attitude toward the project	• Once after the project	• Nearby community

8.14.7 Implementation Schedule

The Community Consultation Plan and Grievance Mechanism will be conducted during all phases of the project's operations. Four weeks prior to site operations, the stakeholder (village headman, household representatives and community leaders) will be informed about project activities and Grievance Mechanism. PCMI will attend monthly meetings at the district office with village headman, household representatives to address any issues regarding PCMI's project as required.

8.14.8 Projected Budgets and Responsibilities

Budget

USD $10,000

Responsibilities

The following are the list of appointed personnel as **COMMUNITY LIAISON OFFICER/ SECRETARY AND MEMBERS OF GRIEVANCE RESOLUTION COMMITTEE (GRC)** for **Myanmar Assets** to carry out the expected roles and responsibilities of above position.

Appointment of Community Liaison Officer / Secretary of GRC and Member of Grievance Resolution Committee & Issue Owner

No	Name	Position	Appointment
1.	U Than Naing Myint	Head, IR	Community Liaison Officer & Secretary of Grievance Resolution Committee
2.	U Nay Linn Khine	Head, CAA	Member (CAA) of Grievance Resolution Committee & Issue Owner
3.	Daw Annie Nilar Sein	Head, HR	Member (HR) of Grievance Resolution Committee & Issue Owner
4.	U Win Aung Zaw	Head, HSE	Member (HSE) of Grievance Resolution Committee & Issue Owner
5.	U Khun Min Swe	Head, Production	Member (Production) of Grievance Resolution Committee & Issue Owner

In the role of **Community Liaison Office and Secretary of Grievance Resolution Committee,** you are expected to ensure effective implementation of Grievance Mechanism for Myanmar Assets by confirming:

(1) Acts as a focal person to engage with community and to receive grievances;
(2) Forms cross-functional team to develop and implement as per PTG 18.92.04 Grievance Mechanism and WW ALL XX S 05 26 Grievance Mechanism Guideline.
(3) Responsible to receive, acknowledge and register all requests / complaints / enquiry & grievance;
(4) Conduct initial assessment and advise Grievance Custodian to assign Issue Owner;
(5) Establish, maintain and update grievance mechanism database;
(6) Permanent secretary to Grievance Resolution Committee;
(7) Report grievances received and actions taken to the Grievance Resolution Committee;
(8) Communicate the process and progress of grievance resolution to complainant;
(9) Analyse grievances together with HSE function and recommend appropriate actions to prevent recurrence of grievances within the control of Myanmar Asset; and
(10) Responsible to proactively conduct regular dialogue or engagement with stakeholders.

In the role of **Issue Owner and Grievance Resolution Committee Members**, you are expected ensure effective implementation of Grievance Mechanism for Myanmar Assets by confirming:

Roles and Responsibilities of Issue Owner

(1) Function/ department that is most relevant to the cause of grievance; Forms and leads investigation team;
(2) Sets and monitors timeframe;
(3) Conducts investigation, and recommend resolution to Grievance Resolution Committee;
(4) Supports CLO on dialogue or engagement with Complaint to achieve a mutually agreed solution; and
(5) Responsible for the implementation and follow-up of agreed action items once the mutually agreed solution has been approved by the Grievance Resolution Committee.

Roles and Responsibilities of Grievance Resolution Committee and Members

(1) Committee that consists of cross-functional senior management of Myanmar Assets;
(2) Complainant, subject matter experts and third party mediator can be invited if deemed necessary by the Committee;
(3) Deliberates on options for resolution and approves the mutually agreed resolution;
(4) Deliberates on appeal cases;
(5) Endorse the case closure; and
(6) Deliberate the grievance trends and endorse the intervention plans.

8.15 Occupational Health/Public Health Plan

8.15.1 Objectives

To prevent and eliminate the risk of personal injury, occupational illnesses and damage to properties.

8.15.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- The Constitution of the Republic of the Union of Myanmar (2008);
- The Myanmar Investment Law (2016);
- Myanmar Environmental Conservation Laws, 2012 (Section 7(o), 14,15,29):
- National Environmental Quality (Emission) Guideline (2015):
- Public Health Law (1972);
- The Prevention and Control of Communicable Disease Law (1995);
- The Control of Smoking and Consumption of Tobacco Product Law, 2006 (Section 9);
- The Petroleum and Petroleum Products Law, 2017, Section 8 (m), Section 9 (a, c, d), Section 19(a,b,e), Section 10 (a,c,d,f);
- The Myanmar Fire Force Law, 2015 (Section 25);
- Employment and Skill Development Law, 2013 (Section 5, 14, 30);
- The Factories Act, 1951;
- The Oilfields Act, 1918;
- The Welfare of Labors of Oilfield Act, 1951(After notification);
- The Workmen Compensation Act, (1951);
- Labor Organization Law (2012);
- Settlement of Labor Dispute Law (2012)
- Minimums Wages Law (2013)
- Payment of Wages Law, 2016 (3,4,8,7(ii),9,10(a) to e);
- Social Security Law, 2012 - 11, 16(a), 48(a), 51(a) (b), 54;
- Leaves and Holidays Act (1951);
- The Explosive Act (1887)
- The Explosive Substances Act (1908)
- The Motor Vehicles Law (2015) and Rule (1987);
- Myanmar Insurance Law, 1993 (Section 16);
- The Prevention of Danger of Hazardous Chemical and related Substances Law, 2013 (Section 16,17,23,27);
- Import and Export Law, 2012 (Section 7).

The management and mitigation measures of the Plan are aligned with the IFC guidelines detailed here below:

- IFC Environmental, Health, and Safety (EHS) Guidelines - GENERAL EHS GUIDELINES: OCCUPATIONAL HEALTH AND SAFETY
- IFC Environmental, Health, 188and Safety (EHS) Guidelines - GENERAL EHS GUIDELINES: COMMUNITY HEALTH AND SAFETY
- IFC Performance Standard 4 Community Health, Safety, and Security

8.15.3 Overview Maps and Site Layout

The study area includes local communities within a 1-km radius of the well site (for all phases of the project) as shown in **Figure 8-9**.

Figure 8-9: Occupational Health/Public Health Map

8.15.4 Management Actions

Prevent Respiratory Irritation Exacerbation Of Asthma from Dust

- Spray water on un-surfaced access roads of project transportation route during dry conditions at least twice a day (morning and afternoon).
- Post speed limits on project access route and limit vehicle speed to 30 km/h on un-surfaced roads.
- Use vehicles with dust flaps.
- Cover loose dry loads.

Prevent Hearing Impairment For Workers And Annoyance For Public from Noise

- Limit vegetation removal to a minimum.
- Schedule operation of noisy construction equipment at different times.
- Ensure use of mufflers on diesel/gas driven machinery and vehicles.
- Ensure all machinery and vehicles are properly maintained and serviced as per maintenance schedule recommended by manufacturer.
- Provide earplugs to drilling workers.
- Select drill site locations at safe distances from nearest community (a minimum of 500 m).

- Should complaints over noise be received, consideration will be given to the provision of noise barriers.

Prevent Food Safety, Gastroenteritis Increase In Vector-Borne Diseases: Malaria, Typhus And Dengue And Others from Non-Hazardous Waste

- Provide septic tank for domestic sewage.
- Ensure treatment and disposal according to accepted international standard.
- Keep waste manifest.
- Enforce "Good Housekeeping" practices.
- Segregate non-hazardous and hazardous waste, store each type of waste in closed containers and make sure all containers are clearly labeled.
- Dispose of waste in labelled containers for possible recycling.
- Implement requirements for waste management and related laws.
- Store hazardous waste in appropriate and safe containers that are suitable for transporting/transferring.
- Always check and record the type(s) and amount of waste generated.

Prevent Acute Exposure of Skin Irritation, Inhalation Exposure from Mud Chemicals and drilling waste

- Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil.
- Use non-hazardous water-based mud system. Inform MOGE in case of change in mud chemicals.
- Construct drainage system around concrete rig pad, mud tanks and pumps, cement units, generators and solid control equipment to divert any spills into the waste pit.
- Store all chemicals in secured storage area with impervious (cement or plastic sheet) floor and bund wall. Handle all chemicals according to its MSDS.
- Provide spill clean up kits and training for designated rapid response teams to clean up any spills.
- In the event of chemical spill, implement spill response plan.
- Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil.
- Implement transportation plan.
- Cement steel casing in place.
- Implement awareness training on the hazards of the chemicals.
- Enforce use of PPE, such as dust masks or respirators, gloves, overalls, and eye glasses.
- Handle chemicals only in well-ventilated and controlled areas.

Prevent Acute Exposure of Skin And Eye Irritation, Inhalation Exposure from Hazardous Waste

- Segregate and store hazardous chemicals and waste in appropriate, labelled and safe containers that are suitable for transporting/transferring. Containers having hazardous waste must be kept in safe areas.
- All hazardous waste will be collected in skips ready for treatment and disposal and sent directly to DOWA waste disposal facility.
- Provide Manifest System for transportation of hazardous waste to treatment area or disposal area.
- Always check and record the type(s) and amount of hazardous waste generated.

Prevent Increased Incidence and Prevalence Of HIV/AIDS, Hepatitis Band C, Syphilis, Etc.

- Implement mitigation measures listed for non-hazardous waste (Section 6.5.3).
- Clearing of overgrowth in perimeter.
- Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil.
- Keep waste manifest.
- Drainage and removal of waste from waste pit upon completion of drilling.
- Health screening of workers before employment.
- On-site health clinic (drilling operations) and referral system during all of project operations with external health agencies to ensure timely diagnosis and treatment of workers' illness and injury.
- Maximize hiring of qualified local workers to reduce reliance on outside labour and increase local employment.
- Do not allow workers to enter communities near the drill site.
- Provide awareness to workers on preventive measures for the prevention of communicable and local diseases

Prevent Heat Exposure and Nuisance Light & Heat

- Post constant fire watch during flaring operations.
- Maintain safety distance between flare stack and well site facilities and adjacent crops.
- Implement PCMI's Emergency Response Plan including specific management procedures to mitigate the impacts if a fire occurs.
- Install fire extinguishers, alarms and windsocks (to be audible and visible from whole site).
- Heat impacts from the flare stack will be minimized by having a protected flare pit.
- Maintain a safe distance from nearest sensitive receptor.

Prevent Increase In Respiratory Illnesses/Diseases, Exacerbation Of Asthma and Disturbance Psychological Wellbeing from Flare Emissions

- Ensure flare system has efficient combustion.
- Clear vegetation around the flare stack and build earth bermed flare pit.
- Maintain pilot flame at the flare tip to ensure that flame is not extinguished by strong wind.
- H2S detection and safety equipment is standard issue. PCMI's emergency response plan (ERP) includes an H2S Contingency Plan. Furthermore, the drilling contractor will have their own H2S Contingency Plan.
- Standard mitigation measures to reduce impacts from hydrogen sulphide release during well testing will be implemented:
    - Install H2S sensors at the flow line.
    - If H2S levels exceed 10 ppm in the gas stream, implement appropriate safety zones.
    - The initial flow of hydrocarbons to surface will be timed to coincide with daylight hours.
- Staff trained in H2S procedures.

8.15.5 Monitoring Plans

Factors	Index	Procedure	Proposed Duration and Frequency of Monitoring	Location
Occupational health and safety	• Accidental statistics • cause of accidents • Mitigation measures	• Record accidents or near misses generated during construction by identifying cause(s) and severity of impact(s), as well as operated mitigation measures • Conduct summary report for accident investigation	• All phases	• Project area, community around project area, and transportation route
Audit of Management Measure Implementation	• Audit of Management Measures	• Conduct Audit of management measure implementation	• Once after the project	• At all project locations

8.15.6 Implementation Schedule

The Occupational Health/Community Health Plan will be conducted during all phases of the project's operations. The personnel and infrastructure necessary for implementing the occupational health/community health plan will be established 2 weeks prior to project initiation and will be maintained until one month after project completion.

8.15.7 Projected Budgets and Responsibilities

Budget

USD $20,000

Responsibilities

- Drilling Contractor;
- Drilling Contractor HSE Manager.
- PCMI Manager, Health, Safety and Environment (HSE)
- Civil Work Contractor

8.16 Emergency Response Plan

8.16.1 Objectives

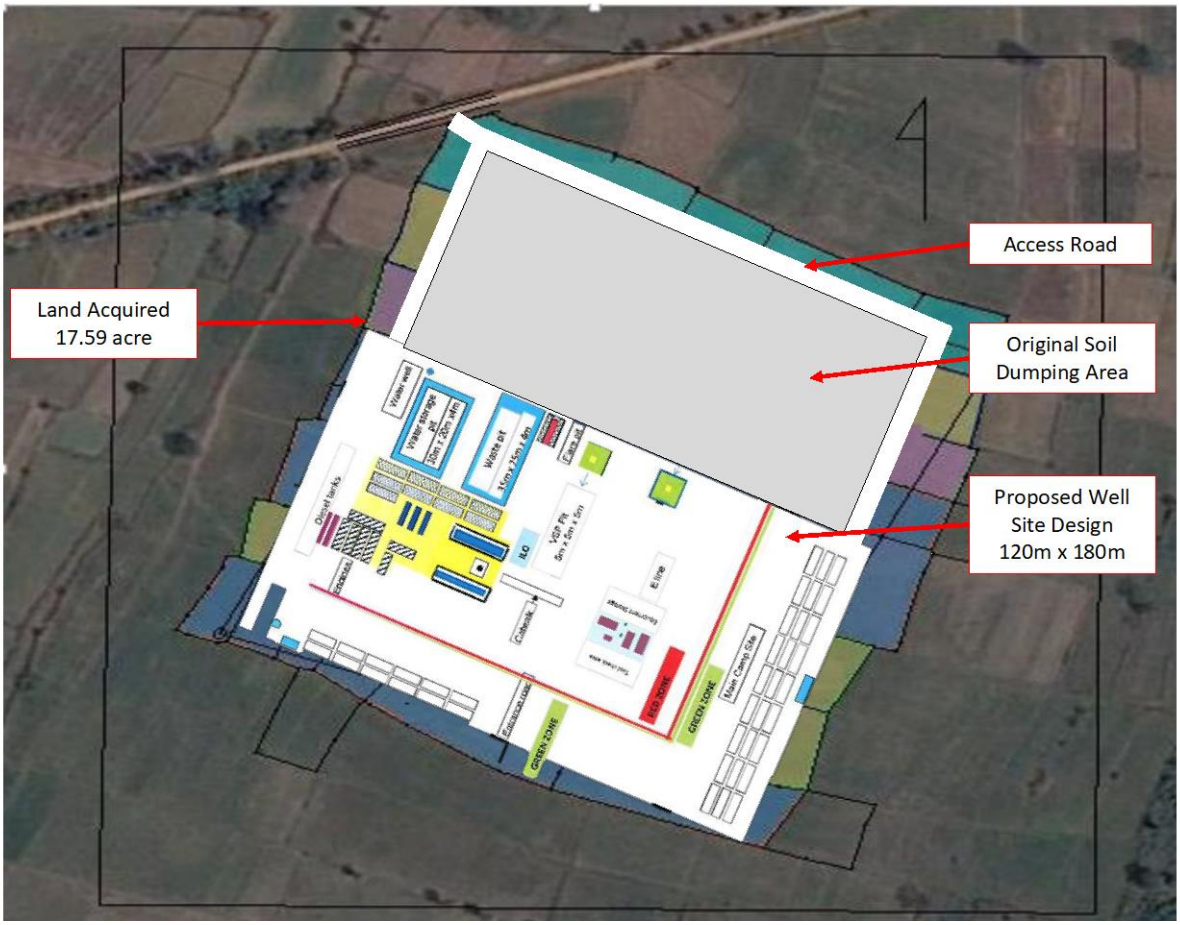
To prevent and eliminate the risk of personal injury, occupational illnesses and damage to properties.

8.16.2 Legal Requirements

Myanmar applicable legislation and regulation include:

- The Constitution of the Republic of the Union of Myanmar (2008);
- The Myanmar Investment Law (2016);
- Myanmar Environmental Conservation Laws (2012);
- Environmental Conservation Rules (2014);
- National Environmental Quality (Emission) Guideline (2015);
- Public Health Law (1972);
- The Prevention and Control of Communicable Disease Law (1995);
- The Control of Smoking and Consumption of Tobacco Product Law, 2006 (Section 9);
- The Petroleum and Petroleum Products Law, 2017, Section 8 (m), Section 9 (a, c, d), Section 19(a,b,e), Section 10 (a,c,d,f);
- The Myanmar Fire Force Law, 2015 (Section 25);
- The Explosive Act (1887)
- The Explosive Substances Act (1908)
- The Factories Act (1951)
- The Oilfields Act (1918)
- The Welfare of Labors of Oilfield Act, 1951(After notification);
- The Motor Vehicles Law (2015) and Rule (1987);
- Myanmar Insurance Law (1993 - Section 16);
- The Prevention of Danger of Hazardous Chemical and related Substances Law, 2013 (Section 16,17,23,27);
- Import and Export Law, 2012 (Section 7).

8.16.3 Overview Maps and Site Layout



8.16.4 Management Actions

Potential for Accidents, Hazards and Emergencies

- PCMI will ensure the contractor will have an Emergency Response Procedures Manual that includes response procedures for blowout, fire, earthquake, medical emergency, release of hazardous/toxic substances, etc. PCMI has an Emergency Response Plan (ERP) that will be updated specifically for each well site operations and site specific location.
- This ERP is considered a standard E&P Emergency Management System and is based on Industry accepted standards and practices (e.g. ISO, BCI, EMI, BS etc.). Topics of the ERP are outlined in **Table 8-15.**

Table 8-15: Emergency Response Plan

Main Sections	Topics
Procedure & Responsibilities	• Drilling Superintendent • On-Scene Commander • PIC (Person-In-Charge)
Emergency Organization	• Introduction • Emergency Response Philosophy • Overview of the Response Organisation
Emergency Arrangements And Facilities	• Major gas release / H2S • Explosion / fire • Accommodation fire • Blow-out Contingency Plan • Oil spill land • Hazmat spill • Helicopter incident • Man missing • Loss or damage of radioactive source • Traffic accident • Medevac • Bomb threat / terrorist act • Fatality • On-scene Commander Field Arrangements and facilities
Risk Management	• Major Hazards • Emergency Plans

Blowout

- Careful planning of drilling operation.
- Examination of existing seismic lines and nearby wells to identify shallow gas hazards.
- Drilling and Well Control Standard Operating Procedures and extensive HSE Management System procedures and operational controls in place.
- Internal hazardous operations reviews and "Table Top drilling" exercises to test procedures and individual personnel performances against the drilling plan.
- Select proper drill fluid formulation, provide well kill fluids/systems, loss control and weighting agents.
- Very careful monitoring of down hole conditions and mud returns.
- Use of appropriate, high quality materials in well construction (casing and cement grades).
- Provide a blowout preventer (BOP) stack that is sized appropriately in proportion to the maximum formation pressure; and test as per procedures.
- Provide of a high-pressure water-spray dousing system around the wellhead, solids removal chokes and flare stack.
- PCMI's Emergency Response Plan.
- PCMI's HSE Integrated Management System Procedures and operational controls will be in place to prevent a blowout/explosion.
- PCMI BOCP in place prior to spudding.

Fire or Explosion (not associated with a Blowout)

- PCMI's HSE Integrated Management System Procedures and operational controls to prevent a fire/explosion.
- PCMI's Emergency Response Plan including specific management procedures to mitigate the impacts if a fire/explosion occurs.

- Install fire extinguishers, alarms and windsocks (to be audible and visible from whole site).
- Pre-arranged call out support from local fire brigades.

Fuel, Chemical or Hazardous Waste/Materials Spill

- Chemicals, Hydrocarbons and hazardous materials or waste will be securely stored and use governed by safe operating procedures.
- Spill containment and recovery equipment will be available near storage areas.
- Procedures for response to Chemicals, Hydrocarbons and hazardous materials or waste spills will be included in PCMI's ERP.
- MSDS Sheets will be posted in areas where Chemicals, Hydrocarbons and hazardous materials or waste is stored and with the ESH Officer.
- Construct one lined waste pit for potentially contaminated runoff and spills (6,000 m^3), surrounded by 0.2 m high bund that will help prevent run-off into the environment. Monitor and transport waste to prevent any overflow from waste pit.
- Construct drainage system around well sites and concrete rig pad which mud tanks, shakers, generators and fuel tanks sit on to divert any spills into the waste pit.
- Use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious floor (e.g. tarpaulin sheet).
- Provide drip pans and absorbents to contain any spillage.
- Provide spill cleanup kits and training for designated rapid response teams to clean up any spills. In the event of oil or chemical spill, implement ERP.
- Prohibit workers from cleaning machines/equipment in/near a public water source.
- Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.
- Maintain oil traps along perimeter drainage ditch to prevent any spills from flowing off site.
- Isolate any area(s) that might be contaminated from non-contaminated areas. The ground of areas where possible contamination occurs will be covered with plastic sheet.
- Store Chemicals, Hydrocarbons and hazardous materials or waste storage tanks on concrete rig pad. The storage unit will be surrounded by a bund wall that is 300 mm high and able to contain liquid chemicals in case of spill.
- Transport produced emulsion-condensate to a DOWA wastewater treatment facility using dedicated tanker trucks.
- The use of chemicals will be avoided through appropriate design where practicable.
- During the procurement process, chemicals will be evaluated for environmental, safety, technical, and commercial performance. As far as practicable, least hazardous chemicals will be selected.
- Procedures for response to chemical spills will be included in PCMI's ERP.
- Use non-hazardous water-based mud system. Inform MOGE in case of change in mud chemicals.
- Drill cuttings to be buried in the waste pit as per IFC 2007 regulations. The cuttings will be tested for contamination and if they meet IFC standards will be mixed with 2/3 subsoil and buried on site. The top of the buried site would be covered with original topsoil.
- Implement transportation plan.

Transpiration Accidents

- HSE Integrated Management System Procedures.
- Limit the speed of project vehicles, according to the road condition (on unpaved road to 30 km/h).
- Maintain construction equipment and vehicles to regulatory standards.
- Conducting RHA (Road Hazard Assessment for identified roads and implement JHA)

- Notify the local authority on the oversized load and put a escort in front of this convoy with horn and hazard lights.
- Consult with community leaders on plan and transportation route before movement of large equipment.
- Restrict/ avoid movement of heavy equipment during rush hours from 07.30 to 08.30 am and 3.30 to 4.30 pm.
- Provide traffic signs or flags at junction of access road and main road.
- Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.
- Strictly enforce training programs to reduce transport and drilling incidents by its contractors.
- Restore any damage to roads caused by project vehicles.
- Implement emergency response training, fire training and response drills.
- Install adequate fire extinguishers around the well sites.
- Test safety devices as determined appropriate.
- Provide PPE to workers on site.
- Provide medic, First Aid kits and First Aid trained personnel at drilling site.
- Restrict smoking to controlled areas.
- Prohibit trespassers from entering the construction site.
- Referral system with external medical facilities for serious injuries or emergencies.

Earthquakes

- Implement PCMI's Earthquakes: Evacuation Plan and Emergency Response Plan.
- Proper training and safety procedures will be the main preventative measures to reduce the potential risk.
- In the unlikely event an accident should occur, the Emergency Response Plan would be implemented, which includes evacuation of personnel during severe circumstances.

8.16.4.1 Community And External Communication

- In the event of any emergency it is necessary to notify the Myanmar Government. Unless specifically advised otherwise, the only government agency to be notified will be the Myanmar Oil & Gas Enterprise (MOGE) who is the official operator of each PSC (Production Sharing Contract).
- MOGE is to be notified immediately of any incident. Initial contact should be by telephone or radio. This should be followed up by fax as soon as possible. When cleared by the PCMI General Manager, the EMT's IC on duty who has the necessary contact numbers will initiate contact with MOGE.
- MOGE will then contact any other government agencies required i.e. police, medical, military, customs, immigration etc. Where required, MOGE should be asked to assist in dealing with other government agencies for issues such as arranging clearance for emergency flights, immigration matters and liaison with the Armed Forces if required. For example, the Armed Forces may be involved in assisting in maritime or land based search and rescue operations or in dealing with terrorist threat or other security issues.
- Contact with Malaysian or other embassies in Myanmar may be necessary in connection with notification of Next of Kin, repatriation of casualties or fatalities, evacuation of personnel due to socio-political developments and other issues. The General Manager will decide whether or not and when such contact will be initiated.

8.16.5 Monitoring Plans

Factors	Index	Procedure	Proposed Duration and Frequency of Monitoring	Location
Occupational health and safety	• Accidental statistics • cause of accidents • Mitigation measures	• Record accidents or near misses generated during construction by identifying cause(s) and severity of impact(s), as well as operated mitigation measures • Conduct summary report for accident investigation	• All phases	• Project area, community around project area and transportation route
Audit of Management Measure Implementation	• Audit of Management Measures	• Conduct Audit of management measure implementation	• Once after the project	• At all project locations

8.16.6 Implementation Schedule

The emergency response plan must be customized for the location one month prior to project initiation to ensure that personnel are trained as required.

8.16.7 Projected Budgets and Responsibilities

Budget

USD $15,000

Responsibilities

8.16.7.1 Emergency Response Framework

During an emergency situation, the centre of operation is known as the Emergency Control Centre (ECC). All information and coordination, regarding emergency management operations, shall flow through the ECC. The centre is staffed by the Emergency Management Team (EMT) and shall include one Incident Commander and members of the appointed representatives.

Within this framework, the EMT can provide, equipment, supplies, facilities, managerial and technical services in support of site ERT mitigation and control efforts. The Incident Commander and the other team members shall be involved in providing all required supports.

Under PETRONAS Incident Command System, the HSE Department has been delegated with primary responsibility for coordinating PCMI emergency preparedness, planning, management, and emergency assistance functions. The department also has been delegated with responsibility for establishing emergency assistance policy. In this stewardship role, the department has the lead in developing this plan.

8.16.7.2 Event Classification

PCMI three-tiered response definitions provide the following classification.

Tier 1- Minor

A situation where there is no danger to life and where risk of damage to property and environment is minimal. The emergency is within the control of the Facility/ vessel, Operation and OPU.

Tier 2 - Major

A situation where there is danger to life and risk of damage to property and environment. The emergency is within the control of the Facility/ vessel, Operation and OPU with limited external assistance.

Tier 3 - Crisis

A situation where there is a potential for multiple fatalities and severe damage to property and the environment involving neighbouring sites and surrounding communities. The emergency is clearly beyond the capacity of the Facility/ vessel, Operation, OPU and Business to control and consequently requires action from PETRONAS corporate, government or other external parties.

8.16.7.3 Emergency Response Organisations

All operational activities (construction, drilling and de-commission) are controlled by PCSB Office in Kuala Lumpur; Malaysia the Yangon Office shall always in direct contact with the site location on a day to day basis on operational matters.

Site Facility

The response to an emergency occurring at the site or facility is undertaken by the facility Emergency Response Team, under the direct supervision of the PIC. The site emergency response team comprises of personnel that are assigned to carry out specific emergency duties. (refer to site Emergency Response Plan for details).

At minimum, the composition of the site ERT are as follow:
For manned facilities, two (2) complete DCTs shall be in place consisting of the following:

a) 1 x OSC
b) 1 x Emergency Operation Centre (EOC) Support (e.g. RO)
c) 1 x DCT Commander
d) 2 x DCT Team, each comprising 1 x DCT Leader,
   2 x Fire Fighter,
   2 x Fire Fighter with Breathing Apparatus (BA), and
   1 BA Coordinator.

The team shall be involved, when responding to emergency situation(s) and carry out mitigation and control (first responder), pending arrival of emergency assistance and supports.

PCMI Emergency Control Centre (ECC)

The PCMI Emergency Control Centre (ECC) is located at Training Building, Yangon Office. The ECC is utilized by the PCMI Emergency Management Team (EMT) when managing emergencies occurring in Myanmar Operations.

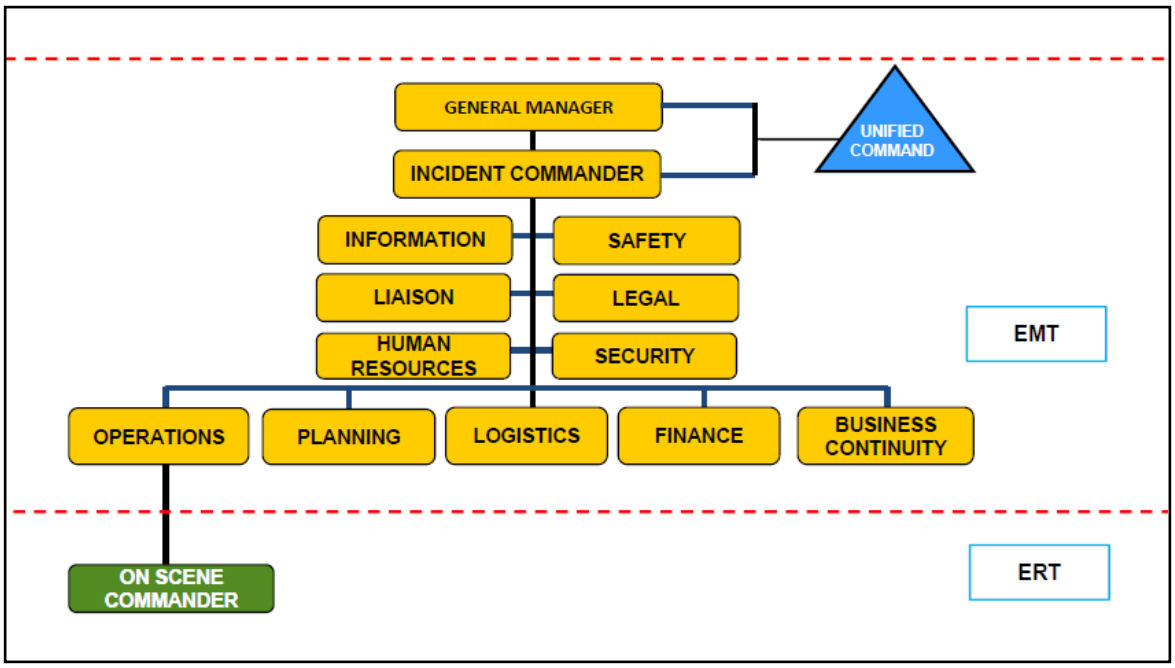
The EMT comprises of core group and support personnel. These personnel are assisted (when mobilized) by the PCSB HQ-EMT, based at Head Office, Kuala Lumpur. The core team members are as follows and shown in **Figure 8-10** which is supposed to be Tier 1 & 2.

Emergency:

a) Incident Commander
b) Operations Section Chief
c) Planning Section Chief
d) Logistics Section Chief
e) Finance and HR Section Chief.
f) HSE & Liaison Officer
g) Computer Operator

The core group is supported by the following group but not limited to as IC can call out other subject matter experts upon agreed by GM:

a) Administration Support Team
b) Next-Of-Kin Response Team
c) Media Response Team (Information)
d) IT/Telecommunications Team
e) Technical/Specialist Group
f) Contractor Representative



Source: PCMI, 2018

Figure 8-10: PCMI Emergency Response and Coordination Parties

8.16.7.4 PCSB Hq Office, Kuala Lumpur

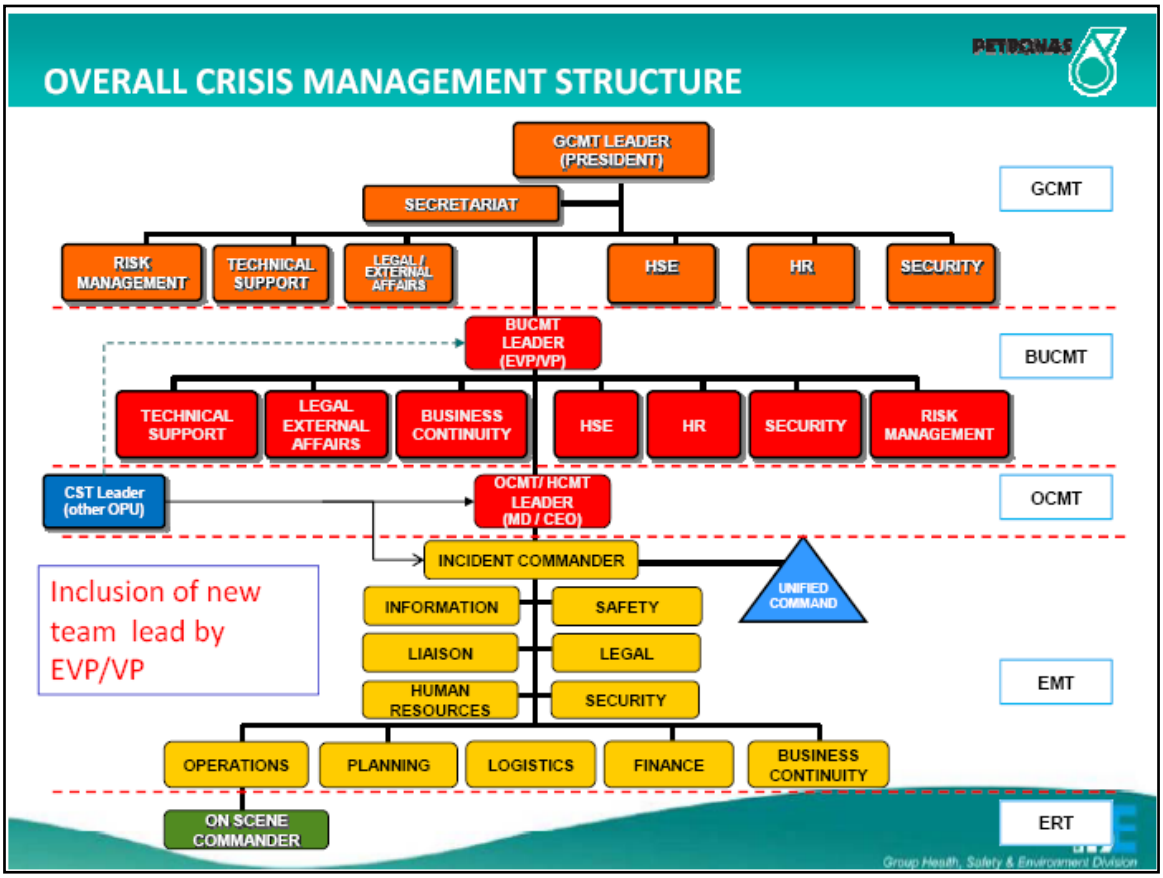
The PCSB Emergency Control Centre (ECC) is at PCSB Head Office, Kuala Lumpur. The ECC is used by Head Office EMT, when coordinating emergency activities and providing supports to PCSB-OPU (local and International).

The corporate EMT is supported by appointed emergency support team members. The Corporate EMT will also organize supports from other OPUs to the affected OPU at the request of the Incident Commander.

8.16.7.5 Petronas Headquarters, Kuala Lumpur

The OPU Crisis Management Team (OCMT) at PETRONAS Headquarters is involved in an emergency, when it escalates into a crisis situation. The team primary roles are to address strategic/tactical group issues and policy guidance to PCSB and OPU team members, when necessary.

PETRONAS Head Office is notified of emergencies by PCSB-HQ IC. Press releases (beside the Holding Statement) must be approved by the President office before the official release.
The overall crisis management structure is as per **Figure 8-11**.



Source: PCMI, 2018

Figure 8-11: Overall Crisis Management Structure

8.16.7.6 Management Of Efforts

The overall responsibility for the safety of the site rests with the PIC. He has the authority and responsibility to take the immediate response actions required to control any emergency; including directly mobilizing or requesting the use of necessary resources such as aircraft, materials, etc., if required.

At Yangon office, the IC will be the overall in charge and responsible for directing key personnel, authorizing or obtaining authorization of any funds required for materials, equipment, contract services or specialist personnel necessary to bring the emergency under control. It is the IC responsibility to establish contact and advise the management at PCSB Head Office, brief them on the emergency and the actions being taken.

The IC shall respond to all requests for assistance from the PIC without delay. It is the sole responsibility of the PIC to identify such requirements, and of the IC and EMT to implement them. If outside assistance is required from other Agencies, such as for the use of equipment, all requests will

be channeled through the IC. Requirements should subsequently be confirmed by fax or in writing. It will be the IC responsibility to ensure that all relevant authorities and organizations are informed and reports subsequently prepared and submitted.

8.16.7.7 Chain Of Command

In the absence of the Duty Incident Commander for any reason, the replacement will be proposed by HSE Department and agreed by GM to act as IC. Once PCMI EMT is exhausted, back up EMT will be notified by HSE Department and agreed by General Manager. Back up EMT team will keep on handling the emergency situation.

8.16.7.8 Resource Coordination And Management

To the maximum extent possible, internal local resources at site shall be used as the first line of support for emergency recovery operations. Arrangements and working collaboration should be made with other agencies as an additional option for resource support after an emergency declaration.

Once PCMI resources and capabilities are exhausted, HQ EMT assistance may be provided to support operational requirements and priorities. Utilization can be requested from the EMT.

Resources are acquired using the standard company procurement vehicle such as a purchase order, blanket purchase agreement, or contract. Additionally, the IC may authorize purchase under the emergency provision power directing completion of a specific task.

8.17 Land Acquisition Procedure

8.17.1 Objectives

As the land on which the well sites and access roads will be constructed is privately owned. The objective is to purchase the land for the project sites and access roads from the owners as per mutual agreement between PCMI, MOGE and the owners.

8.17.2 Legal Requirements

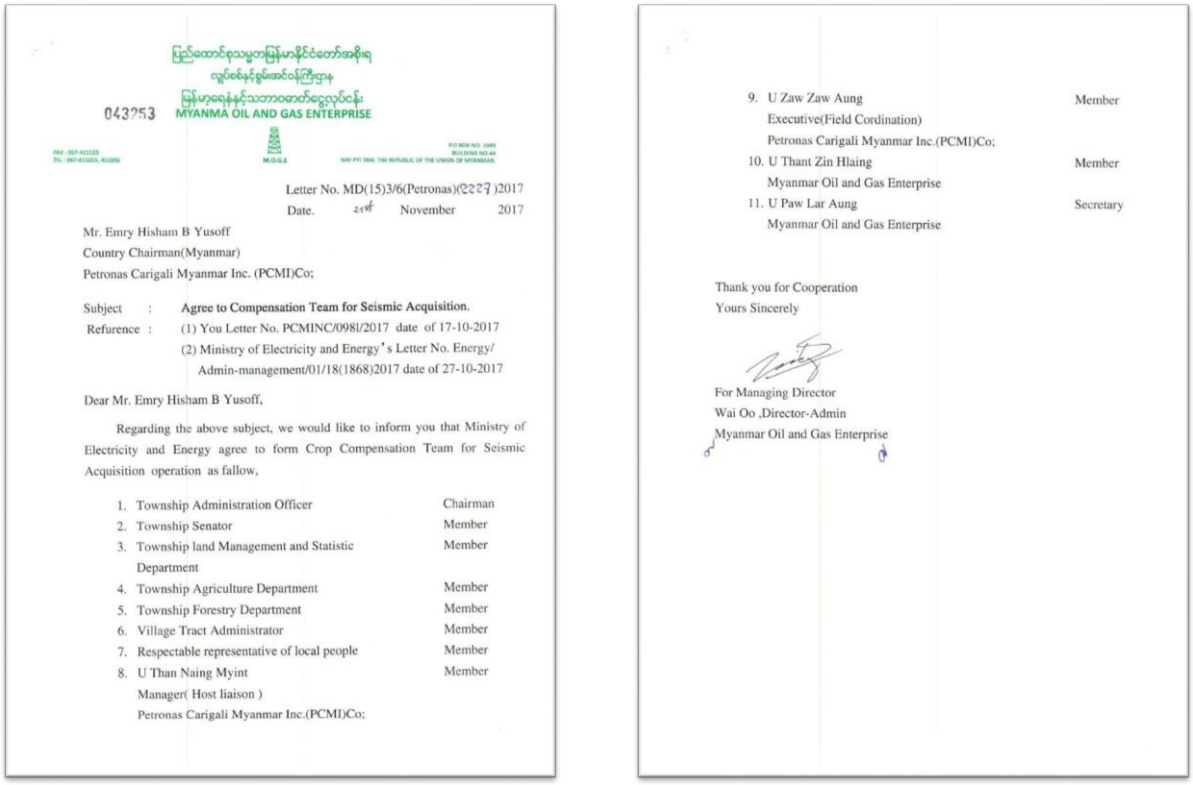
Myanmar applicable legislation and regulation include:

- The Constitution of the Republic of the Union of Myanmar (2008);
- The Myanmar Investment Law (2016);
- The Petroleum and Petroleum Products Law, 2017, Section 8 (m), Section 9 (a, c, d), Section 19(a,b,e), Section 10 (a,c,d,f);
- The Protection and Prevention of Antique Objective Law, 2015 (Section 12);
- The Protection and Prevention of Ancient Monument Law, 2015 (Section 12, 20(f) (c), 15(c));
- The Farmland Law and Farmland Rule, 2012 (Section 30).

The Land Acquisition was carried out in a clear and transparent manner that is in accordance to national regulations through an MOGE approved land acquisition team (**Figure 8-12**). The Ministry of Energy approved the acquisition of the land and compensation was paid to all landowners **Figure 8-13**. The land acquisition details are outlined in detail in this section.

The land acquisition teams was developed to:

- evaluate the market price diligently for the acquisition and give away payment directly to the owners of the land acquired for the drilling operation under the permission of the local authority with a view to pay the reasonable price that is fully satisfied and agreed by the farmland owners.
- To achieve understanding and cooperation from the local community through engagements where the drilling programs and activities are clearly explained as well as the acquisition process.
- to carry out the acquisition exercise in accordance with the authorities' procedure and process.
- To ensure the payment is fair, reasonable and timely.
- To ensure the payment is paid directly to the affected parties.



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MYANMA OIL AND GAS ENTERPRISE

Letter No. MD(15)3/6(Petronas)(၉၉၄၇)2017
Date. ၂၁ November 2017

Mr. Emry Hisham B Yusoff
Country Chairman(Myanmar)
Petronas Carigali Myanmar Inc. (PCMI)Co;

Subject : **Agree to Compensation Team for Seismic Acquisition.**
Refurence : (1) You Letter No. PCMINC/0981/2017 date of 17-10-2017
(2) Ministry of Electricity and Energy's Letter No. Energy/ Admin-management/01/18(1868)2017 date of 27-10-2017

Dear Mr. Emry Hisham B Yusoff,

Regarding the above subject, we would like to inform you that Ministry of Electricity and Energy agree to form Crop Compensation Team for Seismic Acquisition operation as fallow,

1.	Township Administration Officer	Chairman
2.	Township Senator	Member
3.	Township land Management and Statistic Department	Member
4.	Township Agriculture Department	Member
5.	Township Forestry Department	Member
6.	Village Tract Administrator	Member
7.	Respectable representative of local people	Member
8.	U Than Naing Myint Manager(Host liaison) Petronas Carigali Myanmar Inc.(PCMI)Co;	Member
9.	U Zaw Zaw Aung Executive(Field Cordination) Petronas Carigali Myanmar Inc.(PCMI)Co;	Member
10.	U Thant Zin Hlaing Myanmar Oil and Gas Enterprise	Member
11.	U Paw Lar Aung Myanmar Oil and Gas Enterprise	Secretary

Thank you for Cooperation
Yours Sincerely

For Managing Director
Wai Oo ,Director-Admin
Myanmar Oil and Gas Enterprise

Figure 8-12: MOGE Approval Letter to Form a Land Acquisition Team

Figure 8-13: Ministry of Energy Approval Letter to Proceed with Land Acquisition and Payment to one Landowner

8.17.3 Overview Maps and Site Layout

The land required for the IOR-7 well location is situated near Daung Kya village close to Shwe Pyi Tha Oil Field with owner plots as shown in **Figure 8-14**.

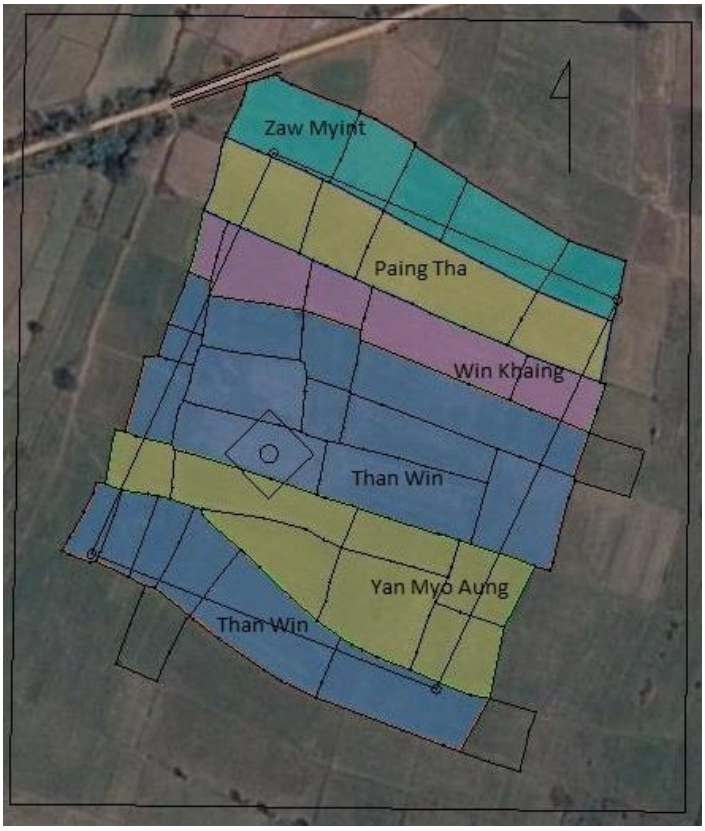


Figure 8-14: Land Acquired for IOR-7 well pad

8.17.4 Management Actions

- ***Engagement Sessions with owners of proposed drilling sites*:** To engage and explain to the local owners of proposed well sites from the affected villages by the team comprising of staff from CAA Host Liaison, Industry Relations ,Stakeholder Management Department in collaboration with MOGE officials. Agreement with farmland owner by signing MOU in front of officials.
- ***Survey and Recording for the proposed lands*:** Before the staking the compensation team is to survey the affected land and crop, take record in the Form that PCMI will use for recording the damage of land and/or crops (**Appendix-B**) and take photograph the well location and access road upon the consent and presence of the respective individual owner as well as the official from local Land Record Department and the village administrative officials. And also Compensation team has to evaluate the fair market price for Land and Crop according to the proposed well locations.
- ***Acceptance and acknowledgement of the land owner*:** The team has to get all detail information about the land and crop in that land in the Primary Record book and later on will transfer these collected data into the form that "record the land and type of crops" and obtain agreement with signature and thumbprint of the owner on area of the land and crops in that land at the presence of the compensation team, village administrator and relevant township land record officers. This data/record will be used in calculating the land

acquisition. The owner's photo is to be taken together his/her affected land.

- ***Liaising with local Authorities and government departments*:** The compensation team members seek confirmation on the price of the land and crops in proposed land area yield of the crops in that area from authorities of relevant townships, district and regional government. They are to liaise with the different levels of authorities to expedite the process by facilitating the efficient correspondence and engagement.

The Standing points for Clarification in Engagement Sessions

Understanding Farm Land Rule (2012): In order not to confuse the villagers the followings are to be clarified to the villagers;

- According to the farm land rule Chapter 8 , Para 67 (a)(b) , the affected farm land owner must be compensated not only for the price of farm but also for the price of crop . And also a farmland owner whose farm has unmovable things such as buildings , trees , water well etc… must be compensated as mentioned above.
- The compensation rate for farmland is decided by the Land and Crop Compensation Team .
- The Compensation rate for Crop of that farm is 3 times of appropriate and market prices decided by the Land and Crop Compensation Team.
- The Compensation rate for unmovable things such as buildings, water-well etc., is 2 times of market prices decided by the Land and Crop Compensation Team .
- The Compensation rate for perennial trees such as palm, toddy etc., is 3 times of market price decided by the Land and Crop Compensation Team.

Explaining to the villagers

The affected landowners are to be explained how the land will be measured and acquisition will be calculated and paid together with the samples of the forms. They also need to be explained the legal binding of the contract and they have no right to complaint after getting compensation.

Arrangement for Land Acquisition

- Report to Township Administrators on the mobilization and arrival of the team at site
- At the same time the team also has to seek information on the local market price and the yield of the crops produced in the area and price of the farm land, crops and trees from the respective township authorities
- Once the Township authorities has come up with the price of the farm land and market price of yield of the crops grown in the proposed land area, the team comprising the Township officials have to forward it to get the approval of the District Administrator on the said data.
- Afterwards, the counter approval from the District level has to be submitted to the relevant Regional Governments. The approved price of farmland and price of crops, trees by the Regional Government will be officially referred as final.
- Once the calculations are done based on the approved land and crop price and yield of the crop, the acquisition as listed in farm by farm are to be compiled and submitted to the Township Administrator (Chairman of Crop and Land Compensation Team) to proceed to give away the payment to the individual farm land owners.
- The completion of the compensation also has to report officially after of all

payments are paid in hand to the owners of the land together with the signed receipts.

- Although it is not a requirement of the Government, the compensation team introduces "Acceptance Deed" as per herewith attached with each and every villager upon their consent on the damage and satisfaction on the compensation clearly stating that the settlement is final.

IMPLEMENTATION

Recording

The ownership of the proposed lands and crops are to be checked with the record of the Land Record department official and verified by the village administrator. The type of crops really grown in the particular proposed land field is also to be recorded for calculation of the compensation.

Condition of the lands before Land acquisition are to be recorded by the Camera

- Following data are also to be recorded by the crop and land compensation team.
  - Name of the owner
  - NRC No
  - Father's name
  - Plot number
  - Field No
  - Ownership number
  - Date

Setting payment the owners of acquired land

The primary data record Form, that recorded the affected persons personal data and his/her land and crops acquired, signed and thumb-printed and countersigned accordingly by the relevant representatives, are to be compiled into (3) original copies for each and every township and distributed to the followings;

- Township Administrator (Chairman of Compensation Team in his townships)
- Township Land Record Department
- PCMI Copy

Once the payment is ready, after completing calculation and getting cash ready in hand, it is to notify to and request permission from the Township Administrator for official cash distribution.

Once the Township Administrator, who is also the Chairman of the compensation team, approves, together with one of his representative, the team has to go village by village and give away the payment directly in hand to the respective farm land owners as individuals.
The payment (money) will be put into individual envelopes with the name of respective farm land owners, then finally give away by the PCMI Finance team.

In doing so, the receiving individuals have to sign and/or thumb-print in the receipt as per Appendix-C and sign the Acceptance Deed as per Appendix-D with PCMI. Each and every physical handover of payment is also to be recorded by camera as evidence.

Use of farmland by other means

After all the above procedures have been implemented, it is necessary to convert land use by other means according to Farm Land law Chapter 10, article 29 and article 30.

And also the need to comply with Farm Land rules Chapter 9, article 78. The Union Ministry or Nay Pyi Taw Council or region / state government which will implement the plan to use farm land by other means for planning work, for the sake of land term national interest.

(a) It shall be submitted to the Union Government with the approval of central farmland management committee.

(b) When getting the approval of Union Government, the planting may be implemented.

8.17.5 Monitoring Plans

A Grievance Mechanism has been established in the form of HSE Complaint Process Flow. Grievance mechanism is a mechanism through which communities and individuals affected by the project activities can formally communicate or channel their concern and grievances to the company and facilitate resolutions that are mutually acceptable by the parties, within a reasonable timeframe. The grievance mechanism along with the Community Liaison Officers (CLO) appointed to facilitate the grievance process is a management tool designed to help address stakeholder concerns promptly and facilitate a trustworthy and constructive relationship.

A post project audit should meet with the landowners to determine their satisfaction with the land purchase procedure.

8.17.6 Implementation Schedule

The land has already been purchased well in advance of the project start date. A post project audit should be conducted within 6 months of project closure.

8.17.7 Projected Budgets and Responsibilities

Budget

USD 100,000

Responsibilities

According to MOGE's official formation order for Land Acquisition for drilling the following team was established including:

- Township Administration Officer - Chairman
- Township Senator -Member
- Township Land Management and Statistic Department -Member
- Township Agriculture Department -Member
- Township Forestry Department -Member
- Village Tract Administrator -Member
- Respectable representative of local people -Member
- U Than Naing Myint, Manager (Host Liaison) PCMI -Member
- U Zaw Zaw Aung, Executive (Field Coordination) PCMI -Member
- U Thant Zin Hlaing, MOGE -Member
- U Paw Lar Aung, MOGE -Secretary

9. PUBLIC CONSULTATION AND DISCLOSURE

Public involvement, in the form of stakeholder consultation and disclosure, is a critical component of an ESHIA. Its primary objective is to maximize public understanding of the project through information distribution and exchange between the project proponent and the communities that might be affected directly or indirectly by the proposed project activities.

The stakeholder involvement for this ESHIA will consist of four parts: focus group meetings, key informant interviews, and attitude surveys.

The comments and concerns of the stakeholders consulted during this ESHIA have been considered and incorporated into the project design and mitigation measures.

This chapter presents the key findings from public consultation and disclosure. It also provides recommendations for future consultation to be implemented throughout the execution of the project.

9.1 Stakeholder Identification

Stakeholders in the IOR-7 Block include:

Stakeholders	Likely interest/ Responsibilities
Farmers/Local Business	• Possible impact/benefit
Vulnerable Groups including landless farm labourers	• Possible impact/benefit
Government (Local - State and Regional)	
Chief Minister	• Administration
Member Ministers	
Ministry of Home Affairs	
General Administration Department	
District Commissioner	
Township Commissioner/Administrator	
Village Head	
Regional Police Force	
Township Police Officer	• Security • Civil jurisdictions
Government (Departments under concerned Ministry)	
Representative of Forestry Dept. / Ministry of Environmental Conservation and Forestry	• Protection, and conservation of the wildlife and sustainable management of the forest resources
Representative of Water Resources Utilization Department, /Ministry Of Agriculture and Irrigation	• Provision of irrigation water by pumping water from rivers and streams and also utilization of groundwater from feasible potentials for boosting crop production in the concerned area
Representative of Settlement and Land Records Department (SLDR), Ministry of Agriculture and Irrigation	• The only government agency with the mandate to collect and disseminate agricultural statistics. SLRD's statistical activities include; • Monitoring the progress of land preparation and

Stakeholders	Likely interest/ Responsibilities
	cropping; condition of weather and crops • Making crop forecasts, • Carrying out periodic crop surveys • Compiling data on farmer and farm size distribution • Taking annual inventory of agricultural machinery and implements • Compiling the annual Season and Crop Report which provides statistics on rainfall; land use; irrigation and flood protection; crop acreage, yield per acre and production; multiple cropping; inventory of agricultural machinery and implements.
Township Medical officer (TMO) Township Health Department or Township Hospital/ Ministry of Health	• Provision of all health care services • Collaboration with organizations such as WHO, UN and NGO etc.
Departmental Head of Labour Relations /Ministry of Labour	• Maintains peaceful workplace between the employer or employer organizations and the worker or the labour organizations
Fire Services Department /Ministry Of Social Welfare, Relief And Resettlement	• Protection and prevention of fire disaster and natural disaster
NGO	• No registered NGOs in the Myanaung Township • Only CSOs in Myanaung Township

9.2 Purpose

Stakeholder involvement allows for scoping of issues that are of significance to the communities. Their concerns can assist in identification of potential project impacts that are unique and specific to the communities where the project is situated. Similarly, recommendations from the affected communities on how to manage the potential impacts are essential in developing mitigation measures and management practices for eliminating/reducing negative impacts and enhancing positive impacts.

Consultations also maximize stakeholder understanding of the proposed project through information exchange between the project proponent and the communities that might be affected directly or indirectly by the proposed project activities.

Key issues and concerns were identified through:

- Experience of project team from past projects
- Discussions with PCMI
- Presentation of the Scoping Report to MONREC
- Focus Group Meetings and
- Opinion Surveys
- Key Informant Interviews

9.3 Public Involvement and Disclosure for Seismic

Based on stakeholder mapping and information collected during EHS baseline surveys, the public consultation and disclosure included the following stakeholder groups:

1. MOGE & MONREC;
2. Village heads and villagers near the project location;
3. Civil Society; and
4. Authorities at the Township Level.

In November 2014, IEM conducted focus group meetings with over 400 villagers in 8 villages in the Myanaung Township of the Ayeyawardy region of Myanmar within Block IOR7 (total area of 246 sq. km). Topographically the block is generally flat and mostly cultivated with paddy plants. The villages consulted included:

- Gyan
- Zan Kywe Kone
- Nyaung Tone Lel
- Zee Kone
- San Ta Khwe
- Daung Kya
- Byoet Kone
- Byoet Yoe

Opinion surveys were completed with approximately 400 villagers, or approximately 50 interviews in each of the 8 villages within the Hinthada district (**Figure 9-1**). As part of the public involvement process, Key Informant Interviews were also conducted with village leaders and health providers.

Figure 9-1: Villages Consulted in Block IOR-7 Seismic Survey

9.4 Public Involvement and Disclosure for Drilling

In December 2017, IEM conducted stakeholder engagement with local officials for Myanaung & Kyangin Townships and focus group meetings with villagers in 4 villages within the Myanaung Township, which are located in the potentially affected area of the survey footprint with a 1km buffer zone.

- Meetings with Myanaung General Administrative Department (GAD), Forestry Department and City Development Committee (CDC) officials
- Meetings with GAD, Forestry Department and CDC officials
- Site Visit of Myanaung & Kyangin Townships waste disposal areas
- 10 Key Informant Interview with key Township officials and community leaders;
- Stakeholders Meeting/Focus Group Discussions with communities
- 111 Opinion & Attitude Survey of households

Detailed opinion & attitude surveys were completed for approximately 111 villagers. As part of the public involvement process, Key Informant Interviews were also conducted with village leaders and health providers. Further, Traditional Ecological interviews and surveys were conducted with villagers and farmers during the combined socio-economic and environmental baseline surveys.

IEM's survey team consisted of the Senior Socio-economic Expert, three supervisors, and ten Myanmar local technicians who were trained by IEM.

The purpose of the opinion & attitude questionnaire was to obtain the stakeholder perceptions and understanding of PCMI's planned exploration drilling program.

At the focus group meetings prior to conducting the opinion surveys, the villagers were informed that PCMI was planning to conduct exploratory drilling for two wells on the same well pad location. Meeting Minutes with the Myanaung General Administrative Department (GAD) and Kyangin General Administrative Department (GAD) and associated authorities are included in **Appendix 8**.

9.4.1 Survey Locations

Within the 1km project area, 4 villages were identified for participation in the survey within the potentially affected by the exploration drilling wellsite.

Table 9-1: Summary of IOR-7 Village and Sample Locations

No.	Date	Village	Township	Households
1	05/12/2017	Ah Tha Lun	Myanaung	89
2	05/12/2017	Zee Kone	Myanaung	108
3	06/12/2017	Daung Kya	Myanaung	198
4	06/12/2017	Kyoe Gone	Myanaung	48

9.4.2 Survey Sample Size

The attitude survey is conducted to evaluate the attitudes of the potentially affected stakeholders who live in footprint with a 1km buffer zone of the planned exploration drilling well as shown in **Figure 9-2**.

Determining the sample sizes

The sample size was collected as follows:

(1) major area – Inside the 1km exploration well buffer area was determined according to Yamane (1973) with the confidence level at 90% as following formula;

$$n = \frac{N}{\left(1 + Ne^2\right)}$$

where n = Sample size
N= Number of population – households in this study
e = Level of precision at 0.1 in this study

Equation 9-1

The project area cover 4 villages consisted of 435 households (HH). Using **Equation 9-1** the minimum sample size in the area is:

$$n = \frac{443}{1 + 443\ (0.10)^2} = 82 \text{ samples}$$

The minimum required sample size was 82 households. The number of samples collected exceeded the minimum for 90% confidence level.

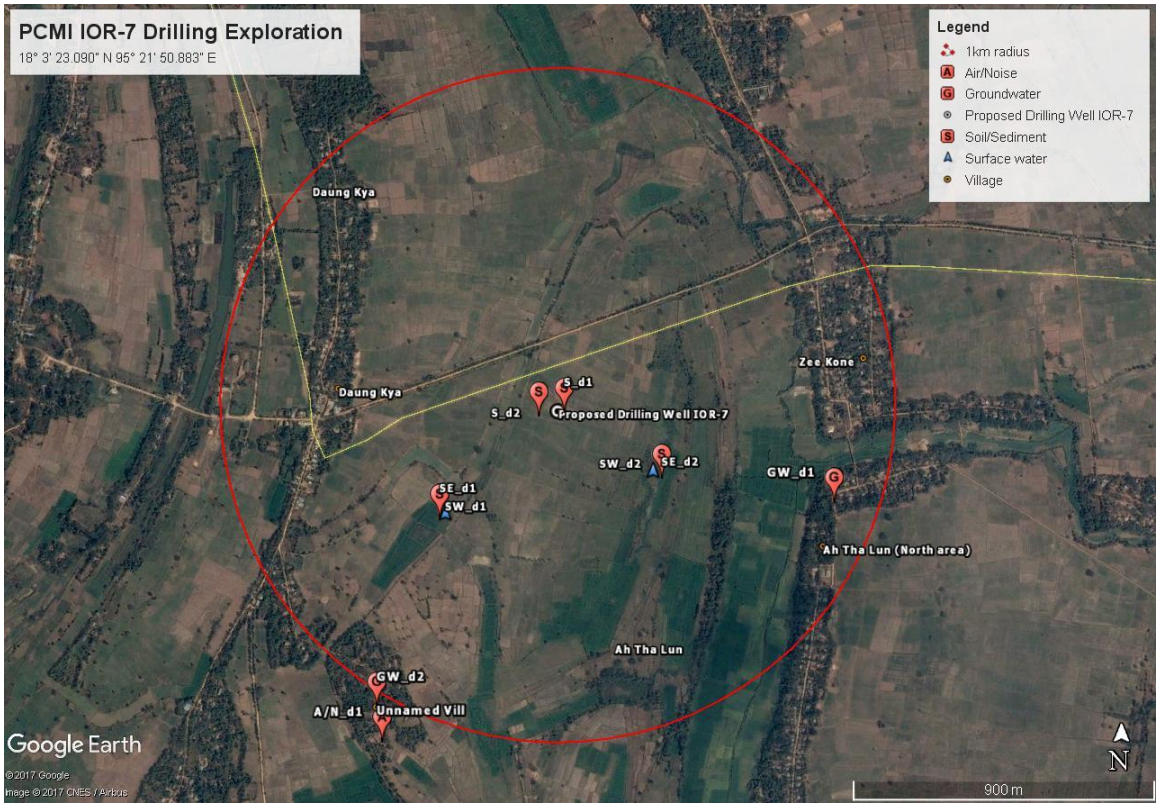


Figure 9-2: Potentially Affected Villages in Project Area

9.4.3 Focus Group Meetings

At the focus group meetings prior to conducting the opinion surveys, the villagers were informed that PCMI was planning to conduct an exploration drilling program including drilling two exploration wells from one well pad area. The project schedule will include 6 months of civil works and up to 10 months for exploration drilling.

The exploration drilling program is to determine if any oil or gas is present. If no oil or gas is found the wells will be abandoned and the area returned to its original state. If oil and gas is found, then the oil and gas will be produced for sale.

The villagers were informed that the focus group meetings and questionnaires were being conducted as part of an environmental, social and health impact assessment that is required to obtain approval for the project to proceed and to help guide PCMI to reduce any potential impacts.

The presentation/discussion topics for public involvement and disclosure included, but not limited to:

- Objective of Public Consultation
- Overview of project description/information
- Methodology of drilling activities
- Existing environmental conditions.
- Key impact aspects
- Proposed project mitigation measures and monitoring program
- Compensation

MOGE assisted IEM/PCMI by contacting local officials in each Township and village and made arrangements for our team to meet with them. MOGE too, participated in each focus group meeting and addressed those questions appropriate for the government to answer.

Prior to initiating community meetings, a presentation was provided to the Key Township Officials and Administrator to obtain understanding of the project, ESHIA objectives and support and approval for village meetings.

9.4.3.1 Record of Meeting Minute for Daung Kha & Zee Kone Village Meeting

Basic Details	
Project Title	Environmental, Social and Health Impact Assessment (ESHIA) for Exploration Drilling in Block IOR-7
Date	6.12.2017
Time	1:00 p.m – 3:00 p.m
Venue	Daung Kya village

Introduction and welcoming speeches by U Thiha Htut, Environmental Quality Management Co., Ltd.

Representatives from PCMI, the operator who will be conducting oil and gas exploration drilling project, third party EIA consultants International Environmental Management (IEM) and Environmental Quality Management (EQM) and MOGE would like to meet with you. The purpose of the meeting is to describe the project to members of the local community and offer you the opportunity to ask questions and provide comments.

Explanation about the project by U Zaw Zaw Aung (PCMI)

Mr. Zaw Zaw Aung from PCMI. The purpose of the visit is to explain about Exploration Drilling project near Daung-Kya and Zee-Kone villages and to receive comments and perceptions from the local communities. The results of seismic data in 2016 showed that there may be oil and gas in the well site area. Before drilling starts, we have to conduct an Environmental Impact Assessment (EIA) report and then submit to Ministry of Natural Resources and Environmental Conservation (MONREC). IEM will prepare this report based on the current conditions of environment and will make environmental impact assessments and recommend mitigation measures.

This is the layout plan of the project where equipment, campsite, offices and water tanks are existed. We will use a land drill rig to complete the wells. It is not sure that this exploration drilling will be successful or not. Based on the occurrence of oil and gas, we will plan to conduct drilling activities. We are very thankful for the successful implementation of seismic activities with the communities' help and efforts.

If there are comments and suggestions from the local communities, local people can send those comments through Grievance mechanism in our office. We are here to introduce the project and then later results of the EIA. Once we have an opportunity to drill a well, we hope we might find oil and gas that will help develop this area. For example we will help to improve the road conditions.

Explanation by Mr. Dylan Jenkins, International Environmental Management (IEM)

PCMI Company plan to conduct an exploration drilling project and they have hired International Environmental Management (IEM) Company as an independent third party consultant to conduct the EIA. IEM will review their exploration project and assess the risks on environment, social and health. This project is an initial exploration drilling project. IEM will be assessing and looking at the project effects on soil, water, air, and biodiversity on the environment. For the social impact assessment, we will be looking at the access on roads, cultural heritage and employment conditions. We will develop recommendations according to the international best practices in the environmental management plan (EMP). The EMP will be developed according to the international standards to reduce negative impacts from the project and to increase positive impacts to the local area. As part of the social impact assessment, we will be here today to conduct initial public consultation to listen to your concerns, comments and questions about the project. IEM will include your comments in our report. Thank you very much for coming. Let us know if you have any questions or concerns.

Explanation by U Paw Lar Aung (MOGE)

I am U Paw Lar Aung from Myanma Oil and Gas Enterprise (MOGE). MOGE cooperates with PCMI for the exploration drilling project in the block IOR-7. The local communities will develop and improve if oil and gas industries are developed in the area. I would like to request your comments and suggestions about the necessities of the project.

Question & Answer Session

<u>Comment 1</u>

Comment by U Win Thein Htun (Local people, Daung Kya Village):

- PCMI working with MOGE on this project can improve the technology to access hydrocarbon resources. We welcome this drilling project as our people can get technologies from this project and they will do the activities in accordance with the international standards. I think that the roads used in this project are not many. These organizations should do environmental awareness raising programs for the local people. And then, the records for the surrounding environmental conditions should be kept before the operation phase.

Answered by U Zaw Zaw Aung (PCMI):

- The EIA report will be prepared by third party. They will study the surrounding environmental conditions before the operation, during the operation and after decommissioning phases. Now, we are studying which road is the most suitable. After selection of what roads will be used, we will firstly prioritize safety for the local people and the environment. We will select the most appropriate road way and upgrade it as required.

Consultation Meeting Photos

	
Introduction by U Thiha Htut (EQM)	Explanation by U Zaw Zaw Aung (PCMI)
	
Explanation by Mr. Dylan Jenkins (IEM)	Explanation by U Paw Hla Aung (MOGE)
	
Comment & Questions from Villagers	Socio-economic survey photos

9.4.3.2 Record of Meeting Minute for Kyoe Gone & Ah-Tha Lun Village Meeting

Basic Details	
Project Title	Environmental, Social and Health Impact Assessment (ESHIA) for Exploration Drilling in Block IOR-7
Date	5.12.2017
Time	1:00 p.m – 4:00 p.m
Venue	Monastery, Ah-Tha-Lun village

Introduction and welcoming speeches by U Thiha Htut, Environmental Quality Management Co., Ltd.

