SS MYANMAR SHING SHING METAL COMPANY LIMITED

ANTIMONY INGOT MANUFACTURING
(ANTIMONY SMELTING AND REFINERY)

INITIAL ENVIRONMENTAL EXAMINATION
(IEE REPORT)

MAWLAMYINE INDUSTRIAL ZONE
MAWLAMYINE, MYANMAR

December, 2021

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STATEMENT OF ENDORSEMENT

To whom this may concern,

Myanmar Shing Shing Metal Company Limited shall fully implement the IEE, all Project Commitments, and conditions, and is liable to ensure that all contractors and subcontractors of the Project comply fully with all applicable laws, Environmental Conservational Law (2012), Environmental Conservation Rules (2014) and Environmental Impact Assessment Procedures (2015).

According to Article- 4, section-35 of the EIA Procedures (2015), Myanmar Shing Shing Metal Company Limited hereby confirm that:

(1) The IEE Report is accurate and complete.
(2) The IEE has been prepared in strict compliance with applicable Environmental Conservation Law, Rules and Procedures and
(3) Myanmar Shing Shing Metal Company Limited will at all times comply fully with the commitments, mitigation measures and plans set out in this IEE Report.
(4) The IEE Report contains all the contents specified in the section – 36 of EIA Procedures.

Respectfully,

Daw Yadanar Lin Aung
Managing Director

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LIST OF ABBREVIATIONS

AAR	Arsenic-Alkali Residue
ALARP	As Low As Reasonably Practicable
As	Arsenic
ASR	Air Supplied Respirator
BAT	Best Available Techniques
BOD	Biochemical Oxygen Demand
CBD	Central Business District
CCTV	Closed-circuit television
CDC	City Development Committee
CEPA	Canadian Environmental Protection Act
CHS	Community Health and Safety
COD	Chemical Oxygen Demand
CPR	Cardiopulmonary Resuscitation
CSO	Civil Society Organization
CSR	Corporate Social Responsibility
dBA	Decibels
DISI	Directorate of Industrial Supervision and Inspection
DMH	Department of Metrology and Hydrology
DS	Desulfurized Slag
EC	Electrical Conductivity
ECC	Environmental Compliance Certificate
ECD	Environmental Conservation Department
ECL	Environmental Conservation Law
ECRs	Environmental Conservation Rules
EHS	Environmental, Health, and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EnvO	EnvO Environmental Management Consulting Services Co., Ltd
EMoP	Environmental Monitoring Plan
EPA	Environmental Protection Agency
ESE	Electricity Supply Enterprise
FAO	Food and Agriculture Organization
FGD	Flue Gas Desulfurization
FGLLID	Factory and General Labor Laws Inspection Department
GAD	General Administration Department
GDP	Gross Domestic Product
GFR	Gas Flow Rate
GHG	Greenhouse Gas
GIIP	Good International Industrial Practices
GRM	Grievance Redress Mechanism
HDL	High-density lipoprotein
HIV	Human Immunodeficiency Virus
IEE	Initial Environmental Examination

IFC	International Finance Cooperation
INGO	International Non-governmental Organization
LOD	Lower Limit of Detection
MD	Managing Director
MOECAF	Ministry of Environmental Conservation and Forestry
MOEE	Ministry of Electricity and Energy
MOLIP	Ministry of Labour, Immigration and Population
MONREC	Ministry of Natural Resources and Environmental Conservation
MSDS	Material Safety Data Sheet
MSS	Myanmar Shing Shing
NEQG	National Environmental Quality (Emission) Guidelines
NGO	Non-governmental Organization
NPI	National Pollutant Inventory
NS	Noise Sampling
OHS	Occupational Health and Safety
PCM	Public Consultation Meeting
PD	Public Disclosure
PDCA	Plan-Do-Check-Act
PGA	Peak Ground Acceleration
PM	Particulate Matter
POPs	Persistent Organic Pollutants
PPE	Personal Protective Equipment
RC	Reinforced Concrete
SOP	Standard Operating Procedures
SPLP	Synthetic Precipitation Leaching Procedure
SR	Stochiometric Ratio
SSB	Social Security Board
SWMP	Solid Waste Management Plan
TB	Tuberculosis
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TSS	Total Suspended Solids
UNFCCC	United Nations Framework Convention on Climate Change
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VOC	Volatile Organic Carbon
WHO	World Health Organization
WQS	Water-Quenched Slag

EXECUTIVE SUMMARY

This Executive Summary is prepared in non-technical language for the stakeholders and the public to be clearly understandable about the proposed project at a glance without any support of technical knowledge background. This is targeted to be one of the enhancements of the public participation into this project by providing a summarized and concise description of the project, the status of surrounding environment, significant impacts, proposed mitigation measures and monitoring arrangements.

1. Presentation of Project Proponent

Myanmar Shing Shing Antimony Smelting and Refinery Factory (Hereinafter referred as MSS), located inside the Mawlamyine Industrial Zone is manufacturing antimony ingots by refining and smelting antimony ore. The factory was previously owned by Kaung Kin Kyal Chout Pwint Company Limited since 2013 and handed over to Myanmar Shing Shing Metal Company Limited, the project proponent in 2016. After implementing a series of renovation in 2017, MSS started its commercial operation in early months of 2018. Since then, the company's products are being exported to European and Asian Countries for the further multiple use.

Table 1. Information of Project Proponent

Project Proponent:	Company	Myanmar Shing Shing Metal Company Limited
	Type of Business	Antimony Ingot Manufacturing
Address:		No. (325,326,327,328,329,330), Shwe Myo Taw 1st street, Mawlamyine Industrial Zone, Nyaung Pin Seik Village Tract, Kyaikmaraw Township, Mon State.
Contact Person:		Daw Yadanar Lin Aung (Managing Director) - 09 450034533 U Khin Maung Latt (Factory Manager) – 09 446608840

Source: Project Proponent

2. Background and Scope of IEE Study

When this factory was owned by the previous company, Kaung Kin Chout Pwint Company Limited, an EIA study has been conducted by Lucky Bird Environmental Studies & Geo-Informatic Solutions Group in June, 2014. Later, EIA Procedures, the precise guidelines for EIA implementation, was enacted by the Ministry of Natural Resources and Environmental Conservation (MONREC) in December, 2015. According to the EIA Procedure (2015) of Annex 1, under the category of number (136) - Refining of Metal Mineral Ore (without using hazardous chemicals), the proposed project is required to conduct IEE, which production is under 50,000 tons per annual. In August 2018, Environmental Conservation Department (ECD) instructed the project proponent to prepare as an IEE report and resubmit to ECD as per the letter number of (EIA – 1/4Ka (971/2018). Hence, this IEE study is conducted as per the instructions of EIA Procedure (2015) and also, it covers the considerations upon the initial comments given by the ECD.