Representatives from PCMI, the operator who will be conducting oil and gas exploration drilling project, third party EIA consultants International Environmental Management (IEM) and Environmental Quality Management (EQM) and MOGE would like to meet with you. The purpose of the meeting is to describe the project to members of the local community and offer you the opportunity to ask questions and provide comments.

Explanation about the project by U Zaw Zaw Aung (PCMI)

Mr. Zaw Zaw Aung from PCMI. The purpose of the visit is to explain about Exploration Drilling project near Daung-Kya and Zee-Kone villages and to receive comments and perceptions from the local communities. The results of seismic data in 2016 showed that there may be oil and gas in the well site area. Before drilling starts, we have to conduct an Environmental Impact Assessment (EIA) report and then submit to Ministry of Natural Resources and Environmental Conservation (MONREC). IEM will prepare this report based on the current conditions of environment and will make environmental impact assessments and recommend mitigation measures.

This is the layout plan of the project where equipment, campsite, offices and water tanks are existed. We will use a land drill rig to complete the wells. It is not sure that this exploration drilling will be successful or not. Based on the occurrence of oil and gas, we will plan to conduct drilling activities. We are very thankful for the successful implementation of seismic activities with the communities' help and efforts.

If there are comments and suggestions from the local communities, local people can send those comments through Grievance mechanism in our office. We are here to introduce the project and then later results of the EIA. Once we have an opportunity to drill a well, we hope we might find oil and gas that will help develop this area. For example we will help to improve the road conditions.

Explanation about the visit by Dr. Ohnmar May Tin Hlaing (EQM)

We have already conducted environmental impact assessments on soil, noise, water and air for the seismic activities and submitted to the relevant ECD Department according to Government guidelines and requirements. Now, we have to conduct environmental impact assessment for the exploration drilling project. We will conduct interviews and ask questions about the socio-economic situation to better understand the current condition of livelihoods, infrastructure and your perceptions of possible impacts from the project. Please ask any questions or provide your comments about the project.

Explanation by U Paw Lar Aung (MOGE)

I am U Paw Lar Aung from Myanma Oil and Gas Enterprise (MOGE). MOGE cooperates with PCMI for the exploration drilling project in the block IOR-7. If oil and gas is discovered in this area, the local communities to will benefit and develop. I would like to request your comments and suggestions about the project.

Question & Answer Session

Comment by U Ye Htut (Principal, Elementary School):

- We would like to request support for a bridge that connects from Ah-Tha-Lun village to Kyoe-Gone village.

Answered by U Zaw Zaw Aung (PCMI):

- We will submit this information for the construction of the bridge to appropriate governmental agencies for their consideration. This is the first phase of the project, if resources are found, this will assist in further developing bridges and roads in the area.

Consultation Meeting Photos

Explanation by U Zaw Zaw Aung (PCMI)

Explanation by Dr. Ohnmar May Tin Hlaing (EQM)

Explanation by U Paw Lar Aung (MOGE)

Comment / Questions by Villagers

Key Informant Interviews

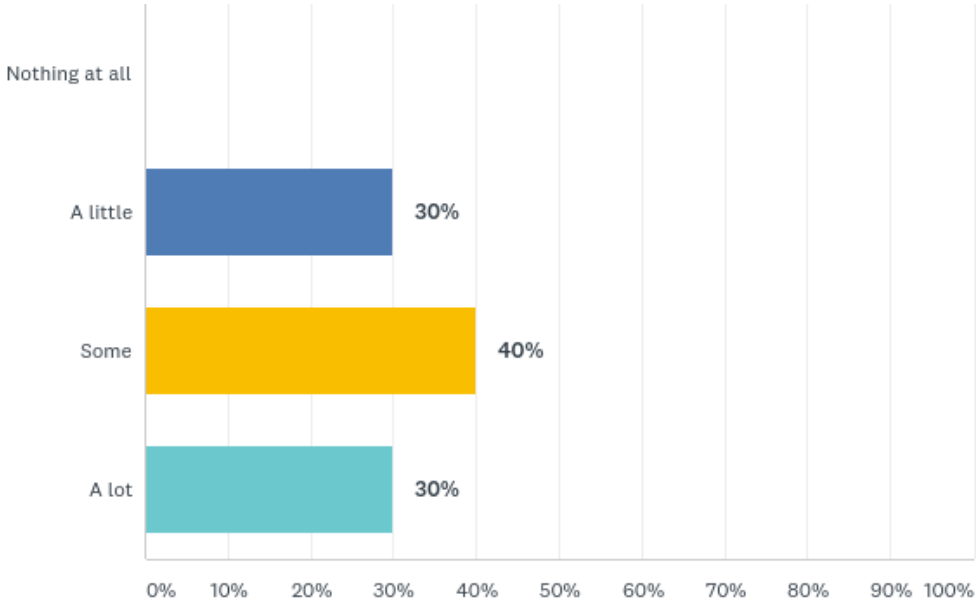
Socio-economic Surveys

9.4.4 Key Informant Interviews

The key informant survey consisted of 19 questions. The results of the surveys have been analyzed and the following summary of the results is provided below/ Key informants from 3 villages (Daung Kya, Ah Tha Lun and Kyoe Gone) were present during the public consultation meetings.

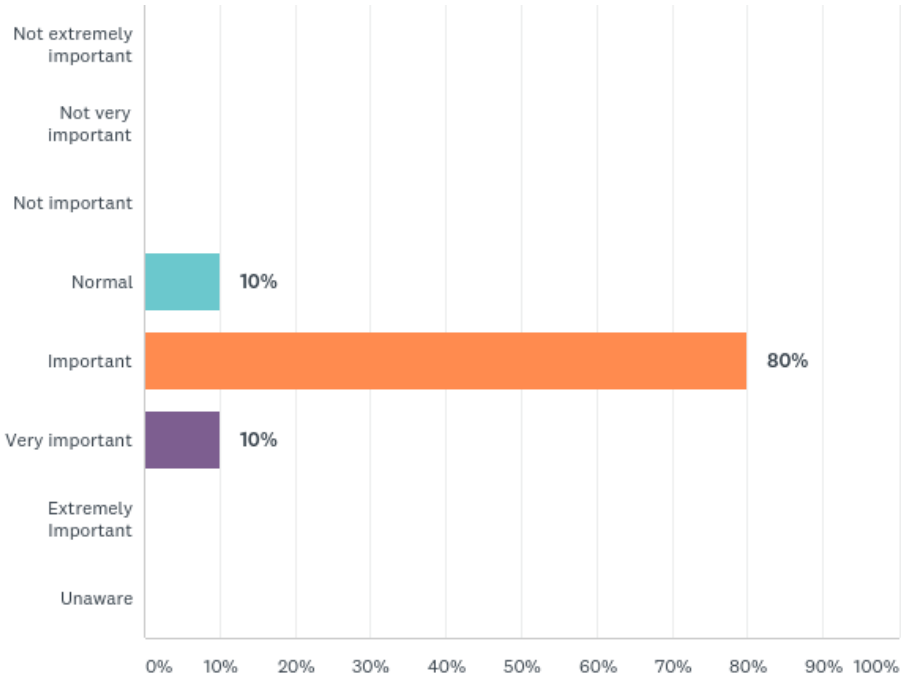
Of the key informants interviewed, all had some knowledge about the project:

Chart 1: How much do you know about this project?



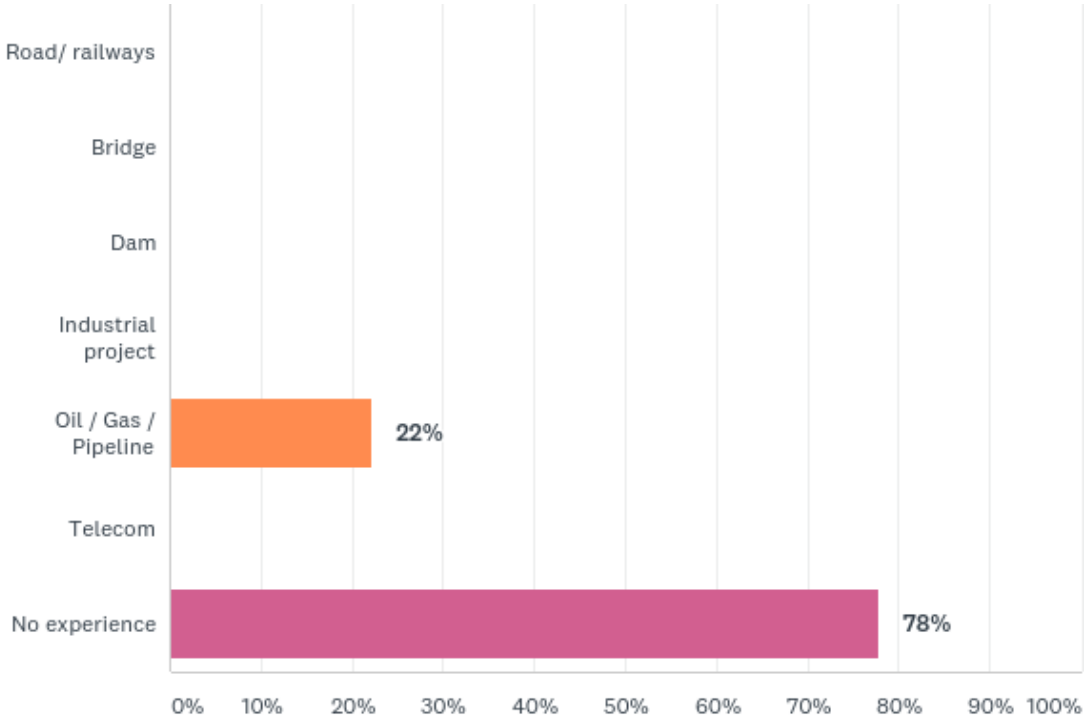
Of those interviewed, 80% rate the importance of oil and gas drilling to the community as important and 10% as very important.

Chart 2: How important will oil and gas drilling activity be to this community?



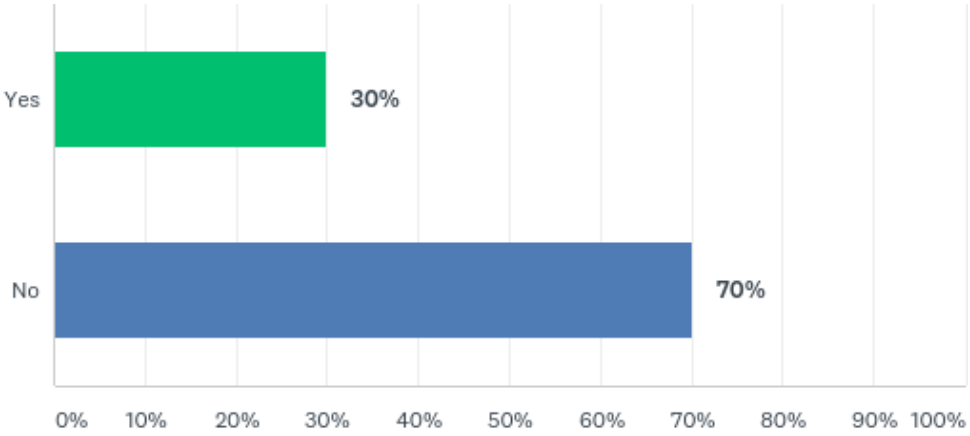
Only 22% of key informants have had an experience with oil/gas/pipeline project before:

Chart 3: What kinds of other projects have you experienced?



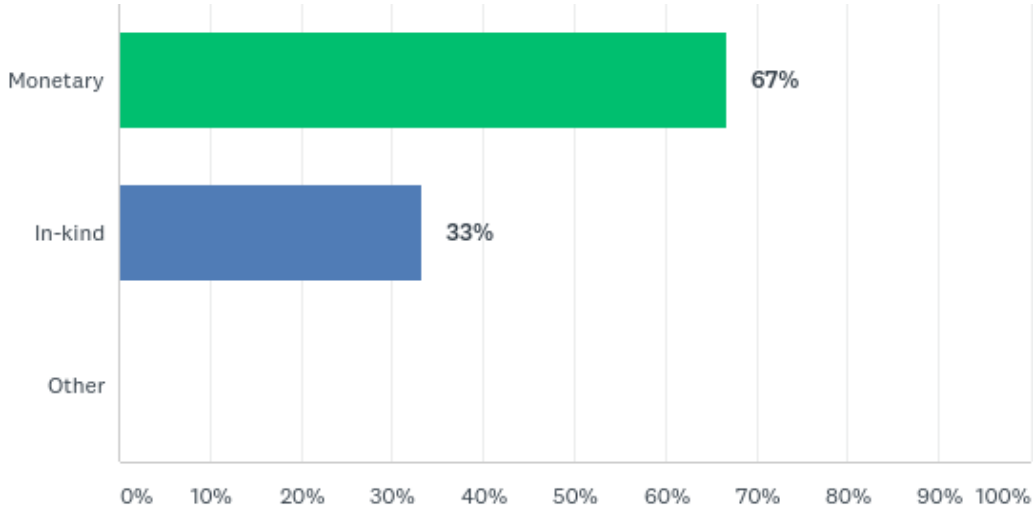
Of the participants interviewed, 30% received compensation from developments in the area:

Chart 4: Have you ever received compensation from any development project?



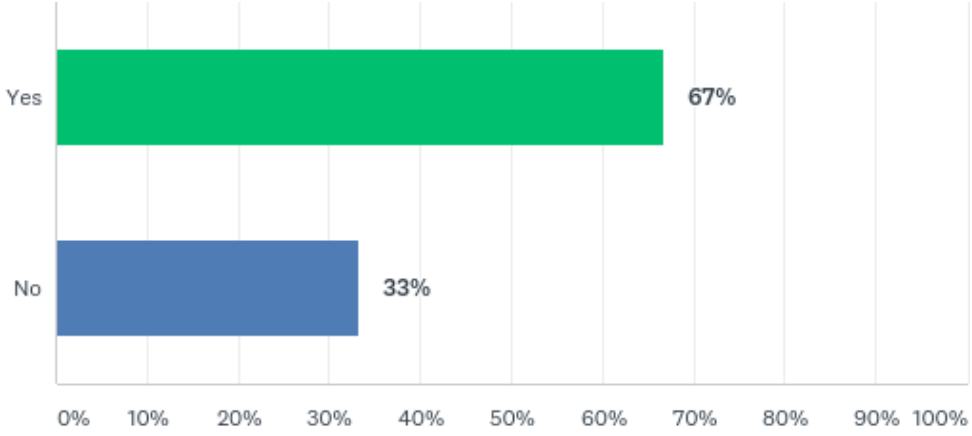
Of those who received compensation, the majority (67%) received monetary compensation, and 33% received in-kind compensation:

Chart 5: What was the type of compensation?



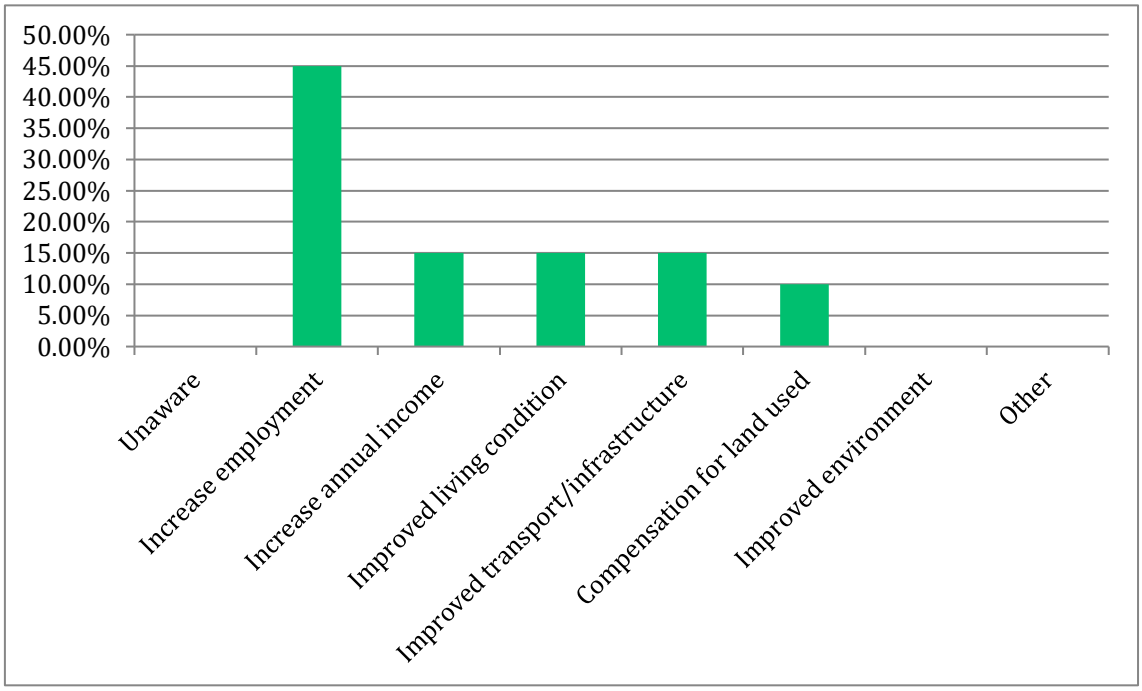
67% of the key informants were satisfied with the compensation received:

Chart 6: Were you satisfied with the compensation?



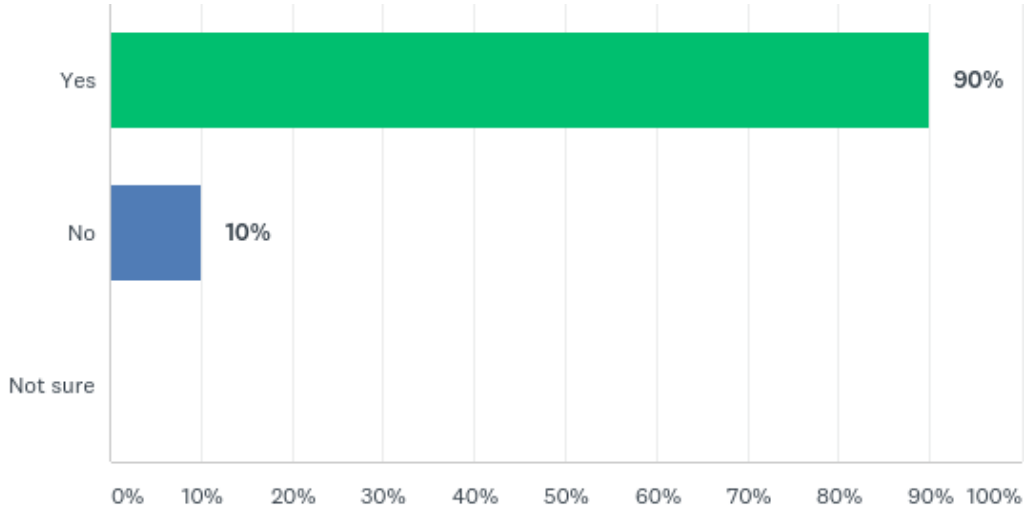
Villagers anticipate positive impacts from the project to include: increased employment (45%), as increased annual income (15%), improved road transport (15%), improved living conditions (15%) and land compensation (10%).

Chart 7: What is the most positive impacts of the project that you anticipate?



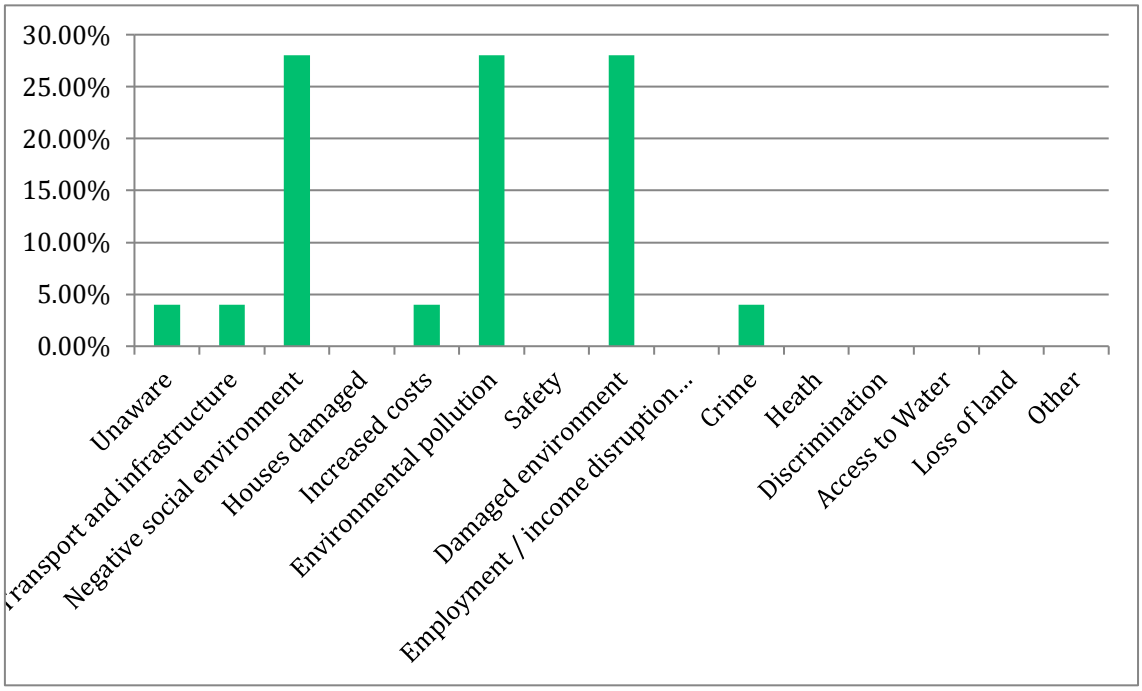
Of those interviewed, 90% agree with the proposed project development.

Chart 8: Do you agree with the proposed project?



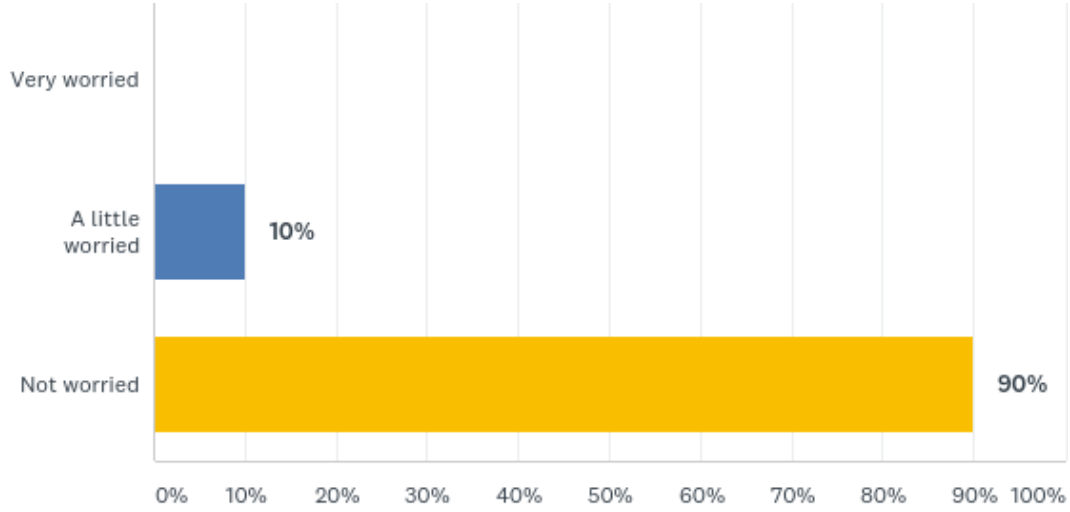
Villagers interviewed were concerned about possible negative impacts of the project including: 28% are concerned about negative social effect, 28% are concerned about environmental pollution, and 28% damaged environment.

Chart 9: What is the most negative impacts of the project that you are concerned about?



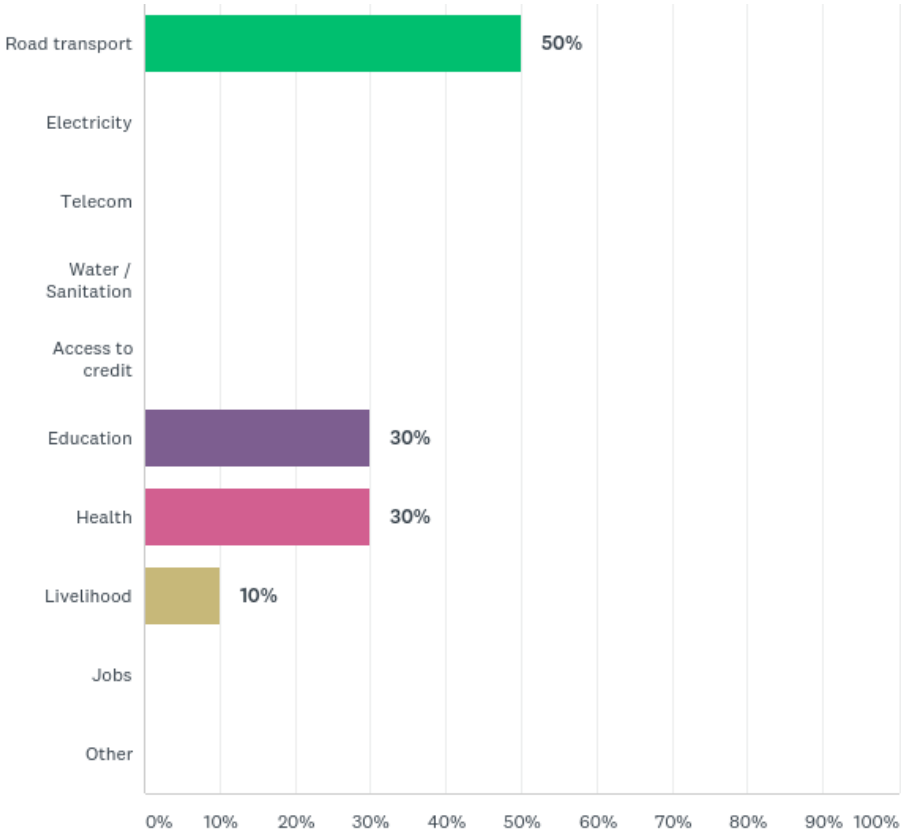
Most (90%) of the respondents were not concerned about worker in migration:

Chart 10: Are you concerned about outside people coming to your village/community to work on the construction and maintenance of the project?



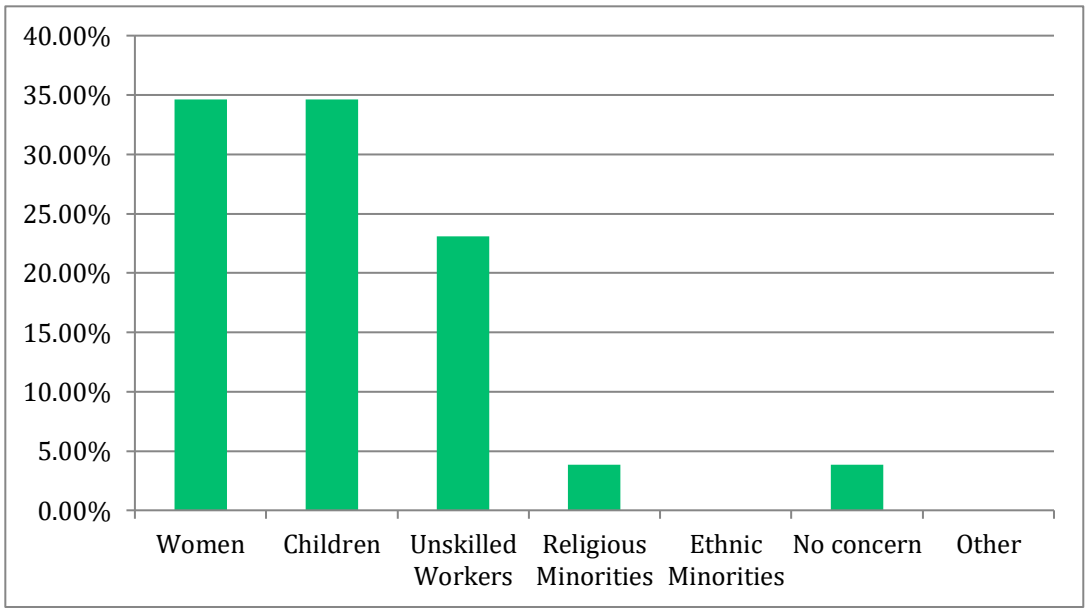
Villagers priority development initiatives for the community include: road transport (50%), education (30%), and health (30%):

Chart 11: What is the priority development initiative for your community?



The majority participants (35%) consider women, children and (23%) unskilled workers to be the most negatively affected from the project.

Chart 12: Which three groups or categories are likely to be most negatively affected from the project?



9.5 Results of Opinion Survey

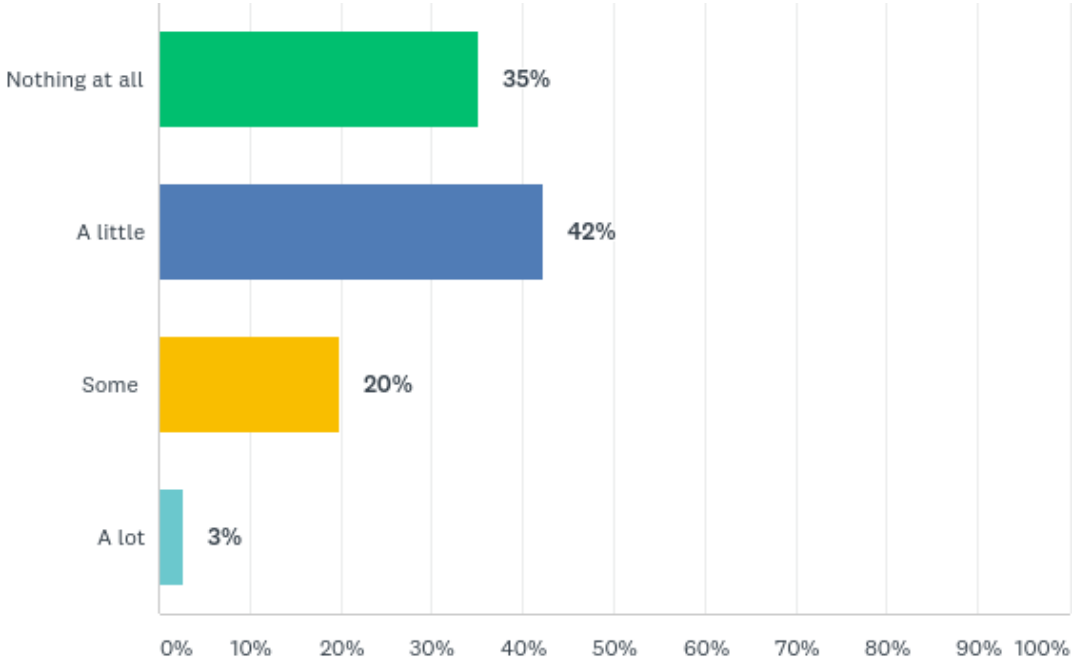
9.5.1 Stakeholder Involvement Location and Populations

Of the responses 59% were Male, and 41% were female. The survey was conducted in 4 villages in Myanaung Township within Block IOR-7. Villages included Daung Kya, Ah Tha Lun, Kyoe Gone and Zee Kone.

9.5.1.1 Knowledge About the Project

Of the villagers interviewed 35% had no previous knowledge of the project, while 65% had some knowledge of the project.

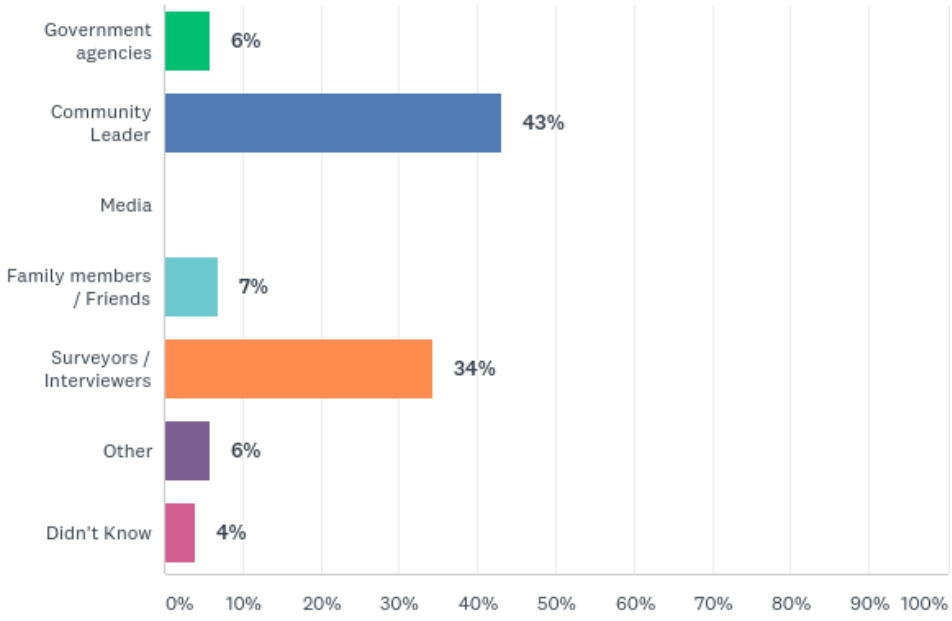
Chart 13: How much do you know about this project?



9.5.1.2 Source of Knowledge About the Project

Villagers learned of the project from community leaders (43%) and surveyors / interviewers (34%)

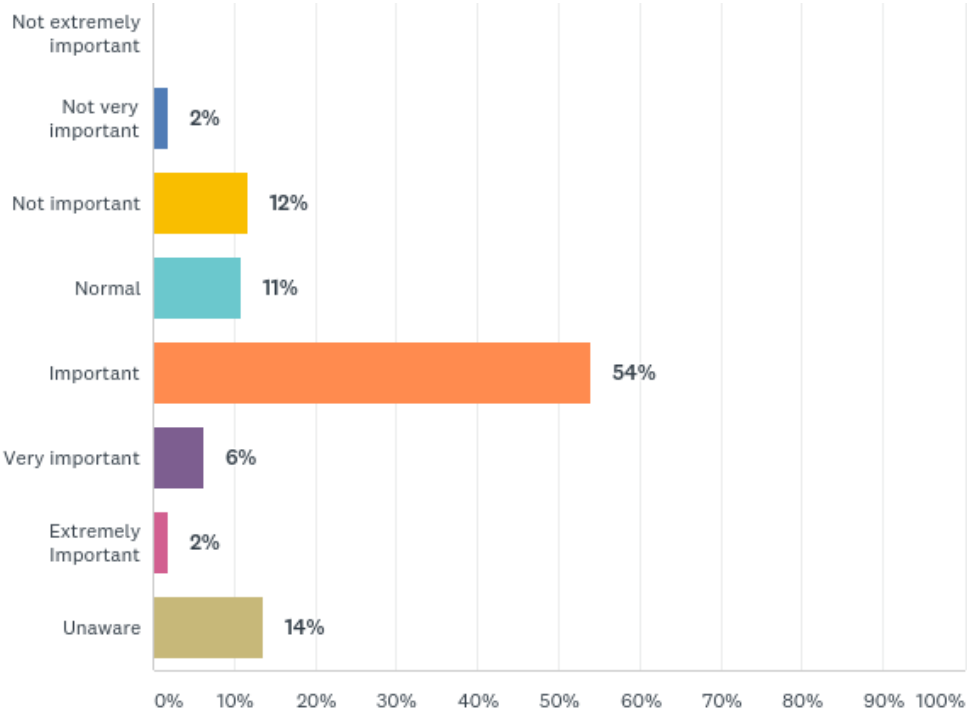
Chart 14: How did you know about this project?



9.5.1.3 Importance of the Project to the Villagers

Of those interviewed, 54% considered oil and gas drilling to be important to the community.

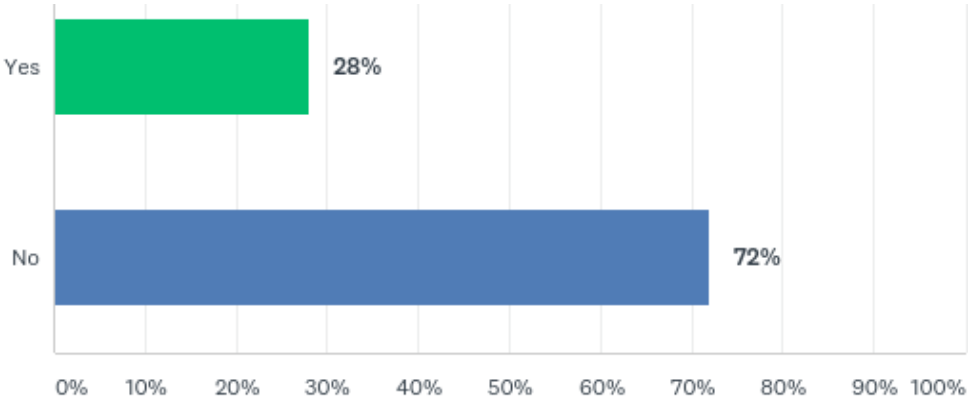
Chart 15: How important will oil and gas drilling be to this community?



9.5.1.4 Opinions on Compensation

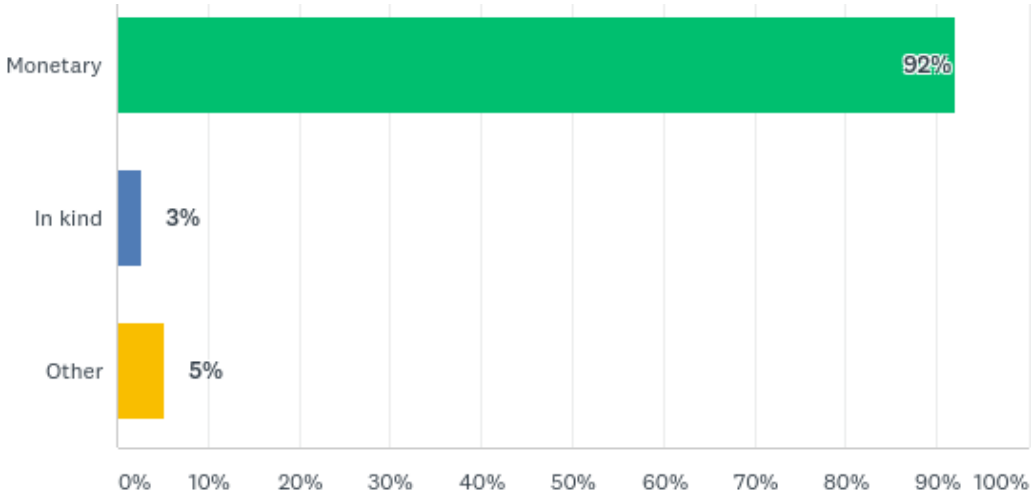
Most villagers (72%) had not received compensation from previous project developments.

Chart 16: Have you received compensation related to impacts from a development project?



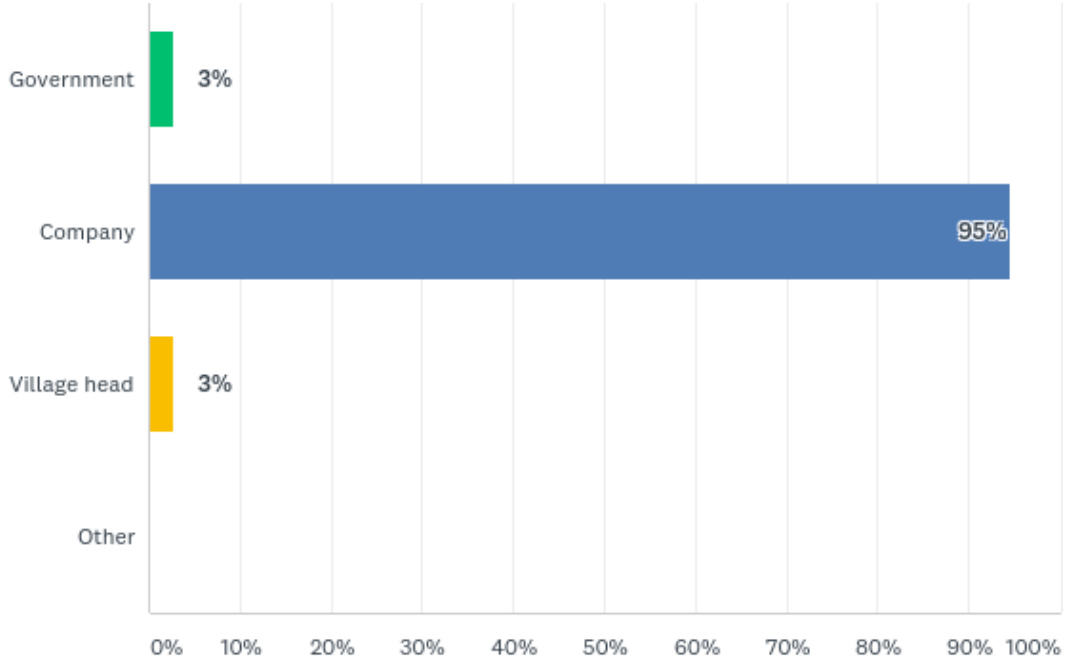
Of those that received compensation, 92% had received monetary compensation.

Chart 17: What was the type of compensation?



Of those that received compensation, 95% had received the compensation directly from the company.

Chart 18: From who did you receive compensation from?

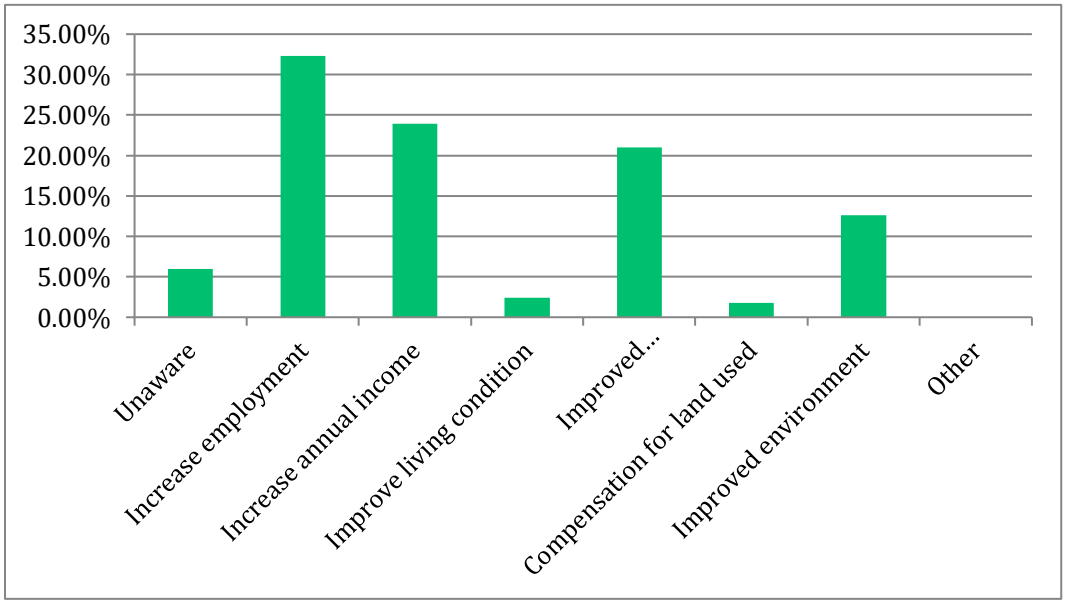


All of the respondents (100%) who had received compensation were satisfied with the compensation they had received

9.5.1.5 Opinions of Possible Project Benefits

Villagers anticipated increased employment (32%), increased annual income (34%), and improved living infrastucture (21%).

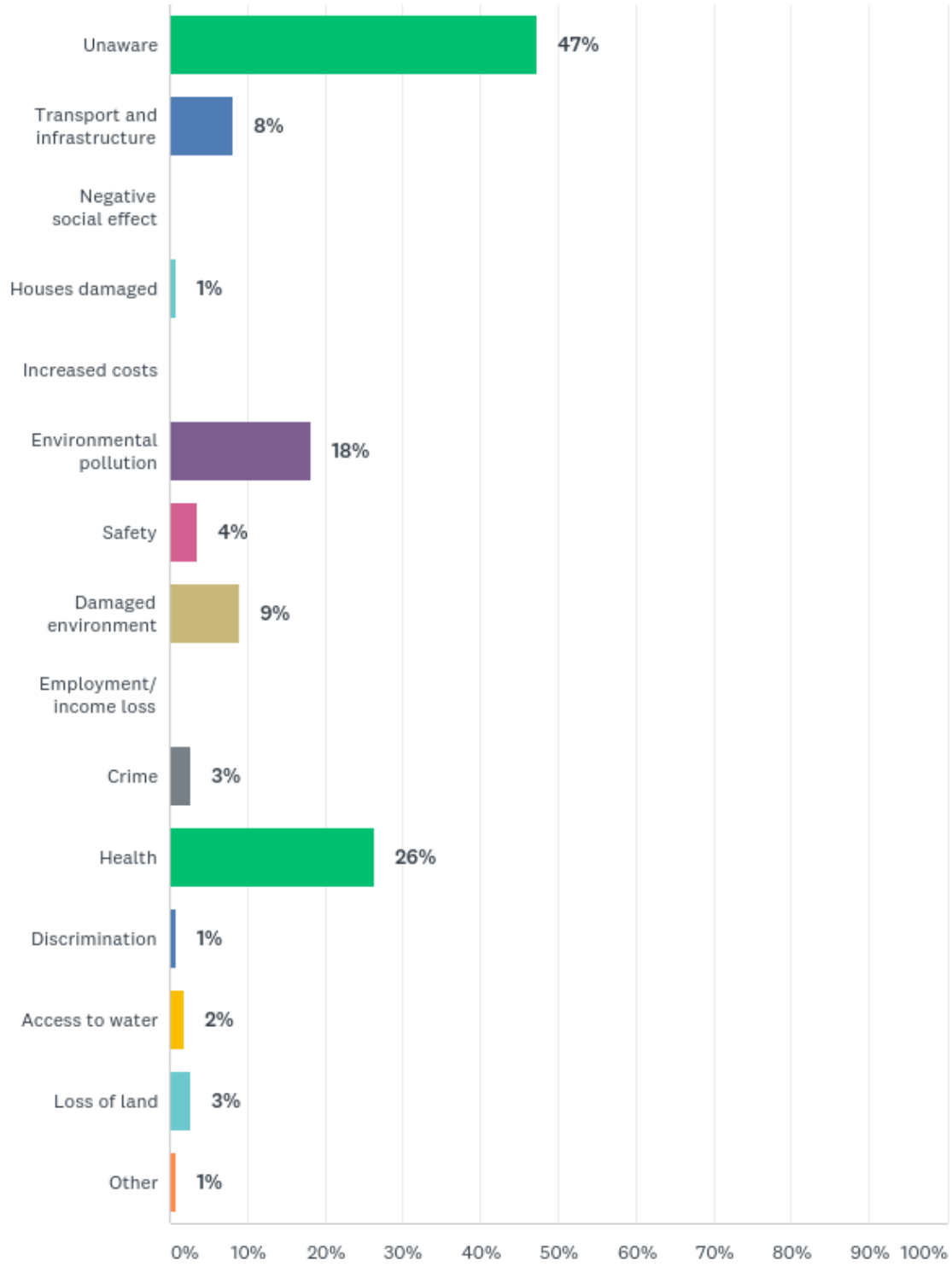
Chart 19: What positive impacts of the project do you anticipate?



9.5.1.6 Opinions of Possible Project Impacts

Most of the villagers (47%) were unaware of negative impacts, while 26% are concerned about health, and 18% are concerned about possible environmental pollution.

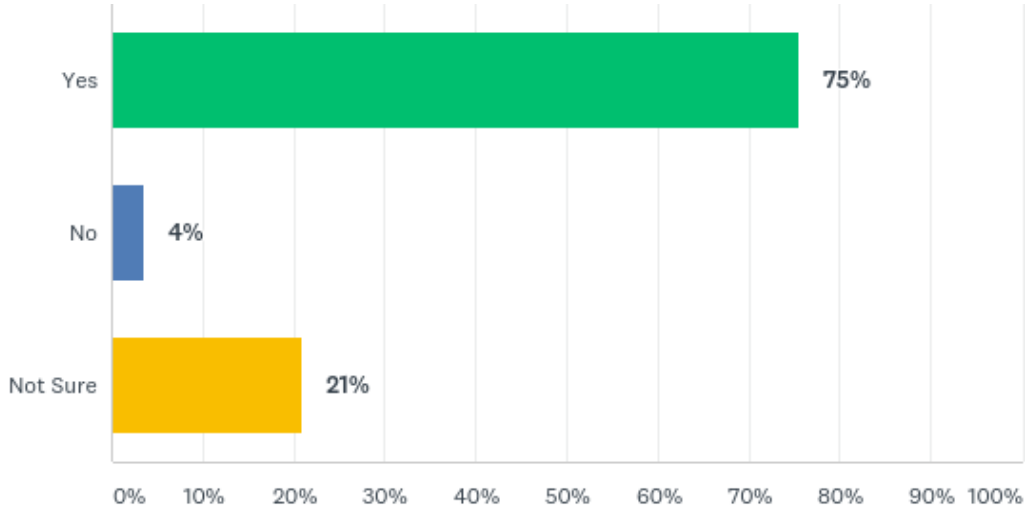
Chart 20: What are the three most negative impact of the project that you are concerned about?



9.5.1.7 Household Support for Project

Of those interviewed, 75% agree with the proposed project development.

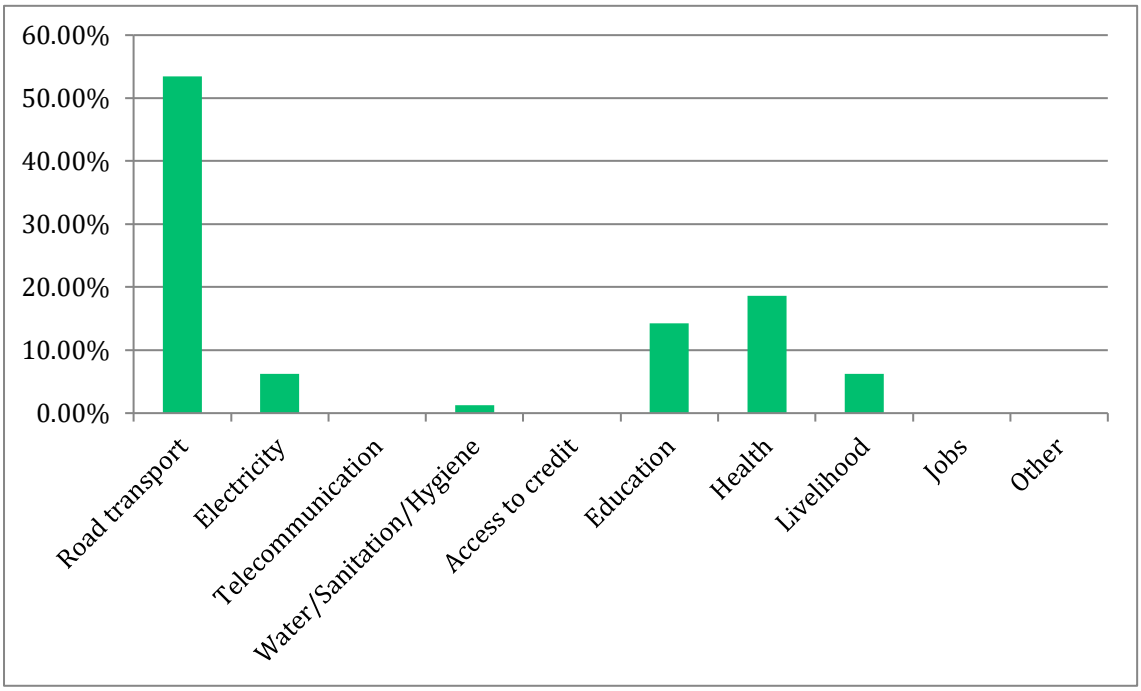
Chart 21: Do you agree with the project development?



9.5.1.8 Community Priorities

Villagers (53%) consider road transportation as a priority development initiative, while health 19% and education (14%) are second and third priorities.

Chart 22: What is the development priority for your community?



9.5.2 Issues to Discuss with Community Stakeholders

The opinion survey results identify the opinions of the level of impact potentially caused by the planned development activities. This assists the company to understand how the stakeholders view the project. If responses to certain issues are determined to be significant, then they should be further addressed to ensure that the stakeholders have factual information about the project and clearly understand the likely effect of the project.

When read a statement describing the planned project, the interviewees were asked their opinions about the positive and negative impacts of the project. Those significant issues perceived to be negatively and positive impacts are highlighted in red in the **Table 9-2** below.

Table 9-2: Perceptions of Potential Impacts of the Project in Block IOR-7

Those highlighted in red are considered significant values.

Answer	Very negative	Negative	Slightly negative	No effect	Slightly positive	Positive	Very positive
Soil quality	1%	2%	29%	67%	1%	0%	0%
Surface water quality	1%	8%	25%	65%	1%	0%	0%
Ground water quality	1%	15%	15%	69%	1%	0%	0%
Air quality	1%	3%	24%	72%	1%	0%	0%
Noise	9%	7%	25%	58%	1%	0%	0%
Forestry and conservation areas	0%	2%	10%	88%	0%	0%	0%
Agriculture / Farming areas	0%	10%	15%	75%	0%	0%	0%
Local animals	0%	0%	12%	88%	0%	0%	0%
Pasture	0%	1%	10%	89%	0%	0%	0%
Aquatic animals	0%	0%	9%	91%	0%	0%	0%
Local Fisheries	0%	0%	3%	96%	0%	1%	0%
Local Livestock	0%	1%	3%	96%	0%	0%	0%
Local Vegetation	0%	4%	9%	86%	0%	0%	1%
Local Industry	0%	0%	1%	94%	4%	2%	0%
Local Transportation	0%	0%	1%	63%	11%	24%	1%
Local Price	0%	1%	0%	82%	15%	2%	0%
Recreation	0%	0%	0%	95%	3%	2%	0%
Local Economy	0%	0%	0%	74%	8%	17%	1%
Housing	0%	0%	3%	95%	2%	1%	0%
Health	0%	7%	5%	75%	12%	1%	0%
Education	0%	1%	0%	81%	18%	0%	0%
Spiritual	0%	0%	2%	95%	3%	0%	0%
Safety	0%	3%	9%	87%	1%	0%	0%
Crime	0%	0%	8%	91%	1%	0%	0%
Family Structure	0%	0%	1%	91%	8%	0%	0%
Job opportunities	0%	0%	0%	56%	18%	23%	3%
Income	0%	0%	0%	58%	13%	26%	3%
Scenery	0%	1%	1%	95%	3%	1%	0%
Access to land	0%	3%	3%	77%	3%	15%	0%
Corruption	0%	0%	0%	99%	1%	0%	0%
Local Culture	0%	0%	0%	93%	7%	0%	0%
Religious Building	0%	0%	0%	100%	0%	0%	0%
Cemetery	0%	0%	0%	100%	0%	0%	0%
Historic buildings / sites	0%	0%	0%	100%	0%	0%	0%

The villagers surveyed perceive that the project will have a very negative impact on noise. Other significant issues that were perceived as receiving a negative impact are ground water quality and agriculture / farming areas. Significant issues that were perceived as receiving a positive impact from the project are local transportation, local economy, job opportunities, income and access to land.

The company should address these issues and provide accurate information to the public prior to project initiation. If stakeholders understand the likely effects and have realistic expectations, it will reduce the risk of negative perceptions, and/or high expectations from project benefits and therefore increase project manageability.

9.6 PCMI CSR Activities & Plan

PCMI has already started implanting CSR activities within IOR-7 from the seismic survey acquisition.

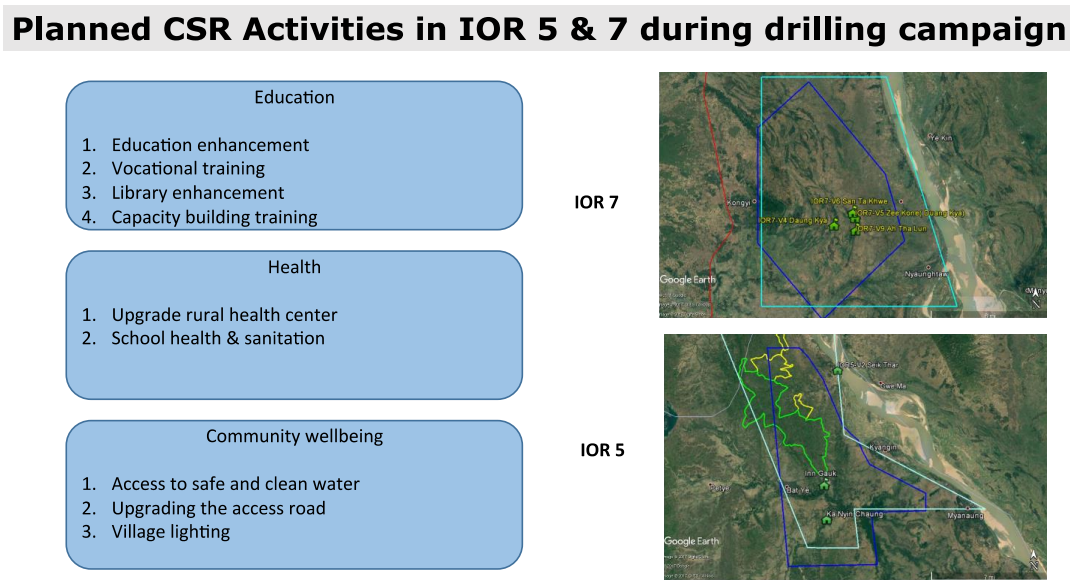
PCMI has donated items to Myanaung Township (MMK 6,000,000) included the following:

1. Two (2) Phlegm suction machine for children to Myanaung Hospital
2. Eight (8) pairs of chairs for the patient waiting room for Myanaung Hospital
3. Twelve (12) steel bed side locker and one (1) refrigerator for Myanaung Hospital
4. Educational aids for 18 Government Primary schools in Myanaung

The CSR contribution items are shown in **Figure 9-3**.

Figure 9-3: PCMI CSR Activities in Myanaung and Kyan Gin Townships

The CSR Budget for the exploration drilling is USD $20,000. The CSR Plan for the exploration-drilling program includes the following:



9.7 Project Disclosure

At the focus group meetings prior to conducting the socio-economic questionnaires, the villagers were informed that PCMI was planning to conduct exploratory drilling for two wells in the area.

Input from stakeholders consulted during this EIA will be considered and incorporated into the project design and mitigation measures to be presented in the EMP.

PCMI will engage with relevant Township Administrative Officers to discuss the public consultation plan and support needs. The project disclosure was conducted in compliance with EIA Procedure. PCMI Myanmar disclosed the project information to the news and media with an announcement in the Myanmar government owned newspapers. PCMI will disclose the planned project via PCMI website (www.petronas.com.my) and at PCMI Myanmar Yangon Office.

In addition copies of the submitted draft EIA and Final EIA will be submitted to the Myanaung Township Administrative Office, the General Administrative Office and the Village Administrative Offices situated within the project area.

9.8 Future Consultation & Disclosure

PCMI will meet and discuss with the local community and stakeholders in order to focus, collaborate and carry out the tasks related to their comments and suggestions before operations begin. Once the project is initiated and throughout project execution a communication process and schedule must be defined. Consultations conducted early on prior to project commencement will assist to ensure that the concerns of the stakeholders are considered, and that mitigation measures are developed to address them.

Similarly, ongoing stakeholder consultations throughout project execution are essential in order to identify and address new impacts, as well as assess the effectiveness of mitigation measures through stakeholder comments and complaints. Overall, stakeholder consultations promote increased understanding between the project owner and affected communities, resulting in stakeholder acceptance of the project.

A Grievance Mechanism has been established in the form of HSE Complaint Process Flow that is provided in the ESHIA Management Plan. A Stakeholder Engagement Log will be kept to document engagement carried out throughout the entire life cycle of the project. A Community Liaison Officers (CLO) will be appointed to facilitate the grievance process and also to provide information/clarification to the local community.

Stakeholder consultations throughout project implementation (construction, operation, and decommissioning) will be handled through the Stakeholder Involvement Program as provided in **Chapter 6: Environmental Management Plan**.

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Appendix 1

IEM & EQM ECD Registrations

REPUBLIC OF THE UNION OF MYANMAR

Ministry of Natural Resources and Environmental Conservation

CERTIFICATE FOR TRANSITIONAL CONSULTANT REGISTRATION

(ကြားကာလအကြံပေးလုပ်ကိုင်သူမှတ်ပုံတင်ခြင်းအထောက်အထားလက်မှတ်)

No. 0011 Date 01 JUL 2017

The Ministry of Natural Resources and Environmental Conservation, hereby, issues this certificate to the organization under Environmental Impact Assessment Procedure, Notification No. 616/2015.

(ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း၊ အမိန့်ကြော်ငြာစာအမှတ်၊ ၅၁၆/၂၀၁၅ အရ သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသည် ဤအထောက်အထားလက်မှတ်ကို အဖွဲ့အစည်းအား ထုတ်ပေးလိုက်သည်။)

(a)	Name of Organization (အဖွဲ့အစည်းအမည်)	International Environmental Management Co. Ltd.
(b)	Name of the representative in the organization (အဖွဲ့အစည်းကိုယ်စားလှယ်၏ အမည်)	Mr. Ronald David Livingstone
(c)	Citizenship of the representative in the organization (အဖွဲ့အစည်းကိုယ်စားလှယ်၏ နိုင်ငံသား)	Canadian
(d)	Identity Card /Passport Numberof the representative person in the organization (အဖွဲ့အစည်းကိုယ်စားလှယ်၏ မှတ်ပုံတင်/ နိုင်ငံကူးလက်မှတ်အမှတ်)	HG068880
(e)	Address of organization (ဆက်သွယ်ရန်လိပ်စာ)	No. 148/B, Dhamma Zedi Road, Bahan Township, Yangon ron@iem-global.com , www.iem-global.com
(f)	Type of Consultancy (အကြံပေးလုပ်ကိုင်မှုအမျိုးအစား)	Organization
(g)	Duration of validity (သက်တမ်းကုန်ဆုံးရက်)	31 March 2018

Director General
Environmental Conservation Department
Ministry of Natural Resources and Environmental Conservation

Areas of Expertise Permitted
(ခွင့်ပြုသည့် ကျွမ်းကျင်မှုနယ်ပယ်များ)

1. Ecology and Biodiversity
2. Socio-Economy
3. Biology and Environmental management, Risk Assessment
4. Geotechnical and Environmental Engineering
5. GIS
6. Marine Science

REPUBLIC OF THE UNION OF MYANMAR

Ministry of Natural Resources and Environmental Conservation

CERTIFICATE FOR TRANSITIONAL CONSULTANT REGISTRATION

(ကြားကာလအကြံပေးလုပ်ကိုင်သူမှတ်ပုံတင်ခြင်းအထောက်အထားလက်မှတ်)

No. 0009 Date 07 JUL 2017

The Ministry of Natural Resources and Environmental Conservation, hereby, issues this certificate to the organization under Environmental Impact Assessment Procedure, Notification No. 616/2015.

(ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း၊ အမိန့်ကြော်ငြာစာအမှတ်၊ ၅၁၆/၂၀၁၅ အရ သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသည် ဤအထောက်အထားလက်မှတ်ကို အဖွဲ့အစည်းအား ထုတ်ပေးလိုက်သည်။)

(a)	Name of Organization (အဖွဲ့အစည်းအမည်)	Environmental Quality Management Co., Ltd. (EQM)
(b)	Name of the representative in the organization (အဖွဲ့အစည်းကိုယ်စားလှယ်၏ အမည်)	Dr. Ohnmar May Tin Hlaing
(c)	Citizenship of the representative in the organization (အဖွဲ့အစည်းကိုယ်စားလှယ်၏ နိုင်ငံသား)	Myanmar
(d)	Identity Card /Passport Numberof the representative person in the organization (အဖွဲ့အစည်းကိုယ်စားလှယ်၏ မှတ်ပုံတင်/ နိုင်ငံကူးလက်မှတ် အမှတ်)	12/Da Ga Ta (N) 024452
(e)	Address of organization (ဆက်သွယ်ရန်လိပ်စာ)	No 233, Block 23, Sayeepin Lane, Thuwunna, Thingungyun Township, Yangon contact@eqmmyanmar.com , 012330291
(f)	Type of Consultancy (အကြံပေးလုပ်ကိုင်မှုအမျိုးအစား)	Organization
(g)	Duration of validity (သက်တမ်းကုန်ဆုံးရက်)	31 March 2018

Director General
Environmental Conservation Department
Ministry of Natural Resources and Environmental Conservation

Areas of Expertise Permitted
(ခွင့်ပြုသည့် ကျွမ်းကျင်မှုနယ်ပယ်များ)

1. Ecology and Biodiversity
2. Ground water and Hydrology
3. Meteorology, Modeling for Air Quality
4. Modeling for Water Quality
5. Socio-Economy

Appendix 2

PCSB HSEM 2.1 – SUPERVISORY SAFETY PROCEDURES MANUAL

MY ALL S 07 003
Rev. 0 March 2001

PETRONAS CARIGALI

PCSB
HSEM 2.1 - SUPERVISORY SAFETY PROCEDURES MANUAL

PETRONAS CARIGALI SDN BHD

Section 8

HAZARDOUS AND TOXIC SUBSTANCES

Contents

1 CHEMICAL CONTROL PROGRAM OVERVIEW

Elements of a Control Program

A chemical control program involves management work in three areas;

- Recognition of the hazards.
- Evaluation of the hazards
- Control of the hazards.

Recognition of the Hazards

Each chemical is unique and has different hazards and different degrees of hazards. The key elements of recognising these hazards includes the following;

- Use of Material Safety Data Sheets (MSDS).
- Knowledge of the work process.
- Walk-through or Planned General Inspections.
- Review of Job / Task Analysis.
- Recall of past experiences.
- Review of Incident Investigation Reports.
- Use of Professional Support.
- Use of surveys and checklists.

Evaluation of Hazards

Evaluation of Heath Hazards presented by chemicals in the workplace includes;

- Identification of all chemicals.
- A review of the chemical and physical properties.
- Quantification of all exposure data - Concentration, duration, frequency, ambient temperature, humidity and routes of entry.
- Determination of what controls are in place - including ventilation and Personal Protective Equipment (PPE).
- A review of all data to determine the potential hazard.

Control of Hazards

Control of health hazards includes;

- Substitution of the chemical with one that is less toxic.
- Engineering Controls - Design out the chemical or design a better process or chemical handling system.
- Work Practices - Establish effective work practices and procedures.
- Develop administrative controls such as chemical requisition procedures.
- Provide the necessary Personal Protective Equipment.
- Ensure personnel are trained, knowledgeable and can demonstrate the needed skills for chemical handling.

Material Safety Data Sheets (MSDS**)**

Material Safety Data Sheets must be provided for every chemical in use or transported by PCSB. A Material Safety Data Sheet must accompany every shipment of chemical to provide the handlers with information should they be exposed to the chemical. MSDS information is available in the MSDS manual. MSDS include information on;

- Identification of the Chemical.
- Hazardous Ingredients.
- Physical and Chemical Characteristics.
- Physical Hazards.
- Special Protection Information.
- Special precautions and Spill / Leak Procedures.

2 CHEMICAL REQUISITION CONTROLS

Purpose

The following procedure outlines the minimum requirements of the Chemical Requisition Control Procedure. The most effective way to ensure that chemicals with unacceptable toxicity do not make their way to the worksite is to control the purchase at the requisition stage.

Approved Chemical List

Each region of PCSB, shall develop and inventory of all chemicals in use at the various worksites. Each chemical on this list will be approved for purchase by the HSE department once they have accessed the risk of the chemical and have found the risk acceptable.

The contractor(s) that operating on PCSB worksite shall have the approved chemical list by PCSB.

Purchase of Approved Chemicals

The purchase of approved chemicals can be done routinely by the buyers. Any chemical which appears on the approved list can be routinely purchased through the MSR system.

Purchase of Non-Approved Chemicals

Chemicals which do not appear on the approved chemical list, SHALL NOT be purchased until a risk assessment has been completed by the HSE department and the risk has been found to be acceptable. A buyer or other person who receives a request for a chemical which is not on the list must comply with the following procedure:

Procedure

(1) Obtain a copy of the MSDS from the manufacturer.

(2) Provide a copy of the MSDS and purchasing request to HSE.

(3) HSE will review the MSDS and supporting data and conduct an assessment to decide if the risk of the new chemical is acceptable.

(4) Should the chemical be of acceptable risk, it will be added to the list of approved chemicals.

(5) The MSDS manual will be updated to include the new chemical.