In this IEE study, various components such as physical, biological, socio-economic, health and safety related impacts and etc. are considered and assessed. This IEE covers all the anticipated environmental impacts which might be resulted from the smelting and refinery process, assesses and thoroughly proposes the applicable mitigation measures for those impacts and prepares the Environmental Management Plan (EMP) to use throughout the project life. Comprehensive monitoring plan is also included in the EMP to enable the evaluation of the success or failure of environmental mitigation measures applied by the project proponent and to conduct the modification of the EMP, if necessary.

3. Environmental and Social Consultants for IEE Study

In accordance with the EIA Procedures (2015), the IEE study is conducted by the third-party consultant, EnvO Environmental Management Consulting Services Co., Ltd so called as "EnvO". The project proponent, Myanmar Shing Shing Metal Company Limited, trustfully cooperates with "EnvO", for the preparation of an IEE report to assess, mitigate and address all environmental, social and health and safety impacts which could be raised by the proposed project activities. The project proponent is responsible for the provision of verified project related information and the team is responsible for the technical assessment and provision of technical support to improve the management of potential environmental, social and health and safety impacts. The EnvO study team is organized with the following members:

4. Timeline for IEE Preparation

The major activity, report preparation takes about 7 - 8 months and the survey measurements of effluent, noise and workplace air quality took about one to two months to complete. During the time of IEE preparation, Covid-19 virus is spreading all over the country and social gathering events are strictly prohibited by the Government and IEE study was suspended for a certain period. Therefore, public consultation activities were postponed until the time when public gathering is allowed back at all. The timeframe of IEE Study is presented in the below table.

Table 2. Timeframe of IEE Study

No.		Major Works for IEE Preparation	Schedule (Week)																																		Note
			Mar-20				Apr-20				May-20				Jun-20				Jul-20				Aug-20				Sep-20- May-21	Jun-21				Nov-21					
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	Suspended weeks	1	2	3	4	1	2	3	4		
1)		Preparing IEE report in line with EIA Procedures																																			
	(i)	Site Visit, Investigation and Data Collection at Project Site																																			
	(ii)	IEE Report Preparation																																			
	(iii)	Translation of Exceutive Summary into Myanmar																																			
	(iv)	Finalization and Submission of IEE Report to ECD																																			
2)		Conducting required Field Measurement & Laboratory Analysis																																			
	(i)	Wastewater sampling and analysis in accordance with NEQG																																			
	(ii)	Onsite Noise Measurement																																			
	(iii)	Indoor Air Quality Measurement																																			
3)		Public Consultation Meeting (PCM) and Public Disclosure																																			Temporarily postponed due to Covid 19 Occurrence in Myanmar during IEE Preparation.
	(i)	Public Disclosure (PD)																																			
	(ii)	Conducting Public Consultation Meeting (PCM)																																			
	(iii)	Recollecting the comments (PD+PCM) and Reflecting back in IEE																																			

Source: EnvO Study Team

5. Project Location

The factory is located at No. (325,326,327,328,329,330), Shwe Myo Taw 1st Street, Mawlamyine Industrial Zone, Nyaung Pin Seik Village Tract, Kyaikmaraw Township, Mon State as shown in Figure 1.