(6) The MSDS will be reviewed by the operations site to ensure all workers are knowledgeable about the chemical before it is put into use.

(7) Should the risk presented by the new chemical be unacceptable, the purchase shall be rejected.

Material Safety Data Sheets

A Material Safety Data Sheet (MSDS) will be requested from the supplier at the time of purchase every time a chemical is purchased. A copy of the MSDS must accompany the shipment of the chemical. This will give the people who handle and ship the chemicals the necessary information to be able to react to an exposure to the chemical.

Administration of Chemical List

The HSE departments will administer and control the list of approved chemicals. The ownership of the MSDS manual also rests with the HSE departments.

Training

All personnel involved in the use and handling of chemicals must receive adequate training and be provided the information necessary for them to work safely. The training curriculum must be updated as chemical products change and new or different hazards are recognised.

3 CHEMICAL HANDLING SAFETY EQUIPMENT

Purpose

The following are the minimum requirements for safety equipment which shall be provided at each site where chemicals are used.

Eye Wash

An eyewash station must be provided at each site where chemicals are used. The eye wash must be of the type with removable bottles of eyewash solution so that the eye wash can be taken to the victim. Eye wash stations must be in very close proximity to the likely site where exposure will occur. A person with chemical splashed in his eyes will be unable to see and can not negotiate his way around obstacles.

Safety Showers

A safety shower and eyewash station must be provided in as close of proximity as possible to the site where chemical contamination may occur.

Breathing Apparatus

Site within a location where chemicals which require breathing apparatus to be used for chemical handling or rescue of a victim must be provided near the site of exposure but far enough away that in the event of a spill or leak they can be reached without exposure to the chemical. A minimum of 2 sets of breathing apparatus is necessary.

Supply Bases

Supply bases must also be provided with eye wash stations, safety showers. Breathing apparatus consisting of a minimum of 2 sets must be provide should chemicals being handled require them.

Support Vessels

Support vessels which transport chemicals must also be provided with eye wash and safety showers. Breathing apparatus consisting of 2 sets must also be provided should the chemical being transported require them.

Personal Protective Equipment

Every site where chemicals are stored or handled must be provided with 2 sets of chemical splash goggles. Full face shields, 2 sets must also be provided at the site. 2 pairs of chemical handling gloves must also be provided at site.

Other personal protective equipment required for chemical handling will be provided to each individual who may be exposed to the chemicals, at no charge to the employee, for their personal use.

4 TRANSPORTATION OF DANGEROUS GOODS

UN Classification System

The following system is used Internationally to classify and group chemicals.

Class 1 - Explosives

(1) Substances and articles which have a mass explosion hazard.

(2) Substances and articles which have a projection hazard but not a mass explosion hazard.

(3) Substances and articles which have a fire hazard and either a minor blast or a minor projection hazard, but not a mass explosion hazard.

(4) Substances and articles which present no significant hazard. The explosion effect are localised to the package and immediate surroundings.

(5) Substance which are very insensitive, but when set off by an outside source, have the same mass explosion effect as (1).

Class 2 - Compressed Gases

(1) Flammable Gases

(2) Non-poisonous and non-flammable gases.

(3) Poisonous Gases

Class 3 - Flammable Liquids

(1) Liquids having a flash point below -10 degrees C.

(2) Liquids having flash point of -18 degrees C., but not including 37.8 degrees C.

(3) Liquids having a flash point of 37.8 degrees C. to 93.3 degrees C.

Class 4 - Flammable Solids

(1) Flammable Solids

(2) Substances capable of spontaneous combustion.

(3) Substances which emit flammable gases when in contact with water.

Class 5 - Oxidising Substances

(1) Oxidising substances.

(2) Organic Peroxides.

Class 6 - Poisonous and Infectious Substances.

(1) Solids, dusts, liquids, mists or volatile substances that are;

- poisonous by ingestion, inhalation or skin contact (group 1).
- harmful to food stuffs (group 2).

(2) Infections substance containing disease producing micro-organisms.

Class 7 - Radioactive Materials

Radioactive Materials.

Class 8 - Corrosives

Corrosive Materials and substances.

Class 9 - Miscellaneous Dangerous Substances or Articles

Miscellaneous Dangerous Substances or Articles.

5 LABELLING REQUIREMENTS

Labelling Requirements

All containers of chemicals and dangerous goods must be clearly labelled so that persons handling the chemicals will be provided the necessary information to safely handle the chemical.

Regulatory Requirements

The regulatory requirements for the identification and labelling of chemicals vary from country to country. Operating regions in these countries must comply with local legislation.

Minimum Label Information

Any chemical label used must meet the following minimum requirements:

(1) Name of the Chemical

(2) Signal Word (Danger, Warning, etc.)

(3) State of the Hazards (gas, liquid, solid etc.)

(4) Precautionary Measures.

(5) Antidote or instructions in case of contact or exposure.

(6) Fire, Spill Leak Instructions.

(7) Handling and storage instructions.

(8) Notes to physician.

Damaged Labels

If a label becomes lost or damaged, it must be replaced at the first opportunity. If the label is not legible before shipment, the chemical can not be shipped. If it is damage during transport, then the MSDS must be affixed to the container as a temporary measure.

Appendix 3

PCMI Oil Spill Response Plan

095/003/008
Rev. 3 Nov 2013

PETRONAS

PCML
OIL SPILL RESPONSE PLAN

PC MYANMAR (HONG KONG) LIMITED

FOREWORD

Authority for original issue

Issue Approval

Issue of this document has been formally approved by:

Signature :	
Name:	Ahmad Lutpi Haron
Position:	General Manager PC Myanmar (HK) Limited
Date:	

Document Custodian

The following person has been assigned as the document custodian:

Signature :	
Name :	Sunny@ Linn Thura Htun
Position:	Health, Safety and Environment Manager PC Myanmar (HK) Limited
Date :	

Prepared by

Signature :	
Name :	Tharaphi Htay
Position:	Executive, Environment Management PC Myanmar (HK) Limited
Date :	

Proprietary Information

Table of Contents

1. Introduction

1.1. PCML Operations

PC Myanmar (Hong Kong) Limited (PCML) is a wholly owned subsidiary of PETRONAS INTERNATIONAL CORPORATION LIMITED (PICL). The company was originally incorporated by Premier Oil on 21st July 1989 under the name of Premier Petroleum Myanmar Limited (PPML). In November 2003, PCML took over the operatorship of the Yetagun.

Yetagun Gas Field, which is located in Block M12, M13 and M14, is currently the only producing field in Myanmar Operations. It was developed and commenced production on 7th May 2000. The field contains a proven reserve of 3.2 Tcf of natural gas, and is currently producing about 460 MMscf/day of natural gas and12,500 bbl/day of condensate.

Condensate produced from the Yetagun gas field is routed to a Floating Storage Offloading unit for storage and export via a 2.5 km, 6 inches flexible pipeline. The FSO is capable of storing up to 610,000 barrels of condensate.

Dry gas from the Yetagun platform is sent to Kanbauk, known as POC, via a 182 km, 24 inches pipeline. The landing pressure ranges is approximately 92 – 125 bars. The gas is subsequently sent, at a reduced pressure, to the Metering Station, which is 68 km away at the border between Myanmar and Thailand. The current design capacity of Metering Station is 460 MMscf/day.

There is an airstrip at Kanbauk (Ohnpinkwin) where PCML's Helicopter is based to service the offshore operation and emergency response.

There is a jetty in the Heinze Channel which is used to bring supplies for the POC and to transport items from the POC warehouse to the offshore operation.

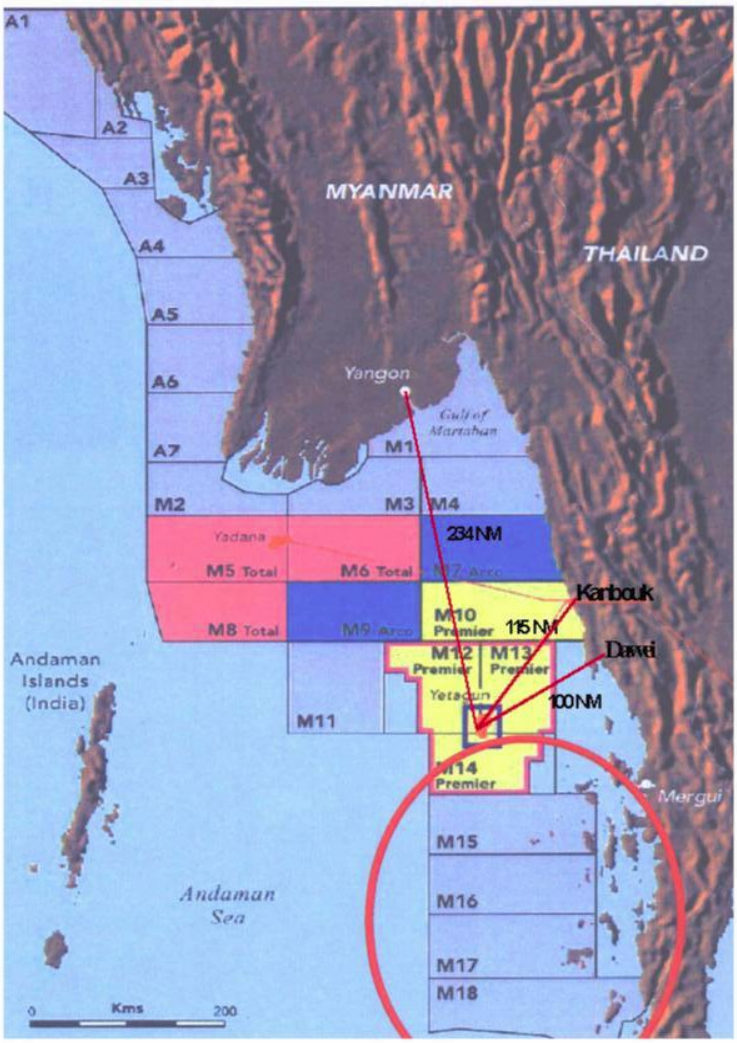

Figure 1.2: LAYOUT OF MO OFFSHORE YETAGUN GAS FIELD

Table 1.1: List of PCML Installations

Installation	Type
Yetagun A	Drilling/wellhead platform
Yetagun B	Living quarters/production platform
Yetagun C	Booster compressor platform
FSO	Floating Storage and Offloading
POC	Onshore Pipeline Operating Centre
MS	Onshore Metering Station
ROW	68 km Onshore Pipeline Right of Way

This Oil Spill Response Plan (OSRP) has been prepared for the above operations in accordance with the international best practice guidelines of the International Maritime Organization (IMO) and International Petroleum Industry Environmental Conservation Association (IPIECA). Federal and State requirements and regulations are also taken into account. The OSRP has been developed taking into account the oil spill risk profile, Tier 1, Tier 2 and Tier 3 response arrangements, and in accordance with national and international legislative requirements. It has been designed to interface with PETRONAS' existing emergency response framework.

All PCML EMT and ERT personnel are required to be familiar with this Plan.

1.2. Purpose

The primary purpose of this OSRP is to establish effective emergency procedures to respond to oil spill affecting the operations of PCML to:

(a) ensure minimal adverse effect to the environment,

(b) minimize the spread of hydrocarbons,

(c) provide the tools to identify the most appropriate response tactics,

(d) protect sensitive areas; and

(e) mitigate negative effects.

The OSRP:

a) Describes the expectations, scope and content of the oil spill response and management systems for PCML;

b) Provides guidance to the PCML Emergency Management Team (EMT) for the response to, and control of, a hydrocarbon spill associated with the operations in PCML;

c) Identifies the way in which the overall response in PCML will be coordinated;

d) Sets out roles and responsibilities of key personnel;

e) Identifies internal and external sources of support, assistance and resources to aid response;

f) Describes local response strategies and organisations; and

g) Defines internal and external notification procedures, response organisations, resources and personnel.

This OSRP is used mainly for condensate or diesel spill incident caused by PCML Operations within the area of Yetagun field where PCML is the operator of the Production Sharing Contract (PSC). In case that Oil Spill occurs beyond the Response Area, the OSRP should be used flexibly in line with PCML's business activities.

The scope of this OSRP covers all installations and facilities managed by and/or operated for PCML including but not limited to the drilling rig, wellhead platforms, FSO, supply vessels and infield pipeline. It focuses primarily on the response to the condensate or diesel spill.

Exploration drilling activities will have a specific Oil Spill Response Plan develop and which will bridge with PCML OSRP.

1.3. Scope of Document

This OSRP covers spills of oil associated with PCML operations including;

- **Drilling & Production:** Oil spills arising from development drilling and production activities.
- **Field Support:** Oil spills arising from activities involving the field support vessels.
- **Port Spills:** Oil spills from the supply/ logistics base port, SBMs, wharfs/jetties.

This plan is part of the MO Emergency Management Plan. The Emergency Response (ER) manual must be referred to in any emergency inclusive of an oil spill. It provides details of the management philosophy utilised by PCSB when defining the organisation and resources used in the response to an emergency and details the overall responsibilities required to handle effectively any emergency which may arise.

This document is linked either **directly or via bridging documents** to:

- **ENVIRONMENTAL CONSERVATION LAW 2012, The Pyidaungsu Hluttaw Law No. 9 / 2012**
- **PORT PLAN** – Port oil spill contingency plan arrangements for FSO.
- **PETRONAS CRISIS AND EMERGENCY MANAGEMENT PLANS (CEMP)** – PETRONAS has a number of internal documents that should be used in conjunction with this OSRP. These include the Corporate Crisis Management Plan. A number of additional, parallel documents have also been prepared by PETRONAS which include Incident Notification Guidelines, and Accident Reporting and Notification Procedures.

1.4. Structure of Document

This OSRP is a single volume document comprises six main sections along with Appendices, organized in line with PCSB-CEMP. The plan consists of the following sections:

I. The preliminary pages cover acronyms and abbreviations, guidelines for changes and revision.

II. Section 1, contained the Introduction, detailing the purpose and scope of the plan. It also introduces assumption planning and emergency response framework.

III. Section 2 discussed the Emergency Organization, describing the integration of response and mitigation actions and organizational relationship. This section covers the summary of emergency responsibilities of each emergency management team member. It describes specific planning roles and preparedness responsibilities.

IV. Section 3, described the Roles and Responsibility, covers the duties of the team members. It describes specific activities and action plans for the EMT.

V. Section 4, entitled Call-out, Mobilization and Communication, which cover the overview of notification and mobilization protocols for the emergency management teams.

VI. Section 5, described the Pre-Incident Action Plans, covers the action checklist for the EMT. The checklists should be referred to during an oil spill incident to ensure the essential actions are being taken.

VII. Section 6, described the Training, Exercises and Review, covers the competency required of the ERT, EMT and Support Groups. It also specifies the review requirements of the OSRP to ensure that the necessary improvements are adequately addressed.

1.5. National Legislative Framework

1.5.1. Environmental Conservation Law 2012, The Pyidaungsu Hluttaw Law No. 9/2012

(a) To implement the above law;

(b) To lay down the basic principles and give guidance for systematic integration of the matters of environmental conservation in the sustainable development process;

(c) To emerge a healthy and clean environment and to conserve natural and cultural heritage;

(d) To reclaim ecosystems as may be possible which are starting to degenerate and disappear;

(e) To manage and implement for decrease and loss of natural resources and for enabling the sustainable use beneficially;

(f) To implement for promoting public awareness and cooperation in educational programmes

(g) To promote international, regional and bilateral cooperation

(h) To cooperate with Government departments, organizations, international organizations, non-government organizations and individuals

1.5.2. Other National Legislations

Other national legislations that address marine pollution are:

I. The Oil Field Act 1952

II. The Factories Act 1951

III. Law Relating to The Fishing Rights of Foreign Fishing Vessels, 1989

IV. The Myanmar Marine Fisheries Law, 1990

V. The Freshwater Fisheries Law ,1991

1.6. Related International Conventions

Myanmar acceded and implemented several key international conventions relating to prevention and control of oil pollution from ships namely MARPOL 73/78, OPRC 1990, CLC 1992 and Fund 1992 under the umbrella of the international Maritime Organization (IMO).

1.6.1. MARPOL 73/78

International Convention for the Prevention of Marine pollution from ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL) 73/78), and it entered into force on 2 October 1983 (Annexes I and II is compulsory). The convention includes regulations aimed at preventing and minimizing pollution from ships – both accidental pollution and that from routine operations and currently includes six technical Annexes:

I. Regulation for the Prevention of Pollution by Oil
II. Regulation for control of Pollution by Noxious Liquid Substance in Bulk
III. Prevent of Pollution by Harmful substances Carried by Sea In Packaged Form
IV. Prevent of Pollution by Sewage from Ships
V. Prevent of Pollution by Garbage from Ships
VI. Prevention of Air Pollution From Ships

1.6.2. International Convention on Oil Pollution Preparedness, Response and Cooperation 1990 (OPRC 1990)

This Convention establishes preparatory methods for contingency plan, reporting procedures for oil, technical cooperation within the region or internationally, and the promotion of research and development in the area of oil spill management among the state parties. The Convention has the following key elements at its heart:

(a) precautionary and preventative measures are important in the avoidance of oil pollution in the first instance;

(b) prompt and effective action is essential to minimize possible damages in the event of pollution;

(c) contingency planning needs to be emphasized and the role of the oil and shipping industries should be included within these plans;

(d) the need for mutual assistance, international cooperation and information exchange (on response capabilities and reporting incidents);

(e) the “polluter pays” principle; and

(f) the importance of related international instruments on liability and compensation, including the 1992 Civil Liability Convention (CLC 1992) and the 1992 Fund Convention.

The OPRC Convention has 19 articles and 10 Resolutions covering both administrative and technical aspects. In summary, these call for Parties to carry out the following actions in relation to oil spill contingency planning:

(a) ships, port and oil industry facilities posing a risk of oil spills should have oil pollution emergency plans, under the coordination of a national contingency planning for major incidents;

(b) there should be clear oil pollution reporting procedures;

(c) reports of oil pollution should be properly assessed and all States whose interests may be affected informed; national and regional systems for preparedness and response should be developed, including the designation of competent national authorities and the compilation of national contingency plans;

(d) provision should be made for the supply of technical support and equipments to Parties requesting assistance to combat spills;

(e) the necessary legal and administrative measures should be taken to facilitate customs and immigration procedures in an emergency, where outside assistance has been mobilized;

(f) technical cooperation between Parties should be active in the field of training, planning, research and development; and

(g) Parties should work together with the oil and shipping industries to establish suitable pollution combating equipment stockpiles and training programmes.

1.6.3. International Convention on Civil Liability for Oil Pollution Damage 1992 (CLC 1992)

The 1969 CLC entered into force in 1975 and lays down the principle of strict liability (i.e. liability even in the absence of fault) for tanker owners and creates a system of compulsory liability insurance. Claims for compensation for oil pollution damage (including clean-up costs) may be brought against the owner of the tanker which caused the damage or directly against the owner's P&I insurer. The tanker owner is normally entitled to limit his liability to an amount which is linked to the tonnage of the tanker causing the pollution. The Convention requires ships covered by to maintain insurance or other financial security in sums equivalent to the owner's total liability for one incident.

The Convention applies to all seagoing vessels actually carrying oil in bulk as cargo, but only ships carrying more than 2,000 tons of oil are required to maintain insurance in respect of oil pollution damage. This does not apply to warships or to other vessels owned or operated by a State and used for the time being for Government non-commercial service. On May 30, 1996 the 1992 protocol came into force. It widened the scope of the Convention to cover pollution damage caused in the exclusive economic zone (EEZ) or equivalent area of a State party. The Protocol covers pollution damage as before but environmental damage compensation is limited to costs incurred for reasonable measures to reinstate the contaminated environment. It also allows expenses incurred for preventive measures to be recovered even when no spill of oil occurs, provided there was grave and imminent threat of pollution damage.

1.6.4. International Convention on the Establishment of an International Fund for Compensation of Oil Pollution Damage 1992 (FUND 1992)

International Convention on the Establishment of an International Fund for compensation for Oil Pollution Damage was adopted at a conference held in Brussels in 1971. It is supplementary to the 1969 Civil Liability Convention.

The purposes of the Fund Convention are:

(a) To provide compensation for pollution damage to the extent that the protection afforded by the 1969 Civil Liability Convention is inadequate.

(b) To give relief to ship owners in respect of the additional financial burden imposed on them by compliance with safety at sea and other conventions.

(c) To give effect to the related purposed set out in the Convention.

Under the first of its purposes, the Fund is obliged to pay compensation to the victims of oil pollution damage who are unable to obtain adequate or any compensation from the ship owner or his guarantor under 1969 Convention. Victims of oil pollution damage may be compensated beyond the level of the ship owner's of liability. However, the Fund's obligations are limited so that the total payable for victims by the ship owner and the fund shall not exceed 30 million SDR (about US$41million) for any one. In effect, therefore the fund's maximum liability for each incident is limited to 16 million SDR (under 1971 Convention – limits were raised under the 1992 Protocol). The Convention contains provisions on the procedure for claims, rights and obligations, and jurisdictions.

On May 30, 1996 the 1992 Fund Protocol came into force. As was the case with the 1992 Protocol to the CLC convention, the main purpose of the Protocol was to modify the entry into force requirements and increase compensation amounts. The scope of coverage was extended in line with the 1992 CLC Protocol. The 1992 Protocol established a separate, 1992 International Oil Pollution Compensation Fund, known as the 1992 Fund.

1.7. Interface with Other Plans

Where there is site specific plan or related Standard Operating Procedures (SOPs) at state, Myanmar Operations to facilitate effective implementation of response measures the PCML OSRP will interface with these plans.

1.7.1. Requirements for Emergency Response Procedures

Operator of premises involved in activities such as oil exploration, production, refining, bringing in oil tanker into Myanmar, involved in bunkering and to ship transfer of oil or any other activity that poses potential oil spill threat regardless type or quantity of oil handled must have in place their Emergency Response Procedures (ERP) or Contingency Plans. These plans should also identify resources available in terms of equipment and trained personnel for the purpose of immediate response in case of emergency. Refer to guideline on Preparation of Tier 1 Contingency Plan.

Operators of such premises should also ensure that their plans supplement the PCML OSRP and these plans identify available OSR resources within the proximity of their business in case the need for external assistance arises. Initiation of regular joint oil spill response exercises between the private and public sector is encouraged.

1.8. Risk Assessment Process

Evaluating oil spill risks requires consideration of three factors:

(a) Hazard identification - identification of risk activities/ operations where spills can occur. The potential spill scenarios for the current operation will be dictated by a whole range of operational factors, weather conditions, reservoir characteristics and fuel inventories on the rig.

(b) Probability – an evaluation of the probability/likelihood of a spill occurring calculated using historical data and the data relevant for a specific location and the organisation.

(c) Consequence – an assessment of the potential consequences should a spill occur, taking into account oil type, location, etc.

The analysis of probability and consequence allows scenarios to be categorised in terms of risk using a standard Risk Assessment Matrix (RAM). Probability and consequence can be expressed in a number of different ways. For the purposes of the current Risk Assessment, the following basis has been applied which is adapted from the standard PETRONAS approach to risk assessment (**Figure 2.1**).

IMPACT		Severity	1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
		People	Slight Injury	Minor Injury	Major Injury	Single Fatality	Multiple Fatalities
		Asset	Slight Damage	Minor Damage	Local Damage	Major Damage	Extensive Damage
		Environment	Slight Impact	Minor Impact	Localized Impact	Major Impact	Massive Impact
		Reputation	Slight Impact	Limited Impact	Considerable Impact	Major National Impact	Major International Impact
LIKELIHOOD	E Almost Certain	Happens several times per year at location	E1	E2	E3	E4	E5
	D Likely	Happens several times per year in company	D1	D2	D3	D4	D5
	C Possible	Incident has occurred in our company	C1	C2	C3	C4	C5
	B Unlikely	Heard of incident in industry	B1	B2	B3	B4	B5
	A Remotely likely to happen	Never heard of in industry	A1	A2	A3	A4	A5

Figure 2.1: PCSB Risk Assessment Matrix

Descriptions on the probability/likelihood and the severity/impact to environment and reputation are presented in **Table 2.1**, **Table 2.2** and **Table 2.3** respectively.

Table 2.1: Assessment of the Probability/Likelihood of Spills

Likelihood/ Probability	Rank	Definition
Not Applicable/ Extremely remote	**A**	Never heard of in E&P Industry
Slight, Low/ Remote	**B**	Heard of incident in the E & P industry or can occur in OPU
Unlikely	**C**	Has occurred in OPU or can occur at Division
Possible	**D**	Has occurred at Division or can occur at location
Likely	**E**	Has occurred at location

Table 2.2: Assessment of the Severity/Impact of Spills on Environment

IMPACT ON ENVIRONMENT	
Severity	Description (Meet one OR all of the criteria)
1 Insignificant	1. Spill/leak causing negligible impact to local environment, contained within the secondary containment and does not reach water and soil, and no volatilization to atmosphere. 2. Noise, air emission, discharges not exceeding company or legislative limits.
2 Minor	1. Spill/leak contained within secondary containment: • causing volatilization to atmosphere • causing limited contamination of soil or water within the containment area • causing non-permanent impacts to the environment 2. Noise, air emission, discharges not exceeding legislative limit but exceeding company limit (where available). 3. No immediate cumulative and/or delayed effect.
3 Moderate	1. Spill/leak causing limited contamination to soil or water outside the secondary containment but remain contained within facility perimeter (for onshore operation)** OR resulting in Potential Consequence A, B or C below. 2. Noise, air emission, discharges not exceeding company or legislative limits OR resulting in Potential Consequence A, B or C below. Note: Potential Consequence A. Cumulative and/or delayed environmental impact B. Short term recovery action <1 month C. Rehabilitation period <6 months ***For offshore operation, spill/leak into marine environment but limited potential contamination to marine water.*
4 Major	1. Spill/leak spreading outside the facility perimeter, managed to be contained/recovered but causing major contamination OR resulting in Potential Consequence A, B or C below. 2. Noise, air emission, discharges exceeding legislative limit with possible prosecution OR resulting in Potential Consequence A below. Note: Potential Consequence A. Immediate effect with serious damage to environment B. Medium term recovery action (1-3 months) C. Rehabilitation period 6-12 months
5 Catastrophic	1. Spill/leak spreading outside the facility perimeter, causing massive contamination OR resulting in Potential Consequence A, B or C below. 2. Noise, air emission, discharges resulting in legal prosecution with possible shutdown of facility, OR resulting in Potential Consequence A below. Note: Potential Consequence A. Severe environmental damage B. Long term recovery action (>3 months) C. Rehabilitation period >12 months

Table 2.3: Assessment of the Severity/Impact of Spills on Reputation

IMPACT ON REPUTATION	
Severity	Description (Meet one OR all of the criteria)
1 Insignificant	**Slight Impact** • Public awareness may exist, but there is no public concern.
2 Minor	**Limited Impact** • Local public concern or complaints. • Local media and/or local political attention with potentially negative impact for company operations.
3 Moderate	**Considerable Impact** • Regional public concern. Extensive adverse attention in local media. • National media and/or regional political attention resulting in negative impact on company operations. • Adverse stance of local government and/or action Groups.
4 Major	**National Impact** • National public concern. Extensive adverse attention in the national media. • Regional/national policies with potentially restrictive measures and/or impact on grant of licences** • Mobilisation of pressure or action groups.
5 Catastrophic	**International Impact** • International public attention. Extensive adverse attention in international media. • National/international policies with potentially severe impact on access to new areas, grants of licences** and/or tax legislation.

1.9. Associated Risk

Major environmental impacts from oil spills generally occur in near shore coastal regions where extensive marine biota exists. Although the risk of a large-scale accidental oil spill is extremely low at the Yetagun field, it is necessary to identify possible environmental impacts and required mitigation measures in the event of such an incident.

1.9.1 Sources of Spill

The most likely sources of spills are:

Fuel transfer and storage – Spills may occur during refueling activities as a result of hose rupture, coupling failure, or overfilling of tanks. Leaking and rupture (however remote) may also occur. The volume of fuel spillage in these situations is likely to be small and further minimized by continued monitoring, secondary containment, and prompt shutdown;

Well testing – Drill stem testing, although of limited duration, could result in small spills of oils. These will be contained on the bounded deck of the platform and will drain to drain – tanks for recovery;

Condensate transfer – Typical causes of accidental spills are pipeline rupture or connection failure. Continuous monitoring and the installation of automatic shut-off devices on pipelines will reduce the chance and the amount of this type of spill;

FSO related spills – Overfilling, bunkering (hose rupture, coupling failure), offloading (hose rupture, coupling failure), and in an extreme case, tank rupture. Continued monitoring and prompt shutdown will limit these spills to a minimum amount (except in the extreme case when a total failure of the tanker occurs);

Maintenance – The spillage of lubricant or fuel oils could occur during maintenance work on the platforms and the FSO;

Fire or explosion – Fire or explosion at the platforms or the FSO could result in a major oil spill. Strict regulations and high standards of safety equipment, servicing, maintenance, and training serve to ensure that fire and explosion are extremely rare events;

Shipping accidents – Failure of oil or fuel tanker during shipping or mooring may result the release of either part or all of the tanker contents. Implementation of standard operating procedures, continuous monitoring and strict personnel training will minimize the chance of a shipping accident.

1.9.2 Probability of Oil Spill

It is not possible to describe all oil spill scenarios; therefore, this OSRP sorts out the most important situations. Oil could be spilled or released from the Yetagun Field as a result of accidents, equipment failures or procedural irregularities with surface or subsurface equipment.

Oil spill scenarios were referenced to the Environmental Impact Assessment document. Potential oil spill scenarios for PCML operations in the Yetagun field include the following: **(see also Table 3.1)**

The most destructive accident and spill scenarios at Yetagun field are related to condensate spills from the FSO and the rupture of the fuel storage tanks. The greatest potential impact, but with very low probability, is for a severe accident causing a major condensate spill. A tanker collision, FSO capsizing, or similar event could cause a major spill of condensate. A worst case scenario would involve a full FSO or tanker containing 610,000 bbl of condensate.

Table 3.1 Potential Oil Spill Scenarios

Condensate Pipeline	FSO	Platform/Drilling Rig	Standby/Supply Vessel
Loss of condensate pipeline inventory to sea: Maximum loss: 6,440 bbl. 6,440 bbl = [(12 hrs night shift x 520 bbl/hr) + (200 bbl at 6" x 2 km condensate pipeline)] 520 bbl/hr = Train 1 (260 bbl/hr) + Train 2 (260 bbl/hr) Though highly unlikely, it may be caused by boat incidents, such as trawling, collisions, anchor drop etc.	*Loss of condensate to sea (four cases):* 1. Hose disconnection during offtake – 30 sec. to shutdown, maximum loss 200 bbl; 2. Ship collision – loss of one of the cargo tanks in the back (5P or 5S); maximum loss 40,000 bbl; 3. Ship sinks with full load – though highly unlikely (given the specific gravity of the cargo), it may result in the loss of 610,000 bbl; 4. Explosion/fire – in the extreme case, the entire cargo (full load 610,000 bbl) could be lost. *Spillage of fuel:* 1. Fuel loss during transfer – maximum 100 bbl 2. Storage tank failure – maximum loss not to exceed 5,000 bbl	*Spillage of fuel:* 1. Fuel loss during transfer – maximum 100 bbl 2. Storage tank failure – maximum loss not expected to exceed 3,000 bbl during drilling, 5,000 bbl during production. *Spillage of drilling mud:* 1. Mud tank rupture – maximum loss 2,500 bbl	*Spillage of fuel:* 1. Fuel loss during transfer – maximum 100 bbl 2. Storage tank failure – maximum loss not expected to exceed 3,600 bbl during operation 3. Ship collision – loss of the cargo tanks in the back; maximum loss 1200 - 3600 bbl 4. Ship sinks with full load – though highly unlikely (given the specific gravity of the cargo), it may result in the loss of 3,600 bbl;

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2. Oil Spill Response Organisation

2.1. General

This OSRP has been developed taking into account the PCML's organisational structure and how it interfaces with the company's Emergency Response Manual and Incident and Crisis Management Plans. A summary of the general organisational structure for PCML operation is shown below (**1**).

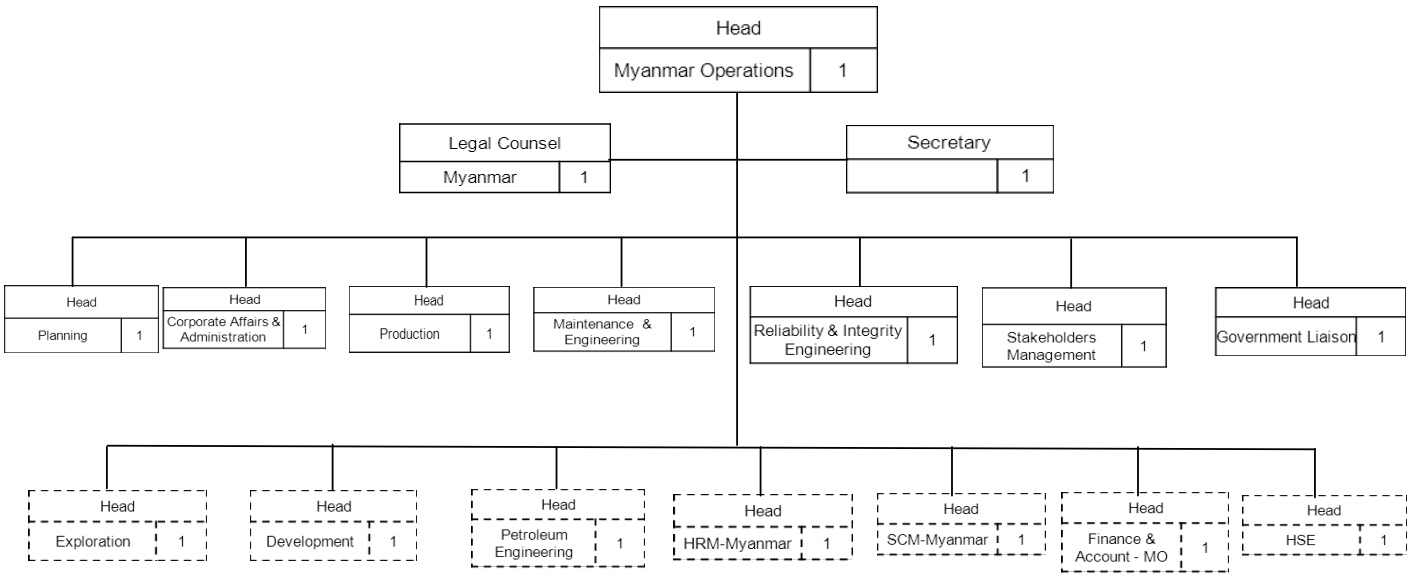

Figure 2.1: PCML Organisation Chart

2.3. PCML Emergency Organisation

PCML has limited resources but in the event of an emergency situation would adopt an organisational structure based on the Incident Command System (ICS) as shown below in **Figure 2.2**. The personnel listed above would together form the framework for the PCML Emergency Management Team (EMT) and site-based Emergency Response Team (ERT). The Emergency Coordination Centre (ECC) is located the PCML office in Yangon.

PCSB has established an ECC in the Head Office in Kuala Lumpur, Malaysia.

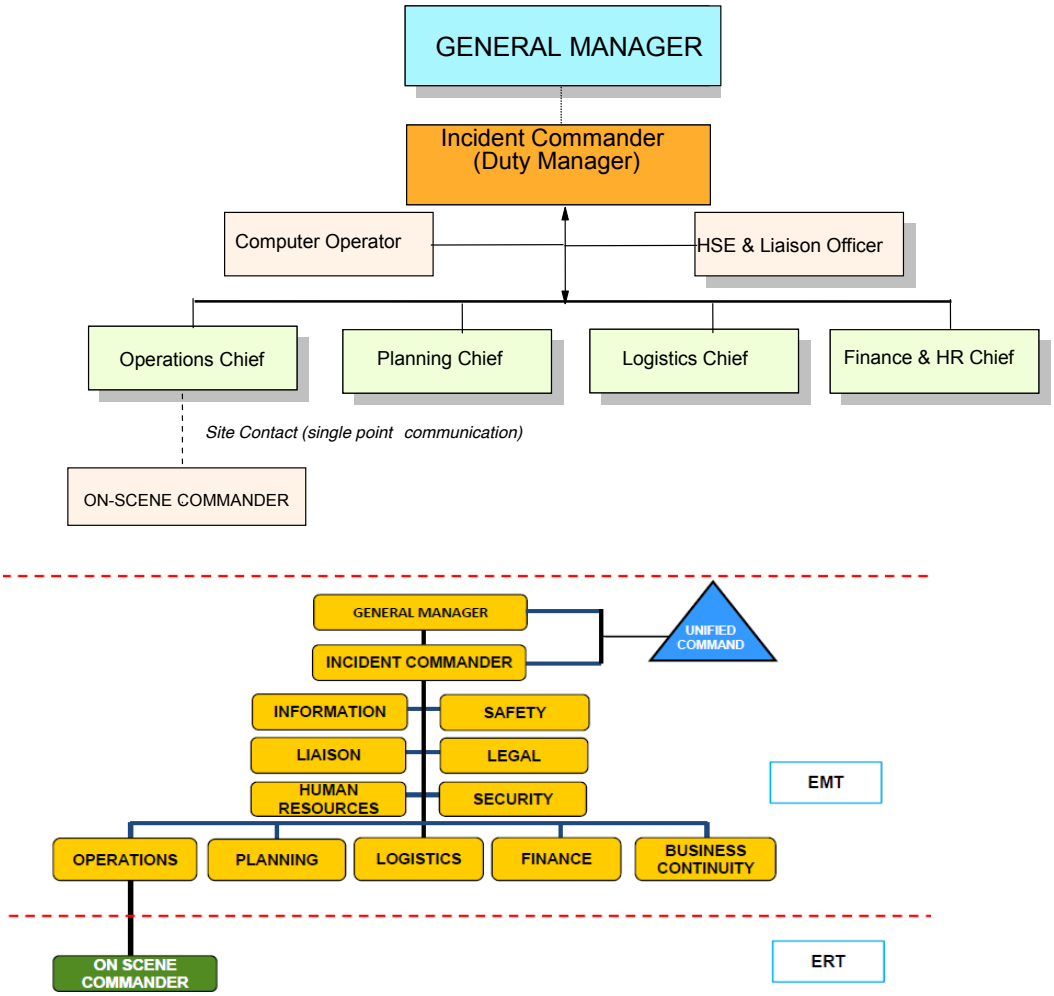

Figure 2.2: PCML Emergency Organisation

The Emergency Organisation will be manned based on the weekly duty roster.

The **OSC** would initially report the spill to the Incident Commander. Thereafter, when the ECC has been established, the **OSC** would report via the Operations Chief who would in turn keep the Incident Commander fully appraised. The

Incident Commander will provide the interface between the EMT in PCML and the CMT at PETRONAS Carigali Head Office, Kuala Lumpur.

The ICS structure is extremely flexible and can be partially activated in the case of minor spills (Tier 1) or expanded in the event of a full blown emergency (Tier 2 or Tier 3). The PETRONAS philosophy with regard to dealing with oil spills of different sizes/ severity is outlined in **Figure 2.3**.

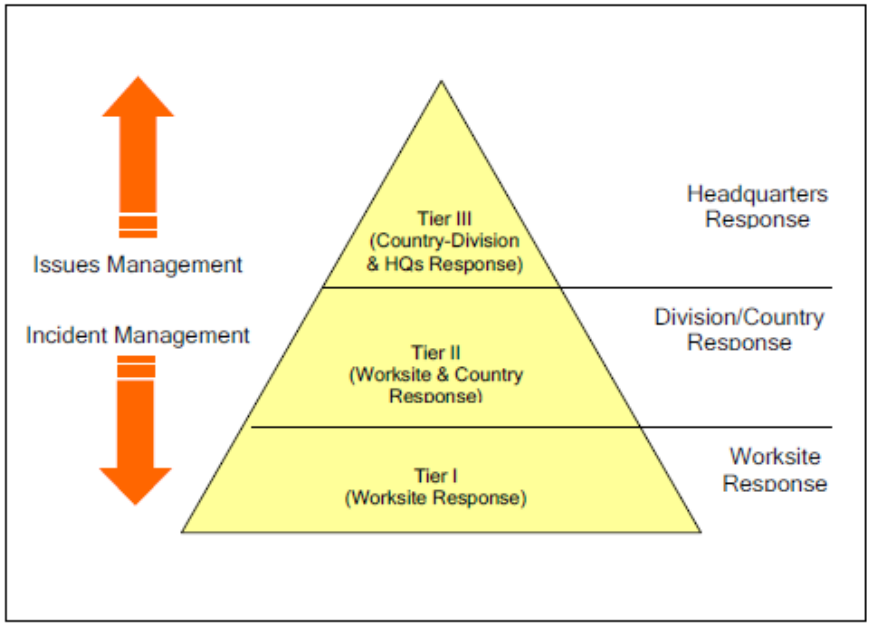

Figure 2.3: PETRONAS Response Levels

2.2.1 TECHNICAL SUPPORT TEAM

Technical Support Team may include PCML staff who are not occupied in the ECC and other personnel who are trained in the Oil Spill Response technique, especially in the beach cleaning etc.

In addition to other technical advisors, the Technical Support Team may include the On-site Commander, Beach Cleaning Advisor and Beach Cleaning Group Leader and Strike Team Leader.

2.2.2 PCSB HEADQUARTER

The PCSB HQ EMT will normally be mobilized in the event of a major emergency and will be responsible for technical and safety advice, and supply of resources beyond the capabilities of PCML EMT. The duties and responsibilities can be outlined as follows:

- Notify COMCEN PETRONAS
- Provide advice on safety and technical matter.
- Coordinate the approval of press release.
- Make corporate decisions.

2.4. Oil Spill Incident Management

2.4.1. Tier Assessment Criteria

The purpose of the three Tier levels (see **Table 2.1**) is to establish, as soon as possible, what is the correct level of response needed to combat the spill. The severity of the spill depends on the size and complexity of the response and the potential consequences for people, environment, assets and reputation.

Table 2.1: Tier Assessment Criteria

Tier 1	**Spills which can be dealt with using local, in-house resources.**
❑ Spill can be easily managed using on-site oil spill response resources ❑ Source of spill has been stopped ❑ Spill contained ❑ Spill likely to naturally dissipate	❑ Day time release ❑ Oil is moving away from the coastline or not moving to sensitive areas ❑ <5 barrels
Tier 2	**Spills that require mobilisation of oil spill response resources from established service providers.**
❑ Danger of fire or explosion ❑ Concentrated oil accumulating in close proximity to the drilling rig/vessel, onshore storage tank, etc. ❑ Possible continuous release ❑ Tier 1 resources overwhelmed, requiring additional resources ❑ Night time or poor visibility	❑ Heavy fuel or crude oil ❑ Oil spill is moving towards the coastline/inland waterway ❑ Oil predicted to impact sensitive areas (e.g. water intakes, fisheries, tourist areas) ❑ Local/National media attention ❑ 5-1000 barrels
Tier 3	**Spills which require the mobilisation of national resources.**
❑ Actual or potentially serious threat to life, property, industry ❑ Tier 2 resources overwhelmed, requiring the mobilisation of government- owned and/or national resources international oil spill response contractor(s)	❑ Significant shoreline impact ❑ Potential to impact neighboring countries ❑ International media attention ❑ >1000 barrels

PCML tiered response system flowchart is shown in **Figure 2.4**.

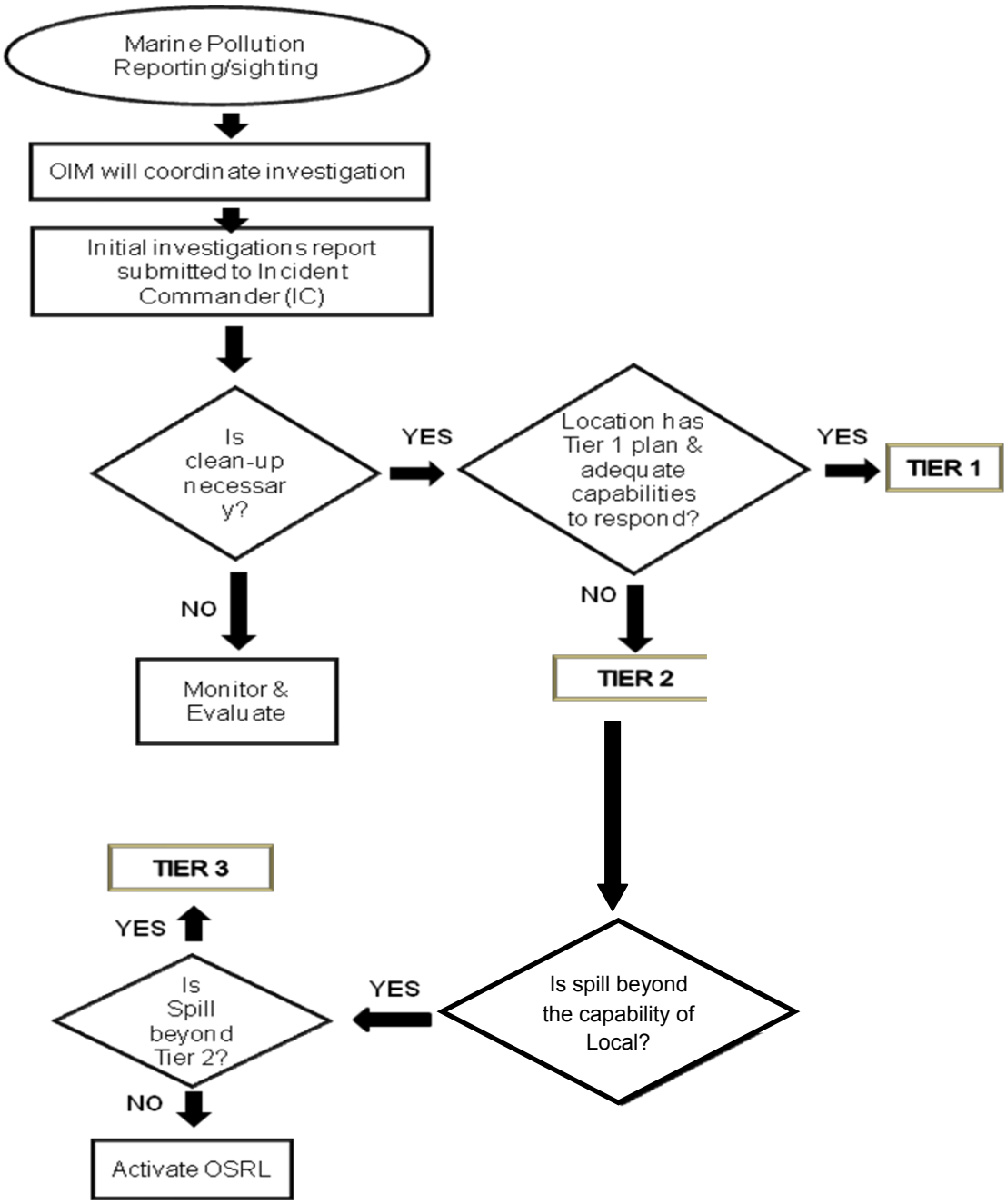

Figure 2.4: PCML Tiered Response System Flowchart

2.4.2. Tier 1 Spills

Spill that can be controlled in-house using PCML own resources (equipment and personnel) less than 5 ***barrels but not occurring at sensitive area***.

2.4.3. Tier 2 Spills

The response capability will be provided primarily by the sources of equipment, materials and personnel in Yangon and sources from others operators, contractors and service providers. Incidents of this level would, in most cases, involve not only SERT but also all or parts of the Emergency Management Team (EMT), based in Yangon.

2.4.4. Tier 3 Spills

In addition to all the resources of PCML and PCSB HQ, the response equipment would be provided by OSRL.

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2.4.5. End of Emergency

The end of the emergency will be declared in a different way depending on the Tier:

- For Tier 1 oil spills, the On-Scene Commander will order the closure of oil spill response operations. The OSC will also be responsible for informing the Incident Commander and all personnel that had been involved or notified, that the emergency has terminated.
- For Tier 2 oil spills, the Incident Commander will order the termination of oil spill response operations. The Incident Commander will also be responsible for informing all personnel and organisations that had been involved or notified, that the emergency has terminated.
- For Tier 3 oil spills, the end of the emergency will be declared by the Head of Country.

The "End of Emergency" will be declared when any of the following circumstances occurs:

- All resources affected by the spill have reverted to the agreed status;
- It is not effective to continue pollution fighting or cleanup operations.

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3. Roles and Responsibilities

3.1. Incident Commander

The Incident Commander is overall in charge of the management of the oil spill response at PCML and is responsible for directing key personnel, for authorising, or obtaining authorisation of, any funds required for materials, equipment, contract services or specialist personnel necessary to bring the oil spill under control.

Among the other responsibilities of the IC are:

(1) Assess the situation and/or obtain a briefing from IC.

(2) Determine incident objectives and strategy.

(3) Establish the immediate priorities.

(4) Establish an appropriate organization.

(5) Ensure planning meetings are scheduled as required.

(6) Approve and authorize the implementation of an Incident Action Plan.

(7) Ensure that adequate safety measures are in place.

(8) Coordinate activity for all ECC Core Team members.

(9) Approve requests for additional resources or for the release of resources.

(10) Notify relevant authorities and PCSB management of the incident.

(11) Update PCSB management and authorities of the spill and cleanup activities.

(12) Authorize release of Holding Statement the news media.

(13) Order the termination/demobilization of the incident when appropriate.

(14) Prepare Cost Analysis Report and third party damage claims.

3.2. Operations Chief

The Operations Chief is responsible for managing all tactical operations of the oil spill incident. The tactical resources include:

(a) Ground or surface-based tactical resources

(b) Aviation (Air) resources (i.e. helicopters and fixed-wing aircraft)

(c) Staging Areas

The Operations Chief reports to the Incident Commander.

Among the other responsibilities of the Operations Chief are:

(1) Immediately establish direct contact with the On-Scene Commander at the installation/site.

(2) Obtain clear and concise details as to the nature and seriousness of the emergency and in particular details of any casualties.

(3) Verify total number of personnel on board the installation/site and their status/disposition.

(4) Determine what assistance is required by the On-Scene Commander at the installation/site e.g. additional manpower, Oil Spill Recovery Equipment, vessel, medical assistance, etc.

(5) Assign appropriate resources to activate the Ground tactical team, Aviation tactical team and establish Staging areas.

(6) Maintain open line communication with the On-Scene Commander at the installation/site throughout the duration of the emergency.

(7) Keep the Incident Commander fully informed of the developing situation and advice accordingly.

(8) Maintain an accurate log of all key events during oil spill emergency.

(9) Update Planning Chief and Logistic Chief of Operations activities.

3.3. Offshore On-Scene Commander

The Offshore On-Scene Commander is responsible for implementing and coordinating oil spill response activities at sea in collaboration with local authorities, boat captains, offshore production operations and contractors.

The Offshore On-Scene Commander reports to Operations Coordinator**.**

Among the other responsibilities of the Offshore On-Scene Commander are:

(1) Establish offshore command base for clean-up activities.

(2) Assess the marine and weather conditions and develop action plan accordingly.

(3) Mobilise mechanical recovery and boat spraying equipment and vessel, and initiate early response to protect sensitive areas.

(4) Supervise the offshore oil recovery and boat dispersant spraying operations.

(5) Assess and request for sea transportation facilities for manpower and equipment required during cleanup operation.

(6) Arrange for sampling of spilled oil and delivery of samples as per approved procedure.

(7) Work closely with local government authorities coordinating at site.

(8) Maintain incident log, update Operations Chief and prepare progress report.

3.4. Onshore On-Scene Commander

The Onshore On-Scene Commander is responsible for implementing and coordinating oil spill response activities on the shoreline in collaboration with local government authorities and contractors.

The Onshore On-Scene Commander reports to Operations Chief**.**

Among the other responsibilities of the Offshore On-Scene Commander are:

(1) Manning on-site Incident Command Post (ICP) / Staging Area for shore cleanup activities once established and activated by EMT.

(2) Assess the affected areas and collection of local information.

(3) Assess the shoreline / onshore situation and develop containment and cleanup plan in collaboration with Operations Chief.

(4) Quantify onshore cleanup equipment and manpower requirement and initiate an early response.

(5) Supervise the onshore oil recovery and beach cleanup operations.

(6) Supervise the transportation and disposal of recovered oil and wastes.

(7) Work closely with local authorities, technical specialist and Environmental Advisor to achieve effective cleanup operations.

(8) Maintain incident log, update Operations Chief and prepare progress report.

3.5. Planning Chief

The Planning Chief is responsible for managing all information relevant to the incident. He/She collects, evaluates, processes and disseminates the information.

The Planning Chief also supervises, organizes and coordinates technical specialist support.

The Planning Chief reports to the Incident Commander**.**

Among the other responsibilities of the Planning Chief are:

(1) Collecting, analyzing, and displaying situation information as the incident develops.

(2) Circulate regular information updates; every 1 - 2 hours initially.

(3) Prepare full chronological report including extent of oil contaminated areas, environmental damage, method used in containing and cleanup of the spill.

(4) Prepare daily and weekly reports to Management.

(5) Secretary to all oil spill coordination meetings.

(6) Provide general secretarial support to oil spill response team.

(7) Preparing and distributing the Incident Action Plan,

(8) Exercise overall responsibility for the coordination of technical supports requirement and activities.

(9) Keeps the Incident Commander informed of significant issues affecting the Planning Section and Log Keeping.

3.6. HSE & Liaison Officer

The HSE & Liaison Officer is responsible to develop and recommend measures for assuring personnel safety and to assess and/or anticipate hazardous and unsafe situations. And also responsible to liaise with related government agencies and other companies on behalf of Incident Commander and relevant local authorities as per Essential Notification Matrix.

The HSE & Liaison Officer reports to the Incident Commander**.**

Among the other responsibilities of the HSE & Liaison Officer are:

(1) Appoints Safety Officers at each worksite.

(2) Analyzes unsafe incidents and recommend corrective measures.

(3) Provide health, safety and environment advice as required.

(4) Notify PCSB HQ Incident Commander, relevant local authorities as per Essential Notification Matrix.

(5) Solicit additional equipment and supplies requirements from outside companies and associated as per Call-Out Procedure.

(6) Advise Incident Commander on impending issues e.g. public complaints, grievances, and notices from relevant authorities.

3.7. NOK & Media Officer

The NOK & Media Officer is responsible to develop and obtain approvals for releasing the information to the media, to response team, and other appropriate agencies and organizations.

The NOK & Media Officer reports to the Incident Commander**.**

Among the other responsibilities of the NOK & Media Officer are:

(1) Collect and screen information.

(2) Prepare draft holding statement and press releases for review by Incident Commander and forward approved releases to HQ ECC for approval by PCSB MD/CEO and President PETRONAS.

(3) Disseminate approved media statements to appropriate agencies and organizations.

(4) Organize Press Conference as necessary.

(5) Respond to enquiries from media and public.

3.8. Finance & HR Chief

The Finance & HR Chief is responsible for managing all financial and administrative aspects of the oil spill cleanup activities.

The Finance & HR Chief reports to the Incident Commander**.**

Among the other responsibilities of the Finance & Admin Chief are:

(1) Ensuring the accurate recording of daily personnel time and equipment time records.

(2) Maintain a file of injuries and illnesses associated with oil spill cleanup, including all written witness statements.

(3) Records all costs data, analyzes and prepares estimates of cleanup costs, and maintains accurate records.

(4) Manages all financial matters pertaining to vendor contracts, leases and fiscal arrangements.

(5) Establishes local sources for equipment and supplies; equipment rental agreements; and processes all billing invoices.

(6) Call out and activate relevant ECC support team members as appropriate

(7) Make adequate arrangements for catering, media receptions, land transport, accommodation for onshore and offshore clean-up personnel as required.

(8) Monitor and record expenses of all resources deployed for the clean-up operations; i.e. equipment, manpower, vehicles.

(9) Arrange immigration formalities for relevant personnel from outstation / overseas.

(10) Arrange for adequate facilities for local labour force (shelter, toilet, food / drink, hygiene, washing / cleaning).

(11) Facilitating accommodation and travel arrangement for affected personnel and government formalities and providing back-up facilities for the clean-up operations such as travel/accommodation, media reception area, catering and other sanitation facilities at the various locations.

3.9. Logistics Chief

The Logistics Chief is responsible on all matters related to logistics and resources, which include the following:

1. Facilities: setup, maintenance and demobilization of all incident support facilities i.e. Command Post, Incident Base, other facilities such as feeding, sleeping, sanitation.
2. Ground support: maintenance, servicing and fueling of all mobile equipment and vehicles. Transportation of personnel, supplies and equipment.
3. Communications: develop communication plans, installation and testing of communication equipment and facilities, distribution and maintenance of communication equipment.
4. Supplies: ordering, receiving, processing, disbursement, servicing and storing of all oil spill response related equipment and resources (including food).
5. Food services: supply of food throughout the entire incident duration, including to all remote locations.
6. Medical services: develop procedures for medical emergencies, provide medical aid.

The Logistics Chief reports to the Incident Commander**.**

Among the other responsibilities of the Logistics Chief are:

1. Assess the emergency situation and determine the adequacy of logistics response resources.
2. Establish communications with logistics service providers, when appropriate.
3. Identify available resources – aircraft, road transports, and materials and arrange for mobilization and movement of those resources as planned.
4. Obtain additional resources from other oil companies/operators, if necessary.
5. Activate equipment load-out and vessel mobilisation.
6. Monitor and record daily all resources deployed for the cleanup operations i.e. material handling equipments, vessels, manpower, land transportation, aircraft.
7. Update EMT regularly on all the resources deployed to site**.**

3.10. Computer Operator

The Computer Operator is responsible for maintaining an accurate written record of all the information and actions carried out by the EMT within the ECC. The Computer Operator reports to the Planning Chief.

Among the other responsibilities of the Computer Operator are:

(1) Update Event Log Sheet with the latest information (ensuring information is current, neat and legible)

(2) Maintain a dated and timed record of EMT information, actions and communications

(3) Commence a time record for key information about the incident including:

- Record the EMT members present
- Record the latest status on the Status Board
- Record actions to be taken

(4) Record Briefings and Time Outs

(5) Collate all personal logs ready for incident review and provide to Incident Commander.

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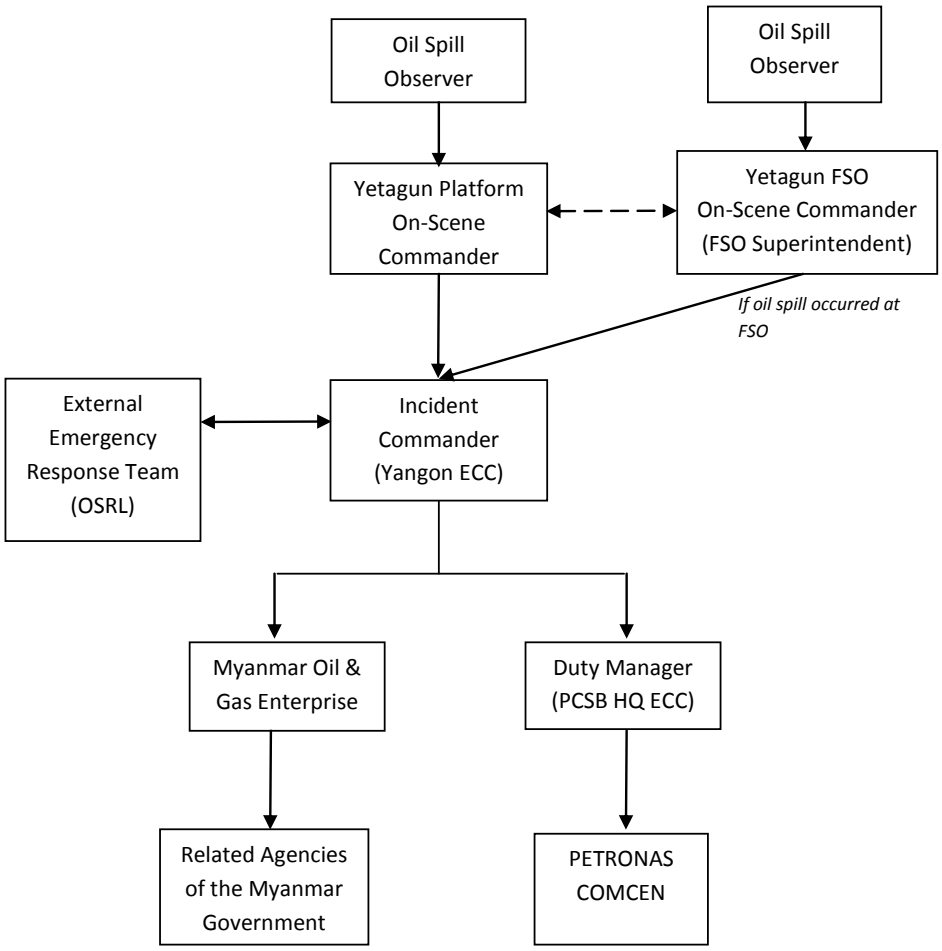
4. Call-Out, Mobilization and Communication

4.1. Alert/Notification Procedure

For oil spills at offshore and onshore, **Figure 4.1** describes the initial notification, key actions and flow of information. Oil spills, irrespective of size or level (Tier 1 to Tier 3) will follow the same internal notification process to the Incident Commander in PCML and Kuala Lumpur.

Figure 3.4 Emergency Organization Structure



4.1.1. Authorisation of Oil Spill Incident Notification

Only the On-Scene Commander or a person appointed by him shall authorise transmission of oil spill incident notification. However, in a distress situation, the non-availability of these designated persons shall not prevent the Radio Operator, at his discretion, from sending any appropriate notification relating to an oil spill incident.

All oil spill incident notification shall use the Initial Notification Form (INF) (see **Appendix 4.0**).The Pollution Report (POLREP) Form (see **Appendix 4.1**) shall be used when more detail information will be required.

4.1.2. Oil Spill Incident Notification Routing

All oil spill incident notification from the installation, drilling rig or vessel shall be addressed to the PCML Incident Commander.

4.1.3. Notification to Authorities

The parties to be notified will depend on the magnitude and environmental sensitivity of affected area.

Every oil spill incident shall be reported as per PETRONAS Carigali Incident Notification Matrix as displayed in the ECC. Any oil spill onto inland waters, sensitive areas categorized as Tier 3 shall be reported (using the best available means) to MOGE.

The list and contact numbers of relevant authorities to be notified is as per **Appendix 4.2.**

4.2. Mobilization Procedure

The following mobilisation procedures will be followed for Tier 1, Tier 2 and Tier 3 oil spills.

4.2.1. Tier 1 Oil Spill Response Mobilisation Procedure

During Tier 1 incidents (**Figure 4.2**), the initial response will be dealt with by the OIM at offshore installations, who will activate the ERT (see list in **Appendix 4.3**) and mobilize Tier-1 oil spill response equipment on the installation stockpile (**Appendix 4.4**). The installations are equipped with spill kits which may include (as a minimum):

(a) oil spill dispersant at offshore installations,

(b) absorbent booms, absorbent pads, heavy duty oily waste bags and PVC gloves .

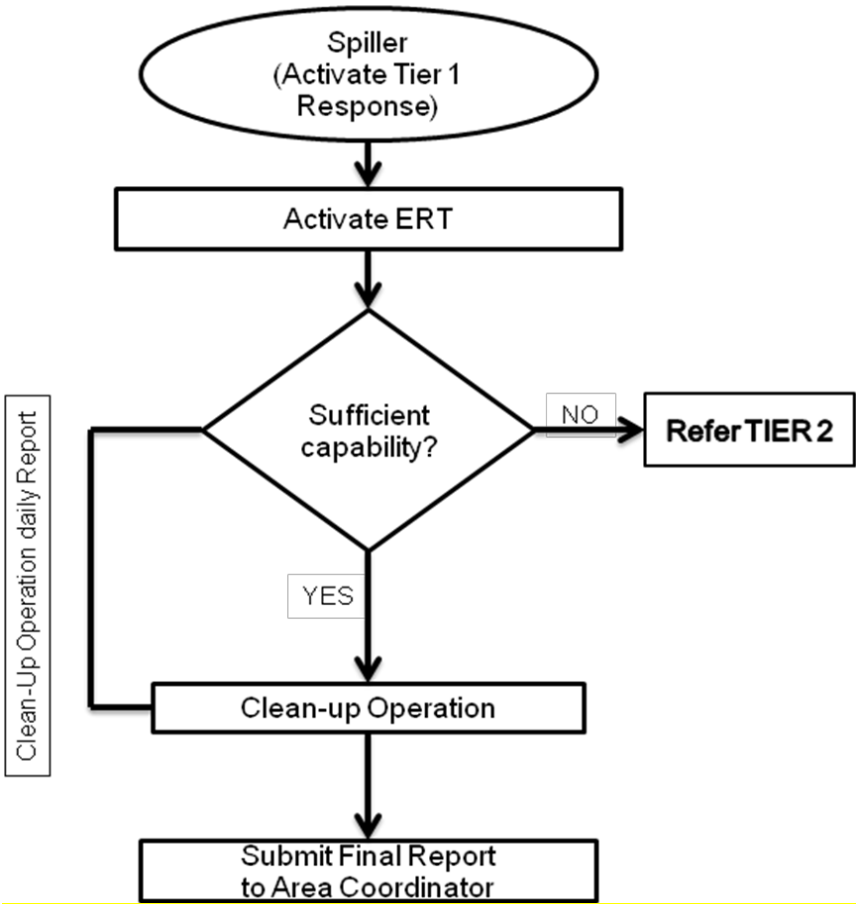


Figure 4.2: Tier 1 Oil Spill Response Mobilisation Procedure

4.2.2. Tier 2 Oil Spill Response Mobilisation Procedure

In the case of Tier 2 spills, ECC at PCML (i.e. EMT) will be mobilized (**Figure 4.3**). The **OSC** will contact the Incident Commander and request additional resources and agree on the appropriate level of response to the incident. The Incident Commander will liaise with the Operations Chief who will then arrange mobilisation of additional resources. A Staging Area will be established to provide front-line support in managing the Tier 2 response effort.

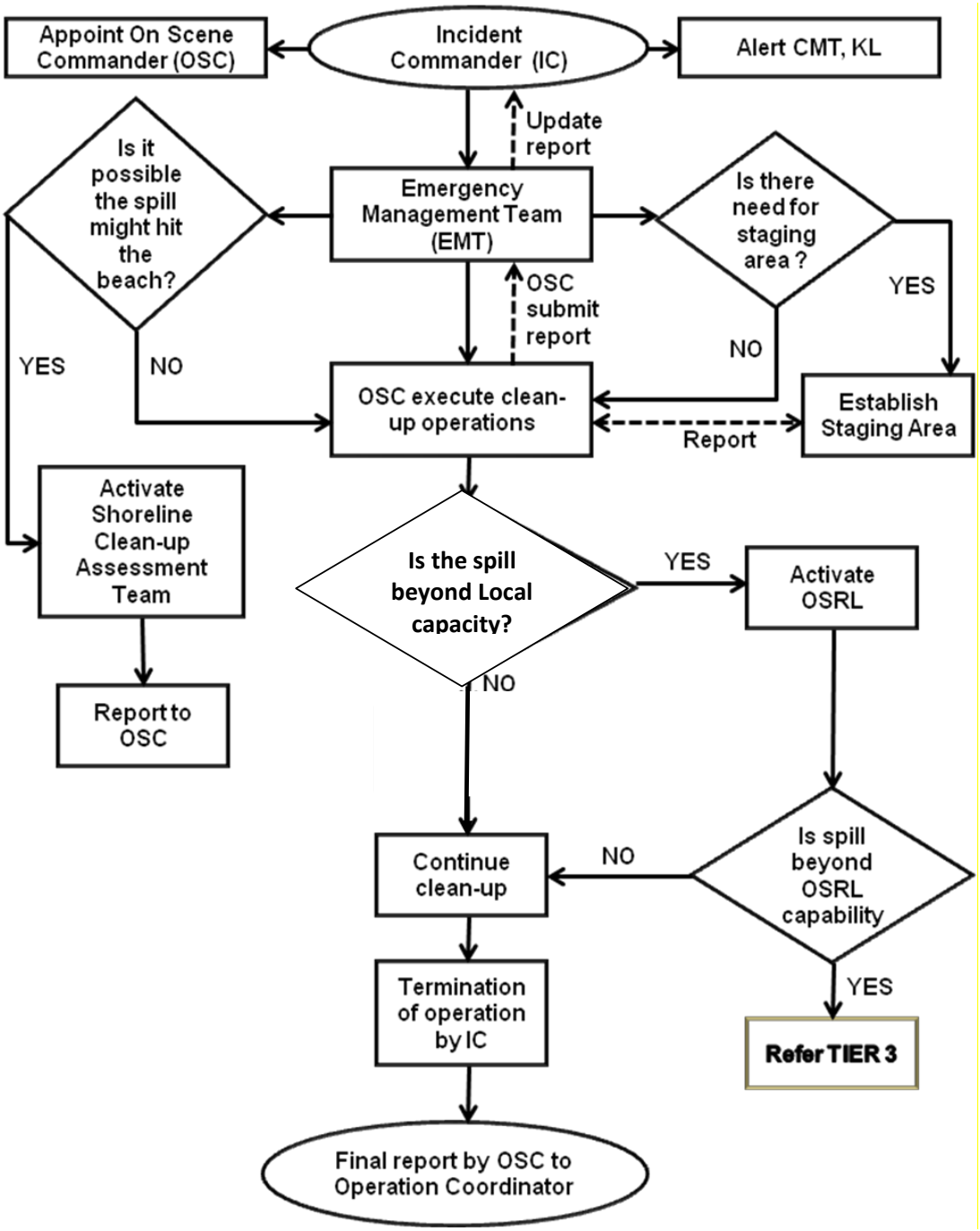


Figure 4.3: Tier-2 Response Flowchart

As a minimum the **OSC** should provide SITREPs to the Incident Commander on a daily basis.