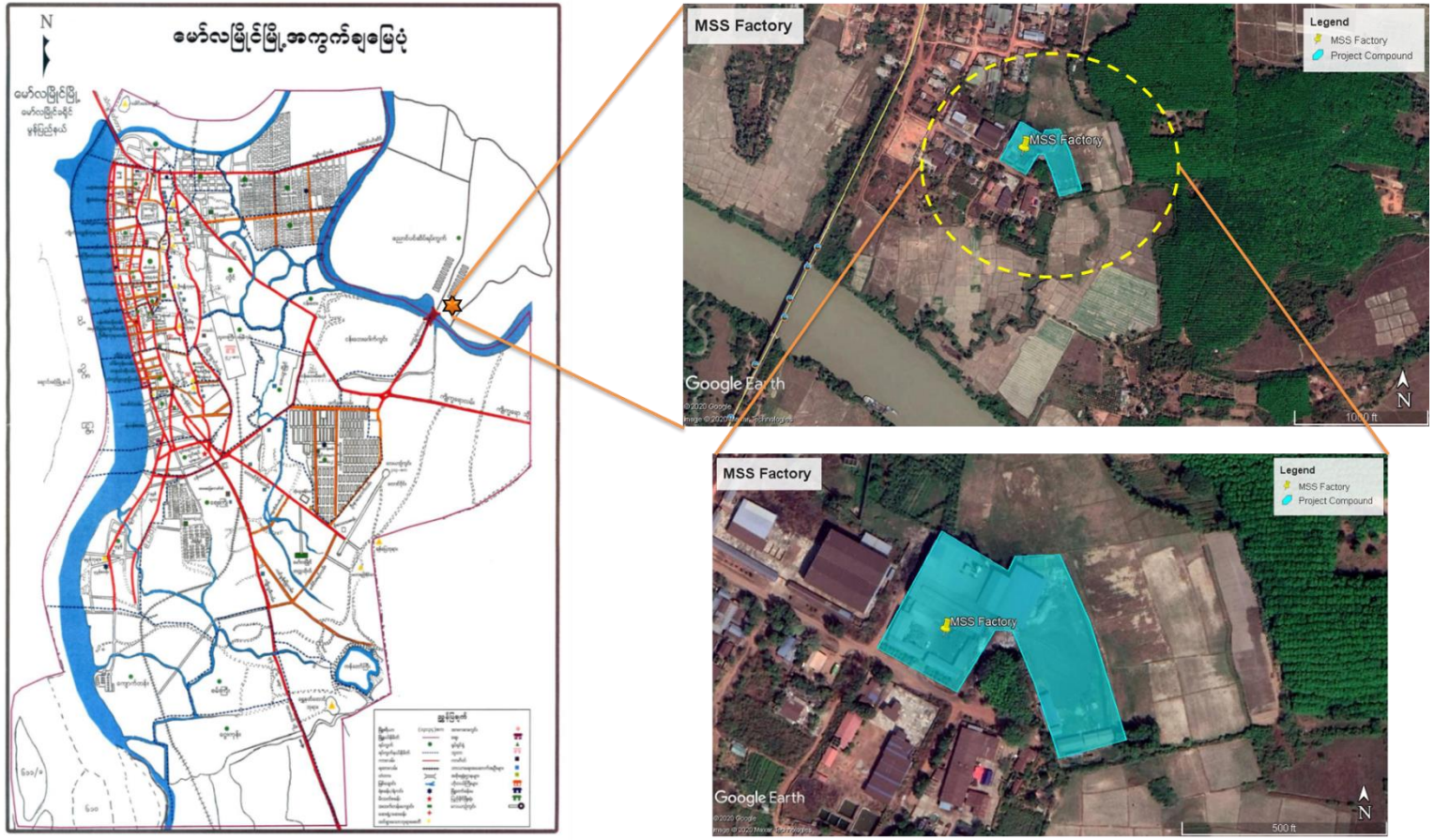


Figure 1. Satellite Photos showing the Project Location in Mawlamyine Industrial Zone

Source: EnvO Study Team

6. Project Process Overview

Generally, antimony can be processed by using two ways: pyrometallurgy and hydrometallurgy techniques. The processing method depends on whether the ore is sulfide, an oxide, or a complex ore, and on the grade, which ranges widely from about 1.5 percent to more than 60 percent antimony by weight. The ore which is used in MSS factory is favorable to use roasting and smelting method in other words, pyrometallurgy technique for the primary production of antimony. The production process is illustrated in Figure 2 and Figure 3 respectively.

As a very first step, the raw materials are prepared to be added into the production process. Roasting stage started to take place by roasting antimony ore with coke and coal around 1000 degree Celsius in the roasting furnace. When stibnite is heated, oxidation occurs with formation of the volatile antimony trioxide and those are recovered by the bag filter and bag houses after passing through the condensing pipes. The roasting stage results the antimony trioxide powder that is nearly 80 percent concentrated.

Then the resulted antimony trioxide powder is melted in the smelting furnace with the help of fluxing agent such as soda ash light and mono ammonium phosphate by heating at the temperature around 800 to 1100 degree Celsius. After smelting for 7 to 10 days, the smelted antimony is casted out. The manufactured antimony ingots are tested at the laboratory for the content of antimony presented. If it reaches the products quality standard, they are packed and ready to be exported. The antimony ingots contain about 97 percent of antimony. The flue gas emitted from both roasting and smelting processes are filtered by the bag filter/bag house and then treated in the wet scrubber before emitting from the stack.

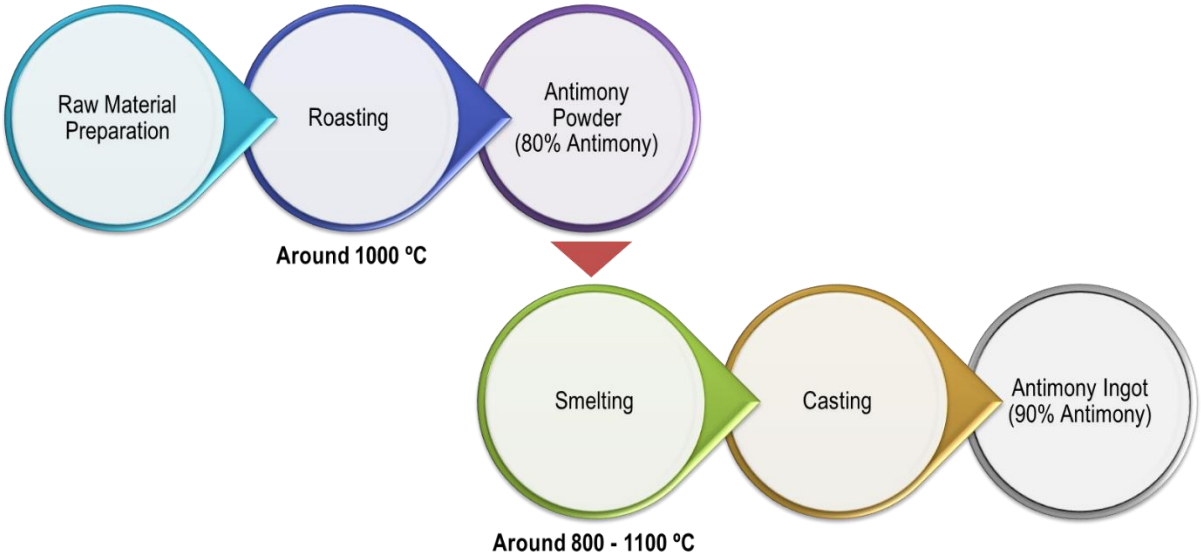


Figure 2. Overview of the Processes of Antimony Ingot Production

Source: EnvO Study Team

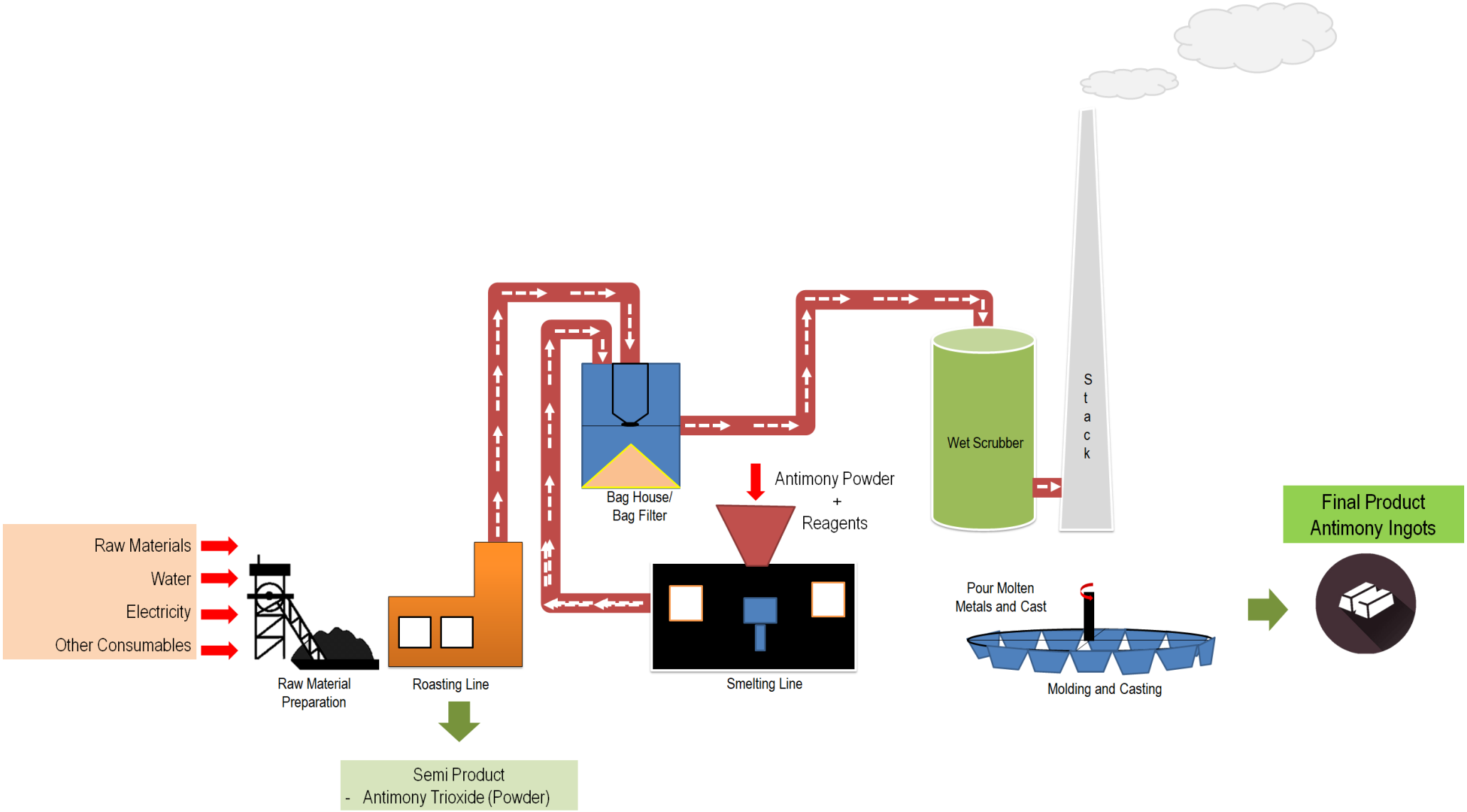


Figure 3. Antimony Smelting and Refining Process Illustration

Source: EnvO Study Team

7. Project Size and Scale

The average annual production of MSS factory is 20 tons/month while full production capacity of installed facilities is 50 tons/month (approximately 500 tons/year) and minimum is 10 tons/month. However, it would be varied on the availability of raw materials (antimony ore) from time to time.

8. Operation Status

MSS Factory normally operates 24 hours a day with a total of three shifts (8 hours per assign), 7 days a week. However, administrative office runs (8 am to 5 pm) from Monday to Saturday. There is a total of approximately 80 staffs assigned at the factory. Operation workers are provided four holidays per month as well as other gazette holidays occasionally.

In some circumstances such as shortage of raw materials, the factory cannot operate fully. It annually pauses during the rainy season, about two to three months for factory maintenance. The factory operates for approximately about 223 days per year.

9. Raw Materials

The major raw material used in the production process is the antimony ore with various quality in three types; soil, granular and solid stone. The antimony ore used in MSS Factory comes from Antimony Mine in Nat San Village, Kyeikmayaw Township, Mon State and other mines. The maximum usage amount is 60 tons per month.

Coal and Coke are used as the main fuels in roasting and smelting furnaces. Coal use is about 25 – 50% of the total and it is received from Kalaewa Township, Magway Region with monthly consumption of approximately 67 tons. Use of coke which is imported from China is about 50 – 75% of the total and it is spent approximately about 133 tons per month.

The soda ash light and mono ammonium phosphate are used as fluxing agent in smelting furnace and wet scrubber operation. The monthly usage of soda ash is about 7 Tons per month and ammonium phosphate is about 6 tons per month, respectively.

10. Final Product – Antimony Ingot

The factory refines and smelts the impure antimony ore into the pure antimony base metal and manufactured as a form of antimony ingot, each of which has a weight of 25 kg. It is 97 % pure antimony, base metal, with the maximum production capacity, 500 tons per annual. All manufactured ingots are all exported to European and Asian Countries for further use in products such as flame retardants, batteries, plastics, glass, semiconductors and alloys.

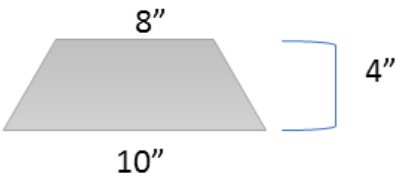


Figure 4. Antimony Ingots and its Dimensions

11. Brief Description of Surrounding Environment

As the project is located near the boundary of Mawlamyine and Kyaikmaraw, both townships are selected to be considered as the surrounding environment of the proposed project in this IEE study. The surrounding environment of the project site is outlined based on the secondary information and other reliable references. The following table summarizes the brief description of surrounding environment of the project site. Detailed descriptions with respective figures and graphs can be found in the Chapter (4) of IEE report.