For all spills, the OSC must notify the Incident Commander immediately. The Incident Commander will continue to provide regular updates and liaise with the CMT /EMT in Kuala Lumpur regarding the extent or further escalation of the emergency.

4.2.3. Tier 3 Oil Spill Response Mobilisation Procedure

Alert PCSB HQ ECC, PETRONAS COMCEN and Myanmar Government via MOGE.
Call in additional resources to protect far field environmentally sensitive areas, other vessels and installations.
Consider environmental survey if coastal resources threatened.
Government may call in own resources depending on size and behavior of spill.

OSRL can be notified by the authorised persons using:

a) Form OSRL 025: Mobilization Authorisation Form (**Appendix 4.6**)

b) Form OSRL 027: Notification Form (**Appendix 4.7**).

The list of other agencies that can be contacted for assistance during an oil spill is listed in **Appendix 4.5**.

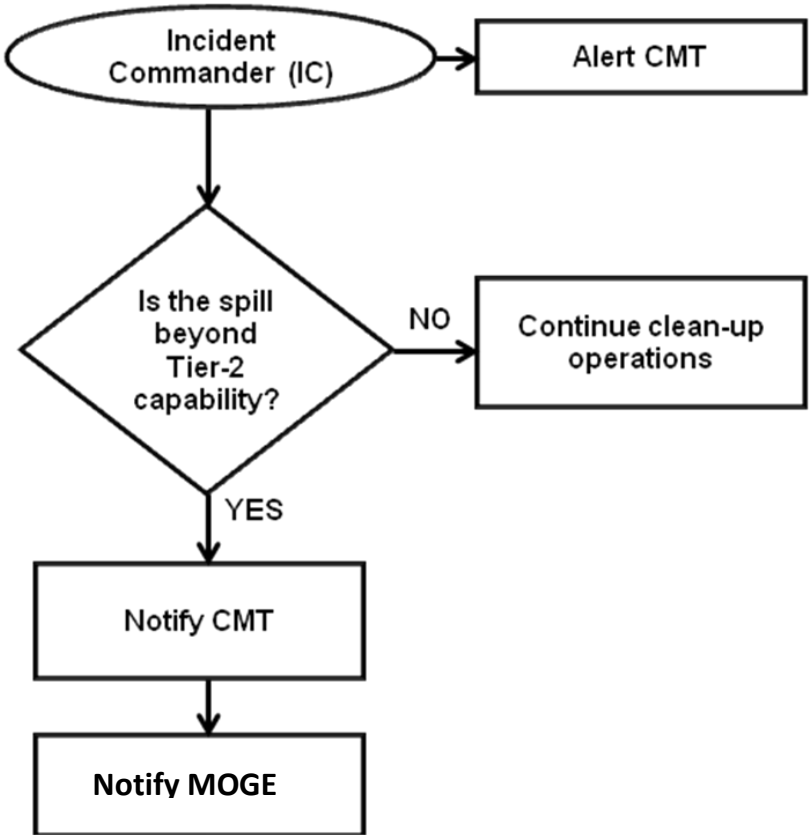


Figure 4.4: Tier 3 Response Flowchart

The Incident Commander will ensure that the authorities (i.e. MOGE) have received a Pollution Report (POLREP) form (**Appendix 4.1**), who will also subsequently send Situation Report (SITREP) (**Appendix 4.8**) to provide updates on a regular basis.

4.2.4. Assistance to OSRL

In the event of a Tier 3 mobilisation, PCML would be required to provide assistance with some aspects of logistical support, customs documentation, transportation (the types of vehicles and boats required), and the number of manpower needed, will rely on PCML to ensure that the requirements are met. **Table 4.1** below shows the typical assistance required during Tier-3 mobilization.

Table 4.1: Typical assistance requirements in Tier-3 mobilization

Action	Assistance Required
Flight	• Liaise directly with the Local Authority to obtain over-flight clearances and landing rights • Liaise with Department of Civil Aviation (DCA) to obtain trans-boundary over-flight flight clearance and landing rights. • Meet the flight (equipment will normally be accompanied by a Response Specialist). Aviation Logistics Executive to arrange for airport clearance, ground support services e.g. dispersant loading point, re-fueling, post- & pre-flight checks/maintenance, waste management, etc.
Customs and Immigration	• Liaise directly with the Customs to obtain emergency clearance on the importation and re-exportation of the oil spill response equipment. • Arrange emergency clearance for immigration / visas for personnel

Unloading	• At the airport, PCML to provide:
	  ○ Ground handling equipment
	  ○ Hi-loader
	  ○ Forklifts (low mast for unloading from aircraft)
	  ○ Local agents to carry out aircraft unloading
	• Transport to Site
	• PCML will be expected to arrange and to assist with:
	  ○ Trucks for transport
	  ○ Loading of equipment onto transport
	  ○ Provision of secure storage
	  ○ Control and tracking of equipment

Action	Assistance Required
On Site Operations	• PCML to pre defined equipment lay-down points, identify a pool of vessels of opportunity to draw from and obtaining the necessary approvals for dispersant application. • *Oil Spill Response Limited* will provide: ○ Technical expertise and services ○ Daily reports on activities and costs ○ Management of own personnel and decisions on duration of duty periods • PCML will arrange: ○ Food, accommodation and transport for *Oil Spill Response Limited* personnel.
De-mobilisation	• *Prepare demobilization plan:* ○ In use / standby decision ○ Onsite cleaning ○ Return freight by air or sea

4.3. Government Agencies for Spill Response

In the event of any oil spill it is necessary to notify the Myanmar Government. Unless specifically advised otherwise, the only government agency to be notified will be the Myanma Oil & Gas Enterprise (MOGE) who is the official operator of each PSC (Production Sharing Contract).

MOGE require to be notified immediately of any incident. Initial contact should be by telephone or radio. This should be followed up by fax as soon as possible. When cleared by the PCML General Manager, the EMT's HSE & Liaison Officer on duty who has the necessary contact numbers will initiate contact with MOGE.

MOGE will then contact any other government agencies required i.e. police, medical, military, customs, immigration etc. Where required, MOGE should be asked to assist in dealing with other government agencies for issues such as arranging clearance for emergency flights, immigration matters and liaison with the Armed Forces if required.

NB: It is important that MOGE are the first external party to be contacted in an emergency situation.

4.4. Termination / Demobilization Procedure

When the end of emergency has been declared, the following actions should be taken:

- Withdrawal of personnel and material.
- Evaluation of the emergency incident and creation of reports and statistics.
- Design and implementation of a Recovery Plan for the affected area, if necessary
- Post-spill environmental monitoring to verify that the spill did not have long-term effect on any sensitive natural or social areas.

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5. Pre-Incident Action Plan

5.1. Generic Response Guidelines

This section contains operational guidance for various oil spill response strategies that may be deployed to mitigate a potential oil spill. Please refer to **Appendix 5.1 – Oil Spill Response Guide** for further information. **Table 5.1** below summarises the generic response guide for the different spill types. .

Table 5.1: Generic Response Guidelines

Response Strategy	Spill Type				Level of Response
	Crude	Diesel/ Condensate	Water Based Drilling Mud	Utility Oils, i.e. hydraulic, lubricating or base oil	
Evaluate and Monitor	✓	✓	✓	✓	Tier 1
Allow to Evaporate		✓			Tier 1
Offshore Containment and Recovery	✓	Diesel likely to evaporate readily both off and near shore*	WBM likely to disperse and dilute through water column	✓	Tier 1/ Tier 2
Chemical Dispersion	✓	✖	✖	✓	Tier 2/ Tier 3
Shoreline Protection	✓ If oil threatens shoreline	Diesel likely to evaporate readily both off and onshore. A shoreline response is unlikely	WBM likely to disperse and dilute through water column. Monitor and evaluate is the only probable strategy.	✓ If oil threatens shoreline	Tier 2/ Tier 3
Shoreline Clean-up	✓ If impacts shoreline			✓ If oil impacts shoreline	Tier 2/ Tier 3
In-situ Combustion	✓	✖	✖	✖	Tier 3

Key

✓ = Recommended **✖ = Not Recommended**

* = If oil does persist then containment and recovery will become the response strategy.

5.2. Response Guide Flowchart

Following any oil spill scenario, **Figure 5.1** provides a guide in initiating the appropriate response strategy.

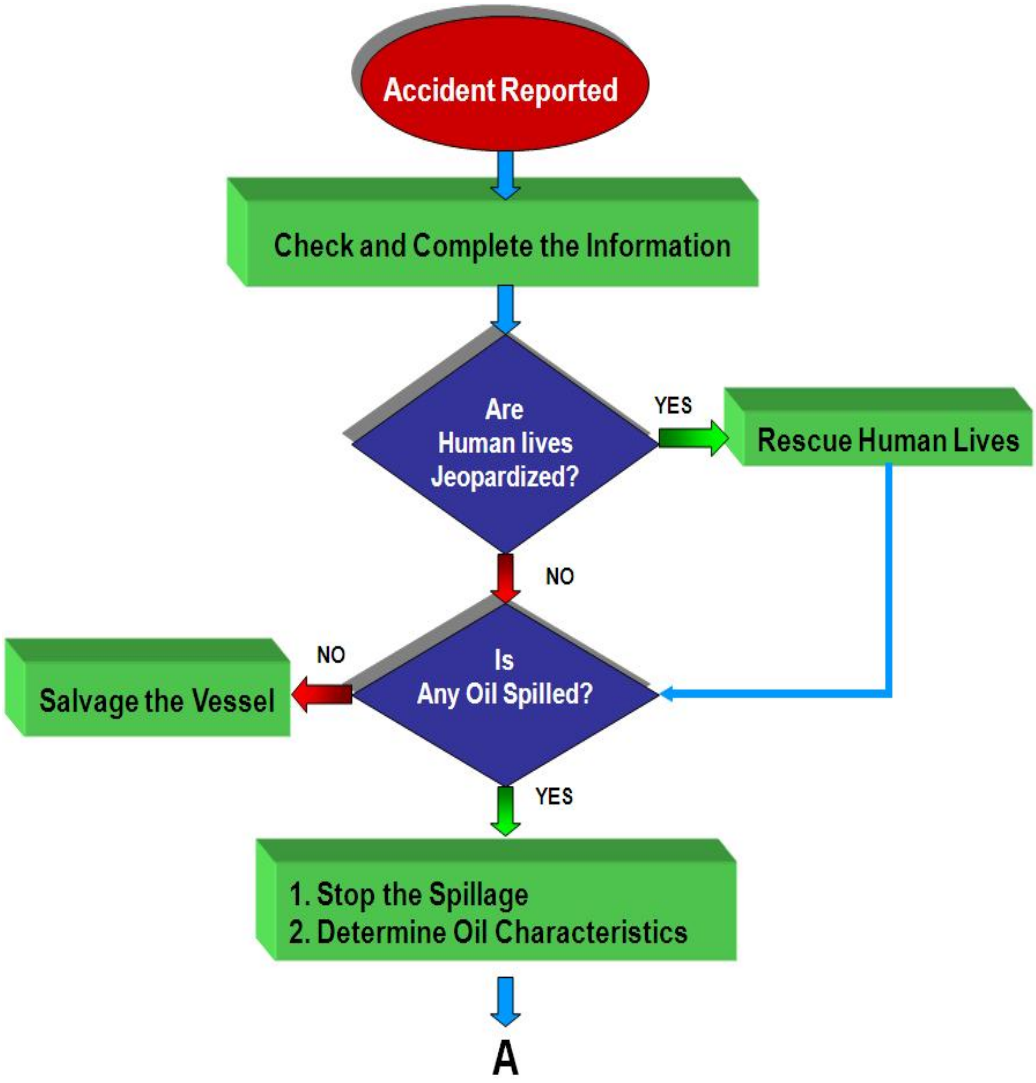


Figure 5.1A: Response Guide Flowchart

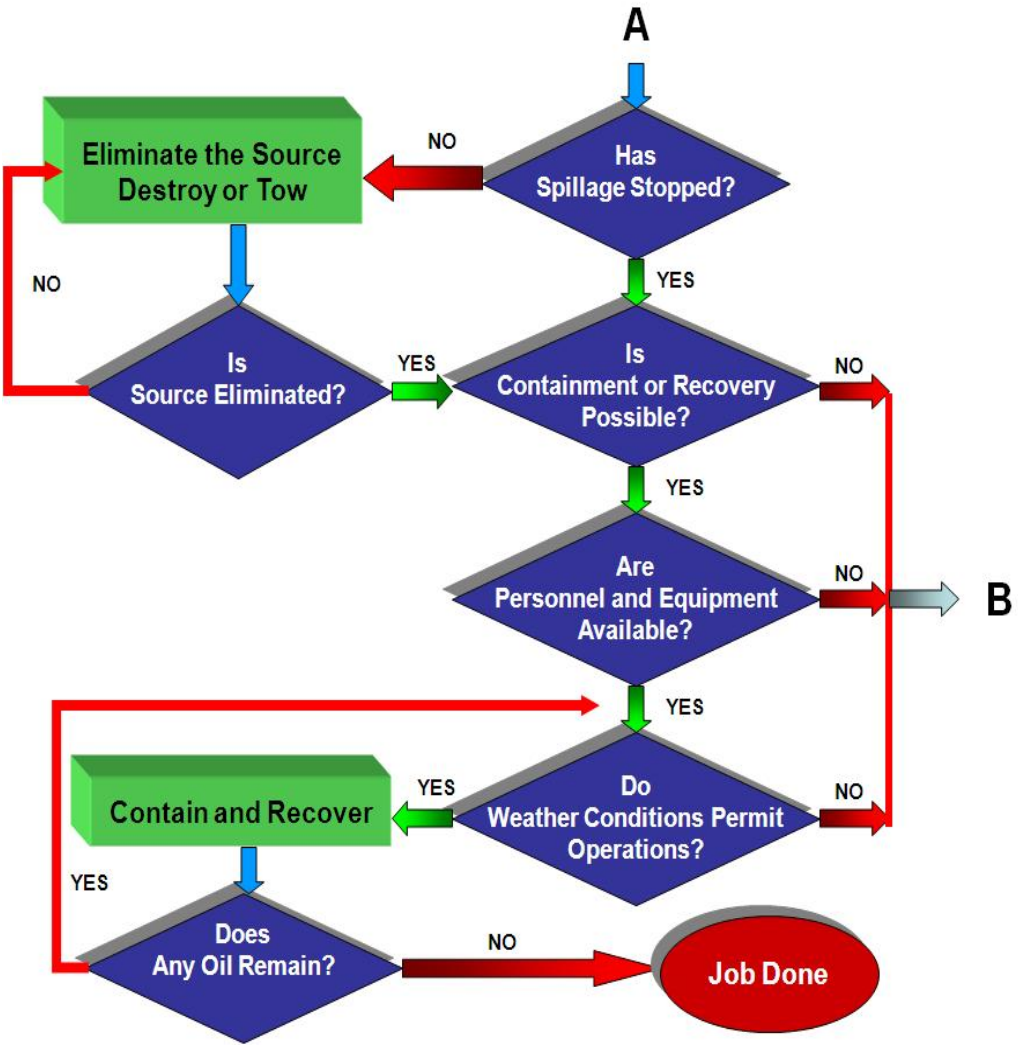


Figure 5.1B: Response Guide Flowchart

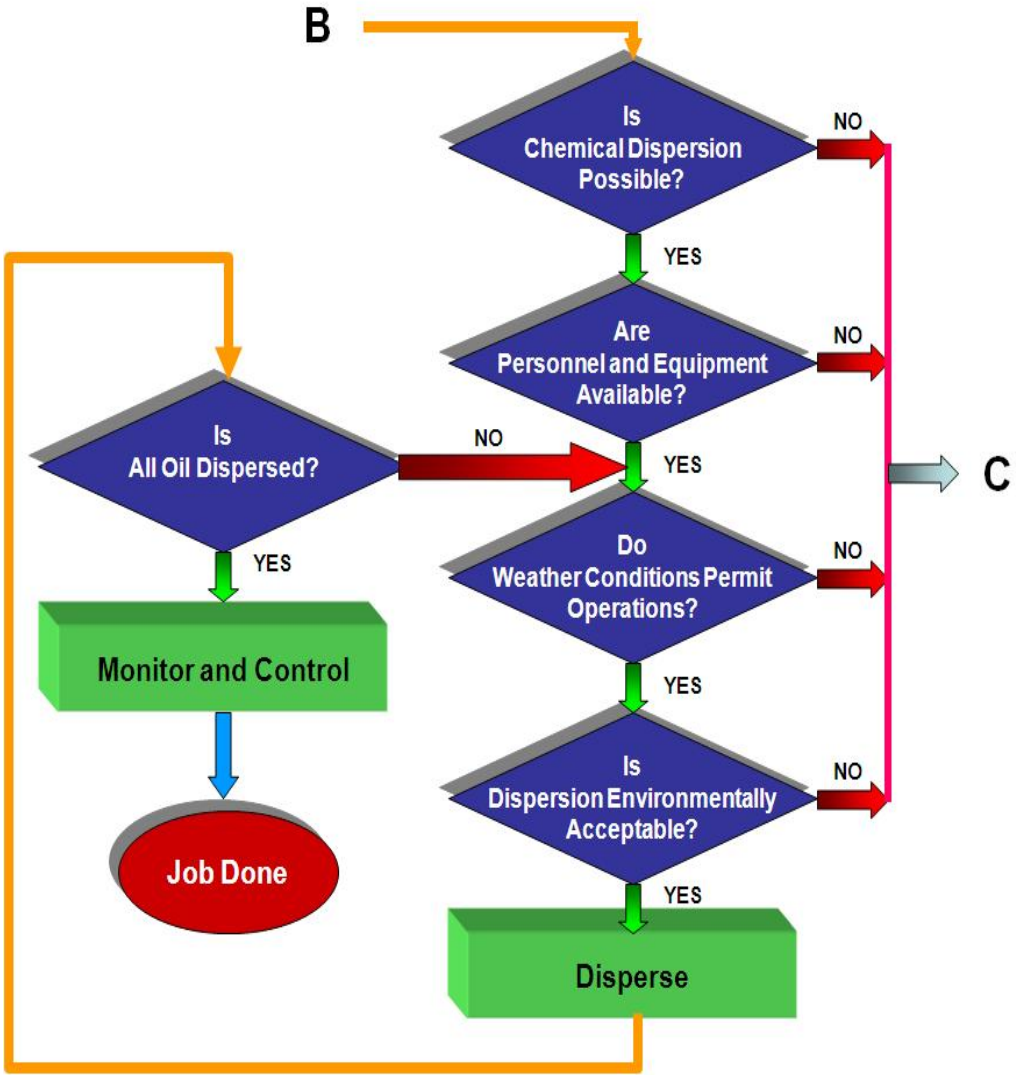


Figure 5.1C: Response Guide Flowchart

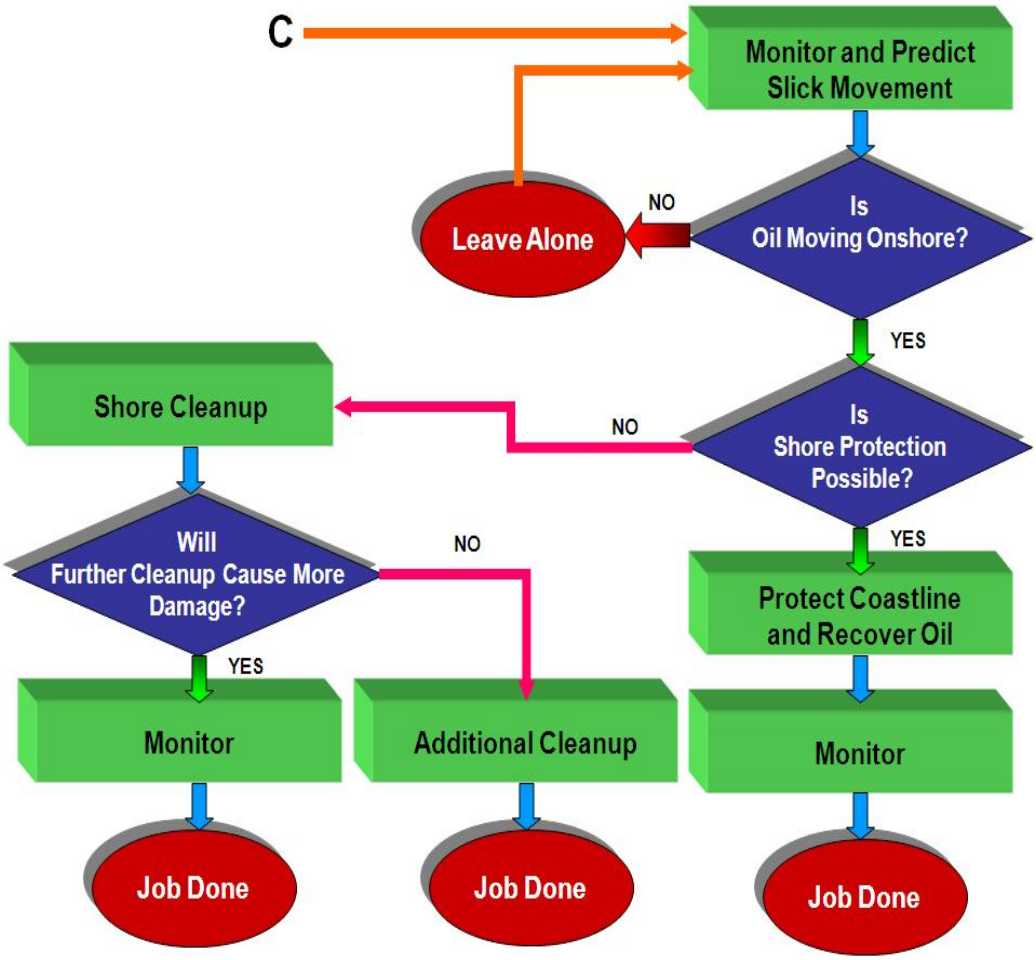


Figure 5.1D: Response Guide Flowchart

5.3. Action Checklists

Action Checklists have been compiled for key individual's in the EMT. These action checklists act as a quick reference for the key actions that should be taken by these key individuals during the initial stage of a response.

5.3.1. Spill Observer

SPILL OBSERVER	
Reports to: Dependent upon location of spill observer: **Onboard installation - Control Room and PIC** **Onboard Vessel – Vessel Master**	
Step	**Actions**

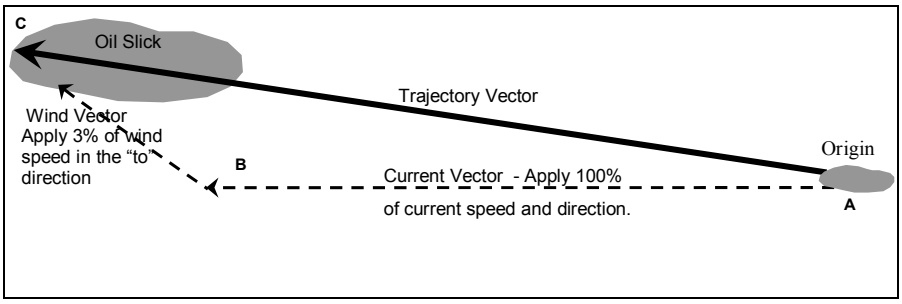
Initial Actions	❑ **ENSURE SAFETY IS FIRST PRIORITY**
	❑ Raise the alarm as soon as possible by verbal means e.g. radio or in person
	❑ Inform the installation Control Room / OIM / Vessel Master of the incident and provide as much information as possible:
	  ❑ Location of pollution incident.
	  ❑ Source of spill.
	  ❑ Extent of spill.
	  ❑ Time of incident.
	  ❑ Potentially hazardous situations/equipment.
	❑ If trained and safe to do so, take reasonable actions to stop the source of the spill until relieved by suitable/ competent individual.
	❑ If unsafe to remain at spill site, leave and instruct other personnel to evacuate the hazardous area.
	❑ Start a **Personal Log** and record time and details of own actions and own decisions.

Further Actions	❑ If safe to do so, continue monitoring the spill, keeping the **OSC** informed until the Damage Control Team arrives. ❑ Be prepared to direct the Damage Control Team to the spill. ❑ If trained and if required, assist the Damage Control Team.
Final Actions	❑ After the incident, take part in the debriefing ❑ Provide recommendations based on observations made during the response.

5.3.2. Offshore On-Scene Commander (OSC)

OFFSHORE ON-SCENE COMMANDER (OSC)	
Coordinates the tactical offshore oil spill response activities. **OIM/ Vessel Master assumes OSC position for spills in water.** **Reports to: Operations Chief.**	
Step	**Actions**

Initial Actions	❑ **ENSURE SAFETY IS FIRST PRIORITY**
	❑ OIM assumes role of **OSC** if spill enters water, regardless of size.
	❑ Make an initial assessment of the incident.
	  ❑ Spill source and cause
	  ❑ Type of hydrocarbon
	  ❑ Size and location
	  ❑ Injuries
	  ❑ Hazards
	❑ If the volume of condensate/ diesel/oil spilt is unknown, estimate the maximum volume which may have spilt and assume 'worst case scenario'
	❑ Mobilise the Damage Control Team, brief the team of the situation.
	❑ Start a Personal Log and record time and details of own actions and own decisions
	❑ Arrange for offshore oil samples to be collected and sent for analysis
	❑ Authenticate the reported emergency details by speaking with the original Observer and obtain full details of the incident
	❑ If the spill or leak is from a vessel, provide guidance to the Vessel Master on taking action to stop operations and move the vessel to safety
	❑ If the spill leak is from an onshore operation, cordon off the area (i.e. Port operations)
	❑ Decide on whether to discontinue or cease operations
	❑ Decide if there is a need to evacuate an area
	❑ For all spills immediately notify Incident Commander (verbally).
	  ❑ For Tier 1 spills send Initial Notification Form (**Appendix 4.0**, INF) within 1 hour.
	  ❑ For Tier 2/3 spills send INF followed by **POLREP** as soon as practicable.
	❑ For Tier 2/3 spills liaise with Operations Chief on additional actions and/or resources required, and the practical deployment of resources.

OFFSHORE ON-SCENE COMMANDER (OSC)	
Coordinates the tactical offshore oil spill response activities. **OIM/ Vessel Master assumes OSC position for spills in water.** **Reports to: Operations Chief.**	
Step	**Actions**
Initial Actions	❑ Identify tasks that must be performed to implement the initial strategy and identify task leaders for tactical response ❑ Agree a danger zone for the spill (i.e. a safe distance from the spill which the Damage Control Team must enforce). ❑ If necessary request a helicopter through the Operations Chief to provide aerial observation. Aerial surveillance will allow you to observe and record the size and location of the slick. ❑ The colour of the oil on water will indicate its thickness. Using the Bonn Agreement Oil Appearance Code (BAOAC, **Appendix 5.2 – Aerial Surveillance Form**) colour chart, calculate the volume of oil based on the area and colour of oil visible from the aerial observation. ❑ Once the scale and movement of the spill are known, and if required, request assistance from the field support vessels.  **Figure 5.2: Predicting movement of oil on water** ❑ Obtain information on tides & direction/speed of current and wind. ❑ Using the information on current and wind, predict the trajectory and speed of movement of the spill as illustrated in **Figure 5.2** above. ❑ Draw the slick on a chart (map) with co-ordinates, showing position and predicted movement of the oil. ❑ Notify Operations Chief via Situation Report (SITREP, **Appendix 4.9**).
Further Actions	❑ Request support/additional procurement of equipment, manpower and services via the Operations Chief. ❑ Maintain real time knowledge of the situation and continue to evaluate the spill. ❑ Keep the Operations Chief updated with the **SITREP** form. ❑ Prepare to meet and brief specialist response personnel if these have been mobilised.

OFFSHORE ON-SCENE COMMANDER (OSC)	
Coordinates the tactical offshore oil spill response activities. OIM/ Vessel Master assumes OSC position for spills in water. Reports to: Operations Chief.	
Step	**Actions**
Final Actions	❑ When safe to restart, approve restart of normal site operations ❑ Hold debrief for onsite personnel who were involved in the response ❑ Collate all information received and personal logs of actions taken ❑ Send logs of the incident and other relevant records to the Planning Chief.

5.3.3. Onshore On-Scene Commander (OSC)

ONSHORE ON-SCENE COMMANDER (OSC)	
Coordinates the tactical onshore oil spill response activities. **Pipeline Site Manager assumes OSC position for spills onshore and inland.** **Implementing and coordinating oil spill response activities on the shoreline in collaboration with local government authorities** **Reports to: Operations Chief.**	
Step	**Actions**

Initial Actions	❑ **ENSURE SAFETY IS FIRST PRIORITY**
	❑ Pipeline Site Manager assumes role of **OSC** if spill occurs at onshore and/or inland, regardless of size.
	❑ Make an initial assessment of the incident.
	  ❑ Spill source and cause
	  ❑ Type of hydrocarbon
	  ❑ Size and location
	  ❑ Injuries
	  ❑ Hazards
	❑ If the volume of oil spilt is unknown, estimate the maximum volume which may have spilt and assume 'worst case scenario'
	❑ Mobilise the Damage Control Team, brief the team of the situation.
	❑ Start a Personal Log and record time and details of own actions and own decisions
	❑ Arrange for onshore oil samples to be collected and sent for analysis
	❑ Authenticate the reported emergency details by speaking with the original Observer and obtain full details of the incident
	❑ If the spill leak is from an onshore operation, cordon off the area (i.e. POC)
	❑ Decide on whether to discontinue or cease operations
	❑ Decide if there is a need to evacuate an area
	❑ For all spills, immediately notify Incident Commander (verbally).
	  ❑ For Tier 1 spills send Initial Notification Form (**Appendix 4.0**, INF) within 1 hour.
	  ❑ For Tier 2/3 spills send INF followed by **POLREP** as soon as practicable.
	❑ For Tier 2/3 spills liaise with Operations Chief on additional actions and/or resources required, and the practical deployment of resources.
	❑ Identify tasks that must be performed to implement the initial strategy and identify task leaders for tactical response

ONSHORE ON-SCENE COMMANDER (OSC)	
Coordinates the tactical onshore oil spill response activities. **Pipeline Site Manager assumes OSC position for spills onshore and inland.** **Implementing and coordinating oil spill response activities on the shoreline in collaboration with local government authorities** **Reports to: Operations Chief.**	
Step	**Actions**
Initial Actions	❑ Agree a danger zone for the spill (i.e. a safe distance from the spill which the Damage Control Team must enforce). ❑ If necessary request a helicopter through the Operations Chief to provide aerial observation. Aerial surveillance will allow you to observe and record the size and location of the spill. ❑ Notify Operations Chief via Situation Report (SITREP, **Appendix 4.9**).
Further Actions	❑ Request support/additional procurement of equipment, manpower and services via the Operations Chief. ❑ Maintain real time knowledge of the situation and continue to evaluate the spill. ❑ Keep the Operations Chief updated with the **SITREP** form. ❑ Prepare to meet and brief specialist response personnel if these have been mobilised.
Final Actions	❑ When safe to restart, approve restart of normal site operations ❑ Hold debrief for onsite personnel who were involved in the response ❑ Collate all information received and personal logs of actions taken ❑ Send logs of the incident and other relevant records to the Planning Chief.

5.3.4. Incident Commander

INCIDENT COMMANDER	
Responsible for the overall management of the incident. **Establish response priorities (People, Environment, Asset & Reputation).** **Establish Incident Objectives, Strategy, and Tactical Direction.** **Establish the Termination Criteria in consultation with relevant authorities.** **Monitor scene safety.** **Establish and monitor incident organization adequacy.** **Conduct planning meetings and briefings, as required.** **Approve and authorize the implementation of an Incident Action Plan.** **Approve requests for additional resources or for the release of resources.** **Authorise the release of Holding Statement and draft Press Release.** **Reports to: Incident Commander (Kuala Lumpur)**	
Step	**Actions**
Initial Actions	❑ **ENSURE SAFETY IS FIRST PRIORITY** ❑ Following notification from **OSC**, discuss incident details and make an assessment of incident severity and collate all information received. ❑ For Tier 2/3 spills liaise with Operations Chief over requirement for additional resources to ensure optimal response. ❑ For all spills > 5bbls notify the Incident Commander in Kuala Lumpur verbally within 1 hour. ❑ Once a **POLREP** is received from the OSC and/ or sufficient information is available, ensure that appropriate Authorities are notified. ❑ Start a Personal Log and record time and details of own actions and decisions. ❑ Establish Incident Objectives, Strategy, and Tactical Direction. ❑ Establish the Termination Criteria in consultation with relevant authorities.
Further Actions	❑ Maintain close contact with the **OSC** via the Operations Chief and obtain regular updates regarding the situation at the spill site. Ensure adequate resources are available. ❑ In the event of Tier 2/ 3 spills, brief Head – MO for external communication with the relevant Authorities and receive regular briefings on same. ❑ Mobilise EMT and support groups as required (ensure roles adequately filled).

INCIDENT COMMANDER	
Responsible for the overall management of the incident. **Establish response priorities (People, Environment, Asset & Reputation).** **Establish Incident Objectives, Strategy, and Tactical Direction.** **Establish the Termination Criteria in consultation with relevant authorities.** **Monitor scene safety.** **Establish and monitor incident organization adequacy.** **Conduct planning meetings and briefings, as required.** **Approve and authorize the implementation of an Incident Action Plan.** **Approve requests for additional resources or for the release of resources.** **Authorise the release of Holding Statement and draft Press Release.** **Reports to: Incident Commander (Kuala Lumpur)**	
Step	**Actions**
Further Actions	❑ Provide initial briefing giving details of actions taken. ❑ Receive regular briefings from Chiefs in EMT. ❑ Provide Incident Commander in Kuala Lumpur with regular updates verbally and using **SITREP** forms. ❑ Discuss feedback/ guidance received to brief Chiefs in the EMT. ❑ In the event that Tier 3 resources are required, authorize procurement of OSRL services (refer to **Appendix 4.6 and 4.7**). ❑ In the event of a well blow-out, ensure regular updates received on capping/ relief well progress.
Final Actions	❑ Obtain approval from relevant authorities on incident close-out/termination. ❑ Conduct debrief session for EMT members who were involved in the response. ❑ Complete and hand-in Log to Planning Chief. ❑ Authorise final close-out report.

5.3.5. Operations Chief

OPERATIONS CHIEF	
Focal point for communications with OSC. **Responsible for managing all tactical operations and resources of the oil spill incident, which include:** • **Ground or surface-based tactical resources;** • **Aviation (Air) resources (i.e. helicopters and fixed-wing aircraft);** • **Staging Areas** **Reports to: Incident Commander**	
Step	**Actions**
Initial Actions	❑ **ENSURE SAFETY IS FIRST PRIORITY** ❑ After being notified of the incident, establish direct contact with the OSC to establish details. ❑ Collate all information received from the OSC. ❑ Liaise with the Incident Commander over the requirement for additional resources. ❑ Attend initial briefing. ❑ For Tier 2/3 spills, notify Logistics Chief and ensure that requirements for Staging Areas are made ready. ❑ Start a Personal Log and record time and details of own actions and decisions. ❑ If Tier 2 resources are required, coordinate with OSC, HSE & Liaison Officer and Logistics Chief to arrange mobilisation of own resources and request available external resources. ❑ In the event that Tier 3 resources may be required, coordinate with Logistics Chief to arrange resources from OSRL and for receiving the resources and transportation to the site.
Further Actions	❑ Maintain close contact with the OSC and obtain regular updates regarding the situation. ❑ Attend briefings and maintain regular contact with EMT (e.g. Planning and Logistics functions to ensure adequate provision of resources in line with Action Plan). ❑ Provide Incident Commander with regular updates (e.g. **SITREP**s). ❑ For Tier 2 incidents, continue to liaise with OSC, HSE & Liaison Officer and Logistics Chief and ensure that additional resources have been mobilised for Tier 2 support.

OPERATIONS CHIEF	
Focal point for communications with OSC. **Responsible for managing all tactical operations and resources of the oil spill incident, which include:** • **Ground or surface-based tactical resources;** • **Aviation (Air) resources (i.e. helicopters and fixed-wing aircraft);** • **Staging Areas** **Reports to: Incident Commander**	
Step	**Actions**
Further Actions	❑ Liaise with OSRL in the event that Tier 3 resources are required. ❑ Act as operational focal point to ensure that that all response resources (internal and external) are coordinated to provide an effective and efficient response in line with operational action plans.
Final Actions	❑ Attend debrief for onsite personnel who were involved in the response. ❑ Complete and hand-in Log to Planning Chief. ❑ Be prepared to provide input to the after action report.

5.3.6. Logistics Chief

LOGISTICS CHIEF	
Responsible for obtaining personnel, equipment, materials and supplies needed to mount and sustain emergency response operations and for providing services necessary to ensure that emergency response operations are carried out in a safe and efficient manner. **Reports to: Incident Commander**	
Step	**Actions**
Initial Actions	❑ **ENSURE SAFETY IS FIRST PRIORITY** ❑ On notification of the incident, report to the ECC ❑ Obtain briefing by Incident Commander ❑ Check Status Boards for the latest information, log arrival on the White Board in the ECC ❑ Start a Personal Log and record time and details of own actions and decisions and all own incoming/ outgoing calls. ❑ Confirm the initial incident severity classification, with the Incident Commander and Operations Chief. ❑ Place aerial surveillance helicopters and support vessels on standby ❑ Advise on the response equipment available ❑ Ensure early availability of MSDS Sheets ❑ Advise and coordinate the EMT on all logistical requirements ❑ Liaise with the Finance & HR Chief to coordinate actions and requirements for Oil Spill Responders i.e. accommodation and transportation, catering and medical services, and sanitation facilities.
Further Actions	❑ Establish a system for recording and tracking all equipment ❑ Establish a refuelling and maintenance schedule for equipment being used ❑ Establish necessary backup systems that can be used to support personnel affected by the incident and those in the response teams ❑ Coordinate Search and Rescue activities ❑ Request aircraft and observer for aerial surveillance activities or equipment transportation ❑ Assist the Planning Chief with the development of the site clean up and waste disposal plan
Further Actions	❑ Ensure all logistical support is provided, e.g. transport and support facilities for all response activities. ❑ Prepare for the potential arrival of Tier 3 equipment and personnel. ❑ Obtain data related with weather, wind, tide, current information, relay information to Planning Chief for oil spill modelling.

LOGISTICS CHIEF	
Responsible for obtaining personnel, equipment, materials and supplies needed to mount and sustain emergency response operations and for providing services necessary to ensure that emergency response operations are carried out in a safe and efficient manner. **Reports to: Incident Commander**	
Step	**Actions**
Final Actions	❑ Attend debrief for onsite personnel who were involved in the response. ❑ Complete and hand-in Log to Planning Chief. ❑ Be prepared to provide input to the after action report

5.3.7. HSE & Liaison Officer

HSE & LIAISON OFFICER	
Responsible to develop and recommend measures for ensuring that all activities in the response to the oil spill are carried out in a safe manner, minimising risk to personnel, the public and environment. **Assess and/or anticipate hazardous and unsafe situations.** **Reports to: Incident Commander**	
Step	**Actions**
Initial Actions	❑ **ENSURE SAFETY IS FIRST PRIORITY** ❑ Once notified by Incident Commander, report to ECC ❑ Obtain briefing by Incident Commander ❑ Check Status Boards for the latest information, log arrival on the White Board in the ECC ❑ Start a Personal Log and record time and details of own actions and decisions and all own incoming/outgoing calls. ❑ Obtain situation status information and response activities from Operations Chief, and collate all information received from the OSC.
Further Actions	❑ Attend Briefings and maintain contact with Chiefs in the EMT. ❑ Develop the site safety, first aid and medical evacuation plans. ❑ Coordinate medical support and provide advice on personnel safety and fire prevention. ❑ Coordinate regular site inspection of all operational sites for compliance with Health & Safety requirements. ❑ Liaise with OSC, Logistics Chief and Operations Chief to ensure that all operations are undertaken safely and within the requirements of applicable legislation.
Final Actions	❑ Attend debrief for onsite personnel who were involved in the response. ❑ Complete and hand-in Log to Planning Chief. ❑ Be prepared to provide input to the after action report

5.3.8. NOK & Media Officer

NOK & MEDIA Officer	
Responsible to develop and obtain approvals for releasing information to the media, to response teams and other appropriate agencies and organizations. **Assess and/or anticipate hazardous and unsafe situations.** **Reports to: Incident Commander**	
Step	**Actions**
Initial Actions	❑ **ENSURE SAFETY IS FIRST PRIORITY** ❑ Once notified by Incident Commander, report to ECC ❑ Obtain briefing by Incident Commander ❑ Check Status Boards for the latest information, log arrival on the White Board in the ECC ❑ Start a Personal Log and record time and details of own actions and decisions and all own incoming/outgoing calls. ❑ Obtain situation status information and response activities from Chiefs in the EMT, and collate all information received from the OSC. ❑ Monitor media coverage of the incident and develop press strategy accordingly with assistance from ECC HQ. ❑ Notify PCSB HQ Incident Commander upon approval by the IC. ❑ **THE POLREP MUST BE SENT WITHOUT DELAY EVEN IF INCOMPLETE** ❑ Missing information can be transferred in a Situation Report Form at a later stage.
Further Actions	❑ Maintain close dialogue with local communities and authorities to disseminate and gather information. ❑ Engage with local communities to seek their involvement and assistance in cleanup activities. ❑ Keep Incident Commander updated of developments and media reports. ❑ Prepares draft press statements for endorsement by IC and approval by HQ. ❑ Set up a Media Centre to respond to media enquiries. ❑ Maintain close contact with the PETRONAS Regional Office and provide updates in status on a regular basis. ❑ Attend briefings and maintain contact with Coordinators
Final Actions	❑ Attend debrief for onsite personnel who were involved in the response. ❑ Complete and hand-in Log to Planning Chief. ❑ Be prepared to provide input to the after action report

5.3.9. Planning Chief

PLANNING CHIEF	
Responsible for all matters related to technical and information support. Coordinates, supervise and organize technical specialist supports. **Maintains an accurate timed log of events, instructions and communications.** **Reports to: Incident Commander**	
Step	**Actions**
Initial Actions	❑ **ENSURE SAFETY IS FIRST PRIORITY** ❑ Attend initial briefing by Incident Commander. ❑ Ensure that the ECC is set up properly and that appropriate equipment and supplies are in place. ❑ Start to collect, analyse information and ensure that information regarding the emergency situation and location of critical resources is displayed at the event boards ❑ Start a Personal Log or equivalent and record time and details of own actions and decisions.
Further Actions	❑ Ensure proper and effective log keeping is maintained by members of the EMT ❑ Ensure that status boards are kept current, neat and legible. ❑ Support Incident Commander in delivery of regular incident briefings. ❑ Maintain contact with EMT Coordinators to ensure that all significant events and issues are recorded. ❑ Provide Incident Commander and members of the EMT regular updates ❑ Recommend (as required) the activation of support teams in anticipation of or immediately following an incident or emergency. (e.g. environmental team, medical team, shoreline assessment team, dispersant application team). ❑ Prepare and disseminate Oil Spill Response Strategy, Objectives and Action Plan ❑ Ensure that worksites activities are integrated into the overall planning process.
Final Actions	❑ Attend debrief and provide support for incident investigation ❑ Complete and hand-in Log to Computer Operator ❑ Be prepared to provide input to the after action report

5.3.10. Finance and HR Chief

FINANCE AND HR CHIEF	
Manages all financial aspects of an incident. **Ensures accurate recording of daily personnel time.** **Managing all financial matters pertaining to vendor contracts, leases, and fiscal agreements.** **Establishes local sources for equipment and supplies, rental agreements, and document billing invoices.** **Maintains an accurate time log of events, instructions and communications.** **Administers all claims for compensation and injuries, including medical claims.** **Provides cost analysis and maintains accurate records of incident cost.** **Reports to: Incident Commander**	
Step	**Actions**
Initial Actions	❑ **ENSURE SAFETY IS FIRST PRIORITY** ❑ Attend initial briefing by Incident Commander. ❑ Ensure that the ECC is set up properly and that appropriate equipment and supplies are in place. ❑ Start to collect, analyse information and ensure that information regarding the emergency situation and location of critical resources is displayed at the event boards ❑ Start a Personal Log or equivalent and record time and details of own actions and decisions.
Further Actions	❑ Ensure proper and effective log keeping is maintained by members of the EMT ❑ Ensure that status boards are kept current, neat and legible. ❑ Support Incident Commander in delivery of regular incident briefings. ❑ Maintain contact with EMT Chiefs to ensure that all significant events and issues are recorded. ❑ Provide Incident Commander and members of the EMT regular updates. ❑ Monitor and records all expenses of all resources deployed for the cleanup operations and prepares expense reports ❑ Monitor timeliness and accuracy of personnel documentation and financial records. ❑ Arrange adequate facilities for labor force (shelter, toilet, catering) ❑ Establish sources for equipment supplies and rentals and maintain agreements.

FINANCE AND HR CHIEF	
Manages all financial aspects of an incident. **Ensures accurate recording of daily personnel time.** **Managing all financial matters pertaining to vendor contracts, leases, and fiscal agreements.** **Establishes local sources for equipment and supplies, rental agreements, and document billing invoices.** **Maintains an accurate time log of events, instructions and communications.** **Administers all claims for compensation and injuries, including medical claims.** **Provides cost analysis and maintains accurate records of incident cost.** **Reports to: Incident Commander**	
Final Actions	❑ Attend debrief and provide support for incident investigation ❑ Complete and hand-in Log to Planning Chief. ❑ Be prepared to provide input to the after action report

5.3.11. Computer Operator

COMPUTER OPERATOR	
Responsible for maintaining an accurate written record of all the information and actions carried out by the EMT within the ECC. Planning Chief to assign this role from available resources. **Reports to: Planning Chief**	
Step	**Actions**
Initial Actions	❑ On notification of the incident report to the ECC and log arrival ❑ Obtain briefing by Incident Commander ❑ Switch on computer and start Event Log Sheet Excel file. ❑ Update Event Log Sheet with the latest information (ensuring information is current, neat and legible) ❑ Maintain a dated and timed record of EMT information, actions and communications
Further Actions	❑ Liaise with Planning Chief and other Section Chiefs and update Status Boards ❑ Commence a time record for key information about the incident including: • Record the EMT members present • Record the latest status on the Status Board • Record actions to be taken ❑ Record Briefings and Time Outs
Final Actions	❑ Attend debrief and provide support for incident investigation ❑ Collate all personal logs ready for incident review and provide to Incident Commander.

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6. Training, Exercises and Review

6.1. Training

PCML personnel will receive training relating to the current OSRP through a Plan Roll-Out Workshop. Specific operator training in the use of oil spill response equipment will be provided.

The International Maritime Organisation (IMO) and PIMMAG provide details of recommended training courses (**Appendix 6.1)**.

PCML shall ensure that the key individuals identified in this OSRP are trained appropriately. An overview of the training required is summarised below in **Table 6.1**.

Table 6.1: Level of Training Required for PCML personnel

Emergency Response Role / Job Title	Course Standard		
	IMO Level 3	IMO Level 2	IMO Level 1
Senior Manager & All PCML EMT	✓		
HSE Staff	✓	✓	
Managers including OIMs, PSM and Drilling Supervisor		✓	✓
Damage Control Team (DCT)			✓

A database will be maintained containing a record, for all company personnel who have attended oil spill response training (or participated in oil spill response exercises) – refer to **Appendix 6.2**.

In addition, volunteers and contractors' workers shall be provided with appropriate briefing/training prior to undertaking designated activities as part of the overall spill response that they are suitably trained. For example, sufficient volunteers and contractors' workers should be trained in dispersant spraying, and the deployment of booms and skimmers from vessels.

6.2. Exercises

The purpose of exercises is to improve responder's skills and maintaining their awareness. Exercises will also provide management with an opportunity to assess equipment, familiarise personnel with their roles and responsibilities, measure performance, obtain feedback from participants and give a clear message about the company's commitment to oil spill preparedness and response. Any feedback or lessons learnt from oil spill exercises are compiled and analysed by the HSE Department for the response plan improvement.

Table 6.2 provides an overview of the different types of exercises recommended.

A record of training and exercises undertaken will be maintained (**Appendix 6.2**). The training database will be updated with the most current information and relevant personnel will be notified of their training requirements. Any feedback or lessons learnt from oil spill exercises are compiled and analysed by the HSE Department for the response plan improvement.

Table 6.2: Overview of Exercises

Exercise	Description	Frequency
Oil Spill Contingency Plan Workshop	• Familiarisation of staff with roles, procedures and responsibilities; • Review of each section of the plan by encouraging discussion to make useful and practical improvements to the plan.	Yearly
Notification	• Practice of the procedures to alert and call out the emergency management teams; • Conducted telephone or radio test, depending on the source of initial oil spill report; • Test communications systems, availability of personnel, travel options and ability to transmit information quickly and accurately. Duration: 1-2 hours, held at any time of the day or night.	Weekly Weekly Communications test once a month.
Tabletop	• Simulated oil spill incident to test teamwork, decision-making and procedures; • Planning of a realistic scenario, clearly defined objectives for participants, exercise inputs, and a well briefed team in control of the running and debriefing of the exercise. Duration: 2-8 hours.	Yearly
Equipment Deployment **Offshore and Shoreline Oil Recovery Equipment**	• Designed to give personnel a chance to become familiar with equipment, or part of a detailed and specific emergency response scenario, where maps, messages, real-time weather and other factors can be included; • Test / evaluation of the capability of equipment, personnel or functional teams within the wider oil spill response; • Verification of availability of oil spill response equipment and its working order; • Level of difficulty can be varied by increasing the pace of the simulation or by increasing the complexity of the decision-making and co-ordination needs. Duration: 1 day.	As and when required

6.3. Review

A full review shall be conducted every three years. The recommendation arising from the review shall be submitted to PCML Management for approval.

In line with PCSB HSEMS, the review will cover wholly or any parts of the PCML Oil Spill Response Plan.

6.3.1. Annual Preparedness Review (APR)

The purpose of this review is to assess the level of preparedness in responding to oil spill incident. The review shall be carried out at least once every year.

6.3.2. Management Review

The purpose of the review is to assess the overall effectiveness and adequacy of the PCML Oil Spill Response Plan. The management review shall be carried out yearly by the MO – HSE Committee (MOHSEC). Findings and recommendations shall be presented to the MO Management Committee (MOMC) for approval.

Appendix 4

PCMI Waste Management Plan

PETRONAS Carigali Myanmar Inc.

WASTE MANAGEMENT PLAN

Onshore Drilling Activities

Block IOR-7

Prepared by

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Contents

LIST OF ACRONYMS

ADR	International Carriage of Dangerous Goods by Road
CCU	Cargo Container Unit
IFC	International Finance Corporation
LoW	List of Waste
PPE	Personal Protective Equipment
WEEE	Waste Electrical and Electronic Equipment
WFD	Waste Framework Directive
WMP	Waste Management Plan
WSA	Waste Storage Areas
WTM	Waste Manifest

DEFINITIONS

Waste Manifest: document to be issued prior to waste transportation. It describes the wastes, conditions, quantities and shall be issued for each back loading, in order to allow the adequate tracking of the wastes, from the site to the waste management facility.

Container: any device such as drums, feed, plastic tanks etc. used to contain wastes.

Discharge: any controlled and regulated release of wastewater or liquid waste to surface water bodies.

Disposal: any waste management operation different from reuse, recycling, treatment and discharge, even where the operation has, as a secondary consequence, the reclamation of substance or energy.

Inert Waste: waste is considered inter if it does not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health.

Operator: any company subsidiary or affiliate that operates in a country under specific permit/license/PSA.

Treatment: Any operation, including reprocessing, that makes the waste suitable for recycling or disposal by reducing its contaminant load and/or changing its chemical-physical properties.

Recycling: Any operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes

Reuse: Any operation by which (residual) products or components that are not waste are used again for the original or other purposes without reprocessing.

Waste: A waste is any solid, liquid, or contained gaseous material that is being discarded by disposal, recycling, burning or incineration. It can be byproduct of a manufacturing process or an obsolete commercial product that can no longer be used for intended purpose and requires disposal.

Wastewater Management: Wastewater management includes water conservation, wastewater treatment, stormwater management, and wastewater and water quality monitoring.

Solid Waste: Solid (non-hazardous) wastes generally include any garbage, refuse. Examples of such waste include domestic trash and garbage; inert construction / demolition materials; refuse, such as metal scrap and empty containers (except those previously used to contain hazardous materials which should, in principle, be managed as a hazardous waste); and residual waste from industrial operations, such as boiler slag, clinker, and fly ash.

Hazardous Waste: Hazardous waste shares the properties of a hazardous material (e.g. ignitability, corrosivity, reactivity, or toxicity), or other physical, chemical, or biological characteristics that may pose a potential risk to human health or the environment if improperly managed. Wastes may also be defined as “hazardous” by local regulations or international conventions, based on the origin of the waste and its inclusion on hazardous waste lists, or based on its characteristics. Sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial operations needs to be evaluated on a case-by-case basis to establish whether it constitutes a hazardous or a non-hazardous waste.

1 INTRODUCTION

The WMP includes the requirements for the management, removal and disposal of all waste generated during PCMI drilling activities and provides the following information:

- a framework of the relevant legislation related to the waste management;
- a list of the types and quantities of wastes potentially produced and a list of the sources of each type of waste;
- a description of the proposed management procedures for the transport, treatment, removal and/or disposal of the produced wastes;
- the identification of the licensed waste management Contractor appointed for the waste management activities.

This document includes the most updated project data and information, with particular reference to:

- waste types and methods proposed for their management by the waste Contractor;
- registered quantities for wastes produced during the drilling operations;
- roles and responsibilities of the personnel appointed for the waste management and the documentation for the tracking of waste produced.

1.1 PURPOSE AND SCOPE OF THE WMP

This WMP is designed for use in all activities associated with this drilling project.

The target users of this Plan are the drilling field personnel (drilling storage, camp, etc.), who will be responsible for the actual handling and management of wastes generated from project activities.

This Plan applies to all sectors and activities related to the drilling operations for Block IOR-7, throughout all operations and includes:

- collection, handling and temporary storage of wastes; and
- management and transportation to treatment/disposal of the waste at authorized facilities.

The main objective of this Plan is to define the management procedures of the waste produced during the activities performed in Block IOR-7, Myanmar, in compliance with the national and international standards and guidelines presented in the following sections.

1.2 WASTE SITE SCREENING & SELECTION

Based on a review of available documents, discussions with knowledgeable Myanmar waste management authorities, and visits to local and urban waste management sites it has been determined that the DOWA Waste Management Facility is the only site in Myanmar designed according to international standard (US EPA) for non-hazardous and hazardous wastes. Details of sites screened are provided in Appendix A (Table A.1).

The DOWA Commercial waste management facilities strive to minimize waste through recycling and reuse. The remaining wastes are treated as applicable to eliminate any potential hazards to human health or the environment. The final disposition of unusable materials is prepared for permanent disposal with appropriate monitoring for potential hazards escaping into the environment.

A goal of this Plan is to use waste facilities that utilize these waste minimization methods and the treatment. Disposal of the wastes generated by the planned drilling activities will be dealt with by licensed DOWA waste management facilities at the Thilawa SEZ.

1.3 REVIEW AND UPDATE OF THE WMP

This Waste Management Plan is intended to provide general guidance for various work activities and consequently it may need to be updated periodically. The Plan may need to be revised when there are changes in the waste streams generated or changes in the treatment/disposed options available. The Plan will therefore be revised as appropriate prior to the start of each onshore drilling campaign.

2 LEGAL FRAMEWORK, POLICIES AND STANDARDS

The section provides a description of the legal framework relevant to the management of the wastes produced during drilling activities.

2.1 INTERNATIONAL CONVENTIONS AND AGREEMENTS

Basel Convention: The Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was adopted on 22nd March 1989 by the Conference of Plenipotentiaries in Basel, Switzerland. The overarching objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes. The provisions of the Convention center around the following principal aims:

- the reduction of hazardous waste generation and the promotion of environmentally sound management of hazardous wastes, wherever the place of disposal;
- the restriction of transboundary movements of hazardous wastes except where it is perceived to be in accordance with the principles of environmentally sound management;
- a regulatory system applying to cases where transboundary movements are permissible.

2.2 MYANMAR LAWS AND REGULATIONS

The Ministry of Natural Resources and Environmental Conservation is the main institutional body responsible for setting a framework for waste management at the national level. Similarly, all major cities across Myanmar are administrated by City Development Committees that are responsible for providing municipal waste management services.

2.2.1 Existing policy and regulations

Existing Laws and Regulations are as follows:

National Level

- National Government Policy (1994)
- Environmental Conversation Law (March, 2012)
- Environmental Conservation Rules (June 2014)
- Environmental Impact Assessment procedures (Dec, 2015)
- National Environmental Quality and Emissions Guidelines (Dec, 2015)
- Hazardous Waste Notification (Draft 2016)
- Factories Act (1951)
- Public Health Law (1972)

Yangon

- The Yangon Civil Development Law 2013
- The City of Yangon Development Law (1990)
- The Underground Water Act (1930)
- The Water Power Act (1927)
- The City of Yangon Municipal Act (1922)

- The Yangon Water-work Act (1885)

In addition, City and Township Development Committees promulgated the solid waste disposal and collection by-law providing the legal basis at the local level.

For the Magway Regional Level, there is the "Magway Region Municipal Act" which is concerned with the whole region.

There are 25 townships under the Magway Region. For each township, for instance Magway Township, there are local by-laws specific to Magway town. These by-laws are based on the township level situation. Thus the by-laws are different between each township.

2.3 STANDARDS AND GUIDELINES

The following Standards and Guidelines are to be considered:

- ISO 14001:2015, Environmental Management Systems - Requirements with Guidance for use;
- International Finance Corporation (IFC), General Environmental, Health, and Safety General Guide-lines, 2007;
- International Finance Corporation (IFC) Environmental, Health, And Safety Guidelines For Onshore Oil And Gas Development, 2017;
- International Finance Corporation (IFC) Environmental, Health, And Safety Guidelines For Offshore Oil And Gas Development, 2015.

3 WASTE MANAGEMENT PRINCIPLES

The Drilling Contractor will be responsible for waste management during the drilling program, and will be required to be in compliance with the local legislation and Environmental Management and Monitoring Plan (EMMP). PCMI will regularly conduct inspections and audits during operations to ensure compliance to contract requirements. .

3.1 GENERAL WASTE MANAGEMENT PRINCIPLES

The following guidance applies to the management of nonhazardous and hazardous waste. Waste management should be addressed through a Waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring.

IFC (2007) notes that Facilities that generate and store wastes should practice the following:

- Establishing waste management priorities at the outset of activities based on an understanding of potential Environmental, Health, and Safety (EHS) risks and impacts and considering waste generation and its consequences.
- Establishing a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes.
- Avoiding or minimizing the generation waste materials, as far as practicable.
- Where waste generation cannot be avoided but has been minimized, recovering and reusing waste.
- Where waste cannot be recovered or reused, treating, destroying, and disposing of it in an environ-mentally sound manner.

The waste management hierarchy below considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes:

- prevention (don't generate waste);
- reduction (generate less waste by better management and by material substitution);
- reuse (reuse in its original form);
- recovery (extract material or energy from a waste);
- recycle (recycle and reprocess the waste to incorporate it into a new product or new use);
- disposal (mitigate the hazard through treatment, relocate the waste to another location).

Efforts should be made to eliminate, reduce or recycle wastes at all times, in line with the waste hierarchy. At a minimum, the waste materials should be segregated into non-hazardous and hazardous wastes for consideration for reuse, recycling, or disposal.

Waste management planning should establish a clear strategy for wastes that will be generated including options for waste elimination, reduction or recycling or treatment and disposal, before any wastes are generated.

3.2 WASTE MANAGEMENT AND MINIMISATION PLAN

Waste minimization practices are to be applied to all types of waste. In addition, the conservation of re-sources (energy, water, gas, and fuel) will be addressed. The waste minimization plan is one part in the overall programme of responsible waste management.

Waste minimization includes reduction and control at source, reuse, recycling and recover. It does not include the treatment or disposal of waste. Waste minimization focuses on preventing the generation of waste and, where this is not possible, reusing waste.

Waste will be reduced at source through management measures such as product substitution (e.g. for toxicity reduction) and product conservation i.e. working efficiently to avoid the generation of waste. Waste will also be controlled through good operating practices i.e. equipment maintenance, spill prevention, routine crew inspections, improved 'housekeeping', and inventory control.

Waste management involves the reuse of waste in place of new products where quality of services and products will not be an issue and also the recycling of waste.

3.3 WASTE AUDITS

Waste audits will be conducted by PCMI as part of the site HSE audit and inspection for the purpose of identification and proper disposal of all waste. PCMI will conduct the audit program and use it as a tool for training employees in waste minimization and management techniques.

3.4 TRAINING

All contractor personnel will be trained on the PCMI Waste Management Plan, so they can be-come familiar with the reporting procedures and the entities involved in the management of the wastes derived by the drilling activities. Training of personnel will take place at the following frequency:

- New Personnel will be initially trained to ensure familiarity with the Waste Management Plan prior to beginning their job assignments (applicable to all shift changes);
- Specific training will be provided for the management of hazardous wastes;
- Refresher training will be conducted whenever there are inadequacies in management of waste (classification, storage, handing) or when deviations from the Waste Management Plan are observed.

3.5 DUE DILIGENCE

Steps toward the establishment of due diligence includes:

- Regular performance of environmental audits or inspections
- The establishment of periodic exercising of contingency plans
- Knowledge and compliance with applicable legislation
- Employee/contractor training
- Establishing and maintaining codes and operating procedures, and
- Maintaining detailed records and inventories

4 WASTE DESCRIPTION, CLASSIFICATION & DISPOSAL METHODS

4.1 CHARACTERIZATION

Characterization identifies the waste's physical, chemical and toxicological characteristics which provides information for the waste classification as per regulatory requirements. In general these properties include:

1. pH
2. Vapour Pressure
3. Flammability and Ignitability
4. Combustibility (Oxidizing)
5. Toxicity – LD50 (Lethal Dose of waste which causes death in 50% of test population) and LC50 (Lethal Concentration of waste which causes death in 50% of test population).
6. Radioactivity
7. Phase – solid, liquid, gas
8. Volume

4.2 CLASSIFICATION

Emissions, discharges and waste generation will conform to applicable government regulations in Myanmar.

Wastes are classified as:

- Air emissions;
- Wastewater (effluent);
- Hazardous waste (e.g., chemical waste, waste oil etc.); and
- Non-hazardous solid waste (e.g., wood, paper, steel, food waste etc.).
- Drilling Mud and Cuttings
- Fluids Produced from the Separators During Drilling and Testing

4.3 AIR EMISSIONS

The air emissions from the well site would be from the following sources:

1. Dust
2. Diesel Combustion
3. Flaring

4.3.1 Dust

During construction and upgrading of access roads and well site construction, the principle air quality issue will be control of dust. Standard operating procedures require the civil engineer contractor to ensure daily sprinkling of water on all non-sealed surfaces to subdue the amount of dust and to restrict speed of traffic on portions of the road that have not yet been sealed. Daily

consultations by the construction contractor with the local villages will ensure that any significant problems are identified and resolved.

The handling and storage of bulk drilling mud additives, including barite, bentonite, calcium carbonate and cement powder will result in relatively minor fugitive dust emissions. Any emissions will be reduced significantly by the standard procedure of equipping all silos with bag filters.

$$8\ m^3/d \times 1{,}000\ L/m^3 \times 0.002705\ tC/L$$

The following equation is used to estimate GHG emissions from fuel use:

$$CO_2\ Emission\ (kg) = Fuel\ Consumption\ (TJ)\ x\ Fuel\ Emission\ Factor\ (kgCO_2 / TJ)$$

where

CO_2 Fuel consumption = diesel use (L) x diesel density (0.8397 kg/L1) x 10^{-6} Gg/kg x 43.33 (TJ/Gg) x 10^{-3} (tonne/kg)

Default Fuel Emission Factor = 74,346.6 kg CO_2 eq/TJ (Table 1)

resulting in

$$CO_2\ Emission\ (tonnes\ CO_2) = Diesel\ Use\ (L)\ \ x\ 0.002705\ (tonneCO_2 / L)$$ ***Eq.1***

Table 1: Emission Factor for Fuel Use by Generators (Stationary Combustion)

Types	Unit	CH4	N2O	CO2	Total
Diesel	kg/TJ	3	0.6	74,100	
	kg CO2 eq*/TJ	69	177.6	74,100	74,346.6

Source: IPCC (2006)

* Global warming potentials (100 year time horizon): CO2 = 1; CH4 = 23; N2O = 296

4.3.2 Flaring

If it is decided to test the well (DST or LPT), a significant quantity of gas could be flared. The actual flow rate of the reservoir at this location is a parameter, which the drilling of the well is intended to determine.

The rate of gas production will range between 0-30 mmscfgd (30 mmscfgd being the maximum handling of the rig's processing equipment). If a DST found less than 5 mmscfgd an LTP test would unlikely proceed. If an LTP test is to proceed, the drilling rig would be demobed and a smaller well testing package brought in to conduct the LTP test. During an LPT test flaring would be conducted at various rates and sustained rates combined with shutin's to observe pressure build ups and flowed again. The data gathered is used to establish reservoir characteristics. The maximum flow during an LPT tests generally never exceed 10 mmscfgd. Thus a worst case scenario flaring is a sustained flow rate of 10 mmscfgd for 22 days.

Emissions from flaring are estimated as 687 tCO2/d for average gas flow production rate of 10 mmscfgd and as 2,061 tCO2/d for a maximum 30 mmscfgd.

Based on official energy statistics from the US, flaring of 10 mmscfd (average gas flow rate) would translate into 687 tCO2/d:

CO2 Gas flaring (kg CO2 eq /d) = 10 mmscf/d x 0.028317 x 106 m^3/mmscf x 0.9 kg/m^3 x 48 TJ/Gg x 10 6 Gg/kg x 56,152.6 kg CO2 eq/TJ (Table 6 2)

Table 2: Emission Factor for Natural Gas

Types	Unit	CH_4	N_2O	CO_2	Total
Natural gas	kg/TJ	1	0.1	56,100	
	kg CO_2 eq*/TJ	23	29.6	56,100	56,152.6

Source: IPCC (2006)

* Global warming potentials (100 year time horizon): CO2 = 1; CH4 = 23; N2O = 296

4.3.4 Total CO2 Emissions

This project is estimated to generate a maximum of 16,259 tonnes of CO2 equivalent per well based on 53 days of drilling and 22 days of flaring **(**Table 3), for a total of 32,518 tonnes of CO2 equivalent for the two planned wells (not including contingency wells). Air emissions and their impacts are discussed in the Impact Assessment chapter.

Table 3: Total Estimated Air Emissions Per Well

Equipment / Emission	Value
Diesel Combustion	21.6 x 53 = 1,145 tCO_2
Flaring	687 x 22 = 15,114 tCO_2
Total Carbon Dioxide (CO_2)	16,259 tCO_2

4.4 WASTEWATER (EFFLUENT)

4.4.1 Waste Water and Sewage

The waste water and sewage will be collected in a concrete-lined closed sewage tank with a capacity of 8 m^3 (8,000 litres) and equipped with degreasers to reduce the organic load. It is estimated that some 3-4 m^3 (3,000 to 4,000 litres) of combined sewage and waste water will be produced each day during maximum manned operations. The sites grey water to be discharged to an infiltration field if site conditions allow for the proper installation of an infiltration field.