Table 3. Brief Description of Surrounding Environment

Item	Description
Natural Components	
Climate and Meteorology	Mawlamyine township, where the project is situated, experiences tropical and wet climate with highest temperature of 39.6°C and lowest temperature of 11.4°C. Kyaikmaraw township also has same climate with highest temperature of 39.5°C and lowest temperature of 17°C.
Hydrology	Plenty of rivers such as the Attaran river, the Gyaing river, and the Thanlwin river are flowing around the Mawlamyine and Kyaikmaraw townships. Most of the water resources are fresh water and can be used for agriculture purpose. The Attaran River is flowing near the project site at about 450 m distance and it is used for water transportation by ships and boats.
Topography and Geology	Kyaikmaraw and mawlamyine townships are located at 18 feet above the mean sea level. Taung Nyo mountain range lies in the west of the township. The common soil types are red brown forest soils, lateritic soil and meadow soil. The soil texture is mostly made up of clay alluvium. The surface yellow brown soils can be utilized for rice cultivation.
Natural Disasters	Mon State is one of the flood prone areas according to the Hazard Profile of Myanmar and wide spread flood occurs along the river at every rainy season. Floods usually occur in June, July and August in the low-lying regions depending on tidal actions, excessive rainfall and combination of topographic and poor drainage system.
Biological Component	
Ecoregion, Key Biodiversity and Protected Areas	Ecosystem in Mawlamyine and Kyaikmayaw generally is divided into different categories such as forest, grass land, wetland, river and urban built-up. Those townships fall within ecoregion of Myanmar Coastal Rainforest. Southern mountain range of Mawlamyine is regarded as one of the high priority key biodiversity area. However, no protected areas are found within the Mawlamyine and Kyaikmaraw township.

Item	Description
Socio-economic Components	
Population and Ethnicity	In 2019, Mawlamyine township has a population of 269,005 and Kyaikmaraw township has a residence of 228,358. Burma ethnic majority is reported as 56.7% of the total in Mawlamyine township whereas Mon ethinc people shares the majority in Kyaikmaraw township with 48.19%.
Local Economy and Livelihood	As being the capital of Mon State, major economic developments can be seen in Mawlamyine. The residents rely on agriculture and service business. Economic development of Kyaikmaraw is comparatively low as compared to Mawlamyine and most of the residents carry out agriculture business.
Industrial Zones	There are two industrial zones in Mawlamyine township; Mawlamyine Industrial Zone (171.04 acres) and Kyauk Tan Industrial Zone (254 acres).
Social Infrastructure and Services	Transportation – Mawlamyine and Kyaikmaraw can be reached by both land and water ways. Medical Facitilies – There are six government hospitals in Mawlamyine and three government hospitals in Kyaikmaraw. Water Supply - Mawlamyine accesses to water via gravity and pumping methods of water supply system. In Mawlamyine Industrial Zone, the factories use river water from Attaran River or from own tube wells for industrial purpose and domestic purpose. Electricity Supply - Mawlamyine Industrial Zone gets electricity supply from 66 kV transmission line from national grids. Sewage and Solid Waste Management System – Wastewater from households, commercial and administrative facilities in Mawlamyine and Kyaikmaraw is commonly deposited to pit toilet or septic tank at their own place. Solid waste management is conducted by the local municipality and dispose at the final disposal (opening dumping) sites.
Township Development Plans	Both Mawlamyine and Kyaikmaraw have planned out with “Thirty Years Town Plan”. Besides, both are included in development projects named “Ever Green Village (Mya Seinn Yaung) Project.
Cultural and Visual Components	
Historical Places, Temples and Monuments	There is no historical place, temple and monument inside and within 4 km of the Mawlamyine Industrial Zone, where the project is located.
Landscape	No significant visual components of hills, colonical era-buildings, limestone caves and mineral springs near the Mawlamyine Industrial Zone is reported.

12. History of Environmental Baseline Measurement

In the following figure 5, a series of environmental baseline measurements in and surrounding of the proposed project is illustrated with the timeline. In 2014, Lucky Bird Environmental Studies & Geo-Informatic Solutions Group (Former EIA Consultant) had conducted surveys for water and wastewater, noise and vibration, soil quality, indoor and ambient air quality while performing EIA study. Since 2018, Mon State ECD has been investigating the environmental status in and surrounding of the Factory such as ambient air quality, emission air quality, and wastewater quality. In Annex-3, the detail of measurements, results, findings and technical evaluations are discussed and recommendations are provided as well for further monitoring activities.

In 2020 and 2021, Envo Study team also conducted the measurements for wastewater quality, noise level and workplace air quality in the Factory during the IEE study. The wastewater sampling, measurements and laboratory analysis resutls are presented in Annex - 6, noise measurement and results are described in Annex - 8, and workplace air quality monitoring results are reported in Annex - 10 of the IEE report respectively, with results and discussions.