The design of the disposal of the clarified outflow will consider specific techniques, such as sub-irrigation, if site conditions allow. The septic tank(s) will be:

- properly designed to treat the estimated maximum daily rate of wastewater and installed in accordance with local regulations and guidance to prevent any hazard to public health or contamination of land, surface or groundwater;

- well maintained to allow effective operation;
- installed in areas of stable soils that are nearly level, well drained, and permeable, with enough separation between the drain field and the groundwater table or other receiving waters.

Septic storage tanks will be located away from areas with a high water table (i.e. floodplain areas) or from water abstraction wells.

The settled sludge in the septic tank will be vacuumed out by tanker trucks as required and the contents sent by the waste transporter to the DOWA licensed waste treatment site. At the end of operations during closure of the camp the septic storage tank and its contents on site will be removed and sent for disposal at the DOWA licensed facility.

4.5 NON-HAZARDOUS WASTE

Both the well site and the accommodation camp site will generate non-hazardous waste daily, consisting of "domestic" garbage such as food scraps, plastic packaging, paper, cardboard, tin cans and glass. In addition there will be "industrial" waste such as wooden cases, large glass containers, ferrous and non-ferrous metal items, plastic and metal drums and containers, plastic and cardboard packaging.

General waste will be separated on-site to facilitate recycling. Domestic and general waste should be segregated and stored using suitability labeled containers to ensure safe collection segregation and handling of all waste streams generated. This waste will be stored in appropriate containers to be transported off site for recycling, reuse, treatment and/or disposal.

It is estimated that the well site will generate between 1 and 10 tonnes of "domestic" waste and 1 to 40 tonnes of "industrial" waste per month. It is estimated that the accommodation camp site will generate between 1 and 4 tonnes of "domestic" waste per month.

All solid general waste will be sent for recycling or disposal to at the DOWA Waste Management Facility.

4.5.1 Specific Non Hazardous Wastes Include

Mixed Metals, scrap metal and empty metal drums

Includes:

- any metallic non-contaminated materials (parts, pipes, etc.) used at all stages of drilling activities. These wastes will require specific segregation and disposal techniques;
- scrap metal may include sheet metal, piping, used casings and tubulars, electrical cables and other wire, empty drums/containers, pump housings, valves, fittings, used process equipment and vehicle parts discarded;

- metal containers are used for a wide range of uses throughout the activities. A container is considered empty if all material has been removed that can be removed using the removal practices commonly employed for that type of container (e.g., pouring, pumping, aspirating). To the extent possible, the empty container should be dry and decontaminated. Containers that contain quantities of residues will be managed based on the characteristics of the contained material.
- aluminium food containers

This waste can be sorted into recyclable and non-recyclable materials.

Mixed waste (paper, plastic, wood) and plastics

This includes discarded items such as plastic water bottles, plastics, cooking and & motor oil containers, from several areas including kitchens and dining areas, bathrooms, laundry, offices, warehouses, etc.

These wastes can be sorted into recyclable and non-recyclable materials.

Wood Packaging

Wood Packaging includes any wooden packaging materials (wooden pallets, boxes, etc.) used at all stages of drilling activities. These wastes will require specific segregation and disposal techniques.

The waste will be sorted into recyclable and non-recyclable materials.

Paper and Cardboard

Includes any paper and carton packages (carton boxes, etc.) used at all stages of drilling activities. These wastes will require specific segregation and disposal techniques.

The waste can be sorted into recyclable and non-recyclable materials.

Domestic wastes

Domestic wastes are the kitchen garbage and non-biodegradable fraction of the waste produced by the human activities connected to the Catering Department. including plastic packaging, paper products, bottles, etc.

These wastes can be sorted and recycled where possible.

Organic Food Waste

Includes Biodegradable food waste coming from the kitchens at the Drilling campsite. Food wastes will be collected and stored at the camp.

The waste will be sent to the non-hazardous landfill.

4.6 HAZARDOUS WASTE

The well site and accommodation campsite combined will generate a low volume of hazardous waste, estimated to be between 2 and 5 tonnes per month. Hazardous waste items include:

- Used lubricating oil
- Used hydraulic oil
- Solvents
- Used batteries and
- Medical waste.
- Filters contaminated with oil
- Drums and containers used for oil or chemical transportation and storage
- Mud additive chemicals
- Rags, paper, plastics and other materials contaminated with oil

All materials brought onto the well site and accommodation campsite will be logged and all sources of potential toxic waste will be identified by the relevant supplier or contractor. Equipment or materials containing heavy metals, such as batteries, will be identified and a special container designated for their disposal as waste. All used chemical and lubricant containers will be collected in separate containers.

The drilling contractor is to ensure appropriate and safe storage until this waste is picked up by the waste transporter and taken to the DOWA Waste Management Facility.

4.6.1 Specific Hazardous Wastes Include

Spent Hazardous Chemicals

Spent Hazardous Chemicals includes any surplus, off specification, discarded or contaminated chemicals (solvents, paints, resigns, glues etc.) used during drilling activities which will come from various workshops at the drilling site.

These wastes will require specific segregation and disposal techniques.

After transportation to the DOWA Licensed Waste Management Facility, the waste will be stabilized and replaced to other containers, possibly recycled for use as fuel mainly and or sent to the hazardous waste landfill and to the water treatment facility.

Spent Lubricants and Exhausted Oils

This waste includes exhausted lubricants and oils, including brake fluid from activities of light maintenance carried out at the Drilling site.

These wastes will require specific segregation and disposal techniques, and possibly recycled for use as fuel.

Contaminated Wastes

Contaminated Wastes includes packages and metals with presence of dangerous substances (e.g. oils), wastes contaminated during routine operations, maintenance activities and oil spill clean-up materials that can be produced. This would include brake pads and clutch kits from maintenance.

These wastes will require specific segregation and disposal techniques.

Packing materials made of plastic, metal and glass will go through the washing line for decontamination and once cleaned will be sent to recycling in authorized facilities. Wood, paper and film material packing (e.g. big bags) will go through shredding stabilization line for the production of Alternative Solid Fuel (ASF) for the incinerator or local cement factories.

Accumulators and batteries

Accumulators and batteries includes industrial and automotive type lead-acid cell batteries and commercial size nickel-cadmium, lithium, and mercury cell batteries, all classified as hazardous. Non-industrial batteries including household and single cell batteries used to power small electronic equipment such as flashlights, radios and watches are considered general trash and are not included in this waste stream.

Electronic wastes

Electronic wastes smoke alarms or electronic devices.

Glass bulbs and used lamps

Glass and bulbs includes used lamps, fluorescence bulbs, halogen light, mercury light used in the Drilling site are included in this typology.

Medical wastes

Medical Wastes include infected gauze, gloves, tissues, cotton balls, suturing tread, intravenous sets.

Construction and demolition wastes

This waste includes materials originated from activities of construction and demolition, including mixed waste, with presence of dangerous substances carried out in the Drilling site.

This waste will be sorted into recyclable and non-recyclable materials.

Contaminated Soil

During the project life it is expected that occasional spills of oil or chemicals will result in some soil contamination. Also, the flare pit will need to be tested if used, if the soil is contaminated it will be treated as hazardous waste.

Cooking Oil & Grease

Cooking Oil and Grease waste coming from the kitchens at the Drilling Camp. Cooking Oil & Grease wastes will be collected and stored at the camp.

May possibly be recycled for use as fuel or sent to the hazardous waste landfill,

4.7 WASTE DRILLING MUD AND CUTTINGS

The major waste products from the drilling operations are used drilling muds and cuttings.

As described in earlier sections the drilling rig equipment contains a standard closed mud circulation and treatment system, that takes the drilling mud as it leaves the well bore, removes the cuttings and suspended fine solids, and returns the cleaned mud to the rig's holding tanks for reuse. The subsequent treatment and disposal of the cuttings and drilling mud are discussed below.

Some of the drilling fluid portion will be lost to porous rocks, such as sandstones, and some of the additive solids will be lost to form a mud-cake along the wall of the hole. The volume of these "losses" cannot be calculated accurately as they depend on the local geology.

A portion of the mud will be attached to the cuttings (the separation system is efficient but cannot remove all the mud from the cuttings). At the end of drilling the surface hole, fresh water-based mud held in the rig storage tanks will need treatment and disposal.

4.7.1 Waste Mud Treatment and Disposal

There is a standard process that is followed for the treatment and disposal of water-based muds. The solid and liquid phases are separated on-site by industry standard physical and chemical means (shaking, centrifuging and flocculation). The solids from the shale shakers are moved to the cuttings dryer by an auger system.

The liquid phase is held in a series of settling and treatment tanks and will be analyzed to determine if any additional treatment is necessary.

The mud and cuttings treatment will be completed onsite by DOWA. The treatment process is outlined below:

- **Step 1:** Onsite treatment for Water Based Mud, separation into "Solid" and "Liquid using centrifuge.
- **Step 2:** Onsite treatment for "The water from separation from cutting mud" and " The water from WBM" using water treatment process.
- **Step 3:** Onsite treatment or Offsite treatment for "Brain water" by removing from site and disposing of it in our factory in Thilawa with water treatment facility".

The DOWA onsite treatment at the site will require about 3-5 month for each well to complete. The process diagram is shown in Figure 1.

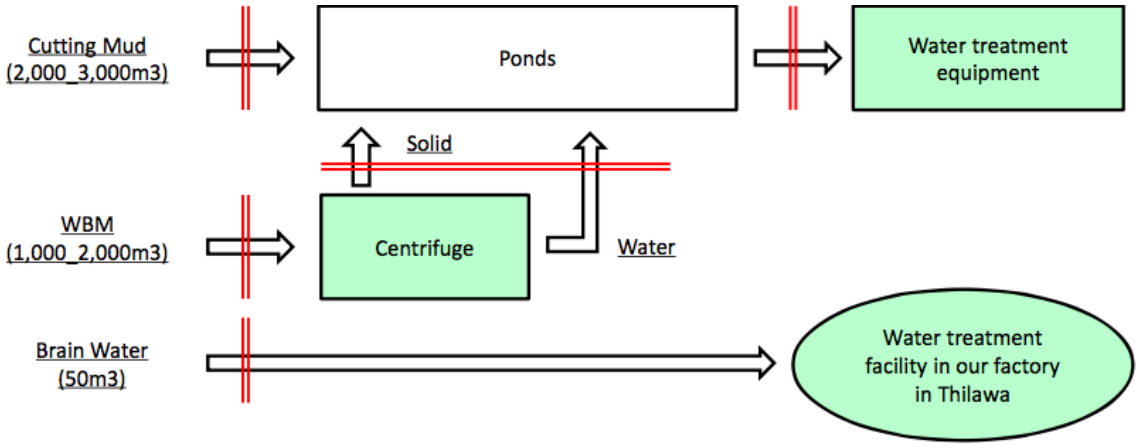


Figure 1: Dowa Onsite Treatment & Management of Mud & Cuttings

Step 1: Centrifuge Separation

The centrifuge treatment of the water-based mud will be completed as shown in Figure 2. The overall process consists of the following steps:

1. **Processing tank:** Add neutralizer and flocculants to remove harmful substances as solid sediment.
2. **Settling Tank**: Settle solid and pump up it to centrifuge. The top layer pump up to your main pond (Liquid part) through storage tanks.
3. **Centrifuge:** Separate it into "Solid" and "Water". "Solid" take to your main pond (Solid part). "Water" pump up to your main pond (Liquid part).

Figure 2: Centrifuge Process and Steps

Step 2 - Onsite Water treatment process

The influent water separated from the water based mud and the held in the cuttings pit. The cuttings generated is expected to be 2000 -3000 m^3 per well. The water based mud generated is expected to be 1000-2000 m^3 per well.

The process water from the cuttings pit will be treated onsite as per the onsite wastewater treatment as shown in Figure 3.

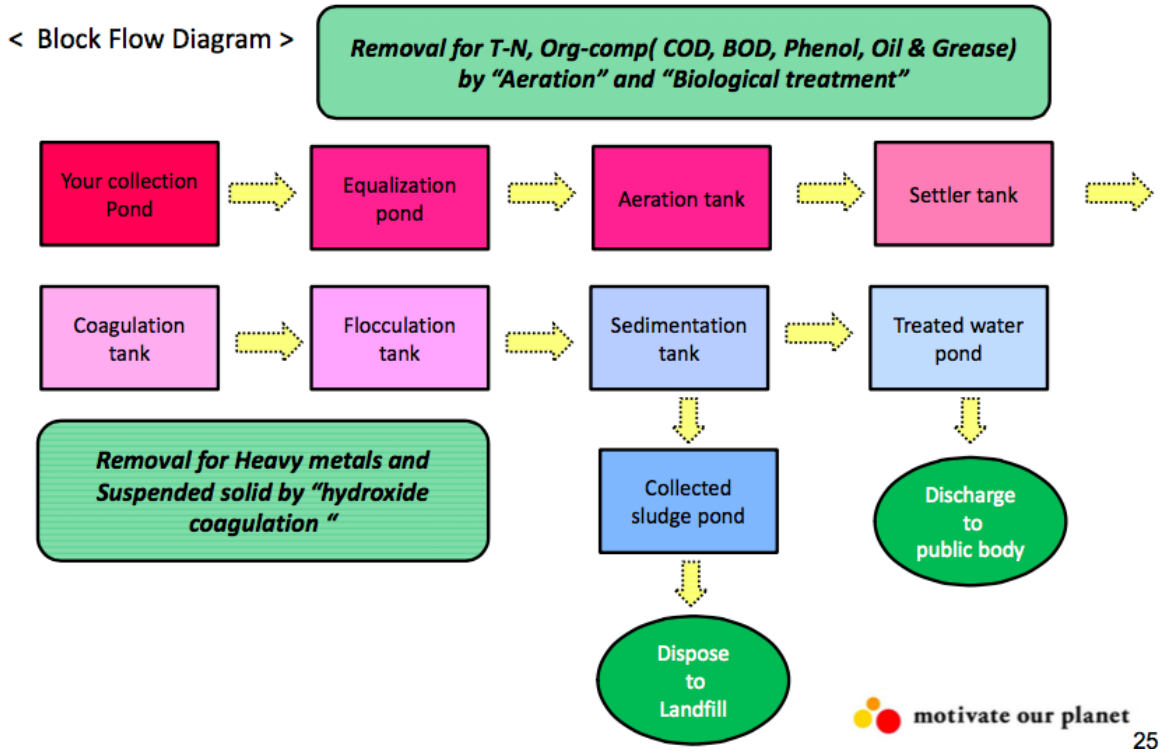


Figure 3: Flow Diagram for Onsite Waste Water Treatment

The treated water will be monitored to ensure it meets IFC and Myanmar National Emission guide-lines before being discharged from the site. The resulting treatment sludge will be removed from site and disposed at DOWA disposal area as shown in Figure 4.

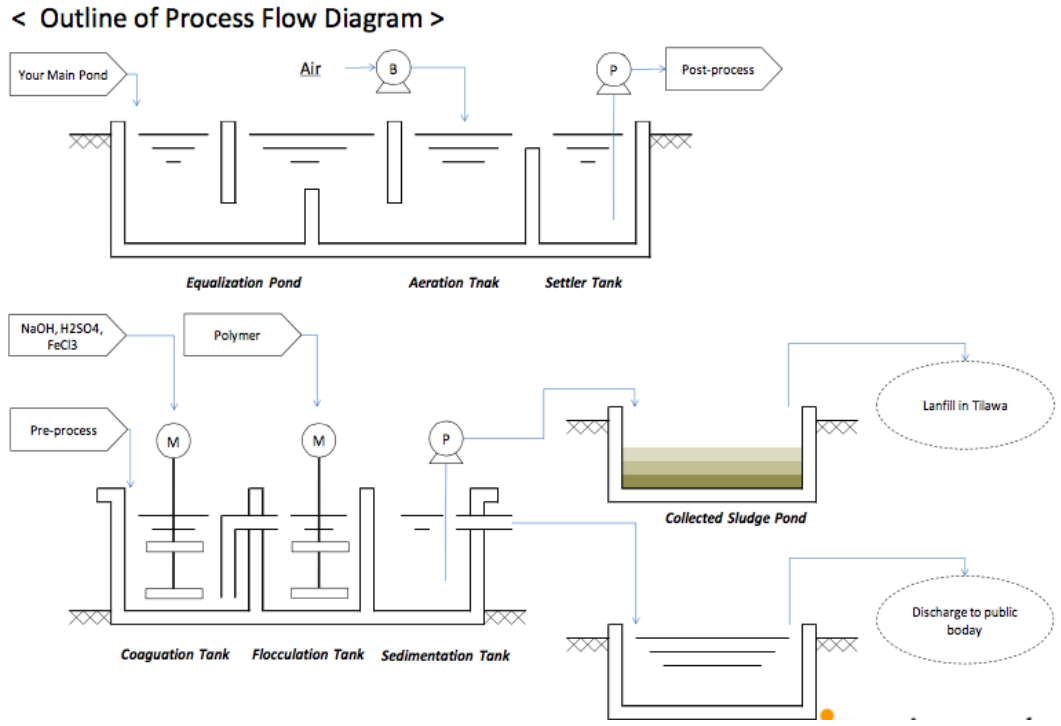


Figure 4: Process Flow Diagram for Onsite Water Treatment and Sludge Removal.

The effluent a standard before discharge will be maintained according to Guidelines values of Produced water in the Myanmar *"National Emission Guidelines"* and IFC *"Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development"* as shown in Table 4.

Water will be monitored every 2 weeks before discharging. The required water quality guidelines will be checked and monitored before disposal.

Table 4: Effluent Standards before Discharge

No.	Item	Guideline value
1	Total hydrocarbon content	10mg/L
2	pH	6-9
3	BOD(5)	25mg/L
4	COD(Cr)	125mg/L
5	TSS	35mg/L
6	Phenols	0.5mg/L
7	Sulfides	1mg/L
8	Heavy metals(total): (As, Cd, Cr, Cu, Pb, Hg, Ni, Ag, V*, Ag)	5mg/L
9	Chlorides	600mg/L(average), 1,200mg/L (maximum)

Source: IFC, Guideline value of Produced water in "Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development"

Step 3 – Offsite Disposal and Water treatment process

Sludge from the onsite process and the hazardous "brain water" which is resulting from the onsite treatment will be removed from the site and disposed and treated at the DOWA Thilawa disposal area.

4.7.2 Waste Drilling Solids

A lined cuttings pit will be installed onsite. The cuttings from the shale shakers will be placed in the concrete lined cuttings pit. The possibly contaminated runoff water from concrete drill pad and shaker area will drain to the cuttings pit. To avoid the cutting pits being contaminated with oil from any emergency spill on the drill pad, the engineering team will add the oil separator unit on both sides of drain gutter to trap oil before flowing down to the cutting pit.

The waste cuttings disposal and management proposed is a dilution burial option, the cuttings pass through the solids control treatment equipment, the cuttings from the shakers are conveyed to the cut-tings pit. The disposal process is as follows:

- Take the cutting sample from the pit for analysis by the certified 3rd party laboratory.
- If the test result is shown with no significant issues. Then PCMI will dry off and re-backfill (cap) with clean soil.
- If the test result is shown with significant issues (contain any heavy metal) the waste will then be classified as hazardous waste material. In this case DOWA will transport to its hazardous waste landfill site at Thilawa Industrial Estate.
- If the test result is shown with only high Electrical Conductivity and salinity value, PCMI will either wash out in the pit with natural water for dilution and pumping the water out to spray on ground or mix the cutting with clean soil. The process will be repeating until lower EC and salinity to disposal criteria. (Sample will be collected and tested).
- Then re backfilling to pit and cap with natural soil

Potential key contaminants of concern are:

- Electrical Conductivity (EC); similar to salinity which could create soil and groundwater contamination leading to agriculture & plantation impact;
- Heavy Metals - If the content is high, the waste is considered as Hazardous Waste.
- Minor concerns on hydrocarbon due to low concentration.

4.8 FLUIDS PRODUCED FROM THE SEPARATORS DURING TESTING

Should testing be conducted, the produced reservoir fluids will be separated at the surface. The gas portion will be flared while the liquid portion will be separated into water and a condensate-water emulsion. The water portion will be stored in the dirty water pit. The condensate-water emulsion will be moved to a series of settling tanks where natural buoyancy of the emulsion breaks down, separating the water and condensate phases further. The separated water will be stored in the dirty water pit for treatment and the remaining condensate and emulsion will be collected in storage tanks for disposal.

4.8.1 Management and Disposal of Condensate

The expected condensate-to-gas ratio is 5 bbl (0.795 m^3) per 1 mmscfg. Based on a worst case of a 10 mmscfgd during a LTP test for 22 days – equating to an average condensate production of 50 bbl (7.95m^3) per day, the total condensate production potential could be 1,100 bbl (175 m^3).

Condensate will be decanted from the settling tanks and stored to await disposal. After analysis the condensate will be transported by road tanker to the waste management facility or directly flared on site. A detailed manifest and chain-of-custody form will be maintained for the management of condensate.

4.9 SUMMARY OF WASTE INVENTORIES

A summary listing of wastes generated by this proposed project is provided in Table 6 4.

Should the well encounter technical difficulties that require contingency wells to be drilled, additional waste will be generated (drilling mud and cuttings, domestic waste, industrial waste, hazardous waste and sewage and grey water).

Table 5: Waste Inventory

Waste Type	Estimated Quantity	Proposed Disposal Contractor	Disposal Plan
Drill cuttings and attached WBM	~3000 m^3 /well	Treated / Separated on Site by DOWA	• Water Separated from the Mud and Cuttings and treated on Site. • Drill Cuttings disposed of in a dilution land burial process.
Water-based mud	1000-2000 m^3/well	Waste Management Facility - DOWA	• Stored in mud storage tanks • Liquids treated on site and WBM residues send to DOWA Landfill. • In case of the well is actually abandoned rather than completed as a producer, some of this mud will be used to make the kill weight spacer between the cement plugs
Brain Water & Sludge	50 m^3	Waste Management Facility - DOWA	• Water Treatment Sludge and Brain Water Disposed at Dowa Facility for treatment and final disposal
Unused chemicals	N/A	Licensed chemical supplier or Waste Management Facility - DOWA	• Returned to supplier or kept for future drilling campaigns.
Domestic waste	1 – 10 tonnes/month well site 1 – 4 tonnes/month camp site	Waste Management Facility - DOWA	• Landfill • Incinerated
Industrial waste (scrap metal, plastic, paper, wood, glass etc.)	1 – 40 tonnes/month	Waste Management Facility - DOWA	• Recyclable or reusable materials to be sold or donated. • Other non-recyclable or reusable waste goes to licensed landfill
Hazardous waste	2 – 5 tonnes/month	Waste Management Facility - DOWA	• Landfill • Incinerator
Sewage & grey water	3 – 4 m^3/day	Treated On Site	• Septic tank. • Treated in on-site bio-digester or infiltration field
Septic Sludge & Black Water	4 m^3 at end of project	Waste Management Facility - DOWA	• Disposed at Dowa and Landfilled
Fluids produced from the separators during testing	0 – 7.95 m^3/day/well	Waste Management Facility - DOWA	• Gas Flared • Separated Fluids disposed at Dowa and Landfilled

5 WASTE COLLECTION, STORAGE, TRANSPORTATION & REPORTING

5.1 WASTE COLLECTION

All personnel have the responsibility to ensure proper waste collection and segregation. The containers for collecting and storing the wastes will be of different colours and appropriately labeled, as follows:

- red colour, for plastic waste such as miscellaneous packaging materials (non hazardous), empty plastic bags, plastic cups/spoons, plastic bottles;
- blue colour, for paper waste such as scarp paper, cardboard, napkins, paper tissue;
- green colour, for glass waste such as glass bottles or containers, broken glass;
- orange colour for food waste, such as waste food from the galley and others, tea dye, toothpick;
- yellow for metallic waste, such as used/damaged tubular and pipes, damaged slings, non-hazardous metallic packaging, beverage cans, drums, miscellaneous scrap metals;
- black for hazardous and contaminated waste, such as; batteries, toner/cartridges, used lamps, used lube oils, filters, adsorbents, waste paint and thinners, waste chemicals, medical waste, electronic waste, oily rags, contaminated Personal Protective Equipment (PPEs).

Wastes shall not be mixed, as mixing could result in chemical reaction or reclassification of wastes.

In case of new waste type, the following shall be considered:

- waste not contaminated with oil, grease, solvents, paints and others shall be considered as Contaminated Waste and shall follow the management procedures;
- waste contaminated by oil, grease, solvents, paints and/or chemicals shall be considered as Non-recyclable Waste and shall be recorded and stored in a separate container.

For any produced waste whose characteristics are not known through prior knowledge and that may exhibit one or more hazardous characteristics (e.g.: flammable, ignitable, toxic, mutagenic, reactive, corrosive, etc.), the following sources should be referred for its classification:

- safety data sheet, waste profile sheet or other information documents;
- information from manufacturer;
- knowledge of the process generating the waste;
- historic information;
- laboratory analysis.

In any case, when a produced waste is showing uncertain characteristics it is to be classified as hazardous

Waste segregation must be ensured both at the drill site and camp and at the DOWA waste management facility.

5.2 STORAGE

Hazardous waste should be stored so as to prevent or control accidental releases to air, soil, and water resources in area location where:

- Waste is stored in a manner that prevents the commingling or contact between incompatible wastes, and allows for inspection between containers to monitor leaks or spills. Examples include sufficient space between incompatibles or physical separation such as walls or containment curbs
- Store in closed containers away from direct sunlight, wind and rain
- Secondary containment systems should be constructed with materials appropriate for the wastes being contained and adequate to prevent loss to the environment
- Secondary containment is included wherever liquid wastes are stored in volumes greater than 220 liters.

The available volume of secondary containment should be at least 110 percent of the largest storage container, or 25 percent of the total storage capacity (whichever is greater), in that specific location

- Provide adequate ventilation where volatile wastes are stored.
- Hazardous waste storage activities should also be subject to special management actions, con-ducted by employees who have received specific training in handling and storage of hazardous wastes:
- Provision of readily available information on chemical compatibility to employees, including labeling each container to identify its contents
- Limiting access to hazardous waste storage areas to employees who have received proper training
- Clearly identifying (label) and demarcating the area, including documentation of its location on a facility map or site plan
- Conducting periodic inspections of waste storage areas and documenting the findings
- Preparing and implementing spill response and emergency plans to address their accidental re-lease (additional information on Emergency Plans in provided in Section 3 of this document)
- Avoiding underground storage tanks and underground piping of hazardous waste

5.2.1 DRILLING PROGRAM WASTE STORAGE AREAS

An exclusive segregated space is arranged in the Drilling Site in order to temporary accommodate waste produced. The waste storage area is paved with concrete, covered, fenced and provided with dedicated collection system and a secondary containment to avoid any possible soil contamination.

The waste produced in the Drilling Site will be collected every day from the containers set all around the site and they will be segregated at the temporary storage area. The Drilling site waste will be transported by the Waste Transporter to the DOWA Waste Management facility when the container

of the waste is full and there is a request from PCMI (a daily visual check of waste containers is to be carried out).

The following best practices guidelines to be followed for the appropriate storage of wastes:

- wastes will be stored in containers that are in good condition (i.e. no severe rusting or apparent structural defects);
- wastes will be stored in compatible containers (i.e. the waste would not react with the container and impair its ability to contain waste);
- incompatible wastes, both in the sense of reactivity and the wastes requiring different treatment and/or disposal methods, will not be placed in the same container;
- empty containers, which had contained raw materials, will be used for storing waste provided that the waste is compatible with any residues that may be left in the container;
- where practical, waste containers will be stored in single layers (i.e. not stacked);
- containers will be stored in a manner that limits the ability of spilled materials to migrate laterally or into the water. For the Drill site, materials such as concrete or metal catch pans, or prefabricated secondary containment units may be used. In all cases, the base material should be designed to support, and not be damaged by, the weight of the containers when full;
- liquid wastes and oily sludge containing free liquids will be stored in closed containers (e.g. drums or tanks). Such containers will be properly sealed and not be leaking;
- all containers containing wastes will be clearly labeled or marked with the type of waste and its hazards. For instance, containers of hazardous substances will display appropriate hazard warning labels (e.g. flammable liquid, corrosive material, poison, etc.);
- the packaging will be secure enough to prevent leaks, spills, and vaporization during transportation.

5.2.2 Container Types

The characteristics of the proposed waste containers are described in the following paragraph.

Waste bins

Waste bins are located in appropriate positions (e.g. accommodation) in order to allow for an effective waste collection and segregation. Bins will be in different color and properly labeled with regard to the specific typology of waste, as shown in the Figure 5 below.

Figure 5: Example containers for the separate collection of waste

Containers for Hazardous waste

Appropriate containers will be located in appropriate positions (e.g.: workshop) in order to allow segregated collection for specific hazardous waste typology (e.g.: batteries, lamps, lube oils).

Open box containers

Other solid waste typologies will be collected in appropriate containers, as shown in Figure 6 below:

Figure 6: Example Collection, Transportation and Sorting

Liquid Waste containers

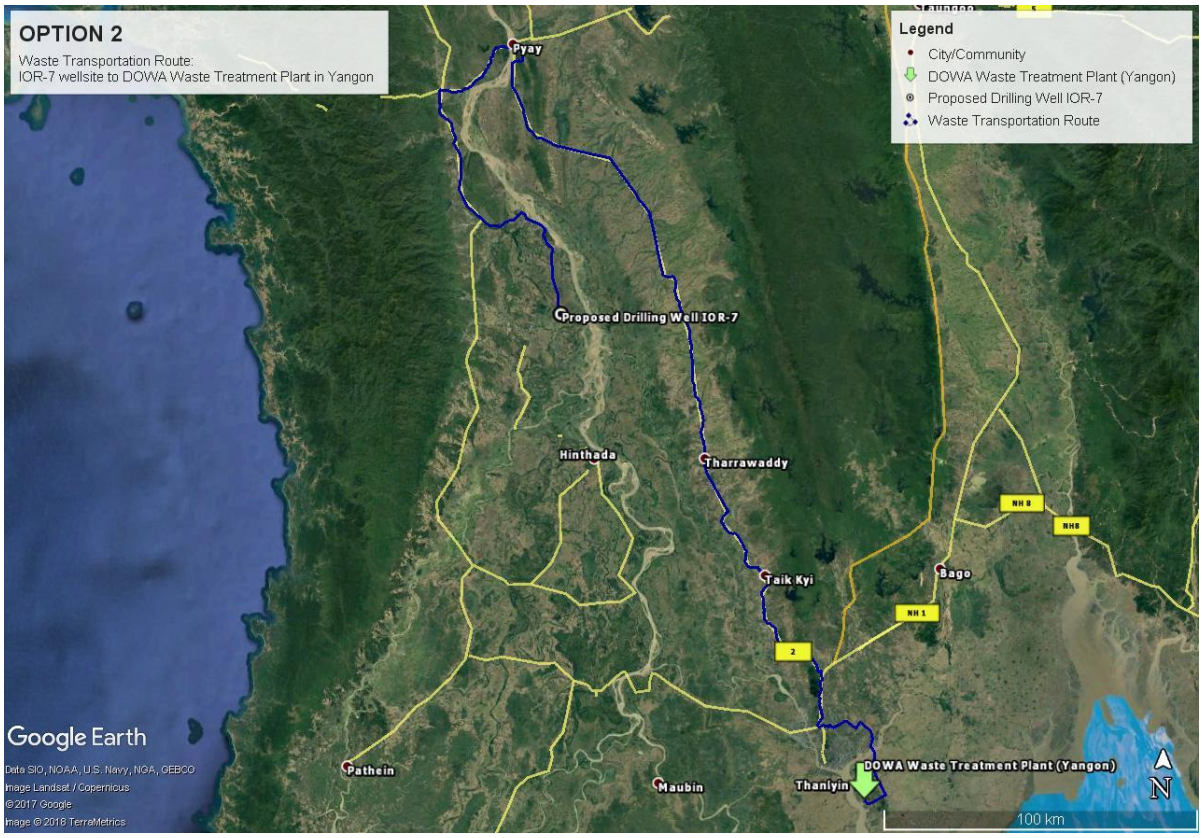
Liquid waste typologies will be collected in appropriate containers, as shown in Figure 7 below:

Figure 7: Example Storage and Transportation Options

5.3 TRANSPORTATION

On-site and Off-site transportation of waste should be conducted so as to prevent or minimize spills, re-leases, and exposures to employees and the public. All waste containers designated for off-site shipment should be secured and labeled with the contents and associated hazards, be properly loaded on the transport vehicles before leaving the site, and be accompanied by a shipping paper (i.e., manifest) that describes the load and its associated hazards, consistent with the guidance on the Transport of Hazardous Materials.

Transportation route for drilling waste transportation is provided in Figure 8.



Source: IEM 2018

Figure 8: Drilling Waste Transportation Route

5.3.1 Labeling

All waste containers will be adequately labeled/marked with the contents prior to shipment.

The Waste Contractor will ensure that the waste containers are correctly labeled for their transportation to the authorized treatment/disposal facility. Labeling placards will be appropriately posted on the containers.

5.4 WASTE REPORTING

PCMI HSE Manager will produce a weekly waste management report that provides and inventory of waste produced, transported and disposed of from the site.

5.4.1 COLLECTION AND TRANSPORTATION PROCEDURE

For the collection and transport of the waste, a specific procedure will be established by the waste Contractor (DOWA) to be followed during the collection and transportation of drilling waste from the Drilling site to the treatment facility.

The procedure is to include:

- responsibilities;
- relevant documents;
- process: general, collection organization, collection and transportation order, preparation, collection, and transportation.

In particular, the collection and transportation of the waste will be carried out using vehicles that are listed in the waste permit and designed to transport the type of waste produced. Drivers shall be licensed and authorized to transport the typology of waste produced. Every collection of waste must be accompanied by the following documents:

- Waste manifest;
- Collection and transportation work instructions;
- Risk Assessment Document;
- Identification and monitoring of Hazardous Waste transportation form;
- Road Spillages Emergency Plan.

The waste weight will be estimated at the site prior to transportation by determining volume of different types of wastes. The container will be loaded on approved waste management trucks for their transportation. Waste will be weighed at the DOWA Waste Management Facility upon arrival. PCMI will need to review all actual waste slips and resolve any discrepancies between estimates and actuals.

The waste contractor (DOWA) will provide appropriate trucks for the transportation of the waste equipped with adequate fittings to transport the proposed containers.

Vehicles will follow a preventive inspection and maintenance program. Each vehicle will be equipped with the following:

- necessary equipment with instructions according to the Hazardous Waste Management Permit;
- appropriate labeling and additional equipment according to ADR rules.

Waste container will be transferred to the authorized facilities. Containers will be stored in an appropriate area or emptied and returned to the drilling site as appropriate.

5.4.2 WASTE IDENTIFICATION AND TRANSFER FORM AND TRACKING

The waste collected by the waste management Contractor (DOWA) at the drilling site will be identified and tracked.

The DOWA Waste Management Facility will maintain data on the time and place of each collection, the transportation route and delivery at the DOWA installation. The system provides information on all transportation journeys thus ensuring that collected waste is managed in accordance with the specified environmental standards and in accordance with applicable DOWA and government regulations. The DOWA waste management tracking system will provide a report based on date, waste type, customer, driver and trucks (Appendix D).

The collected waste amount will be reported by the appointed transporter. This information will contain the following details: date of collection and time, generator of the waste, transporter/truck and disposal company identification and waste information (code and quantity).

The Waste Management Tracking System will apply to all material that will be sent to the DOWA site. This shall allow for the following:

- to provide a control mechanism for the safe handling, transport, and treatment of wastes to demonstrate environmental, health and safety compliance;
- to monitor waste streams in a consistent manner throughout the project.

The waste management Contractor will ensure that:

- the segregation and documentation of all wastes is in accordance with the applicable requirements and documentation system prior to their removal from the site;
- the Waste Manifest is completed by the Drilling Contractor at the moment of its collection/removal and transportation. A continuously numbered, dated copy of the Waste Manifest shall accompany each transfer of the waste to be disposed of. DOWA, shall hold a record of all the Manifests and the Transportation Logs issued in a permanent record;
- all hazardous waste shall be accompanied by a Waste Information Sheet similar to an MSDS or laboratory test results during shipment (an internal HSE document aiming to identify the waste in accordance to its classification) to ensure the safe handling and storage of the waste when subjected to treatment. At the DOWA Waste Management Facility, the wastes will be sampled to deter-mine classification and appropriate treatment requirements. The maintenance of such a log allows a record to be maintained of all wastes collected at any time;
- waste trucks and any other waste management services provided are licensed in compliance with local regulations;
- suitable equipment must be available for the required transport and other related services;

- appropriate incident reporting and any contingency response procedures must be in place.

DOWA and the Drilling Contractor will maintain waste registries as defined in **Appendix D**, which includes the Confidential Waste Profile Sheet.

5.4.3 SPILL CONTROL MEASURES

The Waste Management Transporter will ensure that waste transport trucks are not overloaded. Also waste transport trucks are to be clean when leaving the site, in order to minimize the risk of deposition of wastes on the public road system.

The drivers of the approved truck will be provided with PPE and a spill containment kit, containing absorbent materials, (pads, rolls or granules), impermeable gloves and a shovel, should any accident with potential spillages during transport, or road traffic incident involving wastes occur.

Specific procedures will be established by the Waste Management Transporter for emergency situations. In the event of any spillage of hazardous material the initial response will include the following:

- notify PCMI of the incident;
- if able, without risk, and if correct PPE is available, attempt to stop the source of the leak/spill;
- attempt using either spill containment kit or available absorbent material, (sand, sawdust etc.), to contain the spread of the material;
- all contaminated material resulting from cleaning up the spill shall be contained within proper containers. This material must be disposed of as hazardous waste.

Should any spillage occur on a public road, local Authorities will be timely informed by PCMI.

6 ROLES AND RESPONSIBILITIES

Roles and responsibilities for the involved parties are reported in the following Section.

Prior to waste management collection, transportation and disposal, DOWA will conduct laboratory analytic tests on an amount of sampled wastes to correctly establish waste classification; other complementary information can be collected from Material Safety Data Sheets and process knowledge. This will assist to ensure that proper storage and handling procedures are in place.

DOWA Waste Manifest System

Slip A – Waste Generator Copy (Confirm waste collection)
Slip B – Transportation Company (Office Use)
Slip C – Transportation Company to waste Generator (Delivery approved)
Slip D - Waste services Company copy (office use) (Record of waste Transport)
Slip E – Waste services Company to Waste Generator (Treatment approved)

See Appendix C – DOWA Waste Manifest System

Drilling Contractor (Producers of waste): issue five (5) copies of the Waste Manifest (SLIP A-E in carbon copies) reporting the following:

- date and number of issuance;
- issuer name and signature (drilling manager name & signature);
- waste generator company name , transportation company (DOWA or a third party company) and waste service company (DOWA);
- waste classification:
- kind: hazardous, non hazardous, others,
- name: identification of the waste (e.g. plastic, glass, wood, etc …),
- quantity: description of waste amount or waste weight estimation,
- style of packing: description of containers,
- remark: actual weight waste from DOWA,
- waste classification code is to be assigned by DOWA,
- Request the transportation company signature for all the waste manifest copies;
- keep the first copy (SLIP A);
- deliver the second copy (SLIP B) to the transporter company;
- deliver the third copy (SLIP C) to the Drilling Contractor HSE Manager, who is the custodian of the documentation;
- deliver the fourth (SLIP D) to the waste transport company and;
- the fifth (SLIP E) copies to Drilling Contractor HSE Manager to confirm that treatment of waste has been completed.

Drilling Contractor HSE Manager:

- is primarily responsible for ensuring implementation of the Waste Management Plan throughout the area of collection;
- checks to ensure chemically and physically incompatible wastes are not mixed at the site temporary storage area;
- keep the third copy of the Waste Manifest (SLIP C) filled in and signed by the Transporter (DOWA or third party company);
- keeps the fifth (SLIP E) copy to confirm waste has been treated by DOWA
- receives a monthly summary for the waste disposed, checks it and sends to PCMI HSE Manager.

Transporter (DOWA or third party company):

- delivers the wastes to the waste service company (DOWA) and cross checks the data reported on the Waste Manifest from PCMI with the DOWA;
- the wastes are weighed by DOWA, the waste amount in reported in the "remark" space and waste code and customer code are filled in by DOWA representative:
- delivers the SLIP D to Transporter office and SLIP E to PCMI to confirm waste has been treated.
- the waste service company (DOWA) signs E

DOWA Representative:

- verify that the waste is correctly labeled before transferring it to the authorized treatment/disposal facilities;
- avoid any overloading of vehicles with waste and ensure cleanliness of vehicles leaving the site;
- ensure the vehicles collecting the waste from site are decontaminated and clean;
- checks to ensure chemically and physically incompatible wastes are not mixed;
- weigh the wastes and confirm the exact amount, the waste code, the customer code and signs and dates the SLIPS C, D and E;
- SLIP D is kept by DOWA and SLIP E comes back in original copy to Drilling Contractor by email;
- DOWA will also provide the details of the final disposal for the waste and will attach the waste tracking form to the original copy of the SLIP E;
- prepare and submit monthly summary to the Drilling Contractor providing the following information:
  - types of waste recycled, treated or stored,
  - area/location of treatment, recycling or storage,
  - quantity of waste treated, recycled or stored (weight),
  - date of waste treated, recycled or stored,
  - area/location of waste generation.

7 REFERENCES

IGES, June 2016, Quick Study on Waste Management in Myanmar, Current Situation and Key Challenges,

National Environmental Quality and Emissions Guidelines (Dec, 2015)

Hazardous Waste Notification (Draft 2016)

International Finance Corporation (IFC), General Environmental, Health, and Safety General Guidelines, 2007;

International Finance Corporation (IFC) Environmental, Health, And Safety Guidelines For Onshore Oil And Gas Development, 2017;

International Finance Corporation (IFC) Environmental, Health, And Safety Guidelines For Offshore Oil And Gas Development, 2015;

APPENDIX A

Myanmar Waste Site Screening

Table 6: Alternative Waste Site Screening

Waste Category	DOWA	Yangon City Development Committee (YCDC)	Magway	Myanaung Township	Kyangin Township
(1) Solid Waste					
Waste separation, collection and transport	▪ Maintains waste collection trucks and also contractors to support waste transport to the DOWA waste management facility. It is equipped with waste sorting facility.	▪ Daily collection ▪ Bell ringing collection system, collection at street dump yards, temporary storage system ▪ Transport by trucks to the landfill	▪ Carried with trucks and disposed to the open dumping site	▪ No waste separation ▪ Open dumping	▪ No waste separation ▪ Open dumping
Waste treatment and recycling	▪ Plans to install incinerator by 2018, currently in discussions with Siam Cement for cooperative incineration. Has a USEPA designed hazardous and non-hazardous secured and fill areas. Also provides recycling services.	▪ Recycle materials (Plastic, Tin/Can, Bottle, Iron, Glass, Tex-tile) ▪ No accurate data, assumption is that 86 tonnes/day generated waste is recycling	▪ No pre-treatment ▪ No treatment ▪ No recycle	▪ No pre-treatment ▪ No treatment ▪ No recycle	▪ No pre-treatment ▪ No treatment ▪ No recycle
Waste disposal	▪ Final disposal ▪ Engineered land fill area 80m x 80m x 2 sites with capacity for 44,000 m^3 non-hazardous and 43,000 m^3 hazardous waste.	▪ Open dumping	▪ No defined dumping site area ▪ Just open dumping	▪ Open dumping at designated pit ▪ Pit area is almost full ▪ New pit area has is being purchased	▪ Open dumping in a natural depression area
Waste management staff/vehicles	▪ Management Staff of 10, 30 workers, plus 2 in lab. Trucks to collect waste of various sizes.	▪ Staff (Officers 39, Permanent workers 180, daily workers 4000) ▪ Vehicles 300 trucks (2ton/4ton/7ton/12ton)	▪ none	▪ none	▪ none
Hazardous (industrial/medical)	▪ Collects both hazardous and medical waste from industry in Thilawa SEZ and other oil and gas companies both onshore and off-shore. All hazardous wastes treated and sent to landfill.	▪ Collect waste (once a day for special clinic, once or twice per week for polyclinic) ▪ Categorize into three types (Yellow colour for infectious waste, Red colour for sharpening and syringes, needles, etc, Blue & Green for domestic waste) ▪ Infectious waste incineration ▪ Sharp waste (submerged to concrete deep well)	▪ Disposed to the same area of domestic waste dumping ▪ No pre-treatment	▪ Disposed to the same area of domestic waste dumping ▪ No pre- treatment	▪ Disposed to the same area of domestic waste dumping ▪ No pre-treatment

(2) Liquid waste					
Domestic waste water (residential/ commercial)	▪ Liquid waste is sent to the DOWA wastewater treatment plant for biological treatment and flocculation. Pond capacity is 300m^3 x3. Ability to treat 35m^3/day. Sludge is sent to secure landfill. ▪ Currently septic tank wastes are collected by a contracted vacuum truck for transportation to the DOWA wastewater treatment facility. ▪ After treatment, effluent water is diluted and dis-charged into the canal at the industrial estate for reuse or discharge to the river	▪ Domestic waste water is being released into the YCDC drainage and then to the nearest water body ▪ In 6 downtowns, sewage wastes are connected with the drains to the Than lhet sun pond ▪ YCDC can serve only 4.3% of Yangon City people for sewage waste ▪ For other towns, septic tank wastes are carried by vacuum trucks ▪ Domestic waste water treatment (WWTP), Activated Sludge Process ▪ Sludge is used as fertilizer ▪ 3.25mg per day are disposed to Yangon River as treated water	▪ none	▪ dumped in a natural lake area	▪ none
Industrial waste water	▪ Liquid waste is sent to the DOWA wastewater treatment plant for biological treatment and flocculation. Pond capacity is 300m^3 x3. Ability to treat 35m^3/day. Sludge is sent to secure landfill. ▪ Currently wastes are collected by a contracted vacuum truck for transportation to the DOWA wastewater treatment facility. ▪ After treatment, effluent water is diluted and dis-charged into the canal at the industrial estate for reuse or discharge to the river		▪ none	▪ none	▪ none

Existing Myanaung Township Open Waste Disposal Site

10 acres of land intended to buy for new Myanaung Townships Open Waste Disposal Site

Kyangin Township Open Waste Disposal Site in a existing natural depression

Informal Recycling by Local People at Kyangin Waste Disposal Site

APPENDIX B

Waste Contractor

DOWA Waste Contractor

DOWA is the appointed Waste management Contractor for PCMI drilling programme.

DOWA Waste Management Facilities are located in the Thilawa Special Economic Zone outside of Yangon.

Dowa has 30 years of business experience and related business operations in China, Japan, Myanmar, Taiwan, Thailand, Singapore and Indonesia.

The SEZ Management Committee has approved the DOWA Waste Management Facility to do business (Appendix H– Certificate of Commencement Date of Commercial Operations). An EIA has been conducted and approved by SEZ Management Committee (Appendix I – Approval of EIA).

The DOWA Waste Management Facility provide:

1. Hazardous and Non-hazardous controlled secured landfill
2. Sorting/Stabilization Facilities
3. Waste water and leachate water treatment facility
4. Office with Laboratory (ICP, Ion-chromatography, Mercury analyzer, oil and grease contents meter etc.)
5. Incinerator (to be commissioned by 2018)

The following schematic shows the layout of the DOWA Waste Management Facilities:

Figure B.1 Landfill Layout

The Waste receipt procedures at DOWA are shown in the following schematic:

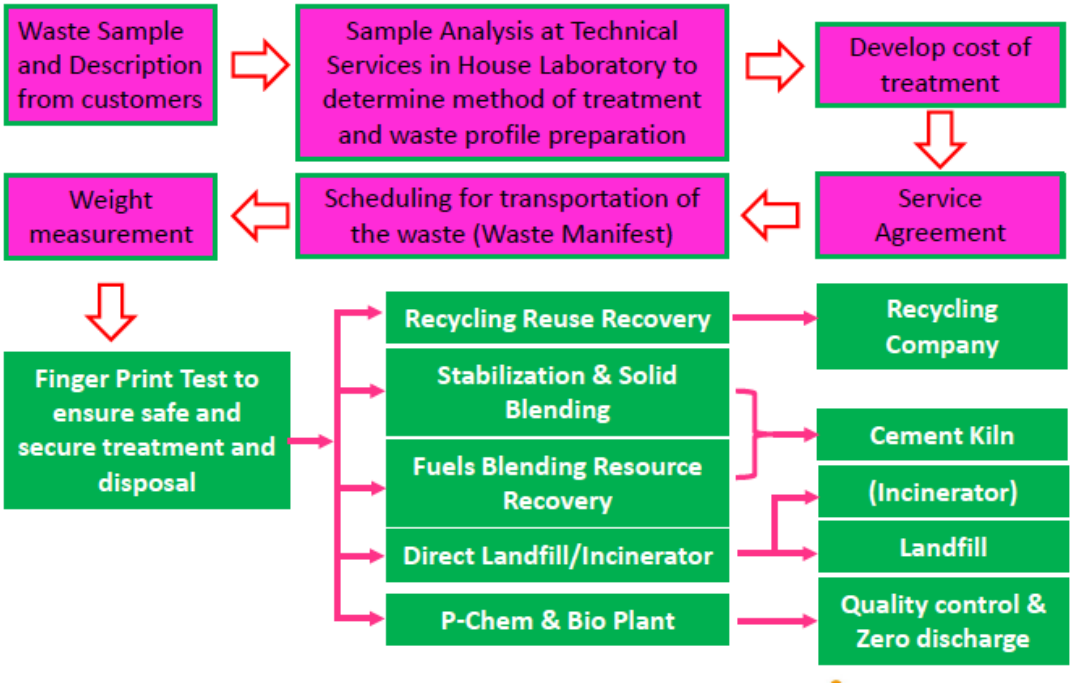


Figure B.2 Waste Receipt Procedures

The Hazardous waste treatment flow at DOWA is shown in the following schematic:

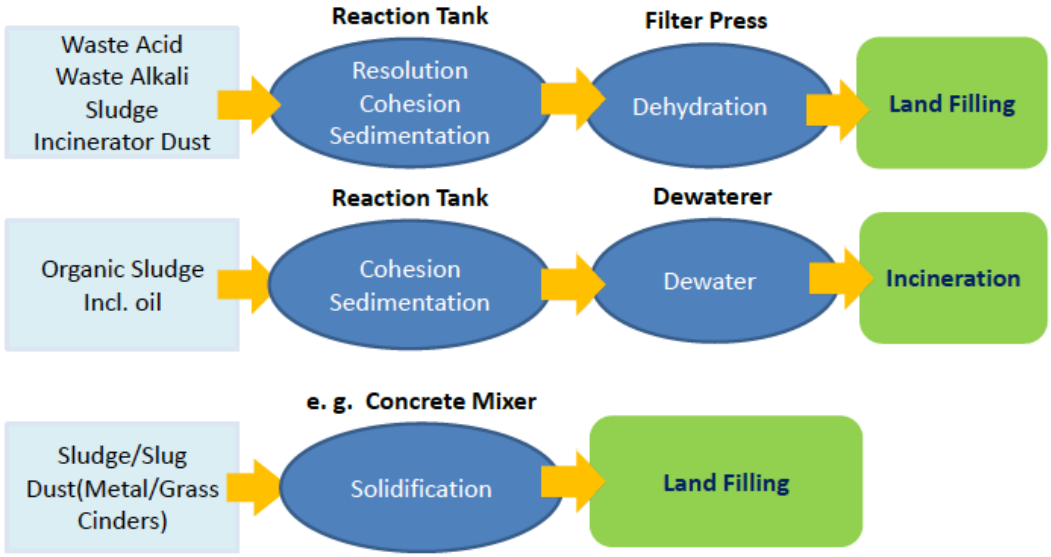


Figure B.3 Hazardous Waste Treatment Flow (General)

The Landfill structure at DOWA is designed according to USEPA Regulations.

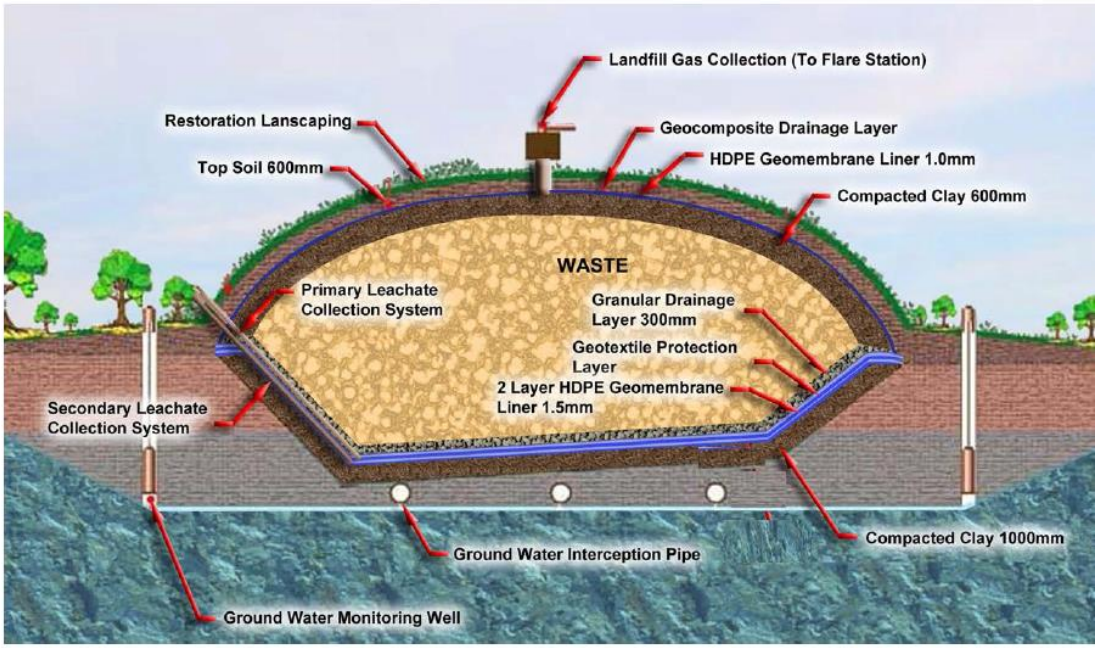


Figure B.4 Landfill Structure

The complete contract between PCMI and DOWA covers:

- non-hazardous recyclable waste (metals, plastic, glass, paper etc.);
- non-hazardous non-recyclable industrial waste (empty packing waste, expired and un-used products);
- hazardous non-industrial waste (fluoresces lamps, dry cells and other wee);
- hazardous industrial waste (chemicals, hazardous packing);
- medical waste;
- waste oil and oily waters;

The Waste contractor has developed specific working instructions, including:

- decontamination of metal solid waste;
- decontamination of non-metal solid waste;
- lamp crushing;
- handling of battery dry-cells.

Protocols that cover collection, transportation, storage, treatment and final disposal of all the waste categories are prepared by DOWA in cooperation with PCMI.

DOWA will be responsible for any foreseeable environmental impact or health and safety risk, arising from routine and accidental operations.

Appendix C

DOWA Waste Manifest System

DOWA Waste Manifest System

Slip A – Waste Generator Copy (Confirm waste collection)
Slip B – Transportation Company (Office Use)
Slip C – Transportation Company to waste Generator (Delivery approved)
Slip D - Waste services Company copy (office use) (Record of waste Transport)
Slip E – Waste services Company to Waste Generator (Treatment approved)

Manifest	A-Slip	*Waste generator Copy	
Date of issuance	(Day Month, Year)	Issuer	(Name&Sign)
Number of issuance			
Contractors	Waste generator	Transportation company	Waste service company
Company Name			
Tel			
Waste	Kind	Name	Style of packing
	☐Non-Hazardous		
	☐Hazardous	Quantity(Unit)	Remark
	☐Others		
Customer code		Waste Profile code	
Trace	PIC(Name&Sign)	Date of Completion	
Transportation company	(Name&Sign)	(Day Month, Year)	
Waste service company	(Name&Sign)	(Day Month, Year)	
Designed by GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.			

Manifest	B-Slip	*Transportation company Copy	
Date of issuance	(Day Month, Year)	Issuer	(Name&Sign)
Number of issuance			

Contractors	Waste generator	Transportation company	Waste service company
Company Name			
Tel			

Waste	Kind	Name	Style of packing
	☐Non-Hazardous		
	☐Hazardous	Quantity(Unit)	Remark
	☐Others		

Customer code		Waste Profile code	

Trace	PIC(Name&Sign)	Date of Completion
Transportation company	(Name&Sign)	(Day Month, Year)
Waste service company	(Name&Sign)	(Day Month, Year)

Designed by GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.

Manifest	C-Slip	*Transpiration company to Waste Generator	
Date of issuance	(Day Month, Year)	Issuer	(Name&Sign)
Number of issuance			

Contractors	Waste generator	Transportation company	Waste service company
Company Name			
Tel			

Waste	Kind	Name	Style of packing
	☐Non-Hazardous		
	☐Hazardous	Quantity(Unit)	Remark
	☐Others		

Customer code		Waste Profile code	

Trace	PIC(Name&Sign)	Date of Completion
Transportation company	(Name&Sign)	(Day Month, Year)
Waste service company	(Name&Sign)	(Day Month, Year)

Designed by GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.

Manifest	D-Slip	*Waste service company Copy	
Date of issuance	(Day Month, Year)	Issuer	(Name&Sign)
Number of issuance			

Contractors	Waste generator	Transportation company	Waste service company
Company Name			
Tel			

Waste	Kind	Name	Style of packing
	☐Non-Hazardous		
	☐Hazardous	Quantity(Unit)	Remark
	☐Others		

Customer code		Waste Profile code	

Trace	PIC(Name&Sign)	Date of Completion
Transportation company	(Name&Sign)	(Day Month, Year)
Waste service company	(Name&Sign)	(Day Month, Year)

Designed by GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.

Manifest	E-Slip	*Waste service company to Waste Generator	
Date of issuance	(Day Month, Year)	Issuer	(Name&Sign)
Number of issuance			

Contractors	Waste generator	Transportation company	Waste service company
Company Name			
Tel			

Waste	Kind	Name	Style of packing
	☐Non-Hazardous		
	☐Hazardous	Quantity(Unit)	Remark
	☐Others		

Customer code		Waste Profile code	

Trace	PIC(Name&Sign)	Date of Completion
Transportation company	(Name&Sign)	(Day Month, Year)
Waste service company	(Name&Sign)	(Day Month, Year)

Designed by GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.

APPENDIX D

Confidential Waste Profile Sheet

&

DOWA Waste Tracking Form

DOWA

Confidential Waste Profile Sheet <Reception Date>

Information of Customer

Company Name:		Type of Industry:
Address:		
Person in charge	Name: □Mr □Ms	Position:

Information of Waste

Waste Name:		Generated Process:	
Classification	☐ Non-Hazardous Waste ☐ Hazardous Waste ☐ Others( )		
Color	State	Liquid(%)	☐ Sludge(nonexistence) ☐ Sludge(existence) ☐ Suspension ☐ Float
		Semi-solid(%)	☐ Mud ☐ Syrup ☐ Gel ☐ Other(like:)
pH:		Solid(%)	☐ Powder ☐ Granular ☐ Flaky ☐ Lumps(fragile) ☐ Lumps(hard)
			☐ Inherent figure( ) ☐ Other( )

Incidental odor: ☐None ☐Yes (intensity: ☐very slight ☐slight ☐moderate ☐strong) Like:

Characteristic	Physicochemical hazards	☐None ☐Explosives ☐*Flammable substance ☐Self-reactive substance ☐Pyrophoric substance ☐Self-heating substance ☐Substance which, in contact with water, emits flammable gases ☐Oxidizing substance ☐Organic peroxide ☐*Corrosive ☐High-pressure gas ☐Other( ) ☐Unknown *Flammability: Flashpoint ☐High(>90℃) ☐Moderate ☐Low(<25℃) ☐Unknown *Corrosive to: ☐ Iron ☐ Rubber ☐ PVC ☐ PE ☐ Other( ) **Reactivity: In contact with ☐Water ☐Acid ☐Alkali ☐Air ☐Other( ) ---> Reaction ☐Emitting gases ☐Exothermicity ☐Endothermicity ☐Other( )
	Health hazards	☐None ☐Acute toxicity ☐Skin corrosion ☐Carcinogenicity ☐Reproductive toxicity ☐Other( ) ☐Unknown
	Environmental hazards	☐None ☐Hazardous to the Aquatic Environmental ☐Hazardous to the ozone layer ☐Other( ) ☐Unknown
	Possibility of emitting gas	☐None ☐HCN ☐H2S ☐H3N ☐H2 ☐HF ☐HF ☐Other( ) ☐Unknown

Component	Chemical Name				
	Rate/Quantity				
	CAS-No				

Hazardous substance/ Special Content	☐Heavy Metals(☐Hg ☐Cr( ) ☐Pb ☐Cd ☐As ☐Se ☐Mn ☐Ni ☐Zn ☐Be ☐Sb ☐Ba ☐Other( )) ☐Pesticides / Herbicides, Substance( ) ☐Cyanides, Substance( ) ☐Shock Sensitive Materials, Substance( ) ☐PBB, PBDE ☐Organochlorine compounds, Substance( ) ☐Organophosphous compounds, Substance( ) ☐Explosives, Substance( ) ☐Dioxins and dioxin-like compounds ☐ Radioactive Materials
☐ None	☐☐Other (☐B ☐N ☐P ☐F ☐Other( ))
Possibility of contamination	☐None ☐Metal piece ☐Glass piece ☐Battery ☐Gas cylinder ☐Electric goods ☐Other( )

Caution when handling	Safety measurement (Personal Protective Equipment)	☐Helmet ☐Hearing protection ☐Eye Protection ☐Respiratory product ☐Glove protection ☐Protective footwear ☐Protective worker wear ☐Other ( )
	First aid (After that, seek medical attention immediately)	☐Inhalation(☐Move to fresh air and keep at rest in a position comfortable for breathing ☐Other( )) ☐Adhesion to skin(☐Flush with much water ☐Other( )) ☐Eye contact(☐Flush with much water ☐Other( )) ☐Ingestion(☐Drink much water and make them throw up ☐Other( ))
	Leakage measurement	The way of removing work ☐Remove with scoops, brooms and so on ☐Other( ) Instructions in removing work ☐Try not to touch waste ☐Other( )
	Measurement for fire	Fire fighting with water ☐ Yes ☐ No ☐other Fire fighting with ABC-Extinguisher ☐ Yes ☐ No ( )

Current	Generated situation	☐Continuation ☐Spot	**Collect waste sample ☐No ☐Yes (Sampling place;)	
	Generated waste quantity		**Attached materials ☐No ☐Yes	
	Routine waste quantity		☐MSDS ☐Analysis sheet ☐Photo ☐Other( )	
	Style of packing		< Other information >	
	Arrival time	☐Expected; ☐Pending		
	Stored waste: ☐ No ☐ Yes			

Customer Signature in agreement with the above information	GEM use only

Golden Dowa ECO-System Myanmar Co. Ltd. (Waste Tracking Form)

Received Date:	
Manifest Number	
Customer Code:	
Waste Name:	
Waste Code:	
Remark:	

Appendix 5

MYANMAR OPERATION EMERGENCY MANAGEMENT PLAN

MYANMAR ASSET
EMERGENCY MANAGEMENT PLAN

PETRONAS

TABLE OF CONTENTS

Appendixes

PETRONAS

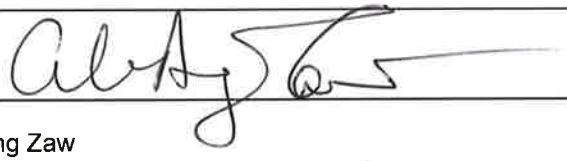
AUTHORITY FOR ISSUE

Authority for Original Issue

Issue Approval
Issue of this document has been formally approved by:

Signature:	
Name:	Emry Hisham B Yusoff
Reference Indicator:	Myanmar Asset
Position:	Head of Myanmar Asset
Date:	21.07.2017

Document Custodian
The following person has been assigned as the document custodian:

Signature:	
Name:	Win Aung Zaw
Reference Indicator:	Myanmar Asset
Position:	Acting Head of Health, Safety & Environment Department
Date:	21.07.17

This document has been prepared by the following person:

Signature:	
Name:	Nay Myo Aye
Position:	Executive, Crisis & Risk Management
Date:	28th June 2017

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13	Head, Project	MYA
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16	Pipeline Site Manager (PSM),Pipeline Operating Centre (POC)	MYA
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20	EVP & CEO Upstream	PCSB – Kuala Lumpur
21	Head, GHSE Crisis Management	GHSE – Kuala Lumpur
22	Head HSE, International Asset	HSE Upstream
23	Head, Crisis & Emergency Response Management	HSE Upstream
24	Upstream ECC Room	PCSB - Kuala Lumpur

25	PETRONAS COMCEN	PETRONAS - Kuala Lumpur

Amendment Summary

This sheet must be completed in detail at each revision once this document has been approved.

Details must include revision number, description and indication of which pages and Paragraphs have been revised, date of revision approval, approvers' title and signature.

Rev	Description	Date	Approver Title	Signature
0	Original Issue	June 2004	GM	
1	Conversion to Incident Command System	January 2006	GM	
2	Changed the title of the document from Yangon Office Emergency Coordination Plan to MYA Emergency Management Plan Added Mercury Incident Emergency Response Plan Updated MYA Emergency Contact Numbers	October 2007	GM	
3	Updated as per PTS 60.0112 GCPS and PCSB Emergency Response Plan Development Guideline	November 2013	GM	
4	Updated as per PTS 18.40.01 PETRONAS Contingency Planning Standard, October 2015 Updated MYA EMT Contact Database and EMT Assignees Updated NF form latest revision Updated Notification Matrix Added EMT Roles & Responsibility of Situation Unit Leader	August 2016	GM	
5	- Updated MYA EMT Contact Database and EMT Assignees -Updated definition of Tier 1, Tier 2 and Tier 3. -Updated MYA EMT	July 2017	GM	

	Organization -Updated Upstream Incident Notification Flowchart -Updated EMT Training Requirement as per PCPS -Updated Drill & Exercise Requirement as per PCPS			

Notes:

(1) Emergency Management Plan shall be reviewed every 3 years, or earlier if dictated by significant operational change, project change, major audit finding, exercise lessons or due to domestic regulation

(2) Document Holders to update Amendment Record as and when amendments/new revisions are received.

(3) For description of amendment the Document Holder should indicate correction, modification, and update or deletion issue.

(4) Document Holder to enter their company reference number, sign and date the record of entry.

(5) Where part amendments are issued, the relevant page(s) will be identified with a lower case letter in the revision status line in the header.

Any proposed changes are to be submitted to the HSE Department, MYA Yangon Office as per the revision procedure contained in this document.

PREFACE

This Emergency Management Plan has been developed to ensure that MYA reacts quickly and effectively in the event of an emergency in its operations. The document is formulated to meet all Company and legislative requirement and to satisfy all moral obligations in the event of any such emergency.

This document addresses the actions to be taken before, during, and after an emergency or disaster. The ability to contain and respond effectively to an emergency is one of the most challenging priorities facing our operations. The Company regards all hazards and risks can be managed and mitigate, if appropriate efforts were made. In doing so, MYA vigorously pursues efforts to deter and preempt these risks and manage through good HSE practice.

This plan was built upon previous experiences for managing risks and further elaborated as emergency management strategies, a mechanism and management structure undertaken by the country office to mitigate all possible emergency situations. The management strategies include implementing measures to reduce our vulnerabilities, responding rapidly and effectively to incidents or actual emergency, and giving the highest priority to developing sufficient capabilities to mitigate and manage the consequences.

To ensure this management strategy is implemented in a coordinated manner, this Emergency Management Plan, hereafter referred to as the EMP, is designed to provide overall guidance to the Emergency Management Team concerning how they would respond to an incident or emergency that occurs in the Company jurisdictional areas. This plan outlines an organized and unified capability for a timely, coordinated response by the Emergency Response Teams and the assistance that will be rendered by other emergency support agencies and government authorities.

It establishes conceptual guidance for assessing and responding, notifying appropriate service providers and government agencies, and deploying the requisite resources to assist the emergency management team in facilitating inter-agency coordination for mitigation and controls. Lastly, it defines the relationships between structures under which the Company will marshal consequence management resources (including supports from HQ Office) to respond to an emergency or crisis situation.