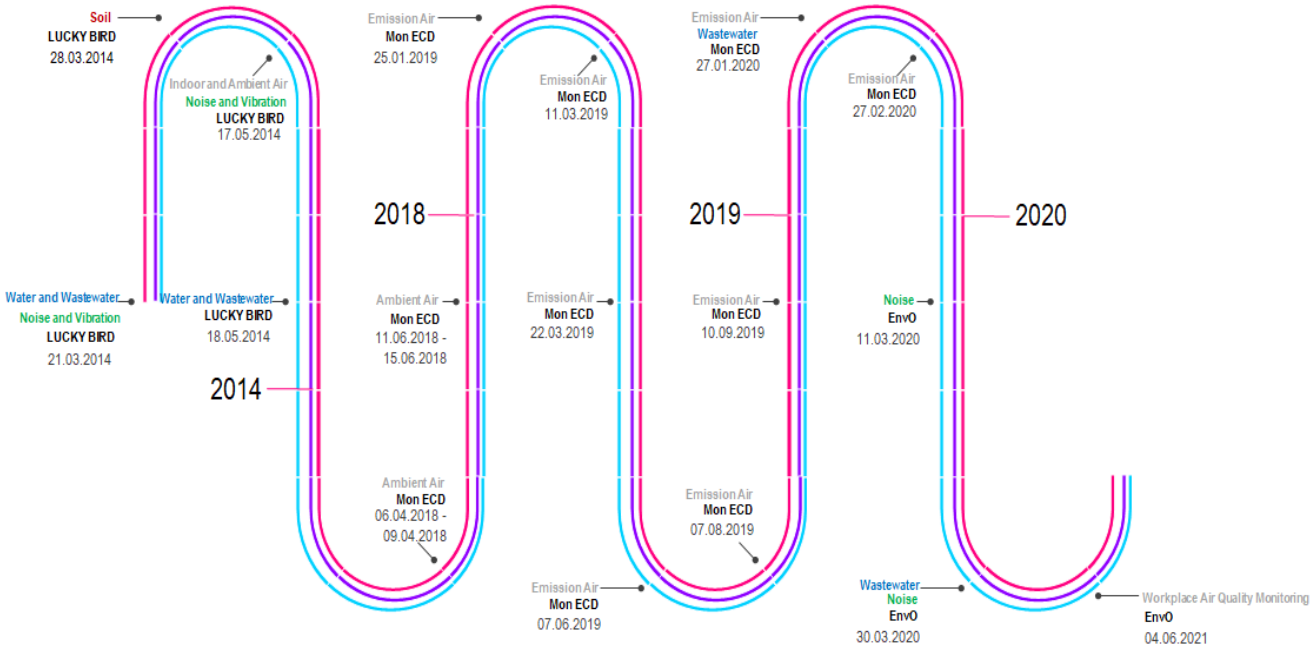


Figure 5. History of Environmental Baseline Measurements in and surrounding of Project Site

Source: EnvO Study Team

13. Overview of Impact & Risk Assessing Process

Hereby, impact assessment is conducted to identify the positive and negative impacts likely to be caused by the proposed project and find ways to avoid and minimize the negative impacts, on the other hand, to enhance the positive ones throughout the project lifetime. The assessment is also aimed to be supportive for the government authority for environmental control, together with the project proponent to comprehend the status of impacts for the proposed project. The illustrated figure shows the clear concept that after assessing the impacts and risks, the identified risks and impacts are mitigated to some extent with the facilities (the controls) installed at MSS and the implementation of mitigation measures, designed in EMP and Sub-plans.

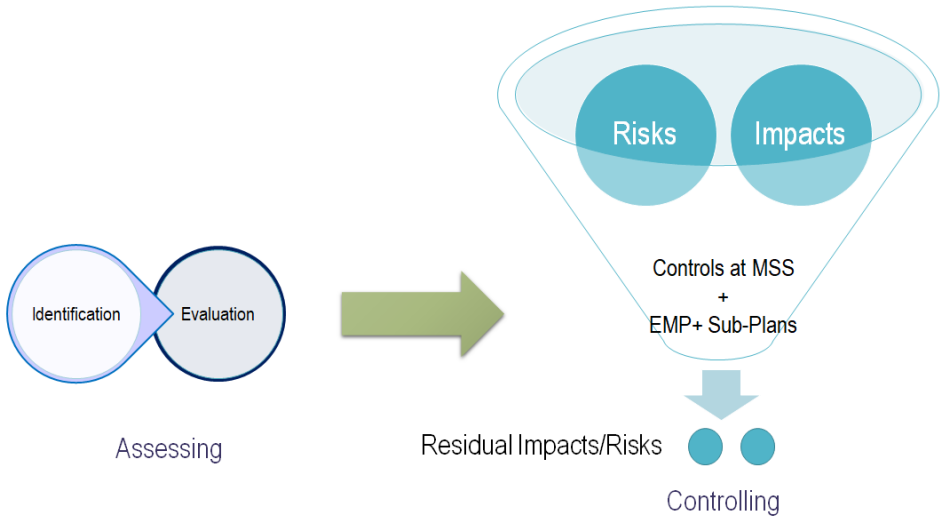


Figure 6. Impact & Risk Assessing Process

Source: EnvO Study Team

14. Summary of the Anticipated Impacts and Risks

For the transformation of Antimony ores to Antimony Ingots, the stages such as raw material preparation, roasting, semi-product collection, smelting and casting are performed step by step. These operational processes may release the pollutants to the atmosphere, produce waste and expose harms to the environment, the workers and the community.

Through the nature of project activities and baseline conditions of surrounding environment, different environmental, social and health impacts and risks were identified. The table below presents the anticipated impacts and risks likely resulted from the operation of proposed project. Detailed descriptions of assessment are discussed in the section 5.2, 5.3 and 6.3 respectively of the main report.

Table 4. Anticipated Impacts and Hazards from Proposed Project

Environmental Impacts	Social, Health & Safety Impacts	Occupational Hazards	Emergency Hazards	Natural Disaster Hazards
1. Air Pollution 2. Solid Waste 3. Water Pollution 4. Soil Contamination 5. Noise 6. Odor	1. Local Economy 2. Local Resource 3. Workers Welfare 4. Community Health and Safety	1. Workplace Air Quality 2. Heat Exposure 3. Chemical Exposure 4. Noise and Vibration 5. Physical Hazard 6. Communicable Diseases	1. Fire Hazard 2. Explosion Hazard	1. Flood 2. Earthquake

Source: EnvO Study Team

15. Pollution Control Facilities at MSS

The proposed project was originally aware of its environmental impacts itself and efforts to reduce the impacts as much as possible by installing the following pollution control facilities:

Bag Filters/Bag House

1

How effectively can it prevent from Causing **Air Pollution**?

With It → Two bag houses and one bag filter installed at MSS factory aims to collect antimony oxide powder and also perform the function of air pollution control device that removes particulate matters from the flue gas released from the refinery processes.

Without It → There will be significant amount of particulate matters which could impact to the surrounding area and unsuitable air quality (disperse) in the working area.

Wet Scrubber

2

How effectively can it prevent from Causing **Air Pollution**?

With It → It is functioning to treat the flue gas which passed through the bag house and bag filter. This system can also be called the "Flue Gas Desulphurization (FGD) System" as it is capable to remove the sulfur dioxide from the flue gas and hence reduces the impact on the environment.