ABBREVIATIONS AND ACRONYMS

The abbreviations and acronyms used in this document shall have the following meaning:

CASEVAC	Casualty Evacuation
CMP	Crisis Management Plan
CMT	Crisis Management Team
CMERT	Crisis Management and Emergency Response Training
COMCEN	Communications Centre at PETRONAS Head Quarters, Kuala Lumpur
DCT	Damage Control Team
DM	Duty Manager (same as Incident Commander and ERM)
ECC	Emergency Control Centre
EMP	Emergency Management Plan
EMT	Emergency Management Team
EOC	Emergency Operation Centre
ERP	Emergency Response Plan
ERT	Emergency Response Team
FSO	Floating Storage & Offloading
IAP	Incident Action Plan
IC	Incident Commander
ICS	Incident Command System
IMS	Incident Management System
KLCC	Kuala Lumpur City Centre
MEDEVAC	Medical Evacuation
MYA	Myanmar Asset
MOGE	Myanmar Oil & Gas Enterprise
MS	Metering Station
NOK	Next of Kin
OIM	Offshore Installation Manager
OPU	Operating Unit
OSC	On Scene Commander
PCSB	PETRONAS Carigali Snd Bhd
PETTs	PETRONAS Twin Towers
PIC	Person-in-Charge
PICS	PETRONAS Incident Command System
POC	Pipeline Operating Centre
UC Unified Command	UC Unified Command

UST	UPSTREAM SUPPORT TEAM

GLOSSARY

Activation	The implementation of emergency response capabilities, procedures, activities and plans in response to an emergency or emergency declaration.
Alert	Notification that a potential emergency situation exists or has occurred; direction for recipient to standby for possible activation of emergency response plan.
Area Command	An organization established to: 1) Oversee the management of multiple incidents that are each being handled by an Incident Command System organization; or 2) To oversee the management of a very large incident that has multiple Incident Management Teams assigned to it. Area Command has the responsibility to set overall strategy and priorities, allocate critical resources based on priorities, ensure that incidents are properly managed, and ensure that objectives are met and strategies followed.
Assessment Meetings	Two-way meetings held in the ECC and scheduled by the IC for the purpose of checking response progress and reviewing objectives, problems and task allocation.
Assignments	Tasks given to resources to perform within a given operational period, based upon tactical objectives in the Incident Action Plan.
CASEVAC	Casualty Evacuation. The urgent evacuation of a sick or injured person because there is a risk of serious injury or death if more comprehensive medical treatment is not available quickly. A Casevac may involve special transport arrangements (i.e. ad-hoc charters, air ambulance, etc.) and will almost certainly require medical staff to accompany the patient.
Cold Zone	This area contains the command post and such other support functions as are deemed necessary to control the incident. This is also referred to as the clean zone or support zone.
Common Emergency Management System (CEMS)	Combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure with responsibility for management of assigned resources to effectively direct and control the response to an incident; PETRONAS ICS.
Command Network	Direct communication link established between the EMT Operations Section Chief and the ERT On-Scene Commander

Control Zone	The designation of areas at an incident based upon safety and the degree of hazard. Many terms are used to describe the zones involved in a hazardous materials incident.
Emergency	Incident where emergency or crisis team have been activated (Tier 1, Tier 2, or Tier 3)
Crisis Network	The direct communication link established between the EMT Incident Commander and the Upstream BU Crisis Manager or Head of Country if CCP activated.
Emergency Control Centre (ECC)	A site from which management-appointed response personnel exercise direction and control in an emergency.
Emergency Operations Centre (EOC)	The physical location at which the coordination of information and resources to support incident management (on−scene operations) activities normally takes place. An EOC may be a temporary facility or may be located in a more central or permanently established facility.
Emergency Response Team	A team of personnel, trained to manage and respond to an emergency. These are the Site Emergency Response Team, Regional Emergency Response Team and Corporate Emergency Response Team.
Hot Zone	The area immediately surrounding an incident, which extends far enough to prevent adverse effects from hazardous materials releases to personnel outside the zone. This zone is also referred to as the exclusion zone or restricted zone.
Incident Commander	He is normally the first person to be contacted in case of emergency. He is responsible, in conjunction with the Person-In-Charge of the installation on which the emergency occurred, for assessing the scale of the emergency and initiating the appropriate response actions, including, if deemed necessary, calling out the Regional Emergency Response Team. He shall also notify all relevant parties of the emergency. During the emergency, the Regional Incident commander shall normally remain in overall charge of and is responsible for directing the Regional Emergency Response Team, for authorizing, or obtaining authorization for, any funds required for materials, equipment, contract services or specialist personnel necessary to resolve the emergency.

Incident Action Plan (IAP)	The IAP, which is initially prepared at the first meeting, contains general control objectives reflecting the overall incident strategy and specific action plans for the next operational period. When complete, the IAP will have a number of attachments. The IAP is used to manage change from one operational period to another in support of the OSC. It is prepared by Planning for review by Operations. The IC is the issue authority.
Initial Briefing	Delivered by the EMT IC at the beginning of the emergency in the ECC which is one way (no questions) and which is designed to push information in front of the EMT.
Incident Command System (ICS)	An organized system of roles, responsibilities, and standard operating procedures used to manage and direct emergency operations.
Incident Management System	The process used by the EMT to navigate the emergency phase, and which consists of; briefings (initial and subsequent), objectives (based on core values, aligned with PEAR priorities, and aligned in support of the ERT objectives), tactical response operations (supporting the field tasks), information management (situation status display), response thought process (solving problems), incident potential (informal and formal assessment of the implications), meetings (scheduled assessment meetings), and action plans (incident action planning cycle managing change from one operational period to another)
Incident Objectives	Statements of guidance and direction necessary for the selection of appropriate strategies, and the tactical direction of resources. Incident objectives are based on realistic expectations of what can be accomplished when all allocated resources have been effectively deployed. Incident objectives must be achievable and measurable, yet flexible enough to allow for strategic and tactical alternatives.
International Direct Dialing (IDD)	With an IDD telephone line, you can make a direct overseas call by using the international access code. With non-IDD telephones, overseas calls must be made via a Myanmar Telecomm Authority operator.
Installation	Offshore - Yetagun A, B & C Platforms, FSO, Drilling Rig, Vessels etc. Onshore - POC, MS, Dawei Base, Thaketa Base and Yangon Office

Jurisdiction	The range or sphere of authority. The teams and agencies have jurisdiction at an incident related to their legal responsibilities and authority for incident mitigation. Jurisdictional authority at an incident can be political/geographical (e.g., site, facility, state or federal boundary lines), or functional (e.g., police department, home ministry, etc.). (See Multi-Jurisdiction Incident.)
Major Emergency	An emergency that, on assessment by the PIC, cannot immediately be brought under control with the first line response team and available equipment onsite without outside assistance.
MEDEVAC	Medical Evacuation. The routine evacuation of a sick or injured person to a location where they can receive more appropriate medical treatment than is possible at the work site. A MEDEVAC will typically involve normal transport arrangements, although timetables may be accelerated and medical staff may accompany the patient during travel.
Minor Emergency	An emergency which when assessed by the PIC, can immediately be brought under control with the first-line response team and available equipment located onsite without any outside assistance. However, if there is any uncertainty regarding the scale of the emergency, it should initially be treated as a major emergency.
Mitigate	Any action to contain, reduces, or eliminates the harmful effects of a spill or release of a hazardous substance/material.
Non- Emergency	Incident where there is no activation of emergency or crisis team
Person-In-Charge (PIC)	PIC of the site/installation/drilling rig or vessel at the time of the emergency. He is the person who coordinates all emergency response activities carried out by his own personnel and any additional assistance from outside the installation.
Personnel On Board (POB)	POB is used in this document to mean the number of people at a certain location, not necessarily on a vessel or aircraft. For example “POB at the Pipeline Operating Centre” means the total number of people located at the POC near Kanbauk.
Personal Protective Equipment	The equipment provided to shield or equipment to isolate a person from the chemical, physical, and thermal hazards that may be encountered at a hazardous materials incident. Adequate personal protective equipment should protect the respiratory system, skin, eyes, face, hands, feet, head, body, and hearing. Personal protective equipment includes both personal protective clothing and respiratory protection.

Resources	All personnel and major items of equipment available, or potentially available, for assignment to incident tasks on which status is maintained.
Situation Status Display	The display managed by Planning which provides the entire EOC staff a ready view of what has happened, where it has happened, and what is being done about it. It should include the following boards; incident facts, casualty status, organization, contacts, map, response objectives, problems/ solutions, action tracking, resource tracking, and a schedule of assessment meetings.
Span of Control	A Command and Control term that means how many organizational elements may be directly managed by one person. Span of Control may vary from three to seven, and a ratio of one-to-five reporting elements is recommended.
Staging Area	That location where incident personnel and equipment are assigned awaiting tactical assignment.
Stakeholders	Any person, group, or organization affected by and having a vested interest in the incident and/or the response operation.
Strategy	The general plan or direction selected to accomplish incident objectives.
Supply Network	Direct communication network established between the EMT Logistics Section Chief and the ERT Staging Area Manager
Tactics	Deploying and directing resources during an incident to accomplish the objectives designated by strategy.
Tactical Direction	Directions given by the IC that includes: the tactics appropriate for the selected strategy, the selection and assignment of resources, tactics implementation, and performance monitoring for each operational period.
Task Force	A group of resources with common communications and a leader assembled for a specific mission.
Triage	The classification of casualties according to the severity of their injuries in order to set priorities for treatment in a multiple casualty situation.
Unified Command (UC)	A unified team that manages an incident by establishing a common set of incident objectives and strategies. This is accomplished without loss or abdication of agency or organizational authority, responsibility or accountability.
Warm Zone	The area where personnel and equipment decontamination and hot zone support takes place. It includes control points for the access corridor and thus assists in reducing the spread of contamination. This is also referred to as the decontamination, contamination reduction, or limited access zone/corridor.

REFERENCED DOCUMENTS

095/020/002	MYA Initial Incident Notification Guideline EP Incident Notification Flowchart
095/020/006	Medical Evacuation and Reception Procedures
095/020/007	Media Response Procedure
095/020/010	Guide on Return of Remains of Deceased
WW ALL S 07 001	PCSB Health, Safety and Environment Management System Manual
MY ALL S 07 003	PCSB HSEM 2.1 - Supervisory Safety Procedure Manual Section 4: Incident Investigation & Reporting
095/009/001/032	Safe Handling of Mercury and Mercury Compound
PTS 18.0510	Group Contingency Planning Standards (GCPS)
PTS 18.0509	Emergency Drills & Exercise Guidelines
MY ALL S 04 005	PCSB Emergency Management Plan Development Guideline
PTS 18.40.01	PETRONAS Contingency Planning Standard Apr, 2017

Section 1
INTRODUCTION
Contents

1. INTRODUCTION

This Emergency Management Plan has been developed to provide guidelines to the on-duty emergency management team, who are directly or indirectly involved, when responding to emergencies occurring at Myanmar Asset operational areas.

The document has been developed to complement the existing Site Emergency Response Plan, which cover in detail the required response to specific emergencies. The document provides details of the management philosophy utilized by MYA when defining the organization and resources used in the response to an emergency and details the overall responsibilities required to handle effectively any emergency, which may arise.

All personnel with emergency roles and responsibilities must ensure that they become familiar with the requirements and procedures contained in this manual.

1.1 Purpose

This Plan establishes procedures to manage and coordinate the mitigation and control measures following an emergency or disaster situation. The following objectives have been established for this plan:

- This EMP is designed to support the MYA ERPs
- Attend to the primary priorities of:
  - People
  - Environment
  - Assets
  - Reputation
- Sets forth fundamental policies, planning assumptions, a concept of operations, the emergency management team responsibilities, and response and mitigation actions.
- Addresses linkages to other existing emergency management plan developed for specific incidents.
- Maximize the effectiveness of counter-measures through an established plan that consists of the following phases:
- Over-reaction; applying all emergency resources as soon as possible
- Assessment; anticipating problems before they become a reality
- Response; the application of resources to contain, isolate & stabilize the emergency
- De-Escalation; the scaling down of the response towards agreed termination criteria which marks the end of the emergency phase. Assign responsibilities to designated EMT members and provide guidance for emergency support groups during prolonged periods of mitigation.
- Serves as the foundation for the development of detailed supplemental procedures to complement this plan for response activities, rapidly and efficiently.
- Ensure compliance with applicable regulatory requirements and industry standards for emergency management.

The plan is organized in sections for easy reference. Each major section deals with a component of the plan beginning with governing policies, plan activation through emergency counter-measures and restoration of normal operations. The appendices contain information such as forms which may be required during the emergency response process; partners contact lists, vendor lists, etc.

1.2 Scope

All activities that are managed by MYA are covered by this Emergency Management Plan. All EMT members are required to understand and be familiar with their duties as they pertain to this Plan.

When there is an actual emergency or potential for an emergency, the procedures written in this Plan will be carried out immediately.

This document covers the response of MYA to emergencies affecting Myanmar Asset, specifically the following area operations:

- Yetagun Field (Yetagun A, B , C & D Platforms)
- Pipeline Operating Centre (POC)
- Metering Station (MS)
- Floating Storage and Offloading (FSO)
- Yangon Office
- Drilling Rig
- Onshore Blocks
- Vessels
- Etc.

This document should be used in conjunction with the following according to the nature of the emergency.

(a) Oil Spill Contingency Plan
(b) Mobile drilling rig emergency procedures (contractors)
(c) MEDEVAC / CASEVAC Procedures
(d) Accident Reporting Procedures
(e) Diving Emergency Procedures (Contractors)
(f) General Procedures for Simultaneous Operations.

This plan shall be used by the on-duty EMT members that are tasked to provide emergency assistance. This plan will be reviewed annually and updated when any of the following occurs:

- Applicable regulations are introduced or revised.
- The plan fails in an exercise or real emergency.
- Changes to the configuration of the facility.
- New hazards are introduced into or near the facility.
- Existing hazards are eliminated.
- There are changes to personnel who have a role in the plan.
    - Applicable regulations are introduced or revised.
    - The plan fails in an exercise or real emergency.
    - Changes to the configuration of the facility.
    - New hazards are introduced into or near the facility.
    - Existing hazards are eliminated.
    - There are changes to personnel who have a role in the plan.

All changes shall be approved by GM. The complete Plan shall be distributed to all relevant parties.

1.3 Overview

During an emergency situation, the centre of operation is known as the Emergency Control Centre (ECC). All information and coordination, regarding emergency management operations, shall flow through the ECC. The centre is staffed by the Emergency Management Team (EMT) and shall include one Incident Commander and members of the appointed representatives.

Within this framework, the EMT can provide, equipment, supplies, facilities, managerial and technical services in support of site ERT mitigation and control efforts. The Incident Commander and the other team members shall be involved in providing all required supports.

Under PETRONAS Incident Command System, the HSE Department has been delegated with primary responsibility for coordinating MYA emergency preparedness, planning, management, and emergency assistance functions. The department also has been delegated with responsibility for establishing emergency assistance policy. In this stewardship role, the department has the lead in developing this plan.

1.4 Document Structure

This Plan applies and shall be used by the emergency management team to coordinate emergency management operations occurring at MYA operations. The plan presented here is based on the following planning assumptions:

1 The plan is current, having been reviewed, maintained and updated on an annual basis. Plan training exercises have been performed.
2 Emergency mitigation is performed in accordance with the procedures that have been set forth within this plan and appendices.
3 The EMT has current strategies in place and any weaknesses have been identified and addressed.
4 Appropriate emergency response equipment is available and accessible.
5 The plan is to be a document that reflects a changing environment. Therefore, part of the plan is to implement on-going practices, in order to sustain the state of readiness.

This Plan utilizes the Common Emergency Management System (PETRONAS ICS) in organizing manpower and equipment during response and recovery operations.

The plan is organized in sections for easy reference. Each Section deals with a component of the Plan beginning with response concept, plan activation through restoration of normal operations. The appendices contain information such as incident notification flow chart, dedicated contact numbers, vendor lists, etc.

1.5 Ownership and Maintenance

This plan shall be reviewed annually by the Custodian, HSE Manager. All EMT members shall be responsible for reviewing their team responsibilities and making any recommendations for change. The plan will also be updated as a result of all post-incident review processes, as a result of information gained from plan training exercises and as a result of new Group Contingency Planning Standard.

Recommendations arising from the annual review will be submitted to MYA management for discussion and approval each year. Minor updates may be made by the Custodian at any time during the year. The Custodian holds ownership to this Manual.

The proper maintenance of this Plan will be the responsibility of ALL copy holders. It will be their responsibility to incorporate all approved revisions into their assigned copy to ensure that the plan is maintained. All removed pages are to be properly disposed or shredded.

Section 2

AUTHORITIES AND POLICIES

Contents

2. AUTHORITIES AND POLICIES

This section describes the authorities and policies associated with emergency and crisis management. Authorities and policies will govern the response concepts and what directs the planning and development of an operational emergency management systems.

2.1 Authorities

(a) Emergency planning shall include the identification of hazards and threats, hazard mitigation, development and preparation of emergency plans and procedures, and identification of personnel and resources required for an effective response.

(b) Implementation of a comprehensive emergency management program at all MYA operation and worksites shall commensurate with the hazards present.

(c) Any worksite that has significant quantities of hazardous materials (radiological and non-radiological) shall develop and maintain a quantitative hazards assessment and meet more detailed emergency planning requirements. Hazardous materials are any solid, liquid, or gaseous material that is toxic, flammable, radioactive, corrosive, chemically reactive, or unstable upon prolonged storage in quantities that could pose a threat to life, property, or the environment. Oil is not included in this definition of hazardous materials.

(d) Readiness assurance shall include assessments and documentation to ensure that stated emergency capabilities are sufficient to implement emergency plans.

(e) Emergency preparedness shall cover acquisition and maintenance of resources, training, drills, and exercises.

(f) All worksites shall establish a readiness assurance program to ensure that stated emergency capabilities are sufficient to implement emergency response plans.

(g) All emergency response activities shall use PICS and CEMS (per recorded in Section 5) in responding to, managing, and coordinating multiple group or multiple jurisdiction incidents.

(h) Emergency response shall include the use of resources to mitigate consequences to personnel, the public, the environment, and company assets, and the initiation of recovery activities.

(i) Recovery shall include planning for and actions taken following termination of the emergency to return the facility/operations to normal.

(j) MYA and Upstream Support Team Duty Managers serve as the point of contact for all emergency alert and notifications.

(k) The On-Scene Commander and Incident Commander have the authority to direct and coordinate emergency management operations and may delegate this authority to a government On-Scene Commander, under or during Unified Command.

(l) Upon activation the appointed ERT members shall initiate immediate mitigation action plan to contain the emergency while for on-duty EMT members, upon notification shall respond and proceed to the ECC within thirty (30) minutes and 60 minutes for Headquarters.

(m) MYA and Upstream EMT members shall assist the Incident Commander for all emergency mitigation activities. Accordingly, the EMT receives, coordinate, and disseminate emergency information to Group, industry partners and government agencies.

(n) Each worksite, along with MYA offices, shall document the emergency management program that implements the requirements of applicable legislations for personnel safety programs (e.g. fire, safety, and security).

(o) Each offshore worksite shall have necessary marine support arrangement to ensure that relevant coverage is made for emergency mitigation needs. As guide the operations marine support vessel shall; 1) maintain a response time of within one (1) hour from the worksite or facility; 2) an Emergency Response Plan must be formulated in case someone falls overboard or the worksite has to be evacuated; and 3) the vessels must be designed and equipped efficiently and comply with the requirement related to evacuation and rescue.

(p) MYA shall have aviation, medical and clinical supports in-placed. For aviation, the requirement shall make use of twin-engine helicopter and fix-wing aircraft.
While for medical and clinical needs, the requirement is to use accredited service providers and has provision for critical care. All the appointed service providers must be able to response and complement the MYA emergency needs.

(q) Each offshore worksite shall conduct emergency response drill every two-weekly and for onshore at monthly intervals to ensure continuous state of preparedness.

(r) Each worksite shall declare an emergency when events or conditions require time-urgent response. Such events or conditions cause, or have the potential to cause, serious health and safety impacts to personnel or the public, serious detrimental effects on the environment as a result of degradation of safeguards conditions.

(s) Each worksite shall notify IC when emergencies occur. The notification and reporting requirements within this authority have been agreed with PETRONAS Carigali requirements for non-emergency incident or occurrence reporting.

(t) Each worksite shall provide accurate and timely information about emergencies to personnel and the public.

(u) Where outside Country assistance is required (e.g. for the use of equipment, transports, etc.), all requests will be channeled through Upstream-BCMT. The requirements should subsequently be confirmed in writing, wherever possible.

(v) For contracted activity (i.e. worksite managed by contractor), the on-scene response and mitigation efforts shall be managed by the main contractor. While for all necessary emergency supports (reporting, communications, logistics, materials, etc.) they shall be managed by the company management person on-site (i.e. CSR, Field Superintendent, Drilling Supervisor, etc.).

(w) On-duty MYA EMT members shall have unrecorded leave entitlement for being on-duty during a government-declared holiday. Other provisions shall be decided by MYA management.

(x) The Managing Director shall be informed of any emergency by HQ-BCMT They shall consider strategic issues, such as the impact in terms of operability and continuity of operations, public relations, high level liaison with government authorities, other organizations and representation when dealing with the media.

(y) The HSE Management Unit provides and exercises management control of PETRONAS Carigali Common Emergency Management System.

2.2 Response Policy

MYA policy on contingency planning and response to emergencies take cognizance of both existing Company and statutory requirements as they relate to the handling of emergencies relevant to the Company operations, as well as to satisfy all moral obligations of the Company.

It is the policy of MYA that:

(a) In the event of any emergency occurring in any of its operations, the respective Site Emergency Response Team shall be immediately mobilized to deal with the emergency.

(b) Additionally, the MYA Emergency Management Team as well as Corporate Emergency Management Team (both headed by management), shall also be Mobilized, as necessary, to provide whatever support required by the site Emergency Response Team.

(c) Both Teams shall give their total support to the site Emergency Response Team with a view to effectively minimizing the harmful effect and to overcome the emergency as quickly as possible. When managing the emergency, the following priorities shall prevail:

1. Saving of lives and safety of personnel;
2. Preserving public health and safety;
3. Preserving the environment;
4. Protecting the property and investment; and
5. Maintaining the company reputation;

(d) Consistent with the overall policy, it is also a requirement that the Emergency Response Procedures of Contractors working for, and on behalf of MYA, shall conform to the contractual requirement and policy on emergency response.

(e) Additionally, regular training of all personnel, both Company and Contractors personnel, shall be conducted to ensure an effective emergency response preparedness exist throughout the Company's operations.

2.3 Terms of Reference EMT Members

The appointed emergency management team members are responsible for the co-ordination of response efforts during any emergency. The team is led by an Incident Commander. When on emergency duty, EMT members activities take precedence over any other duties/or off-site visits. The terms of reference for these EMT members are as listed below.

(a) A company executive and management-appointed person (in writing by Head, Myanmar Asset)

(b) Good working knowledge in operations, engineering or management-related activities

(c) Familiar with hazards and risks associated with various phases of D&P operations

(d) High level of maturity, analytical ability, good leadership qualities, with effective communication and interpersonal skills

(e) Responds to all emergency call-for-assistance when on-duty

(f) Vested with the department and management authority in the discharge of duty

(g) Co-ordinate all emergency supports and counter-measures

(h) Attend emergency management training and oil spill management course

(i) Participate in at least one (1) full-scale emergency response exercise

(j) Attend emergency induction training and department briefing before taking up duty

(k) Only delegate emergency duty to another trained team member

(l) Listed in the Weekly Duty Roster when on emergency duty for the week

(m) Duty Roster is coordinated by HSE, with changes require management approval.

Note: Appointment to Duty Manager designate must be E3 and above at MYA. Appointment of other EMT members shall be E1/E2 (or equivalent) and above for core team members.

2.4 Terms of Reference ERT Members

The appointed emergency response team members are responsible for the mitigation efforts at worksite or facility during any emergency. The team is led by the On-scene Commander. When on emergency mitigation, ERT members' activities take precedence over any other duties at worksite. The terms of reference for these ERT members are as listed below.

(a) A full-time employees of worksite or facility operations team

(b) Good working experience associated with maintenance and operations

(c) Good appreciation of hazards and risks associated with the worksite operations

(d) Able to respond to all emergency call-for-assistance

(e) Vested with the management authority in the discharge of duty

(f) Attend site emergency response team and oil spill operator training

(g) Management-appointed person (in writing by Head, Production Department)

(h) Delegation of emergency duty is only to another trained team member

(i) Listed in the worksite emergency response Duty Roster when on emergency duty

(j) Duty Roster is managed by On-scene Commander; with changes require facility management approval.

Note: Appointment to On-scene Commander designate must be an Executive, while for smaller facility i.e. satellite platform, the individual must be a Supervisor-appointed person.

2.5 Emergency Classifications

Classification of an incident is subjective and may change after additional facts are gathered.
After the Duty Managers have been notified, the incident may be re-classified as deemed appropriate.

PETRONAS three-tiered response definitions provide the following classification.

Tier 1-
A situation where the emergency response is within the control and capability of the ERT, with or without the assistance from response agencies and / or authorities.

Tier 2 -
A situation where the emergency response is beyond the control and capability of the ERT, thus requires EMT support as well as involvement from external response agencies and / or authorities.

Tier 3 -
A situation where the emergency response and management is beyond the control and capability of the EMT, thus, requires CMT support as well as involvement and management from multiple external response agencies and / or authorities.

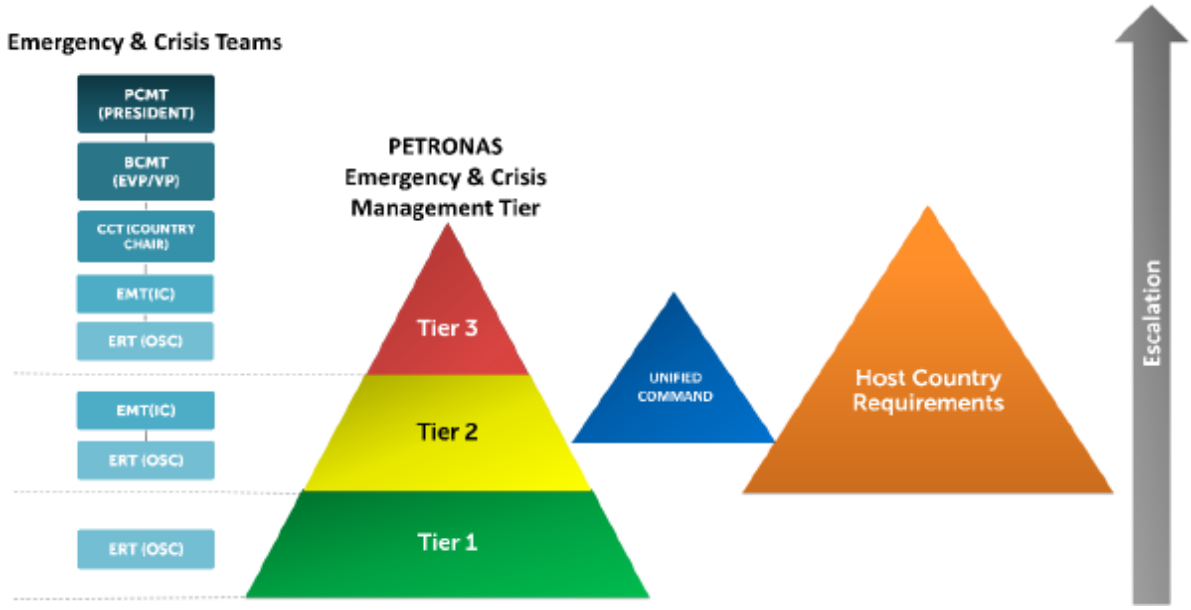


Figure 1: PETRONAS Three-tiered emergency management for international operations

2.6 On-duty Assignments-EMT Members

In the absence of the Duty Incident Commander for any reason, the replacement will be proposed by HSE Department and agreed by GM to act as IC.

Personnel appointed for emergency duty shall be available 24 hours and 7 days active coverage and ready for possible call out. The common rules while on emergency duty are:

- Available for handover or takeover session inside the ECC.
- Ensure telephone contact(s) remain current and advise on changes in writing to HSE Unit.
- Understand emergency responsibilities and be familiar with those of other members.
- Make available a copy of the weekly duty roster and other support documents.
- Keep Incident Commander informed of own whereabouts and means of contacting at all times.
- If, due to circumstances a team member cannot be available;
  1. Arrange for replacement and transfer of duty phone
  2. Advise HSE Unit of the change so that an update made to the Duty Roster.
- Duty can only be transferred to a team member that is trained as EMT member.
- Always carry emergency duty mobile phone and remain within the response times.
- Acknowledge receipt of messages by informing Incident Commander, otherwise proceed immediately.

Once MYA EMT is exhausted, back up EMT will be notified by HSE Department and agreed by Head, Myanmar Operation. Back up EMT team will keep on handling the emergency situation.

2.7 Resources Management

Resource management involves coordinating and overseeing the use of tools, processes, and systems that provide ERT and EMT members with timely and appropriate resources during an emergency. Resources include manpower, teams, facilities, equipment, and supplies. Resource management is divided into four primary tasks:

1. Establishing systems for qualifying, inventorying, requesting, and tracking resources;
2. Activating these systems prior to and during an emergency;
3. Dispatching resources prior to and during an emergency; and
4. Deactivating or recalling resources during or after emergencies.

2.7.1 Concepts and Principles

The underlying concepts of resource management in this context are that it:

(a) Provides a uniform method of identifying, acquiring, allocating, and tracking resources.

(b) Uses effective mutual-aid and other assistance by the standardized classification of kinds and types of resources required to support the incident management organization.

(c) Uses a credentialing system for a uniform training and certification standards to ensure that manpower resources are well integrated during mitigation actions.

(d) Coordination is the responsibility of EOC, ECC and/or multi-agency coordination entities, as well as specific groups in the PICS-CEMS structures.

(e) Should include resources contributed by industry partners and government agencies.

Five key principles underpin effective resource management:

(a) Advance planning by ERT, EMT and line management is required to develop plans for managing and employing resources in a variety of possible emergency circumstances.

(b) Resource identification and ordering conducted making use of standardized processes and methodologies to order, identify, mobilize, dispatch, and track the resources required to support incident management activities.

(c) Categorizing resources by size, capacity, capability, skill, and other characteristics. This makes the resource ordering and dispatch process within the operating divisions more efficient and ensures that ERT and EMT receive resources appropriate to their needs.

(d) Use of agreements among all parties providing or requesting resources are necessary to enable effective and efficient resource management. Formal pre-incident agreements (e.g. mutual aid) between parties that might provide or request resources are established.

(e) Effective management of resources by adopting good practices to perform key resource management tasks systematically and efficiently. Examples include the following:

- Acquisition procedures developed to obtain resources to support operational requirements.
- Management information systems formulated to collect, update, and process data; track resources; and display their readiness status.

- Ordering, mobilization, dispatching, and demobilization protocols to request resources, prioritize requests, activate and dispatch resource, and return resources to normal status. ERT and EMT to develop standard methods for use within their control areas.

Examples include tracking systems that identify the location and status of Mobilized or dispatched resources and procedures to `demobilize' resources and return them to their original locations and status.

2.7.2 Managing Resources

To implement the concepts and principles (recorded at Paragraph 2.7.1), the requirement under this guideline adopts eight processes in managing resources:

(1) Identifying and categorizing resources by capability that OSC and IC commonly request, deploy, and employ. Measurable standards in identifying the capabilities and performance shall serve as the basis for categories, per in PICS doctrine.

(2) Training and certifying ERT and EMT members is necessary as attesting that team members meet professional standards for the training, experience, and performance required for emergency management functions. The needs should be extended to suppliers and service providers personnel. This system helps ensure that personnel representing the suppliers, service providers and functional disciplines personnel possess a minimum level of training, currency, experience, physical and medical fitness, and capability for the emergency management or emergency responder position they are tasked to fill.

(3) Inventorying resources shall be conducted to assess the availability of assets provided by suppliers, service provider and industry partners. Operating Division is required to record all resources available for deployment into resource tracking systems. The data are then made available to HSE Management Unit, Worksite EOC and ECC.

(4) Identifying resource requirements shall be made by the Logistics Chief and Coordinator to identify, refines, and validates resource requirements throughout the incident life cycle. This process involves accurately identifying (1) what and how much is needed, (2) where and when it is needed, and (3) who will be receiving or using it. Resources to be identified in this way include supplies, equipment, boats, aircraft, facilities, and incident management personnel and/or emergency response teams.

(5) Ordering and acquiring resources that the OSC or IC cannot obtain locally are submitted through the EOC or ECC using standardized resource-ordering procedures. If the ECC is unable to provide the order locally, the order is forwarded to the service providers and other industry partners, if necessary.

(6) Mobilizing resources shall commence when notified through the established channels. At the time of notification, they are given the date, time, and place of departure; mode of transportation to the scene; estimated date and time of arrival; reporting location (address, contact name, and phone number); anticipated assignment; anticipated duration of deployment; resource order number; incident number; and applicable cost and funding codes. When resources arrive on scene, they must formally clock in.

(7) Tracking and reporting resources shall be conducted throughout the life cycle of emergency response by all parties. This process provides ERT and EMT members and others with a clear picture of where resources are located, helps team members prepare to receive resources, protects the safety of personnel and security of supplies and equipment, and enables the coordination of movement of personnel, equipment, and supplies.

(8) Recovering resources involves the final disposition of all resources. During this process, resources are rehabilitated, replenished, disposed of, and retrograded:

- Nonexpendable resources should be fully accounted for at the emergency location when they are returned after use. The worksite then restores the resources to fully functional capability and readies them for the next mobilization. Damaged and/or lost items should be replaced. In the case of manpower, such as ERT and EMT members, adequate rest and recuperation time and facilities are provided; including occupational and mental health issues (i.e. critical incident stress management briefing).
- Expendable resources should be fully accounted for. The affected Operating Division bears the costs of expendable resources. Returned resources that are not in restorable condition (whether expendable or nonexpendable) must be declared as excess according to established policies and regulations. Resources that require special handling and disposition (e.g. biological waste and contaminated supplies, debris, and equipment) must be dealt with according to established regulations and policies.

2.8 Multi-Agency Coordination System

A multi-agency coordination system is a combination of facilities, equipment, personnel, procedures, and communications integrated into a common system with responsibility for coordinating and supporting domestic incident management activities. The primary functions of multi-agency coordination systems are to support incident management policies and priorities, facilitate logistics support and resource tracking, inform resource allocation decisions using incident management priorities, coordinate emergency-related information, and coordinate interagency and intergovernmental issues regarding emergency or crisis management policies, priorities, and strategies. Direct tactical and operational responsibility for conducting emergency management activities rests with the Incident Command.

2.9 Coordination and Issues Management

The overall responsibility for the safety of worksite rests with the OSC. He has the responsibility to take immediate response actions required to control the emergency; including directly mobilizing or requesting the use of necessary resources such as aircraft, materials, decision to shutting down, vacate/abandon worksite, etc.

At MYA Office, the EMT Duty Manager (Incident Commander) is empowered for directing key personnel, authorizing or obtaining authorization of any funds required for materials, equipment, contract services or specialist personnel necessary to contain the emergency.

At Headquarters, the UST Duty Manager shall render necessary supports and assistance to affected operating division. For activities that are managed by Headquarters but are conducted at specific operating division, the division-EMT shall implement the mitigation activities, unless superseded.

For emergency or crisis associated with issues management or strategic response, Headquarters EMT shall be directly involved. Issues to be managed include the protection of: employees; public; the environment; company assets; and company reputation. The categories of issues management may include the following:

- People and the environment
- Augment worksite actions to employees and the environment as required
- Reputation issues
- Acknowledge responsibility as appropriate
- Anticipate and address public perception
- Mobilize emergency or crisis management executives and management person

- Communicate with employees, governments, media, and shareholders
- Ensure continuity of business operations
- Meet needs of customers and business partners
- Support or manage asset and liability issues
- Evaluate financial standing and exposure.

To the maximum extent possible, internal local resources at site shall be used as the first line of support for emergency recovery operations. Arrangements and working collaboration should be made with other agencies as an additional option for resource support after an emergency declaration.

Once MYA resources and capabilities are exhausted, HQ EMT assistance may be provided to support operational requirements and priorities. Utilization can be requested from the EMT.

Resources are acquired using the standard company procurement vehicle such as a purchase order, blanket purchase agreement, or contract. Additionally, the IC may authorize purchase under the emergency provision power directing completion of a specific task.

Section 3

COMMANDS AND MANAGEMENT

Contents

3. COMMANDS AND MANAGEMENT

Emergency management expands on the objectives and principles of emergency planning and response, and outlines the methods by which these objectives will be achieved by MYA.

The management system framework should be used to develop plans and procedures which are appropriate to the strategic objectives and risks of MYA, and which satisfy the requirements of the relevant legislations, host country authorities and industry organizations.

In this section, the principles of emergency response planning are expanded to provide a framework of guidance on issues which should be considered and, if appropriate, addressed by MYA in developing its emergency response plans and procedures.

3.1 Emergency Situations

3.1.1 Hazards and Risks Assessment

A hazard is the potential to cause harm, including ill-health or injury, damage to property, facility, products or the environment, production losses or increased liabilities. All hazards within the Operating Unit should be identified ('what can go wrong?') and assessed for consequence ('what will happen, and how serious will it be if it does go wrong?') and, if practicable, for risk (determined by the chance that a specified undesired event will occur and the severity of the consequences of the event).

Hazards must be considered in the context of the ever changing operating environment. Further details and guidance on Hazards Assessment and Vulnerability Analysis is given at Section 4.

3.1.2 Definition and Classification

Hazards can be controlled through elimination, improved design, and improved operating Procedures, competence, reduce exposure. Not all operations can be made hazard free. These 'residual hazards', or failure of control systems to eliminate other hazards, can give rise to emergency situations.

An emergency is any sudden, abnormal or unplanned situation which requires immediate attention and may endanger human life, the environment or have an adverse effect on the Business Unit and general public.
It is likely to attract news media attention, put at risk the Operating Division reputation and may pose a significant financial or legal liability.

The nature, location and scale of the emergency should determine the level of response required to recover control of the hazard and to initiate the restoration of activities required to return the business to normal operating levels.

A tiered (see the classification at Section 2) response is adopted to integrate all available resources e.g. from another Division, a function or from other external parties.

The escalation potential of any emergency situation must be recognized and evaluated. Key decisions on response strategy need to be taken in the early minutes/hours, and it is important to assess the situation on the basis not only of what has happened but on what could happen with the level of response, should correspond to this assessment.

3.2 ORGANIZATION

3.2.1 UPSTREAM SUPPORT TEAM

The PCSB Emergency Control Centre (ECC) is at (TACTICAL ROOM, Level 11, Tower 1), PCSB Head Office, Kuala Lumpur. The ECC is used by Upstream Support Team, when coordinating emergency activities and providing supports to PCSB-OPU (local and International).

The corporate EMT (Upstream Support Team) is supported by appointed emergency support team members. The Corporate EMT will also organize supports from other OPUs to the affected OPU at the request of the Incident Commander.

3.2.2 PETRONAS Headquarters, Kuala Lumpur

The PETRONAS Crisis Management Team (PCMT) at PETRONAS Headquarters is involved in an emergency, when it escalates into a crisis situation. The team primary roles are to address strategic / tactical group issues and policy guidance to PCSB and OPU team members, when necessary. When a crisis is declared, Level 37 of Tower 1 of the PETRONAS Twin Towers meeting rooms may be converted to a centralized management center.

PETRONAS Head Office is notified of emergencies by PCSB-HQ IC. Press releases (beside the Holding Statement) must be approved by the President office before the official release.

The overall crisis management framework for domestic and international operation is shown in Figure - 2.

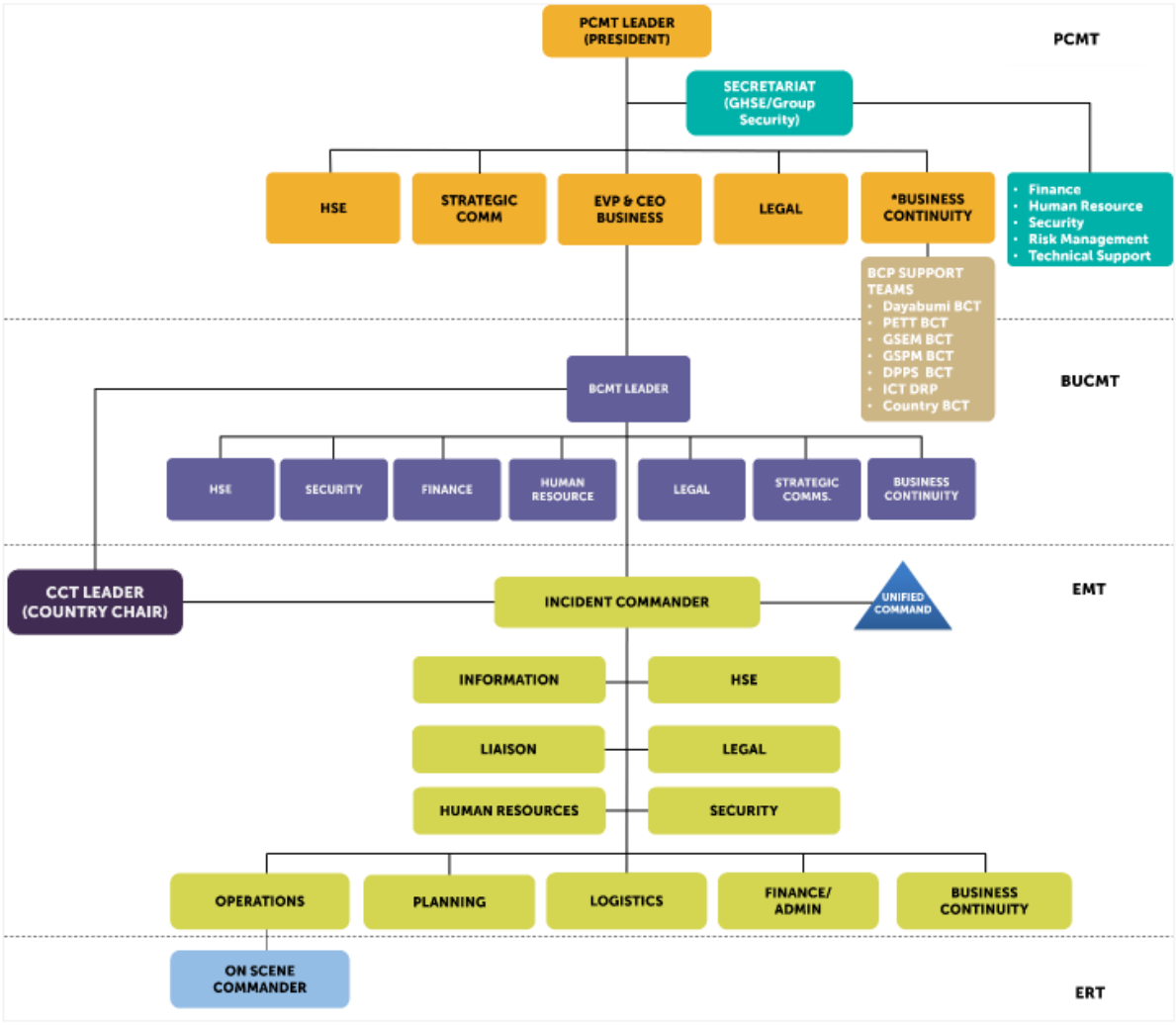


Figure 2: Emergency / Crisis management framework for PETRONAS

3.2.3 Emergency Management Team, Myanmar Asset

The MYA EMT supports the site Emergency Response Team. Following an emergency-declared situation, the IC and EMT members will proceed to the designated ECC at Yangon office.

MYA EMT members shall assist the Incident Commander for all emergency mitigation activities. Accordingly, the EMT receives, coordinate, and disseminate emergency information to Group, industry partners and government agencies.

The command and control of an incident or emergency demands a unified framework for the preparation and execution of plans and orders. Emergency Response Teams at all levels may manage command and control activities somewhat differently depending on the complexity, capabilities and resources.

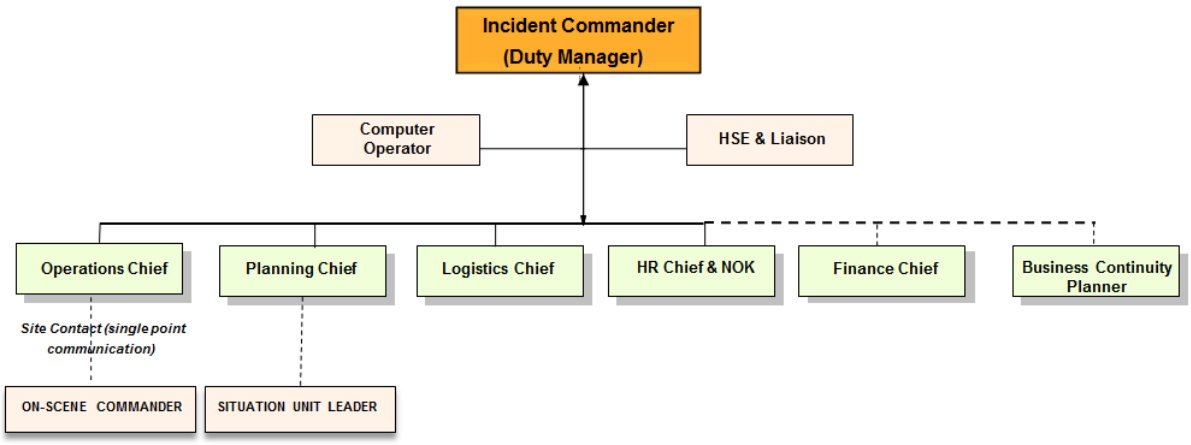


Figure 3: MYA Emergency Management Team (Core Group)

3.3 EMERGENCY ROLES AND RESPONSIBILITIES

3.3.1 Incident Commander

The authority to manage any emergency is delegated to MYA appointed Incident Commander.

Roles

- ☐ Serve as management representative during an emergency.
- ☐ Exercise overall management responsibility for the coordination between emergency response agencies.
- ☐ Establish appropriate staffing level for the ECC and continuously monitor organizational effectiveness and made appropriate modifications, as required.
- ☐ In conjunction with other EMT members, set priorities for response efforts. Ensure that all actions are accomplished within the priorities established.
- ☐ Lead the determination of strategic and tactical issues and actions on a local basis.
- ☐ Ensure that PCSB-HQ EMT is activated in the event of a major incident.
- ☐ Ensure that Inter-Agency Coordination is accomplished effectively.

Responsibilities

- ☐ Activate the EMT and support groups as required.
- ☐ Provide status updates of the conditions and situations at the emergency scene to Head Office and authorities.
- ☐ Ensure that the appropriate tactics and resources are in place at the emergency scene.
- ☐ Ensure that all necessary resources are available for optimal response.
- ☐ Ensure that there is a continuous dialogue with PIC, contractor and other involved parties.
- ☐ Ensure EMT roles (e.g., operations, safety, liaison with external agencies, media liaison, and documentation) are satisfactorily being fulfilled.
- ☐ Inform contractors of MYA expectation and regularly update the UST IC via briefings.

☐ Keep a personal log of events, communications, and decisions.
☐ Co-ordinate response with external response resources.
☐ Co-ordinate with local authorities and consulate office, as appropriate.

Activation Phase

- On being notified of an emergency, shall return the call within 5 minutes and proceed immediately to the ECC.
- Establish direct contact with the PIC and obtain clear and concise details on the nature, seriousness and in particular details of casualties.
- Assessing the emergency situation and determine the adequacy of emergency response capability and resources.
- Verify total number of personnel on site and their status/disposition.
- Determine appropriate level of activation based on situation as known.
- Start and maintain an incident status log until relieved by the Planning Section Chief.
- Maintain open communication with the PIC throughout the emergency and keep as brief as possible; provide advice and assistance as is possible.
- Alerting the Head, Myanmar Asset, Upstream Duty Manager and Mobilize appropriate EMT members for the initial activation.
- On the arrival of EMT brief them fully on the status of the Emergency giving details of any action taken.
- Ensure that the ECC is properly set up and ready for operations.
- Ensure that telephone and/or radio communications with partners/operators are established and functioning.
- Conduct initial briefing and schedule the initial Action Planning meeting.

Operational Phase

- Monitor EMT member activities to ensure that all appropriate actions are being taken.
- Coordinating the overall company efforts to collect, analyze, process, synthesize, report, mitigate and facilitate the supports for effective emergency operations on-scene.
- Providing staffing support for emergency management activities, if deemed necessary.
- Establishing general liaisons with business partner(s), contractor and the relevant government agencies.
- Keep Upstream Duty Manager updated on progress of mitigation and controls.
- If partial or total evacuation of personnel is deemed necessary, ensure that numbers and movements are accurately documented.
- In conjunction with the PCSB or GROUP management, conduct news conferences and review media releases for final approval, following the established procedure for information releases and media briefings.
- Ensure that the HSE & Liaison Officer is providing for and maintaining effective inter agencies coordination.
- Based on current status reports, establish initial strategic objectives to support partners efforts.
- Identify requirements for specific expertise (e.g. Exploration, Drilling, Structural, Aviation etc) depending on nature of the emergency.
- If there are casualties, ensure that appropriate CASEVAC arrangements have been made.
- In coordination with EMT members, prepare management function objectives for the initial Action Planning Meeting.
- Convene the initial Action Planning meeting. Ensure that all EMT members and other key agency representatives are in attendance.
- Once the Action Plan is completed by the Planning Chief, review, approve and authorize its implementation.
- Request Finance & HR Chief to set up a separate cost center/account number for the emergency and ensure that all related expenditure and costs are recorded against this account.

- Establish a separate technical support team outside the ECC to consider detailed technical aspects of the emergency and response if required and staff with appropriate specialists.
- Conduct periodic briefings with EMT members to ensure strategic objectives are current and appropriate.
- Conduct regular updates for Upstream Duty Manager, PCSB and GROUP Management or their representatives.
- Ensure that HSE & Liaison Officer has accurate information regarding the emergency to enable him to co-ordinate the preparation of draft Press Statements.
- Brief your relief (during prolonged response) at shift change, ensuring that ongoing activities are identified and follow-up requirements are known.

Demobilization Phase

- Authorize deactivation of EMT and Support Teams when they are no longer required.
- Notify the UST DM and other appropriate organizations of the expected planned deactivation time.
- Ensure that any open actions not yet completed will be handled after deactivation.
- Ensure that all required forms or reports are completed prior to deactivation.
- Be prepared to provide input to the after action report.
- Deactivate the ECC at the designated time, as appropriate.
- Proclaim termination of the emergency and proceed with recovery operations.

3.3.2 Operations Section Chief

A member of EMT responsible to the IC on all matters related to operations and emergency communication.

Roles

☐ Assess the emergency situation and determine the adequacy of emergency response resources.
☐ Provide on-scene tactical operations support to the site ERT.
☐ Serve as the single focal point of situation assessment operations and overall management of response efforts for team members.
☐ Establish direct contact with PIC and obtain clear and concise details on the nature and seriousness.
☐ Interpret information from the PIC and use them to support the different planning needs of EMT members.
☐ Monitor the actions of ERT and other response agencies (if involved).

Responsibilities

☐ Ensure operational objectives and assignments identified in the agreed Action Plan are carried out effectively.
☐ Establish the appropriate level of operations supports, continuously monitoring the effectiveness and modifying accordingly.
☐ Exercise overall responsibility for the management of emergency operational activities within the Operations Section.
☐ Ensure that the Planning Chief is provided with updated reports (for log keeping) utilizing the Emergency Response Log Sheet.
☐ Conduct periodic Operations briefings to EMT members as required or requested.
☐ Overall supervision and control of the operations Unit activities; including technical supports.

Activation Phase

- Follow the generic Activation Phase Checklist (see Paragraph 4.3).
- Confer with IC to ensure that EMT positions are staffed at levels necessary to provide adequate information and support for emergency operations.
- Ensure that the Operations Section support is set up properly and that appropriate personnel, equipment, and supplies are in place, including maps and status boards.
- Based on the situation, activate appropriate supports within the section. Designate a Leader as necessary.
- Establish communications with the site PIC.
- Based on the situation known or forecasted, determine likely future needs of the operations supports.
- Identify key issues currently affecting the emergency site and affected personnel or secondees; discuss with EMT members and determine appropriate counter-measures for the first operational period.
- Review responsibilities; develop an operations plan detailing strategies for carrying out operations objectives.
- Adopt a proactive attitude. Think ahead and anticipate situations and problems before they occur.

Operational Phase

- Analyze the escalation trends and assists with the development of subsequent action plans.
- Discuss with the IC; obtain a preliminary situation briefing on:
    - Type of emergency
    - Number of personnel on-location
    - Status of mustering and head count
    - Number and conditions of casualties
    - Actions that has been taken on-scene
    - Weather condition (strong wind, sand storms, etc)
    - Resources on site – vehicles, aircraft
    - Assistance requested from others.
- Identify critical issues and provides general planning support to the PIC.
- Maintain open communication with the PIC.
- Ensure that situation and resources information is provided to the Planning Chief on a regular basis or as the situation requires.
- Ensure that all media contacts are referred to the IC or HSE& Liaison Officer.
- Conduct periodic updates and works to reach consensus among EMT members.
- Work closely with PIC to ensure that the MYA objectives, as defined in the current action plan, are being addressed.
- Brief the IC periodically on any updated information you may have received.

Demobilization Phase

- Follow the generic Demobilization Phase Checklist (see Paragraph 5.3)

3.3.3 Planning Section Chief

A member of EMT responsible to the IC on all matters that are related to technical and secretarial supports. The job includes maintaining an accurate timed log of events, instructions and communications during the emergency period.

Roles

- ☐ Serve as the information focal point for the overall compilation of situation assessment.
- ☐ Collect, analyze, and display information regarding the emergency situation and the location of critical resources at the Event Boards.
- ☐ Process information that is common to team members that can contributes to the overall perspective of the emergency.
- ☐ Recommend (as needed) the activation of support teams in anticipation of, or immediately following, an incident or emergency.
- ☐ Maintain the completeness of information displayed, collects and analyzes information to be used for subsequent reporting to Corporate Offices, the status briefings by Incident Commander and by other team members.
- ☐ Contact other support expertise to provide information updates for reporting and analysis requirements. Other members are responsible for inputs to information processing and information displays unique to their functional discipline.
- ☐ Disseminate emergency response summary for the EMT members.

Responsibilities

- ☐ Ensure that the responsibilities of Planning Section are carried out, to include:
    - ❖ Collecting, analyzing, and displaying situation information,
    - ❖ Preparing periodic Situation Reports,
    - ❖ Preparing and distributing the EMC Action Plan,
    - ❖ Providing technical support services to EMT, and
    - ❖ Documenting and maintaining log and files on EMC activities.
- ☐ Exercise overall responsibility for the coordination of technical supports requirement and activities.
- ☐ Keeps the IC informed of significant issues affecting the Planning Section and Log Keeping.
- ☐ In coordination with other EMT members, ensure that consistent log keeping is made, complete Situation Status Reports, and to develop the ECC Action Plan.
- ☐ Ensure all status boards and other displays contain accurate information.

Activation Phase

- Follow the generic Activation Phase Checklist (see Paragraph 4.3).
- Ensure that ECC is set up properly and that appropriate equipment, and supplies are in place.
- Prepare Situation Analysis objectives for the Initial Action Planning meeting.
- Discuss with the IC and EMT members to obtain and review any major incident reports.
- Make a list of key issues to be addressed; in consultation with EMT members, identify objectives to be accomplished during the initial Operational Period.
- Keep the IC and EMT members informed of significant events.

Operational Phase

- Ensure proper and effective log keeping is maintained and keep current information for the situation status report.
- Ensure that major information are compiled by EMT members and are available for recording.
- Ensure that all status boards and other displays are kept current and that posted information is neat and legible.
- Produce situation status report and distribute to EMT members.
- Assist the IC's action planning meetings and during a quick update session after the end of each operational period.
- Work closely with EMT members to ensure the objectives, as defined in the current EMC Action Plan, are being addressed.
- Ensure that fiscal and administrative requirements are coordinated through the Finance & HR Chief.

Demobilization Phase

- Follow the generic Demobilization Phase Checklist (see Paragraph 5.3).

3.3.4 Logistics Section Chief

A member of EMT responsible to the IC on all matters related to logistics and resources.

Roles

☐ Assess the emergency situation and determine the adequacy of logistics response resources.
☐ Establish communications with logistics service providers, when appropriate.
☐ Identify available resources – aircraft, road transports, and materials and arrange for mobilization and movement of those resources as planned.
☐ Validate requests and managed the procurement process with Vendors assistance.
☐ Coordinate resource requests with Service Providers and other suppliers.
☐ Obtain additional resources from other oil companies/operators, if necessary.
☐ Provide status reports on logistics activities to the IC and EMT members.

Responsibilities

☐ Ensure the Logistics function is carried out in support of EMT and ERT operations. This function includes resource tracking; acquiring equipment, supplies, and transportation services.
☐ Establish the appropriate level of staffing and continuously monitoring the effectiveness and modifying as required.
☐ Coordinate closely with all EMT members to establish priorities for resource allocation to support emergency management operations.
☐ Keep the IC informed of all significant issues relating to the logistics operations.
☐ Ensure that the Planning Chief is provided with updated reports (for log keeping) utilizing the Emergency Response Log Sheet.
☐ Supervise all logistics related activities.

Activation Phase

- Follow the generic Activation Phase Checklist (see Paragraph 4.3).
- Ensure the logistics support is set up properly and that appropriate personnel, equipment, and supplies are in place, contact directories, vendor references, and other resource directories.

- Establish communications with logistics support department.
- Advise logistics support units to deliver and coordinate requirement.
- Discuss with the IC and EMT members and identify immediate resource needs.
- Meet with Finance &HR Chief and determine level of purchasing authority for the Logistics Section.
- Provide periodic updates to the IC and EMT members, if required.
- Adopt a proactive attitude, thinking ahead and anticipating situations and problems before they occur.

Operational Phase

- Ensure that logistics position logs and other necessary files are maintained.
- Attend and participate in EMT Action Planning meetings.
- Ensure that transportation requirements, in support of response operations, are met.
- Ensure that all requests for facilities and facility support are addressed.
- Ensure that all resources are tracked and accounted for, as well as resources ordered through Mutual Aid.
- Ensure that the Planning Unit is provided with updated reports (for log keeping) utilizing the Emergency Response Log Sheet.
- Provide section staff with information updates as required.

Demobilization Phase

- Follow the generic Demobilization Phase Checklist (see Paragraph 5.3)

3.3.5 Finance Section Chief & HR Section Chief

A member of EMT responsible to the IC on all matters related to finance and administration.
But as per the requirement of emergency situation the Finance & HR Section Chief will split into Finance Section Chief and HR & NOK officer. The additional man power will take over from Finance & HR Section Chief to concentrate more on either Finance part or HR part. HR officer responsibility is in Appendix X.

Roles

☐ Ensure that all financial records are maintained throughout the event or disaster.
☐ Ensure NOK and Media Response Teams are given only approved information, which they can release.
☐ Allocate personnel to render appropriate assistance to Next of Kin, providing representatives with an initial briefing and copies of press releases.
☐ Identify and arrange specific need for transport, accommodation, catering, clothing, money etc. for evacuated personnel and NOK.
☐ Collate and make copies of all approved press reports and provide to EMT members.

Responsibilities

☐ Determine purchase order limits for the procurement function in Logistics.
☐ Discuss requirement and support with medical service provider, if necessary.
☐ Ensure that compensation claims, resulting from the response to the incident are processed within a reasonable time, given the nature of the situation.
☐ Ensure that all travel and expense claims are processed within a reasonable time, given the nature of the situation.

☐ Provide administrative support to EMT members as required.
☐ Activate support teams as required; Monitor activities continuously and MYAdify the organization as needed.
☐ Coordinate with HSE &Liaison Officer on local meetings and security supports.
☐ Keep current on general status of resources and activity associated with your position.
☐ Ensure that the Planning Unit is provided with updated reports (for log keeping) utilizing the Emergency Response Log Sheet.

Activation Phase

- Follow the generic Activation Phase Checklist (see Paragraph 4.3).
- Ensure that the supports are set up properly and that appropriate personnel, equipment, and supplies are in place.
- Maintain accurate details of all POB MYAvements.
- Co-ordinate response to Relatives/Next-of-Kin enquiries.
- Ensure coordination with all EMT members for the purposes of gathering and consolidating response cost estimates and other related information.
- Discuss with the IC and Logistics Chief and review financial and administrative support requirements and procedures; determine the level of purchasing authority to be delegated.
- Notify and coordinate requirement with medical service provider, if necessary.
- Communicate with contractors/or partners and relevant agencies to address welfare needs.
- Adopt a proactive attitude, thinking ahead and anticipating situations and problems before they occur.

Operational Phase

- Ensure that position logs and other necessary files are maintained.
- Ensure all data (NOK address, contact numbers, etc) are current, and that information is posted in a legible and concise manner.
- Provide NOK and support teams with an initial briefing and copies of press releases.
- Notify the medical service providers.
- Co-ordinate response to media and spouse enquiries.
- Co-ordinate office security, particularly regarding access of media personnel to MYA office.
- Ensure adequate support personnel e.g. telephonist, driver etc. have been called out and transported to the office in a timely manner.
- Participate in all Action Planning meetings.
- Brief all support team leaders and ensure they are aware of EMT objectives as defined in the Action Plan.
- Keep the IC and EMT members aware of the current fiscal situation and other related matters, on an on-going basis.
- In coordination with the Logistics Section, ensure that the purchasing unit processes purchase orders and develops contracts in a timely manner.
- Notify and coordinate requirement with medical service provider, including doctors, ambulances etc.
- Ensure Support teams are given only approved information, which they can release.
- Allocate personnel to render appropriate assistance to Next of Kin, providing representatives with an initial briefing and copies of press releases.
- Identify and arrange specific need for transport, accommodation, catering, clothing, money etc. for evacuated personnel and spouse.
- Collate and make copies of all approved press reports and provide to EMT members.
- Coordinate reception of evacuated personnel, sending representatives to landing places, hospitals etc. as required.
- Ensure that the Planning Chief is provided with updated reports (for log keeping) utilizing the Emergency Response Log Sheet.

Demobilization Phase

- Follow the generic demobilization Phase Checklist (see Paragraph 5.3).

3.3.6 HSE & Liaison Officer

A member of EMT responsible is to the IC on all matters that are related to HSE, Security and Liaison with relevant external agencies. But as per the requirement of emergency situation the HSE & Liaison Officer will split into Safety officer, Liaison officer and Security officer. The additional man power will take over from HSE & Liaison to concentrate more on either Security , Safety part or Liaison part in order to response effectively. Each responsibility is in Appendix X.

Roles

☐ Develops and recommends measures for assuring personnel safety and security, assessing and/or anticipating hazardous and unsafe situations, and taking corrective measures.
☐ Acting as liaison with partners and facilitate requests, but normally do not directly act on or process resource requests.
☐ Obtain situation status information and response activities from EMT Operations Chief.
☐ Identify or act as the spokesperson (seek prior authorization) for public, media, or special interest stakeholders during the emergency.
☐ Coordinate MYA's participation with regulatory agencies at the incident scene, if necessary.
☐ Resolve any conflicts with agencies having jurisdiction over MYA's response efforts.
☐ Prepare press releases and coordinate public briefings.

Responsibilities

☐ Provides a point of reference for identifying and addressing the safety and health hazards that may threaten personnel.
☐ Delineates responsibilities for protecting personnel from these hazards and for providing prompt and effective remedial actions if and when an emergency-related injury or illness takes place.
☐ Establishes a Joint Information Centre (if necessary) to collect, review, and disseminate information to the public media and stakeholders.
☐ Ensures that all parties take reasonable steps to protect deployed personnel from emergency-related hazards, including, but not limited to, compliance with established safety and health standards.
☐ Develops and implements a standard reporting system to centrally document the occurrence of emergency-related injury or illnesses.
☐ Resolve any conflicts between MYA response activities and agencies participating in the response.
☐ Ensure that the Planning Chief is provided with updated reports (for log keeping) utilizing the Emergency Response Log Sheet.
☐ Implement a system to report, investigate, and recommend remediation for accidents, injuries, and illnesses related to the emergency.
☐ Provide written evaluations and after-action reports on the emergency safety and health activities.

Activation Phase

- Follow the generic Activation Phase Checklist (see Paragraph 4.3).

- ❖ On being notified of an emergency, inform the Duty Manager immediately.
- ❖ Commence and maintain a log of all emergency related communications.
- ❖ On instruction from the Duty Manager, call out or locate other Emergency Response Personnel.
- ❖ On instruction from Duty Manager, screen all non-emergency communications.
- ❖ If the emergency has occurred outside normal office hours, handle all emergency related calls until such time as the Switchboard Operator is at the switchboard, including taking details of incoming enquiries from Next of Kin/ Relatives, Media, etc.
- ❖ Send and receive hard copy messages to ECC

- Confide with the IC, as and when appropriate to implement the followings:

  - ❖ Integrate HSE and security requirement structure;
  - ❖ Ensure a safe and healthful working environment is maintained for staff; and
  - ❖ Establish and maintain liaison among emergency services and local officials concerned with safety, health and security.

Establish communications with PCSB HQ Office (upon advise by IC) and government agencies; notify the IC of any communications problems.

- Contact other jurisdictional agency public information officers to coordinate public information activities.

Operational Phase

- Communicate with partners and relevant government authorities.
- Prepare an initial press release regarding MYA's involvement in the response and Monitor approval.
- Identify, investigate, and coordinate abatement of safety and health or security problems.
- Provide teams with approved press releases, updates on significant developments pending next press release and other background information.
- Attend briefings and press conferences and respond to requests for information about MYA's involvement in the incident.
- Establish a system for accomplishing required follow-up activity after the emergency.
- Release information to the media and public (if cleared) through press briefings and press releases.
- Represent MYA at planning meetings, as appropriate, providing update briefings about your agency's activities and priorities.
- Keep the IC informed and ensure that you can provide HSE policy guidance and clarification, as required.
- On a regular basis, inform EMT members of priorities and actions that may be of interest.
- Maintain logs and files associated with your position.

Demobilization Phase

- Follow the generic Demobilization Phase Checklist (see Paragraph 5.3).
- When deactivation is approved by the IC, contact relevant parties and advise them of expected time of deactivation and points of contact for the completion of ongoing actions or new requirements.
- During the stand-down phase, ensure that the emergency safety operation has a smooth closeout by: concluding the emergency recovery functions and activities with the IC; providing follow-up information to deployed personnel; evaluate and document the effectiveness of emergency safety and health effort; and debrief deployed personnel on safety and health issues, if applicable.
- Ensure that you complete all final reports, close out your activity log, and transfer any ongoing missions and/or actions to the IC or other appropriate individual.
- Ensure copies of all documentation generated during the operation are submitted to the Planning Chief.

3.3.7 Situation Unit Leader

Roles & Responsibilities

- Ensure proper and effective log keeping is maintained and keep current information for the situation status report.
- Ensure that major information to be compiled by EMT members and are available for recording.
- Ensure that all status boards and other displays are kept current and that posted information is neat and legible.
- Produce situation status report as instructed by Planning chief and distribute to EMT members.
- Prepare Situation Analysis objectives for the Initial Action Planning meeting.
- Make a list of key issues to be addressed; in consultation with EMT members, identify objectives to be accomplished during the initial Operational Period.
- Keep the Incident Commander and EMT members informed of significant events.
- Assist the Incident Commander's action planning meetings and during a quick update session after the end of each operational period.
- Prepare and maintain Incident Status Display
- Collect and maintain current incident data
- Prepare periodic predictions as requested by IC
- Prepare, post and disseminate resource and situation status information as required, in the Emergency Control Center
- Prepare Incident Status Summary
- Provide photographic services and maps

3.3.8 Computer Operator

Roles & Responsibilities

- Record all incoming and outgoing messages from the main log of events and emergency response messages forms and incorporate into the computer log in related order.
- Assist in accessing any other information held on the computer such as Emergency Contacts.
- Type and print reports, draft press releases and any other material required by the EMT members.

3.3.9 Head, Myanmar Operation

The Head, Myanmar Operation is the legitimate Corporate Management representative, responsible for all business activities and as such retains overall control of all response efforts to incidents or emergencies occurring in jurisdictional areas. On being notified of an emergency the Head, Myanmar Operation will:

- Confide with the IC and obtain clear and concise details on the nature, seriousness and in particular details of casualties.
- Ensure adequacy of emergency response capability and resources to mitigate and facilitate the supports for effective emergency management operations.
- Communicate with PCSB Management and establish general liaisons with business partners and the relevant government agencies.
- Analyze possible long-term trends and assists the IC with the development of strategic plans and critical planning issues.
- Request progress updates on contingency action plans, special planning meetings, and long-range management plans concerning personnel or operational priorities.
- Produce and disseminate emergency response summary for the Corporate Management teams and the relevant authorities.