Without It → There will be a release of sulphur dioxide in the emission which could be greater than the limit which is guided from Government.

Settling Tank

3

How effectively can it prevent from Causing **Water Pollution**?

With It → It reduces suspended matters (antimony oxide dust and etc.) presented in effluents to an extent before discharging to the nearby environment.

Without It → When the effluent will directly flows into the nature without it, it will increase the suspended matter in water. It may harm the aquatic life and microorganisms presented in the water.

Cooling Tanks

4

How effectively can it prevent from Causing **Water Pollution**?

With It → It cools down the temperature of the cooling water used in the production lines. It also plays as the reuse option to reuse the water for production by reducing water temperature. It can also reduce the suspended matters.

Without It → The hot water will directly flows into the nature which will harm the aquatic life and microorganisms presented in the water. Since no circulation of water, water consumption for production lines will be increased.

Figure 7. Pollution Control Facilities installed at MSS Factory

16. Conducted Environmental Measurements for Assessment

During IEE study, EnvO Study Team conducted the following necessary environmental measurements at MSS which strongly support for evaluating of the potential impacts. The results are considered in assessing and evaluating the impacts. The consideration and discussion upon these results can be seen

in the main report, respective sections of Chapter 5 and Chapter 6. In addition, the baseline data measurement, respective photos records and detailed evaluation results are thoroughly described in Annex (6), (7) and (10) of IEE report.

Table 5. Environmental Measurements for Assessment

Baseline Item	Objective	Location/ Measurement Points	Results
Workplace Air Quality	To investigate the workplace air quality status since the particulate matter generated from the furnace operation would be the major pollutant which might affect the worker health condition and consider the results in the assessment to propose better control measures as necessary.	It was measured at the total of two points as designated below: (i) IAQ-1 (Near Roasting Line) (ii) IAQ-2 (Near Smelting Line)	Throughout the monitoring period at IAQ – 1, both PM 2.5 and PM 10 are mostly in the "Good" status. In addition, the hourly average values are well under the range of "Good". At IAQ – 2, the hourly average value of PM 2.5 is showing the status of "Unhealthy for Sensitive Groups" and PM 10 is "Moderate". The slag removing activities from the smelting furnace during the time of monitoring created the fluctuations in the results.
Wastewater Quality	To investigate the status of wastewater quality discharged from the factory into the environment and consider the results in the assessment to propose better control measures as necessary.	It was measured at the total of three points as designated below: (i) MSS-1 (Settling Tanks), (ii) MSS-2 (Cooling Tanks) and (iii) MSS-3 (Earth Drain)	The wastewater from all three points indicated the exceed of concentration of arsenic, chemical oxygen demand and total suspended solids out of 16 parameters measured. At MSS-2, temperature of the overflown water is high at the discharge point as compared to other locations. At MSS-3, Arsenic is ten times greater than the target value likely due to the leaching of arsenics from the waste slag filling up the land inside the project site.
Noise Level	To investigate the status of noise level at the working area and at the boundary of the Factory, and consider results in the assessment to propose better control measures as necessary.	Noise monitoring was carried out at boundary and inside MSS Factory Compound. Points at Boundary – 12 points Points inside Factory – 11 points	All boundary points' measurement is within the NEQG guideline value (70 dB (A)) for the receptor in industrial and commercial place. For points inside the factory, there are four locations which values are higher than 85 dB(A), limit of noise equivalent level for a duration of 8 hours specified by IFC for heavy industries. These locations are near machineries (crushing machine and blowers).

Source: EnvO Study Team

17. Summary of Impact & Risk Assessment

All anticipated impacts were identified and assessed (qualitatively and quantitively) particularly based on the scientific evidences, survey results, referable researchs, local and international guidelines, and professional judgement of EnvO's Senior Consultants. The impacts are evaluated as different level of significance of the impact such as negligible, minor, moderate and major. The identified risks are assessed based on its likelihood and consequence. Each type of risk is rated as "low, medium, high and very high". The table presents overview of assessment procedures, and how the impacts are managed to be controlled with mitigation measures. Moreover, necessary sub-plans and the significance of residual impacts/risks are presented.

Table 6. Summary of Impact Assessment showing Significance before and after Mitigation Measures Applied

Impact	Activities	Significance	Mitigation Measures (EMP)	Respective Control Facilities at MSS	Proposed Sub-Plans	Residual Impacts Significance
Air Pollution	Operation of Roasting and Smelting Furnace	Major	Major Mitigation Measures in EMP are mentioned in the later section. For the detail plan, it can be seen in the main report.	Bag Filter, Bag House and Wet Scrubber	Standard Operation Procedure of Wet Scrubber	Moderate
Solid Waste (Hazardous and Non-Hazardous)	Roasting of Antimony	Major		-	Solid Waste Management Plan	Moderate
	Smelting of Antimony	Major				Moderate
	Wet Scrubbing Process	Moderate				Minor
	Settling Process	Minor				Negligible
	Domestic activities	Minor				Negligible
Water Pollution – Surface Water (Effluent)	Gas cooling system with condensing tubes	Moderate		Settling Tanks and Cooling Tanks	-	Minor
	Cleaning and bag filters washing	Minor				Minor
	Wet scrubber operation	Moderate				Minor
	Small testing laboratory operation	Negligible				Negiligible
Soil Contamination	Waste piling at project site	Moderate		-	Solid Waste Management Plan	Minor
	Storage of fuel, raw material and utilization of fuel	Minor				Minor
	Waste (slag) filling in the compound	Major				Moderate
Noise*	Mineral Processing, blower operation and mobilization of vehicles.	Negligible		-	-	Negligible
Odour	Roasting and Smelting Processes	Moderate		-	Grievance Redress Mechanism	Minor
Local Resource*	Extraction of water from Attaran River	Negligible		-	-	Negligible

Impact	Activities	Significance	Mitigation Measures (EMP)	Respective Control Facilities at MSS	Proposed Sub-Plans	Residual Impacts Significance
Community Health and Safety	Roasting and Smelting Process	Moderate		-	Grievance Redress Mechanism	Minor