3.3.10 Emergency Support Teams

A) Next-of-Kin Response Team (Human Resource Officer)

On being notified of an emergency, the team member (HR Officer) shall proceed to the allocated Next-of-Kin Room as soon as possible and will receive calls from Next-of-Kin or relatives. Such calls will be transferred to them by telephonist in the first instance, and then come direct once these numbers have been disclosed. The team members shall only give information as authorized by the Finance &HR Chief. The team members roles and responsibilities are as follows:

- All calls should be answered by stating the Company name. Do not divulge their real names to callers.
- Establish full name of the caller.
- Establish the identity or relationship of the caller, their contact number and address.
- If the mentioned name by the caller is NOT in the list, advise the caller that the person is not involved in the incident.
- If the name is on the list, reply "No definite information as yet, please give me your name, address and telephone number" and promise to " Call back as soon as details are obtained". The information will only be released after the HR Chief has received confirmation of names and details of injuries and after the next-of-kin has been informed.
- If uncertain of the answer, always reply "We have no information as yet, please leave your telephone number, we will ring you back".
- Any enquiries from Media (Press, TV or Radio) and general public should be referred to Media Support Team.
- Record all messages on the "Next of Kin - Relative Enquiry Form".
- All calls must be handled sympathetically and if the team members cannot satisfy a caller they should have a senior member of HR Representative or other Senior Management to call the individual as soon as it is practicable.

B) Media Response Team (Information Officer)

- On being notified of an emergency, the team member (Information Officer) shall proceed to allocated Media Room as soon as possible and will received calls from Media (Press, TV or Radio). Such calls will be transferred to them by telephonist.
- The team members shall only provide information as authorized by the Finance &HR Chief in the ECC and previously approved by the Company.
- All calls must be handled firmly but politely. The media will employ various methods, some undoubtedly devious, in an attempt to obtain the fullest information possible about the emergency. Any team members facing difficulty in communicating with a Media Representative, obtain the Representative telephone number and have the Finance &HR Chief or Senior Management in ECC return the call.
- The team shall record media queries in "Media Inquiry Form".

C) Medical Advisor

- Assist Operations Chief as required.
- Ensure appropriate hospital facilities are available including doctors, ambulances etc if required.
- Liaise with site Doctor and ensure patient information form is received.
- Liaise with SOS/AEA Doctor on duty in Yangon.
- Liaise with local hospitals
- Liaise with internal medical support organizations.

D) ISOS Doctor

- Receive and acknowledge any request for medical advice regarding casualties.
- Liaise with site Doctor regarding need for CASEVAC.
- Advise helicopter requirements e.g. seat to be removed for stretches, Doctor to accompany casualty, etc.
- Arrange appropriate medical assistance, hospital facilities etc
- If required to proceed to site, proceed immediately to Helibase.
- If not required proceeding to site, standby and waiting further instructions.

E) Driver (Duty)

- On instructions from the IC standby at Yangon office.
- Assist survivors and relatives of company personnel and catering team investigation/ support teams with travel arrangements, accommodation, passports, clothing etc.

F) Security Guards on Duty

- On being informed of an emergency situation, the Security Guards shall be informed of any additional requirements regarding the Security of Yangon office through the IC.
- Proceed to their designated areas and maintain security.
- Keep people under control.
- Do not allow unauthorized persons to enter the office area unless permission is granted by the IC.
- Escort visitors, e.g. Next of Kin/Relatives of the personnel involved of the emergency and media personnel to designated areas.

3.3.11 Legal Officer

The legal officer is responsible for all business activities and as such retains overall control of all response efforts to incidents or emergencies occurring in legal areas.

Section 4

Activation, Notification and Communication

Contents

4 ACTIVATION, NOTIFICATION AND COMMUNICATION

4.1 General

The EMT shall take necessary actions to assist affected site or employees. These actions ranging from initial notification of an emergency to preparation of a final disaster post emergency response report are summarized below. They are not necessarily in sequential order; some may be undertaken concurrently. An overview of the entire emergency management operation, indicating key operational components and the typical sequence of actions appear in Section 6 and 7 of this plan.

4.2 Call-out Assignments

All members of the EMT or their alternates must:

- Be able to reach the Yangon ECC within 60 Minutes
- Be available 24 hours per day, 7 days per week for call out
- Ensure their contact details remain current; make changes in writing to the HSE Manager
- Understand their responsibilities and be familiar with those of the other members
- Ensure that their alternates are appropriately informed and prepared for any call out.

4.3 Activation and Notification

The responsibility of activating an emergency rests solely with the Person-In-Charge of the site, installation, drilling rig or vessel as defined below:

LOCATION	PERSON-IN-CHARGE
Yetagun Complex Platforms	- Offshore Installation Manager (OIM)
Drilling Rig	- PCSB Drilling Supervisor
Drilling Rig (Others, e.g. Exploratory Semi or Jack-up)	- Rig Superintendent - Contractor
Construction Barge	- Barge Master
Pipeline Operating Centre (POC)	- Pipeline Site Manager (PSM)
Metering Station (MS)	- Pipeline Site Manager (PSM)
Yangon Office	- Head, Myanmar Operation
Yetagun FSO	- FSO Superintendent
Vessel	- Master
Onshore Blocks	- Company Site Representative(CSR)

The PIC shall immediately notify the IC of any emergency that exceeds or has the potential to exceed the capability of the facility by calling the dedicated Mobile phone number and follow up by fax or mail of INF (Initial Incident Notification Form) as provided in Appendix III.PIC must notify the IC in Yangon office within notification time as provided in Appendix VII (Incident Notification Flow Chart for Myanmar Asset).The IC then immediately Mobilize the EMT members.

The EMT supports the site Emergency Response Team. Following an emergency-declared situation, the IC and EMT members will proceed to the designated ECC. All EMT members shall try to reach the ECC within 30 minutes of the activation time.

Activation Phase

(a) Proceed to the ECC at Yangon Office.
(b) Report to the IC or other assigned EMT members.
(c) Set up your workstation and review your position responsibilities.
(d) Establish and maintain an event/or position log, which chronologically describes your actions taken.

(e) Determine your resource needs, such as a computer, phone, plan copies, and other reference documents.

The IC will alert the Head, Myanmar Operation and UPSTREAM Support Team Duty Manager according to the incident notification matrix (Table 4.1).

4.4 Emergency Communication

Efficient communication is essential during any emergency. The importance of keeping the Emergency Management Team fully informed of the development of the emergency situation cannot be emphasized too highly. The IC requires such information to enable him to plan his response to the emergency and pass accurate information to UPSTREAM Support Team Duty Manager.

4.5 Emergency Messages

All emergency messages from the site or facility shall be addressed to the IC at Yangon Office (via MYA Switchboard Operator, contact number (+95 1 515011 / 526411) or Duty Mobile phone (+95 9 519 3367). The IC is the designated emergency contact point for the receipt of notification of an emergency and any request for assistance and shall remain contactable at all times during the period when on duty. Overall routing can be referred to **Appendix I.**

Upon notification of an emergency:

(a) The IC will inform the Head, Myanmar Operation and call out the on-duty EMT members.
(b) The IC will inform UST Duty Manager and follow up by fax or mail of NF (Notification Form) as provided in Appendix III and refer to the MYA notification flow chart (Appendix VII) and Table 4.1 for detail.
(c) The IC will inform the relevant government authorities (MOGE) within 24 hours.
(d) PETRONAS COMCEN shall cascade information to other GROUP Management.

4.6 Emergency Mitigation Operations

The EMT will assist in identifying appropriate counter-measures to meet emergency mission-critical needs, synchronizing support, and encouraging incorporation of mitigation measures, where possible. Additionally, they track overall progress of response effort, particularly noting program deficiencies and problem areas.

Upon arrival at the ECC, every member shall review the followings with the IC:

- What had happened?
- When did it happen?
- Where exactly it happens?
- How did it happen?
- What action had been taken?
- Are there people involved?
- What effect it has on operations or productions?
- Has contact been made with other agencies?
- What support is required?

The EMT members are the focal persons for delivering emergency recovery assistance programs. The members ensure that third party agencies that might have appropriate emergency assistance programs are notified in support of mitigation efforts.

4.7 Joint Response Arrangement

In the event of a joint response operation, the On-Scene Commander, in conjunction with the IC, will confer with each other regarding the coordination of the joint response efforts including:

1. Joint response actions to be undertaken;
2. Status of damages and response efforts;
3. Personnel, equipment and financial resources available;
4. Information to be provided to the personnel; and
5. Health and safety issues.

Any issues that cannot be settled by the OSC will be brought to the EMT IC for resolution. If need be, the PCSB HQ IC will be consulted.

4.8 Emergency Notification Protocol

PETRONAS Carigali Emergency Notification protocol is illustrated by Figure 4.1:

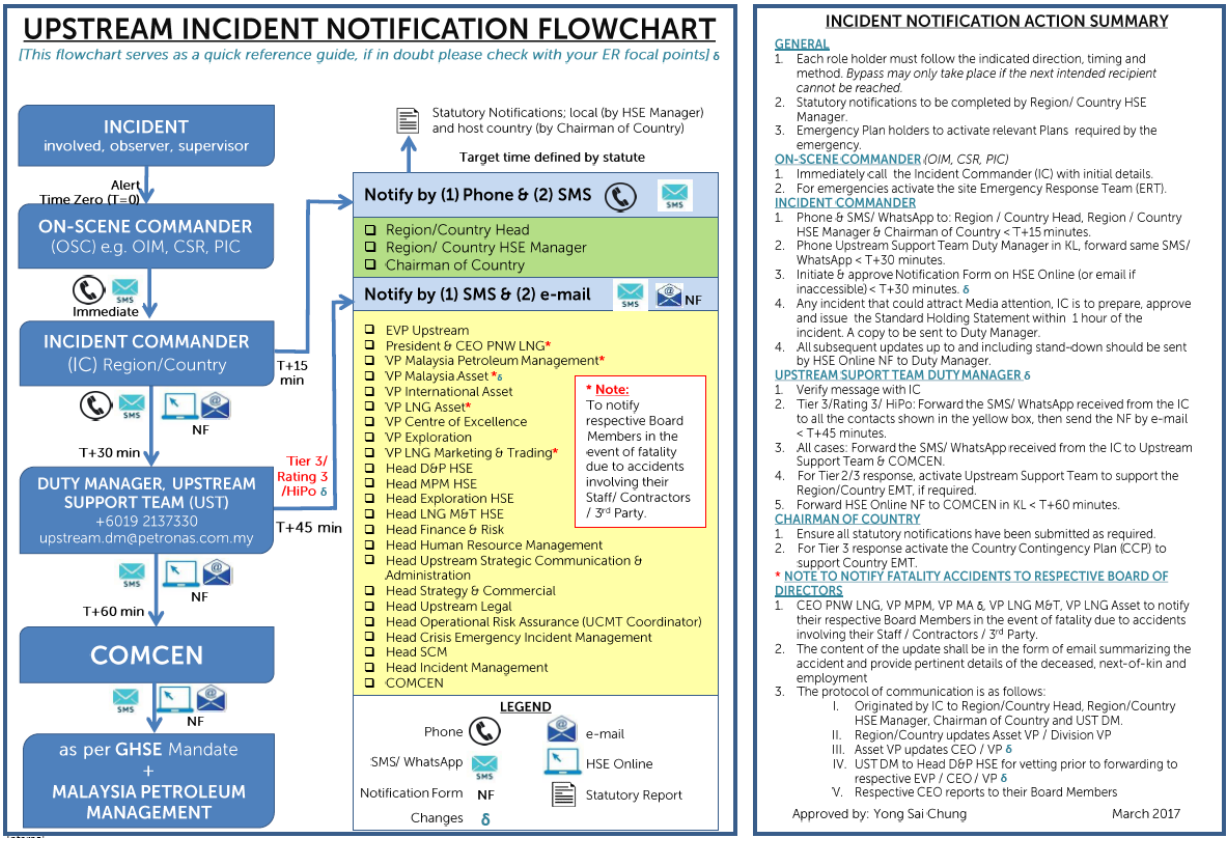


Figure 4.1: Emergency Notification Protocol

MYA IC establishes communication with MYA Management and UST Duty Manager; notifications are also made to higher management and other parties as per notification flow chart in Fig 4.1 and Table 4.1.

Initial Incident Notification Matrix

TYPE OF INCIDENT	LINE OF NOTIFICATION/TIMING		
	OSC to IC	IC to MYA Head	MYA IC to UST Duty Manager
Fatality/Multiple Fatalities	Immediate	15 minutes	30 minutes
Permanent Total/Partial Disability	Immediate	15 minutes	30 minutes
Lost Workday Case	Immediate	15 minutes	30 minutes
Restricted Workday Case	Immediate	15 minutes	30 minutes
Medical Treatment Case	Immediate	15 minutes	30 minutes
First Aid Case	Immediate	15 minutes	30 minutes
Detection of Contagious Disease	Immediate	15 minutes	30 minutes
Process Fire Rating 4 & 5 (Major)	Immediate	15 minutes	30 minutes
Process Fire Rating 3 (Major)	Immediate	15 minutes	30 minutes
Process Fire R 1 & 2 (Minor)	Immediate	15 minutes	30 minutes
Non-Process Fire/Explosion Rating 4 & 5 (Major)	Immediate	15 minutes	30 minutes
Non-Process Fire/Explosion Rating 3 (Major)	Immediate	15 minutes	30 minutes
Non-Process Fire/Explosion Rating 1 & 2 (Minor)	Immediate	15 minutes	30 minutes
Property Damage Rating 4 & 5 (Major)	Immediate	15 minutes	30 minutes
Property Damage Rating 3 (Major)	Immediate	15 minutes	30 minutes
Property Damage Rating 1 & 2 (Minor)	Immediate	15 minutes	30 minutes
Oil/Chemical Spill ≥ 5 bbl	Immediate	15 minutes	30 minutes
Oil/Chemical Spill < 5 bbl	Immediate	15 minutes	30 minutes
Hydrocarbon Gas Release Rating 4 & 5 (Major)	Immediate	15 minutes	30 minutes
Hydrocarbon Gas Release Rating 3 (Major)	Immediate	15 minutes	30 minutes
Hydrocarbon Gas Release Rating 1 (Minor)	Immediate	15 minutes	30 minutes
Near Miss (Hi Po Near Miss)	Immediate	15 minutes	30 minutes
Aviation Accidents	Immediate	15 minutes	30 minutes
Security Threat (hijacking, encroachment)	Immediate	15 minutes	30 minutes
Dangerous Occurrence (M)	Immediate	15 minutes	30 minutes
Radiation Exposure (M)	Immediate	15 minutes	30 minutes

Table 4.1 Initial Incident Notification Matrix

4.9 External Communication

In the event of any emergency it is necessary to notify the Myanmar Government. Unless specifically advised otherwise, the only government agency to be notified will be the Myanmar Oil & Gas Enterprise (MOGE) who is the official operator of each PSC (Production Sharing Contract).

MOGE require to be notified immediately of any incident. Initial contact should be by telephone or radio. This should be followed up by fax as soon as possible. When cleared by the MYA Head, Myanmar Operation, the EMT's IC on duty who has the necessary contact numbers will initiate contact with MOGE.

MOGE will then contact any other government agencies required i.e. police, medical, military, customs, immigration etc. Where required, MOGE should be asked to assist in dealing with other government agencies for issues such as arranging clearance for emergency flights, immigration matters and liaison with the Armed Forces if required. For example, the Armed Forces may be involved in assisting in maritime or land based search and rescue operations or in dealing with terrorist threat or other security issues.

Contact with Malaysian or other embassies in Myanmar may be necessary in connection with notification of Next of Kin, repatriation of casualties or fatalities, evacuation of personnel due to socio-political developments and other issues. The Head, Myanmar Operation will decide whether or not and when such contact will be initiated.

NB: It is important that MOGE are the first external party to be contacted in an emergency situation.

4.10 Partners

MYA's partners in the Yetagun Gas Project, which covers Blocks M-12, M-13 and M-14 are:

- MOGE
- PETRONAS Carigali Myanmar Incorporated (PCMI)
- Nippon Oil
- PTTEPI

The MYA Head, Myanmar Operation, who has all the necessary contact information, will normally perform liaison with Partners. In the absence of the Head, Myanmar Asset, any other member of the MYA Management Team is responsible to liaise with Partners.

NB: It is important that Partners are advised of any emergency situation before the media.

4.11 Managing the Media

The MYA EMT's Media Response & Liaison Officer is responsible for all issues related to the media (press, television, radio) both locally and internationally. Two broad categories of emergency event are recognized:

A minor event

For minor events, local or national media contact will be handled by MOGE using the approved press releases and statements by MYA. For example, no serious injuries or fatalities minor property damage, little or no environmental impact, no significant fire, explosion or hydrocarbon release that would be expected to generate local or national interest.

A major event

For major events, local and national media contact will once again be handled by MOGE using the approved press releases and statements by MYA. However, PETRONAS Headquarters, Kuala Lumpur, will handle international media contact. For example serious injuries or fatalities, serious property damages significant environmental impact, significant fire, significant explosion or a hydrocarbon release that would generate international interest.

4.12 Next of Kin and Relatives

If there are any injuries or fatalities as a result of an emergency situation, then there is a duty to inform and assist the NOK and relatives of such injured or deceased personnel. It is the responsibility of MYA to inform and assist relatives in the case of any MYA personnel so affected (which includes staff and direct-hire consultants and contractors). Generally, if MYA provides travel, accommodation, transport etc for a person then that person may be regarded as one of "MYA's personnel".

It is the responsibility of each Contractor Representative to inform and assist relatives in the event of any contractor personnel who are injured or deceased. MYA will always provide whatever services it can to facilitate such assistance.

Notification of NOK of injuries and fatalities is a sensitive issue and shall be handled with care and compassion. The NOK & Media Liaison Officer is responsible for such notification where MYA personnel are affected.

4.13 Public Information

The notification to the public through relevant Government Agencies (M.O.G.E) on potential and actual impacts of an emergency shall be made as soon as possible. This will increase public awareness of the hazards by providing information to advise the public on appropriate actions to be taken before, during and after emergencies.

MYA EMT IC shall decide to inform the public through communication with the authorities (M.O.G.E) if required.

Section 5

POST INCIDENT MANAGEMENT

Contents

5 POST INCIDENT MANAGEMENT

5.1 Purpose

This section describes the authorities, procedures to be followed and actions to be taken post emergency response activation at MYA.

5.2 Post Incident Procedures

All teams responding to emergency shall ensure that the emergency is managed to completion, including executing post incident procedures. These include the authority to declare termination of the emergency and preparing report on incident management to extract lessons learnt and institute continual improvement to MYA Emergency Management process.

5.3 Ending the Emergency (Stand-Down)

It is essential to ensure all potential hazards have been identified and that the emergency is under control before a decision is made to terminate the emergency.

As response operations begin to diminish, the IC shall demobilize the EMT and support groups. The all clear stand down announcement is made by the IC.

Demobilization Phase

(a) Deactivate your assigned position and close out logs when authorized by the IC.
(b) Complete all required forms and reports. All forms should be submitted to the IC, prior to your departure.
(c) Be prepared to provide input to the post emergency response report.
(d) If another person is relieving you, ensure they are thoroughly briefed before you leave your workstation.
(e) Clean up your work station before you leave.
(f) Leave a forwarding phone number where you can be reached.

The HSE & Liaison officer shall assume responsibility for the closeout of any other activities left unaccomplished following demobilization of other EMT. Once this is accomplished, the HSE & Liaison person will close out emergency response activities by:

(a) Coordinating with affected site and the IC on the disposal, refurbishment, and retrograde of affected assets;
(b) Maintaining proper property accountability processes; and
(c) Conducting post-action meetings and participate in others after-action meetings.

The Custodian (HSE Department) shall revise documents, collect and file paperwork, and develop and assign tasks to improve capabilities. The team may meet with service providers to develop a corrective action plan to improve overall cost-effectiveness and efficiency.

5.4 Management of Evidence

The HSE & Liaison officer shall assume responsibility for keeping evidences of all emergency logs, forms and reports that have been used during emergency in ECC in order to improve MYA EMT response capability.

The affected area should be secured and evidence preserved for further examination and investigation by the investigation team

5.5 Recovery and Restoration

The process of recovery and restoration of MYA to pre-emergency condition will include managing the affected personnel and implementation of BCP shall be implemented as deemed appropriate.

5.6 Emergency Post Mortem

Following any emergency response activities, the IC will submit Post Emergency Response report, detailing problems encountered and key issues affecting overall performance. The IC may convene an interagency forum to identify lessons learned. Each EMT member involved is expected to keep records of its activity to assist in preparing its own post emergency response report.

The Emergency Response Report is at Appendix VIII.

Section 6

EMERGENCY EVENTS REGISTER

Contents

6 EMERGENCY EVENT REGISTER

6.1 Purpose

This section lists the risk events and consequences which have been described and assessed in HSE CASE. It is intended to determine the critical scenarios which provide the basis for the development of Pre Incident Plan.

6.2 Hazard Assessment

HSE Case

The HSE Case identifies the risk to personnel arising from process hydrocarbon release (topsides, risers and well blowouts), ship-platform collisions, helicopter accidents, structural failure and occupational accidents. Detail of Hazard Assessment can be referred to Yetagun HSE Case and POC HSE Case.

The assessment also makes reference to previous incidents within the company and the industry, security incident and natural disaster.

The Risk Matrix used in the hazards assessment is provided as Figure 7.1 below.

Consequence		SEVERITY	1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
		People	Slight Injury	Minor Injury	Major Injury	Single Fatality	Multiple Fatalities
					Major Health Effects*	Permanent Total Disability*	Permanent Total Disability*
		Environment	Slight Impact	Minor Impact	Moderate Impact	Major Impact	Massive Impact
		Asset	Slight Damage	Minor Damage	Local Damage	Major Damage	Extensive Damage
		Reputation	Slight Impact	Limited Impact	Considerable Impact	Major National Impact	Major International Impact
LIKELIHOOD	E Almost Certain	Incident has occurred several times per year in OPU	E1	E2	E3	E4 VERY HIGH	E5
	D Likely	Incident has occurred in OPU; or more than once per year in PETRONAS	D1	D2	D3 HIGH	D4	D5
	C Possible	Incident has occurred in PETRONAS; or more than once per year in industry world wide	C1	C2	C3 MEDIUM	C4	C5
	B Unlikely	Incident has occurred in industry, world-wide	B1	B2 LOW	B3	B4	B5
	A Remotely likely to happen	Never heard of in industry world-wide but could occur	A1	A2	A3	A4	A5

* For chronic health effects

RISK RATING	INTERVENTION
LOW	- Risk is tolerable - Monitor at operational level using procedure/appropriate internal control as per HSEMS - Take corrective action according to availability of resources
MEDIUM	- Risk is tolerable if supported by ALARP demonstration - Undertake control evaluation - Monitor using procedure or appropriate internal control as per HSEMS
HIGH	- Risk is tolerable if supported by ALARP demonstration - Undertake risk reduction by applying appropriate control and recovery barriers - Review and approval of ALARP demonstration by Facility Head/Project Head and Senior management with escalation to Business Head
VERY HIGH	- Risk is not tolerable. - Mitigate the risk by incorporation of control and recovery action(s) to reduce the risk rating to HIGH or below

Figure 7.1: Risk Matrix

6.3 List of scenarios

Incident Action Plan (IAPs) for the following scenarios were developed.

1. Fire and Explosion
2. Hydrocarbon Spill
3. Major Gas Release
4. Threat of Vessel Collision
5. Helicopter Emergency
6. Radioactive Emergency
7. Severe Weather Condition (Tropical Cyclone)
8. Vessel Encroachment
9. Bomb Threat
10. Chemical Exposure
11. Man Overboard
12. Diving Emergency
13. Emergency on Export Tanker
14. FSO Mooring System failure
15. Pipeline Emergency
16. Road Transport Accident
17. Fire at Main office
18. MEDEVAC (Out Country)
19. Terrorist Threat
20. Collision/Structure damage

It is important that the type of emergency is identified as early as possible, so that the appropriate emergency response action plans can be taken.

By their nature, emergency situations are usually unique and unpredictable. Nevertheless, “Incident Action Plans (IAPs) for each of emergency sub-categories listed above can be utilized for effective and fast response.

Section 7

Support Plans

7 SUPPORT PLANS

7.1 Purpose

This section describes the external support that can be readily accessible by MYA during emergency situation.

7.2 Specialised Emergency Support

The list of specialised emergency support is provided in Table 8.1 below.

No.	Agency	Scope
1	International SOS (ISOS)	Medical Services
2	Yangon General Hospital	Medical Services
3	Heli union Limited	Helicopter Services
4	Heavi Lift Limited	Twin Otter Fixed Wing service
5	PTTEPI	Helicopter Services
6	Tidewater (Supply Vessel)	Fire Fighting, Search and Rescue, Oil Spill, etc

Table 8.1 Specialised Emergency Support

7.3 Business Continuity Plan (BCP)

MYA Business Continuity Plan has been developed by MYA BCP Strategy Team. The IC shall immediately notify the Head of Myanmar Operation to initiate MYA Business Continuity Strategy when any emergency escalates into a crisis situation or any disruptions could threaten MYA business survival. Please refer to MYA BCP. As per requirement of emergency response, The Business Continuity Chief will be mobilized to give advice for MYA EMT. The responsibility is in Appendix X.

Section 8

Training and Exercises

8.0 Training & Exercises

8.1 Introduction

It is MYA policy to ensure the emergency preparedness of all their emergency organisations. Regular training of all personnel involved in Emergency Response activities shall take place to ensure that the highest standard of emergency response preparedness exists throughout MYA Operations. It is mandatory for those personnel selected for emergency duties to undertake the required courses in the Crisis Management and Emergency Response Training Programme (CMERT) in order for them to be effective in their role.

Three (3) levels of training have been identified:

CMERT Level 1
CMERT Level 2
CMERT Level 3

8.2 CMERT Level 1 Training Programmed for Emergency Response Team

This is for Emergency response training for the Worksite ERT. The training is to be taken twice a year for each crew change or shift. The objective of the training is to provide an opportunity for the Worksite ERT as a whole to practice all elements of their response from the PIC in his appraisal of the situation, the deployment of resources and command and control aspects, to DCTs in intervention actions, firefighting and casualty retrieval.

NB: This training is in addition to the routine musters and drills carried out at worksite and should follow approved scenarios.

The minimum requirements for Emergency and Crisis Training Program are illustrated in Table below:

The minimum training programme includes the following:

PERSONNEL	TRAINING PROGRAMMES	FREQUENCY
ERT	• Industrial / Structural Fire Fighting (**where applicable**) • Basic First Aid • Hazmat Operation (**where applicable**)	• Once off • Refresher every two (2) years
OSRT	• Oil Spill Response Training Level 1 (**where applicable**)	
OSC	• As per relevant ERT Training • OSC Training • Oil Spill Response Training Level 2 (**where applicable**)	
DM / Manager-in-Charge, IC, EMT, CCT and BCMT	• Emergency and Crisis Management	• Once off • Refresher every two (2) years
New Staff / Transfer-in	• Fire Safety and Emergency Orientation	• As and when required

Table 9.1: Emergency and Training Programme for ERT

8.3 CMERT Level 2 Training Programme for Emergency Management Team

Emergency response training for the Yangon Office EMT. The training is to be taken once a year. The objective of the training is to provide Yangon Office EMT members and Support Team members an opportunity to practice their respective roles in a simulated emergency situation.

8.4 CMERT Level 3 Training Programme for Emergency Management Team

Emergency response training for all levels of the Emergency Response Organizations i.e. Worksite ERT, Yangon Office EMT, Support Teams and Upstream Support Teams and PCSB HQ COMCEN. There will be one training a year. The objective of the training is to provide an opportunity for all levels of the MYA and PCSB emergency response organizations to work together to deal with a major emergency.

8.5 Drills and Exercises

Emergency Drills and exercises shall be conducted to allow responders (ERT's) and all ERT personnel to become familiar with the procedures, facilities and systems incorporated during an actual emergency. The interactions within multiple and external response teams allow the responders to enhance decision-making capabilities and demonstrate individual and group skill abilities to response operations. The drill and exercise requirements are as follows:

TEAM	TYPE OF DRILL / EXERCISE	FREQUENCY	EVALUATOR	DESCRIPTION
• All teams	Notification	Once in 6 months	• OPU / JV / CPO / HCU	• To validate emergency contact numbers of emergency / crisis teams and authorities • To test communication equipment performance
• ERT • OSRT	Drill based on IAP	Once in 2 months for each shift team	• OPU / JV / CPO / HCU	• Tier 1 protocol • Participation or mobilisation of ERT with or without the assistance of the response agencies based on IAP
• EMT	Tabletop / Functional	Once in 2 years	• OPU / JV / CPO / HCU • Business HSE • GHSE (Tier 3)	• Tier 2 / Tier 3 protocol • Participation or mobilisation of EMT and involvement of relevant authorities based on ERP
• EMT	Full Scale	Once in 3 years	• Business HSE • GHSE (Tier 3)	• Tier 2 / Tier 3 protocol • Participation or mobilisation of ERT and EMT as well as involvement of relevant authorities based on ERP **Note**: Full scale exercise conducted by OPU across multiple facilities / locations (regional / clusters / platforms), involving any one of the ERTs / OSRTs, is considered to have complied with this requirement.

TEAM	TYPE OF DRILL / EXERCISE	FREQUENCY	EVALUATOR	DESCRIPTION
• CCT • BUCMT • BCMT	Table top / Functional	Once in 3 years	• GHSE	• Tier 3 protocol • Participation or mobilisation of crisis team members based on related CMPs

Table 9.2: Exercise Type and Frequency for ERT

8.6 Training and Exercise Evaluation

EMT / ERT shall conduct exercise evaluation to identify lessons learnt and to improve the procedures, competency and training programme. Evaluation form is provided in Appendix IX: Form 2: Emergency Drill Report.

All training programme documents and post Mortem reports shall be made available at site and maintained for continual improvement and audit purposes.

Section 9

Assurance Review

9 ASSURANCE REVIEW

9.1 Purpose

This section describes the requirements for Assurance Review to ensure Emergency response capability and preparedness of the facilities and the competency of the Emergency Response Team.

9.2 Compliance Assessment Review

The technical assessment and review of emergency and crisis preparedness programme is conducted periodically. The objective of this assessment and review is to identify gaps and incorporate feedback for continual improvement.
The technical assessment review shall be based on the following:

1. ERP and other related plans
2. Training Records
3. Exercise Post Mortem reports and Gap Closure
4. List of emergency contact
5. Records of Past Incidents/Emergency Calls.
6. Emergency Response Adequacy Audit Checklist

All Emergency Response Documentation must be made available at all times.

9.3 Frequency and Team Composition

The technical assessment shall be conducted at intervals.

Yearly adequacy assessment is conducted by MYA HSE /CHSE. Tier 3 Technical Assessment is conducted by Group HSE Division on a sampling basis.

9.4 Action Tracking and Record Keeping

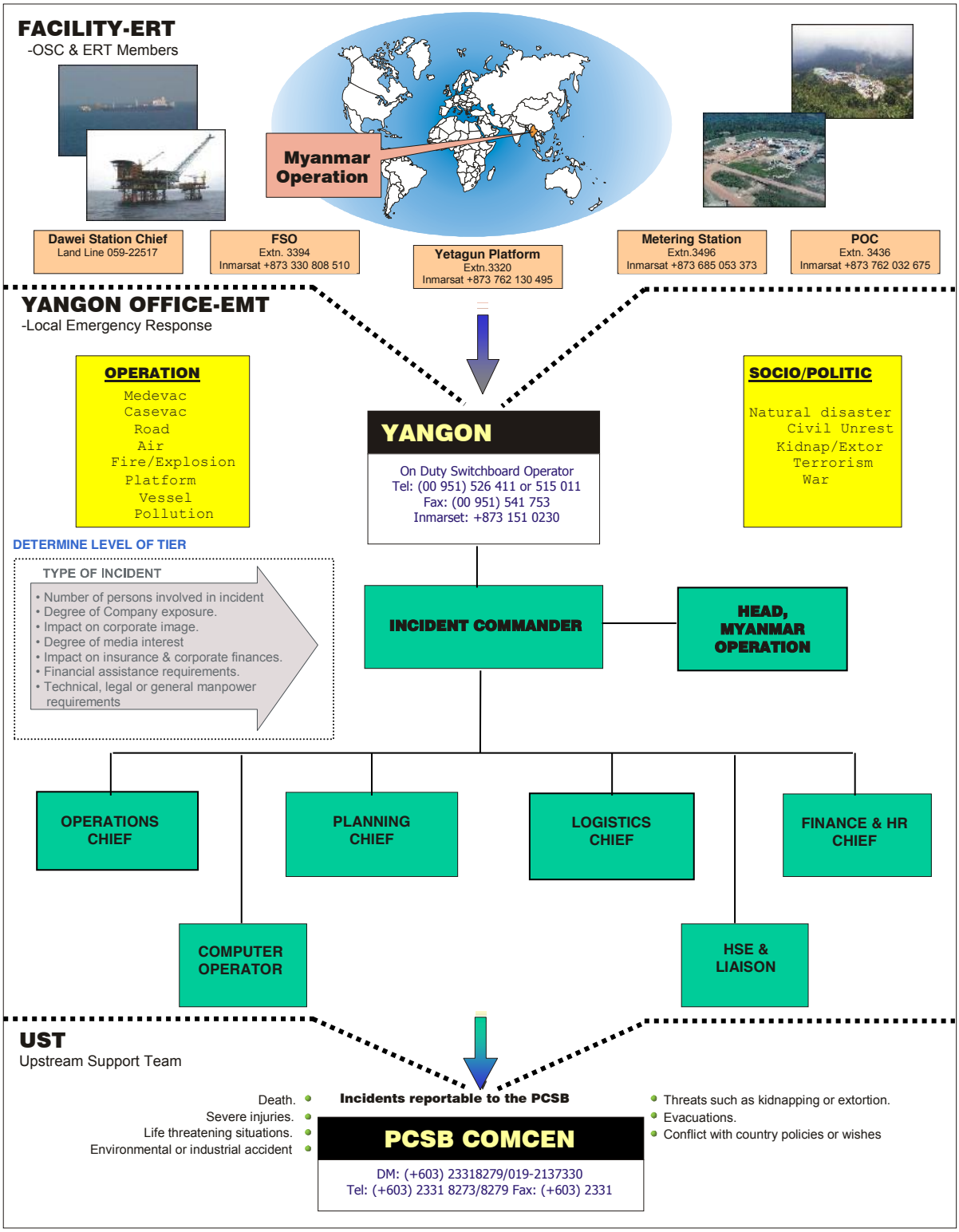
All audit findings shall be communicated to field management and the agreed action item/recommendation shall be tracked to completion. An audit database shall be established and kept at sites for reference and should be captured in HSERAI to follow up.

APPENDIXES

Contents

APPENDIX I

Emergency Response Flowchart



APPENDIX II
EMERGENCY CONTACT DATABASE

PARTIES	CONTACT NUMBERS	
	TELEPHONE	FAX
PETRONAS HQ , KUALA LUMPUR		
PETRONAS COMCEN	+6 03 23312141/42/43	+6 03 2161 1696
UST DUTY MANAGER	+6 019 2137330	+6 03 2331 5742
PCSB HQ, KUALA LUMPUR		
DATUK MOHD ANUAR TAIB EVP & CEO PETRONAS UPSTREAM	+6 01 2900 6566 (h/p)	
UST DUTY MANAGER	+6 03 2331 8279 (ECC) +6 01 9213 7330 (Duty)	+6 03 2331 8280
BACHO PILONG VP INTERNATIONAL ASSET	+6013 8305700 (hp)	
YONG SAI CHUNG HEAD DP HSE	+6019 6669638 (hp)	
PETRONAS & MYA, YANGON		
EMRY HISHAM B YUSOFF HEAD, MYANMAR OPERATION (MYA) PETRONAS COUNTRY CHAIRMAN	515011 ext:3002 (off) 09 519 4985 (h/p)	515092
KHUN MIN SWE HEAD, PRODUCTION	515011 ext: 3087 (off) 09 516 1050 (h/p)	525698
ANNIE NILAR SEIN HEAD, HUMAN RESOURCES	515011 ext: 3039 (off) 09 519 7056 (h/p)	525698
UQBA JAMSHAID HEAD, FINANCE ACCOUNT & IT	515011 ext: 3048 (off) 09 513 0216 (h/p)	525698
NAY LIN KHINE HEAD, CORPORATE AFFAIRS & ADMINISTRATION	515011 ext:3119 (off) 09 508 1537 (h/p)	525698

WIN AUNG ZAW ACTING HEAD, HEALTH, SAFETY & ENVIRONMENT	515011 ext: 3188 (off) 09 518 8137 (h/p)	525698
AUNG SOE MIN HEAD, MAINTENANCE & ENGINEERING	515011 ext: 3082 (off) 09 501 1917 (h/p)	525698
AZMAN BIN AHMAT KAMIS HEAD, SUBSURFACE	515011 ext: 3149 (off) 09 504 2610 (h/p)	525698
NADIA BINTI MOHD NOR HEAD, PROCUREMENT	515011 ext:3166 (off) 09 519 8343 (h/p)	535763
MOHD RIDZUAN BIN MAT ZIN HEAD, BUSINESS PLANNING & PERFORMANCE IMPROVEMENT / PETROLEUM ARRANGEMENT & RISK MANAGEMENT	515011 ext:3027 (off) 09 250 442 959 (h/p)	525698
AHMAD ASFANIZAM HEAD, PROJECT	515011 ext: 3090 (off) 09 510 9734 (h/p)	525698
SYAZWAN B A GHANI HEAD, WELLS	515011 ext: 3145 (off) 09 504 8326 (h/p)	525698
AZLAN BIN MOHD SABIRIN HEAD, EXPLORATION	515011 ext: 3198 (off) 09 505 7980 (h/p)	525698

MYA EMERGENCY MANAGEMENT TEAM

MYA Emergency Management		
#16 Shwetaung Kyar (Golden Valley Road),	Switchboard Tel:	515011 (11 lines)
Bahan Township,	Switchboard Tel:	526411 (4 lines)
Yangon .	Fax:	525698, 525684
	Inmarsat:	+873 151 0230

MYA Yetagun FSO/Yetagun Platform/Yetagun POC/Yetagun Metering Station

For telephone connection to the MYA Yetagun facilities from outside the MYA Yangon office, dial the MYA Yangon Switchboard (see above) and ask to be connected to the required facility. Direct line to POC Radio Room and CCR -**01 525708**.Direct line to Yetagun RO & CCR is **01 515093** and Direct line to Yetagun OIM is **01525672**.

PARTIES	CONTACT NUMBERS	
	TELEPHONE	FAX

INCIDENT COMMANDER	Ext: 3170 (ECC) DL: 525696 (ECC) H/P (09 5193367)	503605
OPERATIONS CHIEF	Ext: 3143 (ECC) OPS - 09 519 3872 FSO/SBM – H/P 09 26111 4004	503605
PLANNING CHIEF	Ext: 3172 (ECC) 09 519 4187 (h/p)	503605
LOGISTICS CHIEF	Ext: 3173 (ECC) 09 519 4253 (h/p)	503605
HR CHIEF & NOK	Ext: 3142 (ECC) 09 519 4607 (h/p)	503605
HSE & LIAISON OFFICER	Ext: 3171 (ECC) 09 519 4569 (h/p)	503605
MEDICAL COORDINATOR	Ext: 3010 (ECC) 09 519 4573 (h/p)	503605
COMPUTER OPERATOR	Ext: 3141 (ECC) 09 519 4571 (h/p)	503605
INNZLAE LOCAL & TRAVEL COORDINATOR	515011 ext: 3161 09-513 8204 (h/p)	525698
ARNT BWEH HLAING MARINE COORDINATOR	515011 ext: 3014 09 519 1018 (h/p)	525698
KYAW KYI PHYU AVIATION COORDINATOR	515011 ext: 3034 09 504 1816 (h/p)	525698
IT ENGINEER	09 519 4984 (h/p)	525698
TELECOMM ENGINEER	09 519 4670 (h/p)	525698
MYA DRIVER	515011 ext: 3270	

CONTRACTORS REPRESENTATIVE	09 261114004 (SBM) 09 450 044484 (TideWater) 09 205 1415(Heliunion) 09 43117580/ 09 4200 15593(Hevilift)	
YETAGUN FSO		
SUPERINTENDENT	+873 330-808-510/ 4463394	+873 330-808-512/ 4463392
D'SOUZA TIDE		
MASTER	+1713 966 6214	
ROMIC TIDE		
MASTER	+1713 357 6342	
DAWEI		
DAWEI BASE STATION DAWEI STATION CHIEF	(059) 22517 Ext-114 09 7300 9901	
TOTAL MYANMAR E&P		
YANGON HEAD OFFICE	650977/ 650989/ 660466	650478/ 650479
JOINT VENTURE PARTNERS		
MOGE MD's OFFICE	657665/657668 (Yangon)	95-1-657678
U MYO MYINT OO MOGE MD	560291 (Residence)	067 403088 (Res:) 067- 411056 (Off;) 067- 411055 (Off:) 067- 411125,78 (Fax)
U KYAW NYAN TUN MOGE DIRECTOR (OFFSHORE)	067 411009 (Off:)	067 411009 (Off:) 067 411331(Off) 067- 411330 (Fax)
MR. HIROSHI HIRATA JX NOEX	+81-70-5026-3414 +81-3-6213-3516	hirata.hiroshi@jxgr.com
KHUN PIYA SUKHUMPANUMET PTTEPI	667782 , 652700, 01, 02,03, 04	PiyaS@pttep.com

KHUN BOOONSOM KETYUNGYOENWONG PTTEPI	+66 8 9968 7061	boonsom@pttep.com
EMBASSIES		
MALAYSIAN EMBASSY	220248 / 220249	221840
BRITISH EMBASSY	370864 / 370865	370866
US EMBASSY	536 509 / 535 756	511 069
THAI EMBASSY	226 721 / 226728	221713
SINGAPORE EMBASSY	559 001	559 002
SOUTH AFRICA	(66-2) 659 2900	(66-2) 250 1064
INDONESIA EMBASSY	254465 / 254469	254 468
AUSTRALIAN EMBASSY	251810 / 251797	246 159
VIETNAM EMBASSY	511 305	514 897
HOTELS IN YANGON		
GOLDEN HILL TOWERS	558556, 558558	558557
SEDONA HOTEL	666900	666911, 666833
MICASA APARTMENT	650933	650950
SAKURA APARTMENT	525001	525002
MARINA APARTMENT	650651	650630
DUSIT INYA LAKE RESORT	662857	665964
SULE SHANGRI-LA HOTEL	242828	242800
MELIA HOTEL	9345000/9345002	9345055
SHANGRI-LA SERVICE APARTMENT	394469	394496

OTHERS		
ISOS CLINIC ISOS DUTY OFFICER (Dr. SOE LWIN TUN)	09 42011 4536 09 262 433 331	657922,
YANGON INTERNATION EDUCATION CENTER (YIEC)	530 082 / 530 083	530 083
HORIZON INTERNATIONAL EDUCATION CENTER (Horizon)	541 085 / 537 739 / 548 452	543 926
INTERNATIONAL SCHOOL YANGON (ISY)	512793 / 512795	525020
FIRE EMERGENCY	191	
POLICE	199	

UPSTREAM MANAGEMENT CONTACT LIST		
POSITION TITLE	NAME	MOBILE NO.
EVP UPSTREAM	Datuk MOHD Anuar Taib anuar.taib@petronas.com.my	+6012 9006 566
VICE PRESIDENT MALAYSIA ASSETS	M Jukris Wahab jukrisw@petronas.com.my	+6017 6307220
VICE PRESIDENT EXPLORATION	Emeliana Rice Oxley e.rice-oxley@petronas.com.my	+6012 2661 302
VP LNG MARKETING & TRADING	Ahmad Adly Alias adly@petronas.com.my	+6012 2095 559
PRESIDENT & CEO PNW LNG	Adnan Zainol Abidin adnanza@petronas.com.my	+6012 3383 849
VICE PRESIDENT MALAYSIA PETROLEUM MGMT	Muhammad Zamri Jusoh zamriu@petronas.com.my	+6012 3773670
HEAD HSE	Yong Sai Chung yongsaichung@petronas.com.my	+6019 6669638
HEAD UPSTREAM HSE MALAYSIA	Alfie@Iskandar Bahrun alfie@petronas.com.my	+6012 984 6977
HEAD FINANCE & RISK	Liza Mustapha lizam@petronas.com.my	+6012 2080291
HEAD STRATEGY & COMMERCIAL	Azman Aziz azmanz@petronas.com.my	+6012 2071904
HEAD HR	Khairul Azman Yasin khairulazman_yasin@petronas.com.my	+6012 238 1844
HEAD CAA	Shuzairin Shuib shuzai@petronas.com.my	+6012 9520162
HEAD HSE MPM	Nor Hashim Yusoff hashimy@petronas.com.my	+6013 345 4262
HEAD POM MPM	Ruslan Abdul Ghani ruslang@petronas.com.my	+6013 8345000

UPSTREAM INCIDENT COMMANDERS		
PMYA	pMYA_ecc@petronas.com.my	+6019 953 0731
SKO	sko.eccinccommander@petronas.com.my	+6019 885 0415
SBO	sboecc_ic@petronas.com.my	+6019 810 2560
MYANMAR	ecc.myanmar@petronas.com.my	+95 9 519 3367
VIETNAM	ecc_vietnam@petronas.com.my	+84 090 332 3201
INDONESIA	eccpcino@petronas.com.my	+62 811 993 4300
TURKMENISTAN	eccturk@petronas.com.my ecckiyanly.turk@petronas.com.my	+993 65 05 8011
BRUNEI	ecc.brunei@petronas.com.my	+673 8245 414
PCIHBV IRAQ	ecc.iraq@petronas.com.my	+971 50 6449 526
AZERBAIJAN	Incident commanders	+994 55 804 2235 Fax ECC : +994 12 599 1316 Fax : +994 12 599 1305
GARRAF INCIDENT COMMANDER	eoc.iraq@petronas.com.my	+964 7808 53000
EGYPT	Duty Manager	+2 010 09990630
DEVELOPMENT & PRODUCTION MALAYSIA ASSETS		
VICE PRESIDENT MALAYSIA ASSETS	M JUKRIS WAHAB	+6017 6307220
HEAD PENINSULAR MALAYSIA	MD MAZLAN TAMYIS	+6019 4093177
HEAD SARAWAK- OIL	ANUAR ISMAIL	+6012 8052344
HEAD SARAWAK - GAS	SOHAIME ABDULLAH	+6016 2192101
HEAD SABAH	M ZAINI M YUNUS	+6019 9154256
DEVELOPMENT & PRODUCTION INTERNATIONAL ASSETS		
VICE PRESIDENT INTERNATIONAL	BACHO PILONG	+6013 8305700
HEAD MYANMAR	EMRY HISHAM YUSOFF	+95 9 519 4985
HEAD VIETNAM	MOHD SHARIFF KADER	+84 901 462 899
HEAD TURKMENISTAN	TEH YAT HONG	+993 65033123 / +6012 3370607
HEAD INDONESIA	MYAHAMAD ZAINI MD NOOR@YUSOFF	+6012 6676335
HEAD BRUNEI	SHARMINAN BOHARI	+6738299399 / +6
HEAD IRAQ	ABDUL MALIK JAFFAR	+971 56 2198790
HEAD SUDAN	AZHAN ALI	+24991234023 / +60139285852
HEAD SOUTH SUDAN	JANIN GIRIE	+211 959 101100
HEAD MAURITANIA	IMRAN ABDUL KADIR	+222 3333 2299
DEVELOPMENT & PRODUCTION LNG ASSETS		
HEAD LNG MALAYSIA	PAU KIEW HUAI@BAW KIEW HUAI	+6019 854750

HEAD FLOATING LNG	MYAHAMMAD FEISAL AZHAR	+60193180846
HEAD EGYPT	DATO'ABU FITRI ABU JALIL	+2 01002333008
HEAD PETRONAS AUSTRALIA PTY LTD	JOSEPH LEONARD	+614 9999 4837
DEVELOPMENT & PRODUCTION CENTRE OF EXCELLENCE (COE)		
VICE PRESIDENT	CHEN KAH SEONG	+6012 2089876
HEAD PETROLEUM ENGINEERING	MAX VOROBIEV	+6012 5833800
HEAD WELLS	HISHAM BASAR	+6013 337000
HEAD OPERATIONAL EXCELLENCE	M NAZORI JANOR	+6019 2775937
HEAD UNCONVENTIONAL	ROBERT ALEXANDER BEFUS	+6017 8917160

EMERGENCY AND SECURITY SERVICES

INTERNATIONAL SOS	+603 2787 3126

UPSTREAM & PRODUCTION HSE MEDICAL ADVISOR :
Dr Devandran A/L Kumarasamy
devan_k@petronas.com.my
+6012 4336 0000 / +603 2331 9864

	TELEPHONE / MYABLIE	FAX NUMBER
COMCEN comcen@petronas.com.my	+603 2331 2141 / 2 / 3 / 4 & +6012 3168496 / +6019 3844696	+603 2161 1696
ECC FAX (TACTICAL ROOM, Level 11,Tower 1)	+603 23311671	+603 2331 8280
UPSTREAM HSE (Level 56,Tower 2)	+603 2392 2188	+603 2392 1884
HSE OPERATION RISK & ASSURANCE (ORA) (Level 56,Tower 2)	+603 2392 1066	+603 2392 1884

DEVELOPMENT & PRODUCTION INTERNATIONAL ASSETS

		OFFICE NO.	MOBILE	FAX
Head Vietnam	MOHD Shariff Kader	00 84 8 383 09966 / 8 701 7801	00 84 901 462 899	00 848 38309955
Head Turkmenistan	Teh Yat Hong	00 993 12 39 80 00 Ext 1045	00 993 65 03 31 23 / 00 6012 3707607	00 993 12 39 80 00
Head Sudan	Azhan Ali	00 249 15 6556103	00 24991234023 / 00 6013 9285852	-

Head South Sudan	Janin Girie	00 249 15 65 56 133	00 211 959 101100 / 00 6012 8772169	-
Head Myanmar	Emry Hisham Yusoff	00 95 1 515011 / 526411	00 95 9 519 4985	00 95 1 525698 / 525684
Head Iraq	Abd Malik Jaafar	00 971 4440 8500	00 971 562 1987 90	-
Head Indonesia	MOHD Zaini Md Noor	00 6221 7592 5200	00 62811 800 6302	00 62 21 7592 5222
Head Mauritania	Imran Abdul Kadir	00 222 4524 5036	00 222 3333 2299	00 222 45244524
Head Brunei	Sharminan Bohari	00 673 2253181	00 673 8299399	00 673 2234068 / 069
Head Suriname	Khairul Hamid Khalid	00 597426777	00 5977182313	00 597421957
Head Azerbaijan	Hanafi Talib	00 994 12 599 1300	00 994 50 287 2953	00 994 12 599 1305
Head Ireland	Fergal Murphy	-	00 353872354814	-
Head Gabon	Salahuddin B Saleh	-	00 241 04187674	
Head Australia	Joseph Leonard	00 617 3238 8000	00 614 9999 4837	00 617 3238 8080

ADMINISTRATORS AND OTHER NUMBERS			
Head Emergency Resource	M HATTA RIZAL MANSOR	+603 2392 0964	+6012 8775892
Head Incident Mgmt	KHAIRUL ZAIM	+603 2331 8448	+6012 2058967
Emergency Assistant / Admin	TAJURUS@TJ	+603 2331 5747	+6012 3999718 +6012 6296344
PEX Administrator	RIDZLY A GANI	+603 2331 0612	+6012 2433310
HR Focal Person	M DANIAL AMRAN	+603 2392 3622	
Upstream CAA	MS.DHARSHINI BALAN FAZLI IBRAHIM	+603 2331	+6016 322 2107 +6016 2982905
Head, Legal	SYED MARZIDY SYED MARZUKI	+603 2331 2218 +603 2331 5171	+6012 308 0569

MYA INMARSAT NUMBERS		
MYA	**Phone**	**Fax**
Yangon Office	00870 772 529 170	
Platform Radio Room	00870 772 520 445	00870 782 441 513
Platform (LV Control room)	00870 772 520 444	
FSO	00873 330 808 510	00873 330 808 512
POC Radio Room	00870 772 520 443	
POC AccomMYAdation	00870 772 520 812	
MS	00870 772 520 810	
Tidewater Marine International		
Reynaldo Tide	00 881 631 852 178	
Romic Tide	00 881 631 852 428	

Inmarsat Calling from Yangon (From Office Extension Phone)	Dial "7" + Full International Number + "#"
N.B. In MYA Emergency Management Centre Inmarsat Access is restricted to Nominated Extensions	
Inmarsat Calling from MYA Sites	Dial: - Full International Number + "#"

MYA IRIDIUM NUMBERS		
MYA	**Phone**	**Fax**
POC (Security Advisor)	00881 6315 52350	
Tidewater Marine International		
Reynaldo Tide	00 881 631 852 178	
Romic Tide	00 881 631 852 428	
IRIDIAM CALLING - ENTER PIN "1111+OK"	Find Signal, Dial: - Full International Number 00. + "OK"	

APPENDIX III
INCIDENT NOTIFICATION FORM

From: Upstream Business OPU (Country/Region): Myanmar Operation Tel: +951 515011/526411 Fax: +951 525698/503605 Sequence No:	**From: Upstream Business** **To : Duty Manager, UST** Mobile: +6019 2137330 Fax : +603 2331 5742 / +603 2392 1884 Email : upstream.dm@petronas.com.my Tel : +603 2331 8279 (ECC Activated) Fax : +603 2331 8280 (ECC Activated)	**From: Duty Manager UST** **To: COMCEN:** Tel: +603-2331 2141/42/43/44 **OR** +603-2161 1703 Fax: +603-2161 1696 / +603-2051 2101 SMS: +6019-384 4696 / +6012-316 8496 Email: comcen@petronas.com.my

NOTIFICATION FORM (NF)

Type (OPU to Tick)	**COMCEN** to notify the following notification list: (OPU to tick **With IMPACT / Hi-PO / No IMPACT** where relevant)	**OPU** to notify internally as follows:
☐ Non-emergency ☐ Tier 1 ☐ Tier 2 ☒	☐ **With IMPACT / HIGH POTENTIAL INCIDENT*** • PETRONAS ELT • VP GHSSE • Head GHSE • Head Group Security • Head Group Strategic Communications • GM HSE MPM (for Domestic Upstream Emergency only) ☐ **No IMPACT*** • VP GHSSE • Head GHSE • Head Group Security • Head Group Strategic Communications • GM HSE MPM (for Domestic Upstream Emergency only)	• Notification list as established by OPU / BU
`☐ Tier 3	• PETRONAS ELT • VP GHSSE • Head GHSE • Head Group Security • Head Group Strategic Communications • GM HSE MPM (for Domestic Upstream Emergency only)	• Notification list as established by OPU / BU

***DESCRIPTION OF IMPACT, EMERGENCY, NON-EMERGENCY & HI-PO**

Impact:
- Fatality
- Major injury / health effect that resulted in Permanent Partial Disability / Lost Workday Case MYAre than 4 days
- Occupational Illness with irreversible health impact
- Asset damage equal or exceeding USD 100,000
- LOPC release equal to or above Tier 1 threshold quantity**
- Spill no longer confined within company site, with off-site environmental impact (e.g. visible contamination to soil / water system, fish killed, vegetation damaged).
- Emission or discharge from regulated / permitted source, exceeding regulatory standard
- Chemical / Noise over exposure (exceeds the occupational exposure limit (OEL))
- Local media / public concerns with considerable reputation consequence or worst

Emergency:
- **Incident where emergency or crisis team have been activated (Tier 1, Tier 2, or Tier 3)**

Non-Emergency:
- Incident where there is no activation of emergency or crisis team

High Potential (Hi-Po) Incident:
- Any incident which, under different circumstances, would have caused more severe consequences leading to a major incident

** Note:
Natural gas, Methane, Ethane, Propane, Butane, LPG, LNG = 500 kg
Petrol, Gasoline, Methanol, above 15 API Gravity Crude oil = 1000 kg or 7 bbl.
Diesel, below 15 API Gravity Crude oil = 2000 kg or 14 bbl.
For other material, please refer to PTS 18.06.01 / API 754 Standard

PETRONAS	NOTIFICATION FORM	BU:	Upstream Business
		OPU:	Myanmar Operation
		Tel:	+951 515011/526411
		Fax:	+951 525698/503605

*** Type of Notification	☐ Initial ☐ Update ☐ Nothing To Report ☐ Stand Down / All Clear ☐ Temporary Cease of Operations (will be resumed on: Date : Time:)

*****SECTION A: BASIC INFORMATION**

Location:	☐ Onshore:	☐ Malaysia	Date	
	☐ Offshore:	☐ International	Time	
Department Responsible:				

*****SECTION B: TYPE**

HSE & Process Safety	☐ Fire	☐ Explosion	☐ HAZMAT	☐ Hi-Po Incident	☐ Chemical / Noise Over Exposure
	☐ Loss of Primary Containment (Liquid)			Release Volume:	
	☐ Loss of Primary Containment (Gaseous)			Recovered Volume:	
	☐ Spillage				
	☐ Others. Please specify:				
Security	☐ Arson	☐ Kidnapping / Hostage	☐ Bomb Threat	☐ Community Disturbance	☐ Hijack / Piracy
	☐ Others. Please specify:				
Transportation	☐ Land	☐ Water	☐ Air	Others, please specify:	
Natural Disaster	☐ Flood	☐ Earthquake	☐ Tsunami	Others, please specify:	

*****SECTION C: IMPACT**

☐ People (specify in **SECTION D**)	☐ Environment	☐ Asset	☐ Reputation

*****SECTION D: INJURED / ILL / FATALITY / MISSING**

Number of Injured Person	Number of Ill Person	Number of Fatality	Number of Missing
☐ PETRONAS ( ) ☐ Contractor ( ) ☐ 3rd Party ( )	☐ PETRONAS ( ) ☐ Contractor ( ) ☐ 3rd Party ( )	☐ PETRONAS ( ) ☐ Contractor ( ) ☐ 3rd Party ( )	☐ PETRONAS ( ) ☐ Contractor ( ) ☐ 3rd Party ( )

*****SECTION E: POTENTIAL ESCALATION**

☐ Under control with available resources. No potential of escalation	☐ May require additional resources (e.g. authorities, contractors, mutual aid group)

☐ Authorities may take over command and control	☐ May trigger significant authorities / public / community / media interest

***SECTION F: AUTHORITIES INFORMED			
Authorities / Date Informed:	☐ Police ☐ Fire Dept. ☐ Medical ☐ Civil Defence	☐ HSE Regulator: e.g. DOSH, Department of Environment, etc. Please specify:	☐ Others: e.g. Coast Guard, Marine Dept., Municipality, etc. Please specify:

SECTION G: BRIEF DESCRIPTION (Who, What, Where, When & Consequence)

SECTION H: RESPONSE / ACTION TAKEN

SECTION I: ADDITIONAL INFORMATION

SECTION J: STAND DOWN / ALL CLEAR	**Date:**		**Time:**
***Prepared / Reported by**	**Name:**		**Signature:**
	Designation:		
	Contact No		

	Date / Time		
***Approved and Submitted by**	**Name:**		**Signature:**
	Designation:		
	Contact No		
	Date / Time		

SMS Template:

SAMPLE SMS Notification The following are the mandatory information for SMS notification: (1) Type of incident i.e. fire, injuries/casualty/fatality; (2) Basic Information: Incident location, date and time; (3) Incident Potential: Incident under control or potential to escalate; (4) Impact & Consequence: Fire/Injury/Environment/Security (No. of Casualty/Fatality); (5) Sender:	Sample of SMS notification showing all the information above is shown as below: Initial Notification: Fire Incident @ Platform ABC, OPU XYZ on 31/12/2010 @0030 hrs. Tier 2 declared & incident under control. 5 staff injured @ Medevac ongoing. Sender: Incident Commander, ECC – OPU XYZ

1. Proforma Sheet

This Proforma Sheet will be used by the Incident Commander to record initial reporting by the Person-in Charge on essential details and to prompt responses required.

ITEM	COMMENT
Date and Time of notification.	
What has happened?	
Where and when did it happened?	
What is the emergency description (blowout, fire etc.)?	
Immediate actions taken e.g. muster, fire teams, evacuation etc.	
Number and severity of casualties?	
POB/PAX numbers and lists. All personnel accounted for?	
Road Ambulance on-locations.	
Aircraft locations.	
Facility Emergency Response Team informed/Mobilized.	
Additional resources required? (Aircraft, equipment, materials etc)	
Long-term actions required?	
External notifications made? (Government agencies, other authorities)	
Emergency Assessment?	Minor Serious Crisis
Weather conditions?	Wind Condition: Wind Speed & Direction: Temperature:

This form shall be filled by the Person-in-Charge (at the site immediately after the initial reporting of emergency situation and then faxed or e-Mail to the Incident Commander.

2. **MEDEVAC Form**

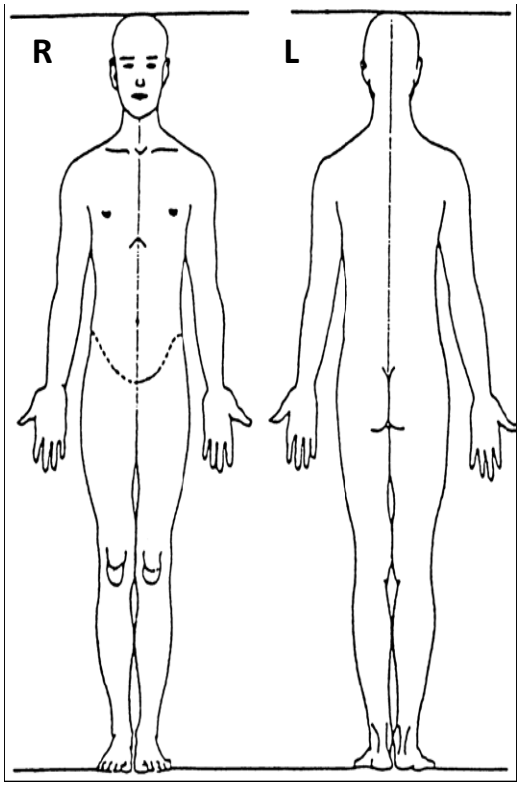
From: On-Scene Commander		
To:		
Subject: Medical Evacuation of		
1.	Patient Name	
2.	Nationality	
3.	Passport Number	
4.	Employer	
5.	Nature of Illness/Injury	
6.	Treatment Given	
7.	Medical Evaluation - Detailed Diagnosis and Prognosis	
8.	Patient's Present Location - Provide full address and telephone number	
9.	Physician - Name of attending physician, and telephone number if available	
10.	Travel Date and Time - Approximate date and time patient will be able to travel	
11.	Hospitalization Requirement - Indicate hospitalization is required upon arrival	
12.	Medical Records - Indicate whether medical records will accompany the applicant	
13.	Escort Requirement - Indicate escort is accompanying per recommended	
14.	Escort's Final Destination - Will accompany the subject to the final destination	
15.	Special Requirements - Special reception requirement (wheelchair, ambulance)	
16.	Other Medical Information - Provide other information not covered above.	

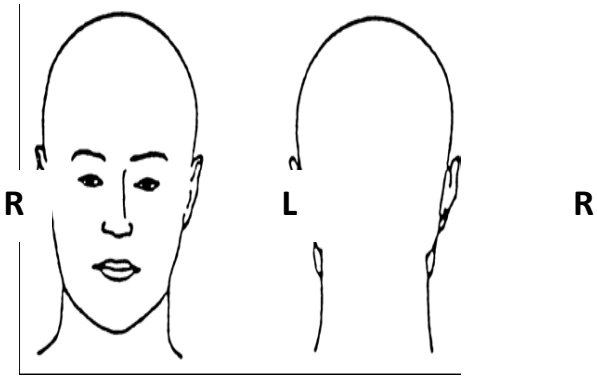
3. Bodily Injury Form

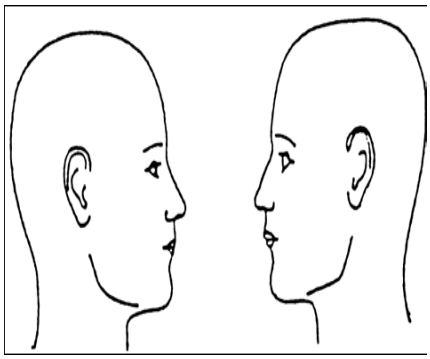
BODILY INJURY CHART

Injured person's name :	**Date :**
Preparer's name :	**Time :**

Indicate location of abrasions, lacerations, bruises, suspicious marks, etc., on the charts below. Number each location, and describe the injury in the space provided. If MYAre space is needed for descriptions, use the back of this page. Attach available photographs.







R L

Description of Injuries :

1.	
2.	
3.	
4.	
5.	

APPENDIX IV

LIST OF EMT ASSIGNEES

PRIMARY CALL OUT TEAM

INCIDENT COMMANDER (DUTY MOBILE: 09 519 3367)

DUTY OFFICER	PERSONAL PHONE/MOBILE	DUTY MOBILE	Contact Address
AUNG MYINT THEIN	**09 421 116079**	**09 519 3367 / ECC (3170) ECC Ph +(951) 525696**	**No. 127, Nant Thar Myaing Street, 50 Qtr, North Dagon.**
NANDA HLAING	**09 5086 168**	**09 519 3367 / ECC (3170) ECC Ph +(951) 525696**	**E-107,133, Lamintharyar Condo, Mill Road, Mingalartaungnyunt, Yangon**
KHUN MIN SWE	**09 516 1050**	**09 519 3367 / ECC (3170) ECC Ph +(951) 525696**	**17, 6th Fl, Thukamein St, Sanchaung**
AUNG SOE MIN	**09 501 1917**	**09 519 3367 / ECC (3170) ECC Ph +(951) 525696**	**131, 32nd Street., Pabedan**
AZLAN B M SABIRIN	**095057980**	**09 519 3367 / ECC (3170) ECC Ph +(951) 525696**	**08-06 Tower 1, Golden Hill Towers**
AZMAN B A KAMIS	**09 504 2610**	**09 519 3367 / ECC (3170) ECC Ph +(951) 525696**	**211 Marina Residence, Kabar Aye Pagoda Road**
WIN AUNG ZAW	**09 518 8137**	**09 519 3367 / ECC (3170) ECC Ph +(951) 525696**	**12 B, Shwe Taungkyar, Bahan Yangon**
TIN AUNG	**09 5079876**	**09 519 3367 / ECC (3170) ECC Ph +(951) 525696**	**No.8,4th Floor,146 Street, Tamwe,Yangon**

OPERATION CHIEF (DUTY MOBILE: 09 519 3872)

DUTY OFFICER	PERSONAL PHONE/MOBILE	DUTY MOBILE	Contact Address
SANDAR AUNG	09 515 8581	09 519 3872 / (3171)	277/12, East Yankin, Yankin TSP
SOE THIHA	09 430 514 49	09 519 3872 / (3171)	Rm 108, Sibin Housing, Myawaddy Min Gyi Road, Block 51, North Dagon.
THU REIN PHOO	0925 2440 798	09 519 3872 / (3171)	14(2B), Yonegyi St, Kyeemyindine Tsp, Yangon.
YIN THIDA HTET	09 540 3402	09 519 3872 / (3171)	No. (528), Shwe Yin Mar Street, 41-Quarter, North Dagon.
NAY LIN TUN	0973901209 / 09259866137	09 519 3872 / (3171)	No, 376, Aung Myitta Street, (29) Quarter, North Dagon Myo Thit, Yangon. MYR.

PLANNING CHIEF (DUTY MOBILE: 09 519 4187)

DUTY OFFICER	PERSONAL PHONE/MOBILE	DUTY MOBILE	Contact Address
WIN THU	094500 326 222	09 519 4187 / **(3172)**	1260, Room 205,Thiri Street, Myittar-Nyunt, Tamwe,
WIN MYINT	09 505 1960	09 519 4187 / **(3172)**	111, first floor, 156 St, Tarmwe, Yangon.
KHIN MYINT WAI	09 513 1435	09 519 4187 / **(3172)**	No.127, 4th Floor, 101st street, Mingalar Taung Nyunt Township, Yangon, Myanmar
KYAW LIN OO	09450052567	09 519 4187 / (3172)	No. 67, Hantharwaddy 22nd Road, 6th Quarter, South Oakkalarpa
HAN ZAW OO	09 975710698	09 519 4187 / **(3172)**	No. 6, Anawyahtar Road, Pazudaung
ZIN MAR OO	09 97 299 3565	09 519 4187 / **(3172)**	No.21-A Yadanar Street, 3 Quarter ,Kamayut Township , Yangon

SITUATION UNIT LEADER (DUTY MOBILE: 09 510 8435)

DUTY OFFICER	PERSONAL PHONE/MOBILE	DUTY MOBILE	Contact Address
THI HA	0 99 -77-2 444 22	09 510 8435	Building No 210, Room No 10, 4 Ward, Yankin, Yangon.
PHYO PAING SOE	09450032479	09 510 8435	Bldg # 37, RM#401, Innwa Housing, south Dagon Tsp.
HTET WIN	09450029013	09 510 8435	No.(243), 20 Ward, Myin Sai St, Shwepaukkan, Township
DON SAN NUAM	09260624601	09 510 8435	No.205/21,Yan Shin Road, Yankin
THANDAR THEIN	09-96-3168818 09-50-68916	09 510 8435	Room No. 601, 6th Floor, Condo (B) Taketho Yeik MYAn,New University Avenue,.Bahan Township, Yangon,
HSET AUNG WIN	09 420 135 162	09 510 8435	Bldg 2, Sein Pan Myine Avenue, North Oakkalapa.
SANDAR WIN	09 519 9566 01295975	09 510 8435	No.185 (8th floor), 50th Street (Upper Block), Pazundaung Township, Yangon
MYAT HTOO HTOO AUNG	09 504 9275	09 510 8435	No.943, Shwe Nyaung Pin St., Aye Thate Di lane, East Ywama Quarter, Insein Township,Yangon.
AUNG THET NAUNG	0973007760	09 510 8435	Bld# 50 , Rm# 5A,Kyauk Myaung St, Kyauk Myaung Gyi Qtr, Tamwe Tsp, Yangon
YIN MIN HTUN	095163630	09 510 8435	No,431, Ywet Hla Street, West Gyogone, Insein.

LOGISTICS CHIEF (DUTY MOBILE: 09 519 4253)

DUTY OFFICER	PERSONAL PHONE/MOBILE	DUTY MOBILE	Contact Address
ARNT BWE HLAING	095191018	09 519 4253 / **(3173)**	No.20 A, Thiri Mingalar St.Shann Lann, SanchaungTownship
CHAW SU WIN –SU SU	01-548 929 09 431 84855	09 519 4253 / **(3173)**	21, 1st Fl, Atesarthaya St, Kyauk Myaung Tsp
HAN THU	09 423 689239	09 519 4253 / **(3173)**	No.83, 7-flat, 94th Street, Mingalar Taung Nyunt Township, Yangon.
NYO OO KHE	09 43020643	09 519 4253 / **(3173)**	No.(243), 20 Ward, Myin Sai St, Shwepaukkan Township
HEIN THU AUNG	09 4307 5466	09 519 4253 / **(3173)**	58/2B, Inya Road, Kamayut Ts, Yangon, Myanmar.

FINANCE CHIEF (DUTY MOBILE: 09 519 4513)

DUTY OFFICER	PERSONAL PHONE/MOBILE	DUTY MOBILE	Contact Address
YAMIN KHA	555 828 09 430 43316	09 519 4513 / **(3142)**	No.90, Min Street, Bahan Township, Yangon
TIN MAUNG MYINT	09 732 41572 09 515 4969	09 519 4513 / **(3142)**	No.71, Level 6,Hledan Street, Lanmadaw Township, Yangon, Myanmar
AUNG MYINT OO	0925 4135 472 09 519 1151	09 519 4513 / **(3142)**	No. 30, 3rd Floor (Left), Thiri Street, Thiri Khemar Qr, Sanchaung
SAN SAN WIN	09-513 0362/ 09-730 84241	09 519 4513 / **(3142)**	No. 125, 4th Floor, 46th Street, Botahtaung Township, Yangon, Myanmar
AYE AYE AUNG	09 421149023	09 519 4513 / **(3142)**	No.19-A, Weikzar Street, 9 Mile, Mayangone Township.
SANDAR SOE	510967 09 73117731	09 519 4513 / **(3142)**	No. 17, 57-Street, 7-Qtr, Hlaing, Yangon.
HNIN YEE SOE	09 540 2111	09 519 4513 / **(3142)**	No. 864/865, Innwa Street, Block (6), South-Okkala, Yangon.
WIN MIN THAN	09 541 2098	09 519 4513 / **(3142)**	Bldg 8, Room 36, ShwegoneyeikMYAn Housing, Bahan Township.
HNIN HNIN SOE	572923 09 513 1573	09 519 4513 / **(3142)**	335, Thitsar Road, (9) Ward, South Okkalapa, Yangon.
YU YU WAH LIN	09 531 1948	09 519 4513 / **(3142)**	Bldg 4,Room 202,Pazundaung Tsp, Tharyargone Street,Ygn
HNIN YEE SOE	09 540 2111	09 519 4513 / **(3142)**	No. 864/865, Innwa Street, Block (6), South-Okkala, Yangon.
AYE MYA MYA PHU	09975551626	09 519 4513 / **(3142)**	Room 42, Building 15, Plam Village, West Yankin, Yangon
YIN THWE NYO	09799660805	09 519 4513 / **(3142)**	41/25 A Shwe Taung Gone Avenue, Inya Myaing, Bahan, Yangon

HSE & LIAISON OFFICER (DUTY MOBILE: 09 519 4569)

DUTY OFFICER	PERSONAL PHONE/MOBILE	DUTY MOBILE	Contact Address
KHIN OHNMAR SOE AUNG	667045 / 09-5066998	09 519 4569 / **(3175)**	231, Shwe Hnin Si Lane 6, 9th Mile, Mayangone
SULAIMAN	09 781965654	09 519 4569 / **(3175)**	No.26, 26th Street, Pabedan Township, Yangon, Myanmar.
NAY MYO AYE	09 250 804 724 01 250 013	09 519 4569 / **(3175)**	85, 92nd st, Kandawgalay, Mingalar Taungyunt TS, Yangon.
SAW TAR HAY THAR	09 5161997	09 519 4569 / **(3175)**	40/1254, U Ba Cho Rd, North Dagon TSP, Yangon.
PHORE KYAW	09448012480	09 519 4569 / **(3175)**	911, Bo Thone Lan, 49th Quarter, North Dagon.
KYAW KO LATT	09 787234680	09 519 4569 / **(3175)**	90th Street, Kandawlay,yangon
MYO MIN HTIKE	09-420074750	09 519 4569 / **(3175)**	No.100, Kha Yae Pin Yeik MYAn No.1 Street, Mingalardon TSP, Yangon.
MYO THET NAING	09-448011581	09 519 4569 / **(3175)**	No.18 (6B), Chan Thar Street, San Chaung Tsp., Yangon

COMPUTER OPERATOR (DUTY MOBILE: 09 519 4571)

DUTY OFFICER	PERSONAL PHONE/MOBILE	DUTY MOBILE	Contact Address
PWINT HLAINE ZAR	0950 46476	09 519 4571	No. 40A, Myita St., Mikyaungkan Part(2), Thingangyun Tsp., Yangon
EI CHO CHO MAUNG	09-4480 12903 01 586 509	09 519 4571	16/10, Taw Win Housing, 41 Quarter, North Dagon Township.
HNIN SI PHYU	09254199667	09 519 4571	Bldg 74/76, Room 50, Anawrahta Road, Pazundaung Tsp, Yangon.

HLAING MEE MYO	641128 095089664	09 519 4571	No. 1347/C, Hyde Park 2nd Street, Taung Thu Gone, Insein
HLA THUZAR	01-205778 / 0931041196	09 519 4571	No.25, 126 street, Mingalar Taung Nyunt Township, Yangon.
HAY MAR SAW AUNG	09-43091782	09 519 4571	No.36, Pathein Street, Sanchaung , Yangon
MYAE MYAE AYE	09 254546357	09 519 4571	Room 44,Building 4, Malikha Housing ,Yadanar Street , Thingangyun Twsp ,Yangon.
SU SU HLAING	09 250508133	09 519 4571	No.128, 46th Street, Botahtaung Township, Yangon.
SU MYAN AUNG	09-250069378	09 519 4571	06-05, Kandawgyi Tower, No. 4/6 Kyaikkasan Road,Tamwe Township, Yangon.

SECONDARY CALL OUT TEAM

BUSINESS CONTINUITY PLANNER (DUTY MOBILE: 09 513 1856)

DUTY OFFICER	PERSONAL PHONE/MOBILE	DUTY MOBILE	Contact Address
EI MYAN SWE	09-5171789.	09 513 1856	Bldg 12A, Room (A4), Insein Road, Mayangone
KADAE KADAR HLAING	09-4210 31857	09 513 1856	No.6, Sipinthayar Street, Parami, Mayangone
SAW NAN HTWE	09-43031302	09 513 1856	21A, 4TH FLOOR, Aung Zay Ya Road, Kyauk Kone
ZAIN AZRAEN B ZAHARIM	09-970 9552 37	09 513 1856	Shangri-La Residence

MEDIA RESPONSE TEAM (DUTY MOBILE: 09 513 1856)

DUTY OFFICER	PERSONAL PHONE/MOBILE	DUTY MOBILE	Contact Address
MI CHO @ KHIN HNIN AYE	09 509 7754	09 517 8708 (**3140)**	No 13 Daw Hla Pan Street, Ward 2, Mayangone, Yangon
MINN MINN	0950 12787	09 517 8708 **(3140)**	No. 402, Building No. B, Yuzana Hiway Complex, Kamayut Township, Yangon
TIN NWE NYO	09-5037456	09 517 8708 **(3140)**	Room 8F, Sinmalite Business Tower, Kannar Road, Kamayut Township, Yangon.
MYAE MA MA MYO	09 5100151	09 517 8708 (**3140)**	24/5, ward 6, Housing Project (South),8 mile, Mayangone Township, Yangon.
OHNMAR LWIN	577923 09420027266	09 517 8708 (**3140)**	NO.132, 5th Street, 10th Quarter, South Okkalapa.

HR CHIEF & NEXT OF KIN OFFICER (DUTY MOBILE: 09 513 4607)

DUTY OFFICER	PERSONAL PHONE/MOBILE	DUTY MOBILE	Contact Address
PHONE KHINE WIN	580625 09 503 7049	09 519 4607	34/649, Yamanay Road, North Dagon
THANDAR AUNG	09-799700422	09 519 4607	No. 16/1271, Room C-6, 6th Floor, Sabe Street, Myitta Nyunt Quarter, Tamwe Township
HAN ME KO	524241 09 502 0292	09 519 4607	217, Dhamazedi Road, Bahan
NAW GAY NAY PAW	09 254873528	09 519 4607	No.15, Julibee road, Taung Thu Gone Qtr, Insein Tsp.
MYAT SANDAR	541005 09 540 7957	09 519 4607	213, Bldg 6, Kyaik Ka San Housing, Tamwe

THAN THAN SHEIN	660796 09 501 9796	09 519 4607	6, Aung Thuka St., 9 Mile, Mayangone
MARY ANTHONY	0943202613	09 519 4607	23 (B), Yadanar Road, Yankin
HNIN SI PHYU	09254199667	09 519 4571	Bldg 74/76, Room 50, Anawrahta Road, Pazundaung Tsp, Yangon.
HLAING MEE MYO	641128 095089664	09 519 4571	No. 1347/C, Hyde Park 2nd Street, Taung Thu Gone, Insein

IT TEAM (DUTY MOBILE: 09 519 4984)

DUTY OFFICER	PERSONAL PHONE/MOBILE	DUTY MOBILE	Contact Address
THUTA HTAY	01-687026	09 519 4984	No. (B-31), Padauk Wah 3rd Street, FMI City, Hlaing Thar Yar Tsp., Yangon
MIN THEIN	095351584	09 519 4984	No.107, Theingyi Street, Ahlone Township, Yangon.
ZAW MIN TUN	09 730 22648 01122153	09 519 4984	158, 8th floor, Sanchaung Street, Saunchaung Tsp.

TELECOM (DUTY MOBILE: 09 519 4670)

DUTY OFFICER	PERSONAL PHONE/MOBILE	DUTY MOBILE	Contact Address
YADANA HANDI	09 420250505	09 519 4670	No. (1), Aung Thiri Lane, Aung Mingalar Ward, Thanlyin
ZAW WIN MAW	01 536 593	09 519 4670	No. 56/58B, Room 402, Mingalar Thukha Street, Hanthar Yeik MYAn Housing, Kamaryut Township
KO OO	01 536 593	09 519 4670	No. 56/58B, Room 402, Mingalar Thukha Street, Hanthar Yeik MYAn Housing, Kamaryut Township

CONTRACTORS			
Name	**Home**	**Mobile**	**Address**
OPERATIONS			
SES, SBM (FSO) (Duty Mobile 09 50 85070)			
YIN MIN MIN HTET	C/O 552163 09 421 112 677	09 508 5070	34, 2nd Floor , Damawihara St, Kyauk Myaung.
Tidewater (Shipping)			
Capt: YE LIN HTUT (Tide Water)		01 – 556780 09-450 044484	No.15, Inya Myaing Road, Bahan Township, Yangon Room-601, Bldg-A, Shwe Than Lwin Condominium, New University Avenue Road, Bahan (OFFICE)
MS HAY MAR THET (Tide Water)		01 – 556780 09 4210 25849	#862, Net Ya Kan (3)St; 35th Quarter, Dagon (North) Township, Yangon, Myanmar.
ISOS (Medical)(Focal Mobile No: 09 254044263)			
Duty Doctor	667877/667879	+ 66 2205 7777 09 254 044 263	1) Bangkok Alarm Centre Dusit Inya Lake Hotel (Yangon Office)
Heliunion(Aviation)			
Base Manager (Heli union)	650 933	09 205 1415	Base Manager Room (418), Micasa Hotel
Hevilift(Aviation)			

U MAUNG MAUNG LAY(IPSC, HeviLift)	647050 Fax - 647060	09 513 0398	105 A, Zion Hill St, Nanthar kone, Insein ipsc@myanmar.com.mm
M&A (Catering)			
WIN KO (Myint Associates) MYAT MIN U MYO THI HA	09 7315 2203 09 7303 4715	507 100/ 521 003/ 516 201/ 505 077 09 500 1609 09 7321 7329	84-85 Hlaing Myint MYAh Lane # 1, 10th Quarter, Hlaing Tsp, Yangon
TNS			
KHINE THI TUN (TNS)	09 510 1453	09 862 4137	Room (0301), Sedona Hotel (Residence) 11(A) (GFL) South Race Rd,Tamwe.
WIN TOP			
Myint Hlaing Oo	09 254717121	09 254717121	-
Land Transport			
Kyaw Zin Oo (Transport section, CAA)	-	097855 55032	206,D2,Baho Road, Sannchaung, Yangon
Aviation			
Kyaw Kyi Phyu	211881	09 504 1816	G202, Manawhari Housing, Baho road, Alone.
Marine			
Arnt Bweh Hlaing	-	09 519 1018	No.20 A, Thiri Mingalar St.Shann Lann, SanchaungTownship.
Security			
Minn Minn	-	09 501 2787	No. 402, Building No. B, Yuzana Hiway Complex, Kamayut Township, Yangon

APPENDIX V

LIST OF ECC EQUIPMENT

1 EQUIPMENT

As a minimum, the following equipment will be maintained within the EMC at all times:

1. At least 4 large tables
2. Comfortable chairs for at least 12 persons
3. 2 wall clocks (set for Yangon and Kuala Lumpur time)
4. A desktop computer and local laser printer (with access to the Yangon office network and the PCSB global e-mail system)
5. At least 8 standard office telephones (connected to the MYA switchboard)
6. An Inmarsat mini M-telephone
7. Wall boards for information logging
8. At least 3 four-way extension socket outlets (UK 3-pin 13 Amp style)
9. Various socket outlet adapters (USA and Continental)
10. 8 nos. of Mobile cellular phones for all EMT Core Members
11. 3 nos. of hotline phones connected to each site

2 CONSUMABLES

As a minimum, the following consumables will be maintained within or adjacent to the EMC at all times:

1. At least 12 whiteboard non-permanent marker pens (various colors)
2. At least 4 flip-chart pads
3. At least 12 A4 pads of lined paper
4. At least 2 reams of A4 plain paper
5. At least 12 pens
6. At least 12 pencils
7. At least 4 erasers
8. A calculator (with spare batteries)
9. At least 4 12-inches rulers
10. At least 4 rolls of masking tape
11. At least 1 clear-tape dispenser with a roll of tape
12. At least 1 pair of scissors

3 LOCATION AND COMMUNICATION INFORMATION

Additionally, the folio cases should contain up-to-date location and communication information for:

1. The PCSB Headquarters Office in Kuala Lumpur
2. The MYA Yangon Office
3. The TOTAL Yangon Office
4. The MYA Pipeline Operating Centre (POC) in Kanbauk
5. The MYA Metering Station (MS) in Ban I Tong
6. The TOTAL Pipeline Centre (PLC) in Kanbauk
7. The Yetagun A & B Platforms
8. The Yetagun FSO
9. SOS Clinic (Medical Services Provider)
10. Heliunion Helicopters Limited (Aviation Services Provider)
11. Any MYA Supply Boats or other Marine Vessels
12. Any MYA Mobile Drilling Units
13. Any MYA Survey Spreads
14. Any MYA Construction Spreads

15. Any MYA onshore design offices and fabrication yards

4 MAPS

The folio cases should also contain up-to-date maps as follows:

1. The Yetagun field (showing the Yetagun A & B platforms, the Yetagun FSO and the field no-entry zone.
2. The onshore pipeline right-of-way and service track.
3. The offshore gas and condensate pipelines.
4. Aviation navigation map (showing Yangon, Kanbauk, Dawei, Myeik and Yetagun as a minimum)
5. Marine navigation map (showing Yangon, Heinze Chaung, dawei, Myeik, Yetagun and Singapore as minimum)
6. Yangon City street map.
7. Myanmar national road map.
8. Onshore pipeline area regional map (showing villages and other main features in the pipeline area.

Note: Maps 1 through 5 above **must** include latitude/longitude grid

5 DRAWINGS

There should be up to date plans and elevations (or general arrangements / layouts) for the following facilities within Myanmar:

Permanent onshore and offshore facilities:

1. The Pipeline Operations Centre (POC)
2. The Metering Station (MS)
3. The Yetagun-A wellhead platform
4. The Yetagun-B production platform
5. The Yetagun FSO
6. Any Yetagun field supply vessel

Temporary onshore and offshore facilities

1. Drilling rigs
2. Survey spreads
3. Diving Spreads
4. Construction spreads

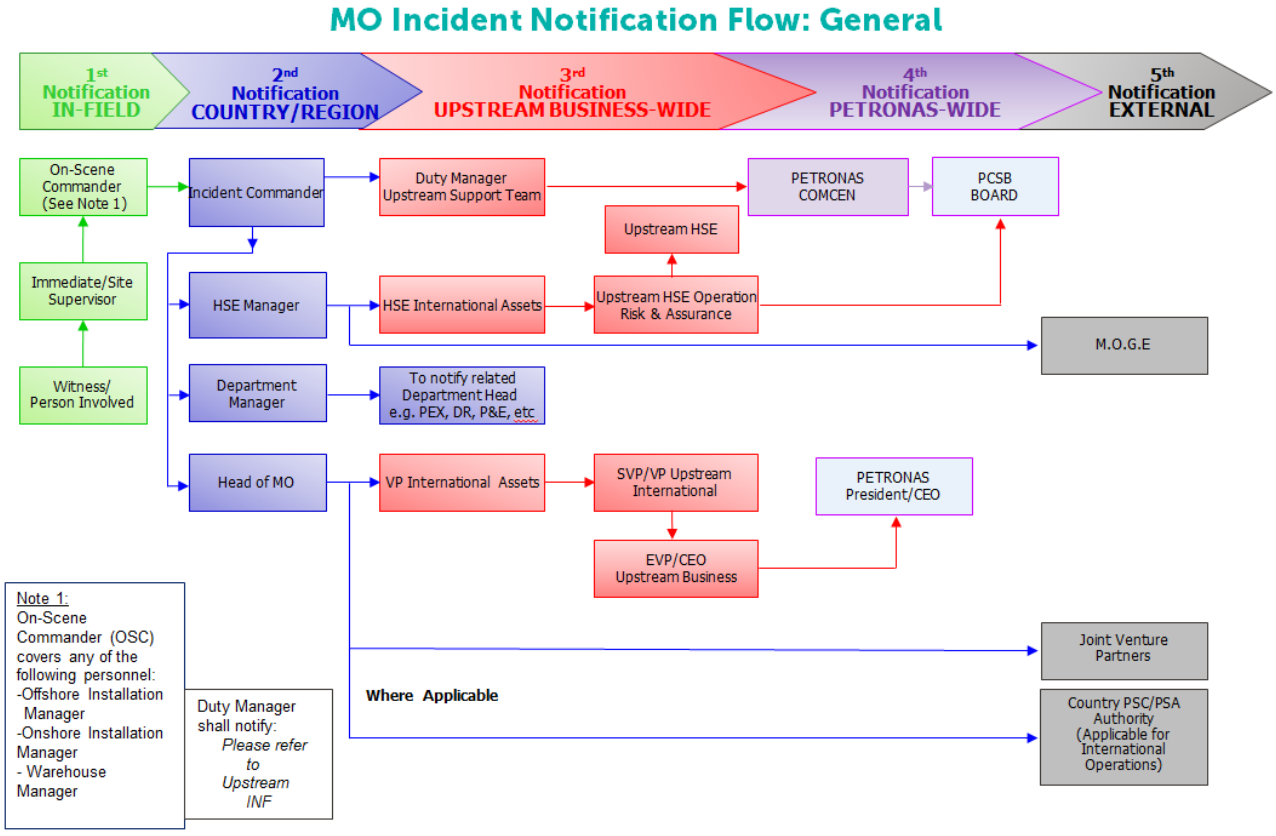
Note: Preferred drawing size is A3 and A4. A2 sized drawings can be accommodated if A3 and A4 sized drawings are not available. However, A0 and A1 sized drawings should be avoided.

6 OTHERS

The cupboards/shelves in the EMC should also contain comprehensive A3 drawings of all gas/condensate production facilities (i.e platforms, pipelines, FSO)

APPENDIX VI

INCIDENT NOTIFICATION FLOWCHART FOR MYANMAR OPERATION



APPENDIX VII

EMERGENCY RESPONSE REPORT

1. Emergency Response Report

Location:		**Shift:**
Date:	**Time:**	**POB:**
ERT Organization		
OSC	DCT Commander	Medical Team Leader
Recorder/Communications	Process Control	Mustering/Lifeboat Commander
Incident Description		
Sequence of Events		

Time	**Event**

Findings

No.	Element	Findings
1	Mustering	
2	Communications	
3	Tactical Response (DCT)	
4	Process	
5	Competency	

6	Equipment	
7	Staging	
8	Others	

Recommendation for Improvement

No.	Item	Recommended Action	Action party
1			
2			
3			
4			
5			
6			

Prepared By:

_____
Name:
Position:

Approved By:

_____
Name:
Position:

APPENDIX VIII

EMERGENCY DRILL REPORT

Emergency Drill Report

Location:		**Shift:**
Date:	**Time:**	**POB:**
ERT Organization		
OSC	DCT Commander	Medical Team Leader
Logger/Communications	**Process Control**	**Mustering/Lifeboat Commander**
Exercise Scenario:		
Reference PIP(s): 1. 2. 3.		
Sequence of Events		

Time	Event

Findings:	
Element	Findings
Mustering	
Communications	
Tactical Response (DCT)	
Process	
Competency/Training	
Equipment	
Others	

Recommendation for Improvement	
Item	Recommended Action

Prepared By:

_____
Name:
Position:

Approved By:

_____
Name:
Position:

APPENDIX IX

ADDITIONAL ROLES & RESPONSIBILITIES FOR MYA EMT

Information Officer		Responsible for organizing and managing all public affairs activities associated with incident response operations.
HSE & Liaison Officer	**Safety Officer**	Responsible for supporting the EMT and Site Safety Officer and to provide expertise on safety issues that may arise during the conduct of incident response operations.
	Liaison Officer	Responsible for organizing and managing all government and community affairs activities associated with incident response operations.
	Security Officer	Responsible for providing advice on security issues associated with incident response operations.
Legal Officer		Responsible for providing advice on legal issues associated with incident response operations.
Finance & HR Chief	**Human Resource Officer**	Responsible for addressing human resources issues that arise for response personnel and for arranging humanitarian assistance to the NOKs of individuals injured or killed by the incident or during response operations.
	Finance Section Chief	Responsible for managing and supervising all financial and administrative aspects of incident response operations, including accounting, invoice processing, contracts, cost control, insurance coordination, and financial reporting.
Business Continuity Chief		Responsible to ensure the team is activated to provide response related to Business Continuity Management.

Appendix 6
GHG Emission Calculations

Appendix 6 - Emission from Onshore Petroleum Exploration in Block IOR-7

1. Exploration Drilling

Emissions from Construction Phase

Greenhouse Gases (GHG)

The main source of GHG emissions during construction are from transportation of granular fill for well site and access road construction. These GHG emissions are estimated following the Tier 1 approach of IPCC (2006) mobile combustion (transportation). GHG emissions are estimated using emission factors and global warming potentials for the three main greenhouse gases (CO_2, CH_4 and N_2O).

To calculate the amount of each of these gases emitted, the following calculations can be used, using emission factors presented in **Table 1** and a conversion factor of 10^{-6} to convert g into ton:

$$CH_4 Emission\ (tonne\ CH_4) = \#\ truck\ trips\ x\ distance/\ trip\ (km)\ x\ 0.08 x\ 10^{-6}\ (tCH_4/km)$$

$$N_2O Emission\ (tonne\ N_2O\ ) = \#\ truck\ trips\ x\ distance/\ trip\ (km)\ x\ 0.03\ x\ 10^{-6}\ (tN_2O/km)$$

$$CO_2 Emission\ (tonne\ CO_2) = \#\ truck\ trips\ x\ distance/\ trip\ (km)\ x\ 753.6\ x\ 10^{-6}\ (tCO_2/km)$$

To calculate the total CO_2 equivalent GHG emissions, global warming potentials need to be used as some gases have a much greater greenhouse gas effect. The total CO_2 equivalent GHG emissions from transportation of mostly heavy-duty diesel vehicles are obtained using an emission factor of 0.000764 tCO_2 eq/km (**Table 1**). Emissions are calculated based on number of trips completed and distance travelled:

$$CO_2 Emission\ (tonne\ CO_2) = \#\ truck\ trips\ x\ distance/\ trip\ (km)\ x\ 0.000764\ (tCO_2/km) \quad \textbf{\textit{Eq. 1-3}}$$

Table 1: Emission Factor for Mobile Combustion (Transportation)

		CH_4	N_2O	CO_2	Total	tCO_2 eq/km
European diesel heavy-duty vehicle	g/km	0.08	0.03	753.60*		
	gCO_2 eq/km**	1.84	8.88	753.60	**764.32**	**0.000764**

Source: IPCC (2006) & EMEP/EEA air pollutant emission inventory guidebook (2009)[1]
* Tier 1: 240 g fuel/km*3.14 gCO_2/g fuel = 753.6
** Global warming potentials (100 year time horizon): CO_2 = 1; CH_4 = 23; N_2O = 296[2]

2.3.1.2: Granular Fill Transportation:
GHG emissions from fill transportation are obtained using the emission factor of **0.000764 tCO_2 eq/km** (**Table 1**), number of trips completed and distance travelled.
Total distance (round trip for the well site) = 50 km

Trucks will transport approximately 20 m^3 per trip from a granular source within 25 km of each location. The GHG emissions vary per well site due to different fill volumes and

[1] http://www.eea.europa.eu/publications/emep-eea-emission-inventory-guidebook-2009/part-b-sectoral-guidance-chapters/1-energy/1-a-combustion/1-a-3-b-road-transport.pdf

[2] http://www.grida.no/publications/other/ipcc_tar/

distance from the source: the emissions during construction total **9.2 (t CO_2 eq)** for the wellsite (**Table 2**)

Table 2: GHG Emissions for Granular Fill Transport

Well Site	Fill Volume well pad, work camp and access road (m^3)	Number of trips	Total Distance (round trip - km)	CH_4 emission (t CH_4)	N_2O emission (t N_2O)	CO_2 emission (t CO_2)	CO_2 emissions (t CO_2 eq)
Well Pad	6000	240	12,000	0.0022	0.001	9.0432	**9.2**

Gaseous Emissions during Drilling phase

Drilling Rig Diesel Generators

Diesel generators will be used as a source of power supply for drilling. The generators will operate 24 hr/day throughout a drilling period of 90 (30 days drilling and 15 completion for each well) days.

Based on compilation of air pollution emission factors established by the U.S. Environmental Protection Agency (EPA), air pollutants generated from diesel oil combustion of 8 m^3/day for the Land Drilling Rig.

This will consist of carbon monoxide, nitrogen dioxide, sulphur dioxide, and methane at estimated concentrations shown in **Table 3**.

The total emission values are a worst case scenario for 2 drilling wells. The rig is powered by 4 diesel driven generator sets and each rated 400KVA to supply the rig site with power.

Table 3: Air pollution emissions from Drilling

Air Pollutant	Emission Factor (kg/TJ)	Emission of Air Pollutant (tonne/day	Total Emission (tonnes)
Drilling Rig Century Generator and Camp Site – (8 m^3/day/well), 90 days for 2 wells			
Nitrogen Oxides (NO_x)	1,896	0.552	**49.7**
Sulphur Oxides (SO_x)	126	0.037	**3.3**
Carbon Monoxide (CO)	410	0.119	**10.71**

Sources: US.EPA, "Compilation of Air Pollution Emission Factors, Volume 1, Stationary Point and Area Sources", Fifth Edition, January 1995; http://www.epa.gov/ttn/chief/ap42/ch03/bgdocs/b03s03.pdf.

Greenhouse Gases (GHG)

Combustion products from fuel use are the same whether the fuel is used for drilling, well testing or transportation. Regular maintenance of the power generators and equipment will be conducted to minimize fuel use and emissions. The main impact from these emissions is the emission of greenhouse gases and their contribution to climate change.

GHG emissions from diesel generators are estimated following the Tier 1 approach of IPCC (2006) for stationary combustion. GHG emissions are estimated using emission factors and global warming potentials for the three main greenhouse gases (CO_2, CH_4 and N_2O) according to:

$$CH_4 \ Emission\ (kg) = Fuel\ Consumption\ (TJ)\ x\ Fuel\ Emission\ Factor\ (kgCH_4/TJ)$$

$$N_2O\ Emission\ (kg) = Fuel\ Consumption\ (TJ)\ x\ Fuel\ Emission\ Factor\ (kgN_2O/TJ)$$

$$CO_2 \ Emission\ (kg) = Fuel\ Consumption\ (TJ)\ x\ Fuel\ Emission\ Factor\ (kgCO_2/TJ)$$

$$CO_2\ eq\ Emission\ (kg) = Fuel\ Consumption\ (TJ)\ x\ Fuel\ Emission\ Factor\ (kgCO_2\ eq/TJ)$$

where

CO_2 Fuel consumption = diesel use (L) x diesel density (0.8397 kg/L[3]) x 10^{-6} Gg/kg x 43.33 (TJ/Gg) x 10^{-3} (tonne/kg)

Default Fuel Emission Factors are 3 kg CH_4/TJ, 0.6 kg N_2O/TJ and 74,100 kg CO_2/TJ.

To calculate the total CO_2 equivalent GHG emissions, global warming potentials need to be used as some gases have a much greater greenhouse gas effect. The total CO_2 equivalent GHG emissions from fuel use by generators are obtained using an emission factor of 74,346.6 kg CO_2 eq/TJ (**Table 4**)

resulting in

$$CH_4\ Emission\ (tonnes\ CH_4) = Diesel\ Use\ (L)\ x\ 1.0915\ x\ 10^{-7}\ (tonneCH_4/L)$$

$$N_2O\ Emission\ (tonnes\ N_2O) = Diesel\ Use\ (L)\ x\ 2.183\ x\ 10^{-8}\ (tonneN_2O/L)$$

$$CO_2\ Emission\ (tonnes\ CO_2) = Diesel\ Use\ (L)\ x\ 0.002696\ (tonneCO_2/L)$$

$$CO_2\ Emission\ (tonnes\ CO_2\ eq) = Diesel\ Use\ (L)\ x\ 0.002705\ (tonneCO_2\ eq/L) \quad \textbf{Eq. 1-3}$$

Table 4: Emission Factor for Fuel Use by Generators (Stationary Combustion)

Types	Unit	CH_4	N_2O	CO_2	Total
Diesel	kg/TJ	3	0.6	74,100	
	kg CO_2 eq*/TJ	69	177.6	74,100	74,346.6

Source: IPCC (2006)
* Global warming potentials (100 year time horizon): CO_2 = 1; CH_4 = 23; N_2O = 296

GHG emissions are estimated following the Tier 1 approach of IPCC (2006) for stationary combustion (generators), mobile combustion (transportation), and fugitive emissions (flaring).

GHG emissions are estimated using emission factors for the three main greenhouse gases (CO_2, CH_4 and N_2O) and converted to carbon dioxide equivalent using global warming potentials using the procedures and equations described above and for the construction phase.

The transportation requirements are as follows:

Description	Quantity	Remark
Estimated number of round trips for rig equipment	175	Based on previous onshore campaign by PCMI in 2015.
Estimated number of round trips for drilling support equipment (Including casing, chemical and etc)	100	One well is about 50 trips.
Estimated number of round trips for personnel	100	One well is about 50 trips.

The distance from Yangon to Well Site is 330 Km for this route. The route is via Pathain – Mon Ywar Highway Road

[3] IEA (2004), Density of Oil Products, Energy Statistics Working Group Meeting

Drilling Rig Transport:

It is estimated that the total number of truck trips required for equipment and supplies 175 trips per well for a maximum distance of 700 km. The IOR-7 drilling programs will be done with the same rig mobilization.

Table 5: Estimation of the distances between Yangon and rig sites

Location	Distance	Total Distance
Rig Mobilization	700 km * 175 trip	122,500 km
Rig Demobilization	700 km* 175 trips	122,500 km
	Total rig move distance	**245,000 km**

Total CH4 released = 245,000 km x 0.08 x 10-3 kg CH4/km = 19.6 kg CH4

Total N2O released = 245,000 km x 0.03 x 10-3 kg N2O/km = 7.4 kg N2O

Total CO2 released = 245,000 km x 753.6 x 10-6 tCO2/km = 184.6 t CO2

Total CO_2 eq. released = 245,000 km x 0.000764 tCO2 eq/km = 187.2 ton eq. CO_2 (II)

Equipment and Supplies

The drilling equipment and supplies will be transported to the site from Yangon (Thaketa or MITT port) to well site via the public highway. It is estimated that the total number of truck trips required for equipment and supplies is 200 trips (100 for equipment and 100 for personnel). The total distance is 350 km per trip (Yangon to Myanaung). Therefore the total distance for equipment transportation is a total of 140,000 km. Using the mobile combustion emission factor (**Equation 1-3**),

Total CH_4 released = 140,000 km x 0.08 x 10^{-3} kg CH_4/km = 11.2 kg CH_4

Total N_2O released = 140,000 km x 0.03 x 10^{-3} kg N_2O/km = 4.2 kg N_2O

Total CO_2 released = 140,000 km x 753.6 x 10^{-6} tCO_2/km = 105.5 t CO_2

Total CO2 eq. released = 140,000 km x 0.000764 tCO2 eq/km = 107.0 ton eq. CO2(II)

Heavy Equipment Use:

Based on previous experience, diesel consumption would be for operating heavy equipment, such as cranes, air compressors, cement pump unit, wireline logging, etc. Moreover, based on ("Air Quality – Health Risk Analysis of Onshore Pipeline Construction," n.d.), diesel consumption for operating heavy equipment such as Trenching, pipelay and shore crossing construction is approximately total 120,104 gallon or 480,416 liters for approximately 90 days.

Total CH_4 released = 480,416 L X 1.0915 x 10^{-4} kg CH_4/L= 52.5 kg CH_4

Total N_2O released = 480,416 L X 2.183 x 10^{-5} kg N_2O/L= 10.5 kg N_2O

Total CO_2 released = 480,416 L X 0.002696 tCO_2/L= 1295.2 ton CO_2

Total CO_2 released = 480,416 L X 0.002705 tCO_2 eq/L) = 1299.55 ton eq CO_2

Drilling a maximum 2 contingency wells would triple the amount to 3898.65 ton eq CO_2.

Total CO_2 eq. released = 3898.65 ton eq. CO_2(IV).

Diesel Generators to Power Drill Rig and Camp Site:

During drilling operations, generator for the drill rig and camp site consume 8,000 L/day (mentioned by PCMI) of diesel over a period of 90 days/well (mentioned by PCMI) of drilling for drilling 2 wells (not including contingency wells). Total fuel use is therefore 1,408,000 L. Using the fuel use emission equations (***Eq. 1-3***),

Total CH_4 released = 1,408,000 L X 1.0915 x 10^{-7} t CH_4/L= 0.15 t CH_4

Total N_2O released = 1,408,000 L X 2.183 x 10^{-8} t N_2O/L= 0.03 t N_2O

Total CO_2 released = 1,408,000 L X 0.002696 t CO_2/L= 3,795.7 t CO_2

Total CO_2 eq released = 1,408,000 L x 0.002705 tCO_2 eq/L = 3,808.6 ton eq. CO_2

The total release of CO_2 during the drilling phase is estimated to be as a worst case maximum of **3,808.6 ton of CO_2 eq.**

Drilling maximum 2 contingency wells per site would triple the amount to 11,425.9 ton eq CO2.

Total CO_2 eq. released = 11,425.9 ton eq. CO_2(V). The CO_2 eq. released per well is 5713.0 ton eqCO_2.

Summary of the Emissions

Table 7: Estimated GHG Emissions for Drilling phase

Project Phase	Activity	One Time CO_2 Release (ton CO_2)
Drilling	Drilling rig mobilization	9.2
	Equipment and Supplies	187.2
	Transport (fuel, water, personnel)	107.0
	Heavy equipment use	3,898.6
	Generator to power drilling rig and camp site	5,713.0
Total for project		9,915

Emissions during Well Testing Phase

Diesel generators will be used as a source of power supply for testing. The generators will operate 24 hr/day throughout a testing period of 30 days for both wells.

The maximum flow during a DST test generally never exceeds 10 mmscfgd. Thus a worst case scenario flaring is a sustained flow rate of 10 mmscfgd for 7 days for one well at each of the two well sites.

Based on compilation of air pollution emission factors established by the U.S. Environmental Protection Agency (EPA), air pollutants generated from diesel oil combustion will consist of carbon monoxide, nitrogen dioxide, sulphur dioxide, and methane at estimated concentrations shown in **Table 8**. Estimated carbon dioxide emissions are discussed under Greenhouse Gases below.

Table 8: Estimated Air Pollutant Emissions for Well Testing Phase

Air Pollutants – Fuel Use	Emission Factor (kg/TJ)	Emission of Air Pollutant (tonne/day/well)	Total Emission (tonnes)
350-KVA Camp Site Generator (1.5 m^3/day/well) – 30 days for both wells			
Nitrogen Oxides (NO_x)	1,896	0.103	3.1**
Sulphur Oxides (SO_x)	126	0.007	0.2**
Carbon Monoxide (CO)	410	0.022	0.7**
Air Pollutants – Flaring	**Emission Factor (lb/10^6 Btu)**	**Emission of Air Pollutant (lb/day)**	**Total Emission (tonnes)***
Flaring max 10 mmscfgd or 10 x 10^9 BTU/day/well – 7 d/well for 2 wells			
Carbon Monoxide (CO)	0.37	3700	23.5
Total Hydrocarbons**	0.14	1400	8.9
Nitrogen Oxides (NO_x)	0.068	680	4.3

Sources: US.EPA, "Compilation of Air Pollution Emission Factors, Volume 1, Stationary Point and Area Sources", Fifth Edition, January1995; http://www.epa.gov/ttn/chief/ap42/ch03/bgdocs/b03s03.pdf; http://www.eppo.go.th/ref/UNIT-OIL.html.
Note: Density of diesel oil is 0.8397 kg/L for calculation, IEA (2004), Densities of Oil Product, Energy Statics Working Group Meeting; Net Calorific Values is 43.33 TJ/Gg for calculation, IEA (2009), CO_2 Emission From Fuel Combustion, Documentation For Beyond 2020 Files

Greenhouse Gases (GHG)

Greenhouse gas emissions were calculated using the same methods described for the construction phase.

Diesel Generators to Power Equipment During Testing

Well Testing is assumed to perform 15 days/well or 30 days for both. During testing, a generator typically consumes an estimate of 1,500 L/day of diesel over a period of 30 days of testing, for a total of 45,000 L. Using the fuel use emission equations:

Total CH_4 released = 45,000 L X 1.0915 x 10^{-4} kg CH_4/L= 74.9 kg CH_4

Total N_2O released = 45,000 L X 2.183 x 10^{-5} kg N_2O/L= 1.0 kg N_2O

Total CO_2 released = 45,000 L X 0.002696 tCO_2/L= 121.3 ton CO_2

Total CO_2 eq released = 45,000 L x 0.002705 tCO_2 eq/L = 121.7 ton eq CO_2(VI).

Condensate Transport during Testing

During testing, the produced reservoir fluids will be separated at the surface: the gas portion will be flared and the liquid portion will be further separated into water and condensate. The separated water will be stored in the dirty water pit or steel tanks and the separated emulsion-condensate will be stored in storage tanks and disposed by the proper method or directly flared on site. Therefore, the transport for condensate will not be included in the estimation.

The expected condensate-to-gas ratio is 25 bbl per mmscfd with flow rate of 10 mmscfd based on the data of the similar projects.

Source: The condensate-to-gas ratio is 20-30 bbl/mmscfd in DST tested well of West Katakolon onshore block *("Status of existing and possible new production in Greece," 2006) with flow rate of 15.7 mmscfd, and it is 20 bbl/mmscfd with flow rate of 5-7 mmscfd of DST tested well in Papua New Guinea* (Andrews, 2010).

*http://www.elliny.gr/includes/event/Xenopoulos_Roussos_AAPG_presentation.pdf

*http://www.interoil.com/investor-relations-news-and-press-releases/2010-2/antelope-2-horizontal-drill-stem-test-5-confirms-stabilized-condensate-to-gas-ratio-at-20-4-bblsmmcf/

Flaring During Testing:

GHG emissions from diesel generators are estimated following the Tier 1 approach of IPCC (2006) for stationary combustion. GHG emissions are estimated using emission factors and global warming potentials for the three main greenhouse gases (CO_2, CH_4 and N_2O) according to:

$$CH_4 \text{ Emission (kg)} = \text{Gas Flared (TJ) x Fuel Emission Factor (kg}CH_4\text{/TJ)}$$

$$N_2O \text{ Emission (kg)} = \text{Gas Flared (TJ) x Fuel Emission Factor (kg}N_2O\text{/TJ)}$$

$$CO_2 \text{ Emission (kg)} = \text{Gas Flared (TJ) x Fuel Emission Factor (kg}CO_2\text{/TJ)}$$

$$CO_2 \text{ eq Emission (kg)} = \text{Gas Flared (TJ) x Fuel Emission Factor (kg}CO_2\text{ eq/TJ)}$$

where

Gas flared = gas (10^6 scf) x 0.0283168 (m^3/scf) x 0.9 kg/m^3 x 10^{-6} Gg/kg x 48 (TJ/Gg) x 10^{-3} (tonne/kg)

Default Fuel Emission Factors are 5 kg CH_4/TJ, 0.1 kg N_2O/TJ and 56,100 kg CO_2/TJ (**Table 9**)

To calculate the total CO_2 equivalent GHG emissions, global warming potentials need to be used as some gases have a much greater greenhouse gas effect. The total CO_2 equivalent GHG emissions from fuel use by generators are obtained using an emission factor of 56,244.6 kg CO_2 eq/TJ resulting in

$$CH_4 \text{ Emission (tonnes } CH_4) = \text{Gas Flared } (10^6 \text{ scf}) \text{ x } 0.00612 \text{ (tonne}CH_4/10^6 \text{ scf)}$$

$$N_2O \text{ Emission (tonnes } N_2O) = \text{Gas Flared } (10^6 \text{ scf}) \text{ x } 0.000122 \text{ (tonne}N_2O/10^6 \text{ scf)}$$

$$CO_2 \text{ Emission (tonnes } CO_2) = \text{Gas Flared } (10^6 \text{ scf}) \text{ x } 68.626 \text{ (tonne}CO_2/10^6 \text{ scf)}$$

$$CO_2 \text{ Emission (tonnes } CO_2) = \text{Gas Flared } (10^6 \text{ scf}) \text{ x } 68.8032 \text{ (tonne}CO_2 \text{ eq}/10^6 \text{ scf)} \quad \textbf{Eq. 1-4}$$

Emissions are calculated based on volume of gas flared per day and the number of flaring days.

Table 9: Emission Factor for Flaring Natural Gas (Stationary Combustion)

Types	Unit	CH_4	N_2O	CO_2	Total
Natural Gas	kg/TJ	5	0.1	56,100	
	kg CO_2 eq*/TJ	115	29.6	56,100	56,244.6

Source: IPCC (2006)

* Global warming potentials (100 year time horizon): CO_2 = 1; CH_4 = 23; N_2O = 296

GHG emissions from flaring during well testing are estimated by the amount of gas production (max 10 million scf/d/well) for a maximum 14 days (7 days * 2 well) to be tested, for a total of 140x10^6 scf. Using the gas flare equations (***Equation 1-4***):

Total CH_4 released = 140 x 10^6 scf x 0.00612 t CH_4/10^6 scf = 0.86 t CH_4

Total N_2O released = 140 x 10^6 scf x 0.000122 t N_2O/10^6 scf = 0.02 t N_2O

Total CO_2 released = 140 x 10^6 scf x 68.626 t CO_2/10^6 scf = 9,607.64 t CO_2

Total CO_2 eq released = 140 x 10^6 scf x 68.8032 t CO_2 eq/10^6 scf = 9,632.45 ton eq CO_2

The total release of CO_2 during the flaring phase is estimated to be as a worst case maximum of **9,632.45 ton of CO2 eq.**

Total CO_2 eq. released = 9,632.45 ton eq. CO_2(VII).

Summary of Emissions

A worst case maximum gas flaring of 10 mmscfd/d was used in the calculation. It is quite likely that the amount of gas flared is less, which would reduce the amount of CO_2 emissions.

Table 10: CO2 emissions from Flaring

Project Phase	Activity	One Time CO_2 Release (ton CO_2)
Testing Activity	Generator to power beam pump	**121.7**
	Flaring	**9,632.45**
Total		**9,754.15**

Emissions from Well Abandonment Phase

During abandonment and restoring well, similar onshore project used 140,000 L per site for 120 m* 120 m well pad, and it is estimated to use 102,200 L per site. Using the fuel use emission equations (***Equation 1-3***),

Total CH_4 released = 102,200 L X 1.0915 x 10^{-7} t CH_4/L= 0.01 t CH_4

Total N_2O released = 102,200 L X 2.183 x 10^{-8} t N_2O/L= 0.002 t N_2O

Total CO_2 released = 102,200 L X 0.002696 t CO_2/L= 275.5 t CO_2

Total CO_2 eq released = 102,200 L x 0.002705 tCO_2 eq/L = 276.5 ton eq CO_2

The total release of CO_2 during the abandonment phase is estimated to be 276.5 ton of CO_2 eq. (IX).

Reference

Air Quality – Health Risk Analysis of Onshore Pipeline Construction. (n.d.). Retrieved September 26, 2013, from http://www.slc.ca.gov/division_pages/DEPM/DEPM_Programs_and_Reports/BHP_Deep_Water_Port/RevisedDraftEIR/1aCabTransport/Appendices/G6 Air_Health Risk Analysis.pdf

European Commssion. (n.d.). AIR-EIA: air pollution and environmental impact assessment: the multimedia information source, Default Mixing Height. Retrieved September 24, 2013, from http://www.ess.co.at/AIR-EIA/def_mix.html

Appendix 7
Biodiversity Species List

Appendix

Fish

NO.	ORDER	FAMILY	Local Name	SCIENTIFIC NAME	COMMON NAME	STATUS
1	**Siluriformes**	**Siluridae**	Nga Bat	*Wallago attu*	Wallago catfish	NT
2	**Anguilliformes**	**Anguillidae**	Nga La Man	*Anguilla bicolor eel*	Eel	NT
3	**Anguilliformes**	**Anguillidae**	Nga-mee-toung	*Anguilla bengalensis*	Indian mottled eel	NT
4	**Osteoglossiformes**	**Notopteridae**	Nga Phae	*Notopterus notopterus*	Bronze Featherback	LC
5	**Cypriniformes**	**Cyprinidae**	Nga chin phyu / Nga Kyinn	*Cirrhinus mrigala*	Carp	LC
6	**Cypriniformes**	**Cyprinidae**	N/A	*Cirrhinus reba*	Reba carp.	LC
7	**Cypriniformes**	**Cyprinidae**	Niya gwoh nadee	*Cirrhinus rubirostris*	N/A	DD
8	**Cypriniformes**	**Cyprinidae**	Nga Gyin	*Cirrhinus cirrhosus*	Mrigal carp	VU
9	**Cypriniformes**	**Cyprinidae**	Nga Khone Ma	*Puntius sophore*	Pool Barb	LC
10	**Cypriniformes**	**Cobitidae**	Nga Thale Toe	*Pangio pangia*	Loach	LC
11	**Cypriniformes**	**Cobitidae**	N/A	*Lepidocephalichthys goalparensis*	Loach	LC
12	**Cypriniformes**	**Cobitidae**	N/A	*Lepidocephalichthys micropogon*	Loach	LC
13	**Cypriniformes**	**Cobitidae**	N/A	*Lepidocephalichthys guntea*	Guntea loach	LC
14	**Cypriniformes**	**Cobitidae**	N/A	*Lepidocephalichthys hasselti*	Loach	LC
15	**Cypriniformes**	**Cobitidae**	N/A	*Lepidocephalichthys berdmorei*	Loach	LC
16	**Siluriformes**	**Bagridae**	Nga-zin-yaing-kywe	*Mystus bleekeri*	Day's mystus	LC
17	**Siluriformes**	**Bagridae**	Nga-zin-yaing	*Mystus cavasius*	Gangetic mystus	LC
18	**Siluriformes**	**Bagridae**	Nga-zin	*Mystus gulio*	Long whiskers catfish	LC
19	**Siluriformes**	**Bagridae**	Nga-zin-yaing-kyet-chay, Nga-zin-yine	*Mystus vittatus*	Striped dwarf cat fish	LC
20	**Siluriformes**	**Clariidae**	Nga Khu	*Clarias gariepinus*	North African Catfish	LC
21	**Siluriformes**	**Clariidae**	Nga-khu	*Clarias macrocephalus*	Broadhead catfish	NT
22	**Siluriformes**	**Heteropneustidae**	Nga Gyi	*Heteropneustes kemratensis*	Air-sac Catfish	LC
23	**Siluriformes**	**Heteropneustidae**	Nga-gyee	*Heteropneustes fossilis*	scorpion cat fish	LC
24	**Mugiliformes**	**Mugilidae**	Nga Zin Lone	*Rhinomugil corsula*	Mullet	LC
25	**Synbranchiformes**	**Synbranchidae**	Nga Shint	*Monopterus albus*	Asian swamp Eel	LC
26	**Synbranchiformes**	**Mastacembelidae**	Nga yint ma	*Macrognathus dorsiocellatus*	Eel	LC
27	**Synbranchiformes**	**Mastacembelidae**	N/A	*Macrognathus zebrinus*	Zebra spiny eel	LC
28	**Synbranchiformes**	**Mastacembelidae**	Nga Mway Toe	*Macrognathus aculeatus.*	Lesser spiny eel	Not Evaluated
29	**Synbranchiformes**	**Mastacembelidae**	N/A	*Macrognathus aureus*	N/A	Not Evaluated
30	**Synbranchiformes**	**Mastacembelidae**	N/A	*Macrognathus aral*	One-stripe	LC

					spiny eel	
31	**Synbranchiformes**	**Mastacembelidae**	Nga La Mway	*Mastacembelus alboguttatus*	Boulenger's spiny eel	LC
32	**Perciformes**	**Cichlidae**	Shwei-ni	*Oreochromis sp.*	Red Tilapia	Not Evaluated
33	**Perciformes**	**Cichlidae**	Tilapia	*Oreochromis niloticus*	Nile tilapia	LC
34	**Perciformes**	**Cichlidae**	Oreochromis mossambicus	*Mozambique tilapia*	Oreochromis mossambicus	NT
35	**Perciformes**	**Channidae**	Nga Yant Gaung Toe	*Channa gachua*	Dwarf Snakehead	LC
36	**Perciformes**	**Channidae**	Nga Yant Panaw	*Channa panaw*	Snakehead	LC
37	**Perciformes**	**Channidae**	Nga-yan, Nga-yau-auk,	*Channa striata*	Striped snake head murrel	LC
38	**Perciformes**	**Channidae**	Nga yan-panaw, Nga-thilon, Nga-yan-lon	*Channa punctata*	Spotted snakehead	LC
39	**Perciformes**	**Channidae**	Nga-ya Daing	*Channa marulius*	Bullseye Snakehead	LC
40	**Perciformes**	**Channidae**	N/A	*Channa harcourtbutleri*	Burmese snakehead	NT

Mammals

No.	ORDER	FAMILY	Local Name	SCIENTIFIC NAME	COMMON NAME	IUCN STATUS
1	Carnivora	Felidae	Kyar Min/ Kyaung Min	*Catopuma temminckii or Felistemmincki*	Asian Golden Cat or Golden Cat	**NT and MCP**
2	Carnivora	Felidae	N/A	*Felis chaus*	*Jungle cat*	LC and MP
3	Chiroptera	Pteropodidae	N/A	*Pteropus vampyrus*	Common Flying Fox	**NT**

Birds

No.	ORDER	FAMILY	Myanmar Name	SCIENTIFIC NAME	COMMON NAME	STATUS
1	**Accipitriformes**	**Accipitridae**	N/A	*Aquila clanga*	Greater Spotted Eagle	**VU and MCP**
2	**Ciconiiformes**	**Ciconiidae**	Kha Yu Tote	*Mycteria leucocephala*	Painted Stork	**NT and MCP**
3	**Charadriiformes**	**Scolopacidae**	Snike	*Gallinago nemoricola*	Wood snipe	**VU and MCP**
4	**Accipitriformes**	**Accipitridae**	N/A	*Accipiter trivirgatus*	Cresred goshawk	LC and MCP
5	**Passeriformes**	**Leiotrichidae**	Swae	*Turdotdes gularis*	White-throated Babbler	LC and MCP
6	**Gruiformes**	**Rallidae**	Baung Tote	*Gallicrex cinerea*	Water Cock	LC and MCP
7	**Pelecaniformes**	**Ardeidae**	Sat Byane	*Ardea cinerea*	Grey heron or similar species	LC and MCP
8	**Trogoniformes**	**Trogonidae**	Htat Ta Yu	*Harpactes oreskios*	Orange-breasted Trogon	LC and MCP
9	**Piciformes**	**Picidae**	Thit Tauk	*Meiglyptes tukki*	One species similar to buff-necked woodpecker	**NT and MCP**
10	**Strigiformes**	**Tytonidae**	Mai	*Tyto alba*	barn owl	LC and MCP
11	**Accipitriformes**	**Pandionidae**	Won Let	*Pandion haliaetus*	Osprey	LC and MCP
12	**Falconiformes**	**Falconidae**	Thein Nget	*Falco jugger*	laggar falcon	**NT and MCP**
13	**Passeriformes**	**Sturnidae**	Thar Li Gar	*Gracula religiosa*	Common hill myna	LC and MCP
14	**Pelecaniformes**	**Threskiornithidae**	Kha Yu Sote	Threskiornis melanocephalus	black-headed ibis Forestry rep informed it Migrates in rainy season but is very rare.	**NT and MCP**
15	**Anseriformes**	**Anatidae**	Species of Geese and Duck	*Family-Anatidae*	One common duck species. The pecies could not be identified. However, it is not a IUCN protected species as below: • Not bear's pochard - EN • Not falcated duck or falcated teal (Mareca falcata) – NT • Not common pochard • Not scaly-sided merganser	LC and MCP
16	**Anseriformes**	**Anatidae**			One common goose species White-fronted Goose (LC) or Bean Goose (Anser fabalis) - LC	LC and MCP
17	**Charadriiformes**	**Scolopacidae**	N/A	*Tringa nebularia*	A species similar to Nordmann's Green Shank (EN) was identified. The Greenshank is expected to be the species	LC and MCP
18	**Charadriiformes**	**Scolopacidae**	N/A	*Tringa*	Marsh Sandpiper	LC and

				stagnatilis		MCP
19	**Charadriiformes**	**Scolopacidae**	N/A	*Tringa totanus*	common redshank or simply redshank	LC and MCP
20	**Charadriiformes**	**Scolopacidae**	N/A	*Tringa erythropus*	Spotted Redshank	LC and MCP
21	**Charadriiformes**	**Laridae**	Zin Yaw	*Rynchops albicollis*	Indian skimmer	**VU and MCP**

Amphibians and Reptiles

No.	ORDER	FAMILY	Myanmar Name	SCIENTIFIC NAME	COMMON NAME	IUCN STATUS
1	**Testudines**	**Trionychidae**	N/A	*Chitra vandijki*	Burmese Narrow-headed Softshell	Not Evaluated and MCP
2	**Squamata**	**Pythonidae**	Sa Ba Gyi	*Python reticulates*	Reticulated Python	Not Evaluated and MCP
3	**Squamata**	**Elapidae**	Ngan Taw Gyar	*Ophiophagus hannah*	Kind Cobra	**VU and MCP**
4	**Squamata**	**Pythonidae**	N/A	*Python bivittatus*	Burmese Python	**VU**
5	**Squamata**	**Scincidae**	N/A	*Lygosoma bowringii*	Bowring's Supple Skink **One skink species identified in the area as common.**	If *Lygosoma bowringii* it is **NT**
6	**Squamata**	**Colubridae**	N/A	*Boiga multimaculata*	Spotted Cat Snake	**NT**
7	**Anura**	**Ranidae**	N/A	*Amolops indoburmanensis*	Indoburman Torrent Frog	DD
8	**Anura**	**Dicroglossidae**	N/A	*Limnonectes (Rana) blythii*	Giant River Frog	**NT**
9	**Anura**	**Microhylidae**	N/A	*Glyphoglossus molossus*	Big-lipped Burrowing Frog	**NT**

Table A1-2 Naturally growing tree species in IOR-7	
Local Name	Scientific Name
1. Nabe	*Lannea coromandelica*
2. Yon	*Anogeissus acuminate*
3. Htanaung	*Acacia lecucophloea*
4. Neem	*Azadirachta indica*
5. Tamarind	*Tamarindus indica*
6. Dahat	*Tectona hamitonia*
7. Sha	*Acacia catechu(prohibited tree)*
8. Didu	*Bombax insigne*
9. Let pan	*Bombax ceiba*
10. Ganda	*Prosopis spicigera*
11. Tha Khyut	*Dolichan dronespathacea*
12. Tha Pout	*Cyperus corymbosus*
13. PhaLan	*Bauhinia racemosa*
14. TaukKyan	*Terminalia crenulata*
15. ThitYar	*Shorea obtuse(prohibited tree)*
16. In Gyin	*Shorea siamensis(prohibited tree)*
17. Pyin Ma	*Lagerstoremia speciosa*
18. Kokko	*Albizzia Lebbek*
19. Tama	*Azadirachta indica*
20. Baw Sa Khaing	*Leucaena leucocephala*
21. Eucalyptus	*Eucalyptus camuldulensis*

Appendix 8

Township Authority Meeting Minutes

Record of Meeting Minute

Basic Details	
Project Title	Environmental, Social and Health Impact Assessment (ESHIA) for Exploration Drilling in Block IOR-7
Date	5.12.2017
Venue	Administrator office, Myan Aung Township, Ayeyarwaddy Division
Attendance Lists	1) U Cho Cho (Township Administrator) 2) U Zaw Zaw Minn (Forest Department) 3) U Maung Toe (Myan Aung City Development Committee) 4) U Paw Hla Aung (MOGE) 5) U Zaw Zaw Aung (PCMI) 6) U Kyaw Thiha Hla Myint (PCMI) 7) U Phoe Kyaw (PCMI) 8) Mr. Dylan Jenkins (IEM) 9) Dr. Ohnmar May Tin Hlaing (EQM) 10) U Thiha Htut (EQM) 11) U Khun Set Thar (EQM) 12) Daw Soe Moe Nwe (EQM)

Explanation by Dr. Ohnmar May Tin Hlaing, Managing Director, Environmental Quality Management Co., Ltd. about the visit

Petronas Carigali Myanmar Inc. (PCMI) plans to conduct Exploration Drilling around the Zee-kone, Ah-tha-lun, Daung-kya and Kyoe kone villages. Regarding the exploration drilling, it needs to consider the surrounding conditions around the well site such as the forest and biodiversity conditions. Moreover, it is also necessary to consider the current condition of waste management practices conducted by Myan Aung City Development Committee. Based on this, it needs to discuss how to cooperate with CDC to dispose the wastes generated by exploration drilling. If there is cultural heritage site around here, we also discuss with conservational organizations of Cultural heritage.

Question & answer section

<u>Question 1</u>

Questioned by Dr. Ohnmar May Tin Hlaing (EQM):

- Is there a place to handle the wastes generated from camp site, households and offices of the well site by CDC?

Answered by U Maung Toe (City Development Committee, Myan Aung Township):

- CDC cannot handle to manage the wastes systematically. Now, CDC is planning to buy 10 acres of land for waste disposal. But, some local people are objecting about that case.

Question 2

Questioned by Dr. Ohnmar May Tin Hlaing (EQM):

- Do CDC collect the wastes and then dispose to that disposal site?

Answered by Maung Toe (City Development Committee, Myan Aung Township):

- CDC collects the wastes and then dispose to the disposal site.

Question 3

Questioned by Dr. Ohnmar May Tin Hlaing (EQM):

- How do CDC manage the sea waste, liquid waste and waste water generated from the houses?

Answered by U Maung Toe (City Development Committee, Myan Aung Township):

- We have wastewater pump. If we give services, we receive service fees.

Question 4

Questioned by Dr. Ohnmar May Tin Hlaing, (EQM):

- How do CDC manage the construction wastes?

Answered by U Maung Toe (City Development Committee, Myan Aung Township):

- CDC dispose the same waste disposal site.

Question 5

Questioned by Dr. Ohnmar May Tin Hlaing (EQM):

- We would like to know the forest condition.

Answered by U Zaw Zaw Minn (Forest Department):

- It is near the Sin-thay reserved forest. There is also a peat land (about 500 acres) protected by NGOs since 2014. We have data about peat land. Community forestry is established by forest department in the reserved forest. The forests are the natural degraded forests and aggressive shifting cultivation. The forest type is Indaing (Low) forest. Thit-ya, Ingyin, Tauk-kyant, Indaing species are found in this forest. Most of the area is covered by aggressive shifting cultivation and only some areas are forest plantations.

Question 6

Questioned by Dr. Ohnmar May Tin Hlaing (EQM):

- PCMI have to submit their profile and project map to the regional forest department to get the approval letter that the project area is not concerned in reserve forest area. This approval letter is important in the ECD review.

- We will submit the letter for the details required information such as protected species and migration species lists that we want.

Question 7

Questioned by U Zaw Za Minn (Forest Department):

- Is there any plan to conduct in the forest area?

Answered by U Zaw Zaw Aung (PCMI):

- It may be to upgrade the road in the forest area. Now, we are considering which road is used.

Answered by U Zaw Za Minn (Forest Department):

- It needs to submit a letter about the upgrading road. We have working plans for every 10 years and biodiversity lists that you require.

Question 8

Questioned by U Phoe Kyaw (PCMI):

- Do IEM advise which road should be used?

Answered by Dr. Ohnmar May Tin Hlaing (EQM):

- PCMI have to choose which road is the most suitable access. IEM will conduct impacts assessment and mitigation measures upon that road.

Question 9

Questioned by Dr. Ohnmar May Tin Hlaeing (EQM):

- We would like to request to give general data for Myan Aung Township. PCMI will submit a letter for this information. How many NGOs are there in this region?

Answered by U Cho Cho (Township Administrator):

- NGOs are not registered yet. But, there are 9 CSOs.

CSO Lists

Sr.	Name	Location	Job Title
1	Parami	Kyaik Tan (North)	Ambulance
2	Ayeyarwaddy	Sar Tae Street	Social welfare
3	Myit-Tar-Shin	TarWaTainThar Street	Blood Donation
4	ThaHaPonNyaKarYee	PyinNyarYarma	Social welfare
5	PaySatThawLat	LetPanKwin village	Social welfare
6	ShwePyinSu	PyinSu village	Social welfare
7	APhyuYaung Blood Donation	Shwe Kyin	Blood Donation
8	SheSaung Star	Kyauk Taung village	Social welfare
9	Myit-Tar-Linn	Kayin Pauk Kone	Social welfare

Photos

Meeting at Township Administrator Office

Talk with parliament, PCMI and MOGE, IEM & EQM

Discussion with CDC near the waste disposal site

Waste Disposal Site

10 acres of land intended to buy

Record of Meeting Minute

Basic Details	
Project Title	Environmental, Social and Health Impact Assessment (ESHIA) for Exploration Drilling in Block IOR-7
Date	6.12.2017
Venue	Administrator office, Kyangin Township, Ayeyarwaddy Division
Attendance Lists	1) U Aung Ko Win (Township Administrator) 2) U Tin Soe (Head of Forest Department) 3) U Kyaw Soe Oo (Forester of Forest Department) 4) U Aung Thu Win (Executive Officer) Assistant Director of Kyangin City Development Committee 5) U Paw Hla Aung (MOGE) 6) U Zaw Zaw Aung (PCMI) 7) U Kyaw Thiha Hla Myint (PCMI) 8) U Phoe Kyaw (PCMI) 9) Mr. Dylan Jenkins (IEM) 10) Dr. Ohnmar May Tin Hlaing (EQM)

Explanation by Dr. Ohnmar May Tin Hlaing, Managing Director, Environmental Quality Management Co., Ltd. about the visit

Petronas Carigali Myanmar Inc. (PCMI) plans to conduct Exploration Drilling around the Zee-kone, Ah-tha-lun, Daung-kya and Kyoe kone villages. Regarding the exploration drilling, it needs to consider the surrounding conditions around the well site such as the forest and biodiversity conditions. Moreover, it is also necessary to consider the current condition of waste management practices conducted by Kyangin City Development Committee. Based on this, it needs to discuss how to cooperate with CDC to dispose the wastes generated by exploration drilling. If there is cultural heritage site around here, we also discuss with conservational organizations of Cultural heritage.

Question & answer section

Question 1

Questioned by Dr. Ohnmar May Tin Hlaing (EQM):

- Is there a place to handle the wastes generated from camp site, households and offices of the well site by CDC?

Answered by U Aung Thu Win (City Development Committee, Kyangin Township):

- CDC waste pit is 30 years old and does not have enough capacity for the next 3 years. It is an open pit with an area of 2.9 acres. It is a natural depression use for disposal. The waste pit receives 2-3 tonnes per day from the township. The pit is close to a residential area. There is no waste separation or composting at the waste pit.

Question 2

Questioned by Dr. Ohnmar May Tin Hlaing (EQM):

- How do CDC manage the septic waste, liquid waste and waste water generated from the houses?

Answered by U Aung Thu Win (City Development Committee, Kyangin Township):

- Liquid waste is treated by each household with septic tanks, CDC can not receive liquid wastes or industrial waste. Septic scum is disposed in a natural pond area near the waste pit.

Question 3

Questioned by Dr. Ohnmar May Tin Hlaing, (EQM):

- How do CDC manage the construction wastes?

Answered by NAME (City Development Committee, Kyangin Township):

- CDC dispose the same waste disposal site.

Question 4

Questioned by Dr. Ohnmar May Tin Hlaing (EQM):

- We would like to know the forest condition.

Answered by U Tin Soe (Forest Department):

- Block IOR-7 is far from the Forest areas in the Township. However in Block IOR-5 there are 6 reserved forests (Kyan Gin R.F, Myin War Taung R.F., , Yaynam Taung R.F., Swe Taumin R.F. and Padaw R.F., etc.). Forestry department has information on flora in the area, however no detailed information on fauna is available.

Photos

Discussion with CDC near the waste disposal site

Waste Disposal Site in Natural Depression

Informal Recycling by Local People