Note: * these impacts are negligible so no mitigation measure is needed to mitigate the impact further.
Source: EnvO Study Team

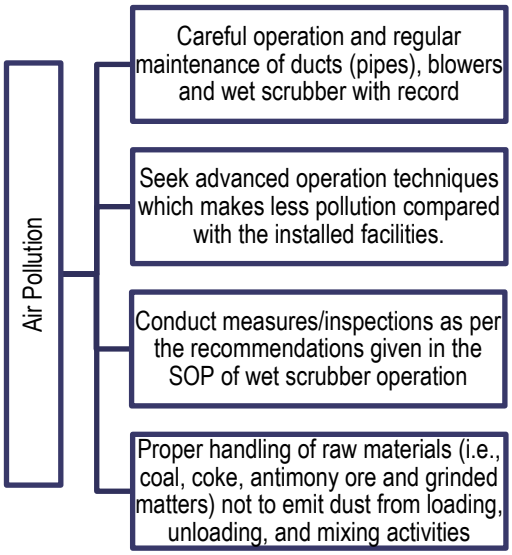
Table 7. Summary of Risks Assessment showing Significance before and after Mitigation Measures Applied

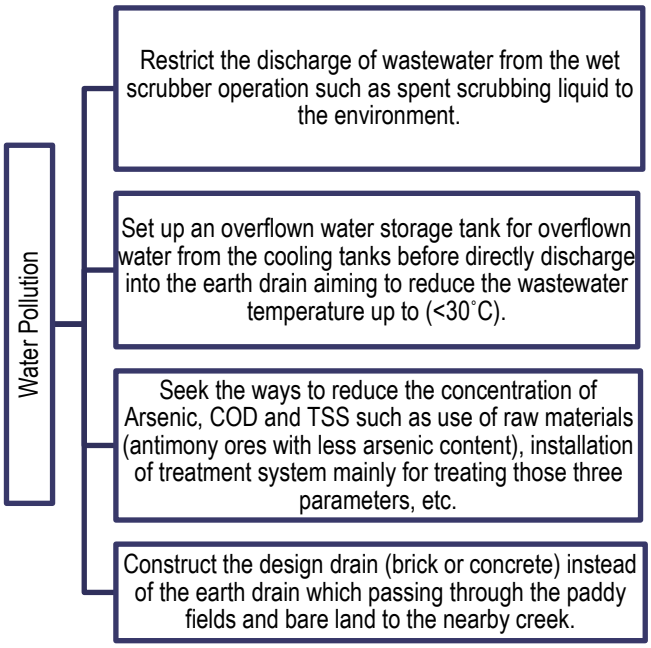
Risks	Source of Risks	Significance	Respective Control Facilities at MSS	Mitigation Measures (EMP)	Proposed Sub-Plans	Residual Risks Significance
Occupational Hazards (Industrial Hazards)	Indoor Air Quality	Very High	-	Major Mitigation Measures in EMP are mentioned in the later section. For the detail plan, it can be seen in the main report of section 8.3.	Occupational Health and Safety Plan	Medium
	Heat Exposure	High				Medium
	Chemical Exposure	High				Low
	Noise	High				Low
	Physical Hazards	High				Low
	Communicable Diseases	High				Medium
Emergency Hazards	Fire	High	-		Emergency Response Plan	Medium
	Explosion	High				Medium
Natural Hazards	Flood	High	-		Emergency Response Plan	Medium
	Earthquake	Low				Low

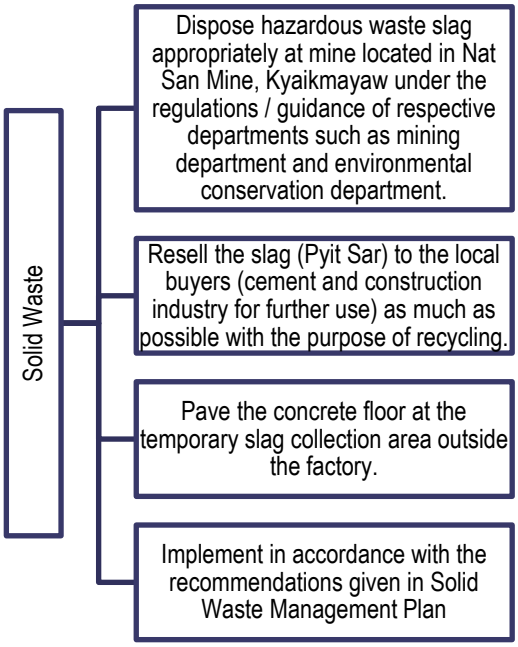
Source: EnvO Study Team

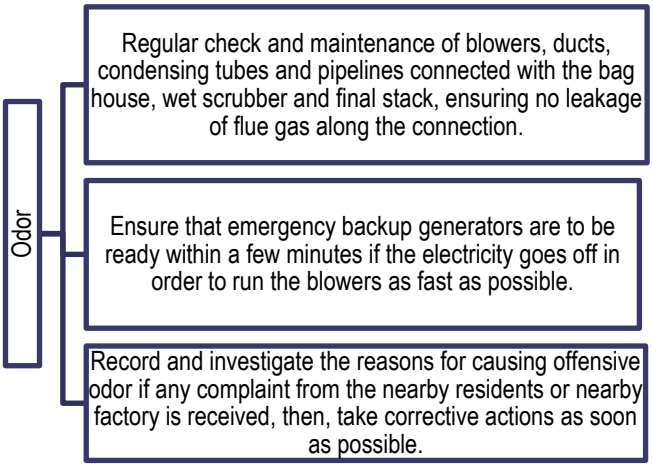
18. Environmental Management Plan (EMP) with Sub-Plans

The applicable and compulsory mitigation measures, which shall be implemented by the project proponent are mentioned in EMP. The major mitigation measures for anticipated impacts and risks are described in the following diagrams (Please refer section 8.2 and 8.3 of the IEE report for detailed mitigation measures).









Soil Contamination

- Avoid piling on the unpaved area and direct piling on the ground
- Proper storage, handling of fuel/chemicals and proper disposal of used chemical containers in accordance with guidelines without spillage, and leakage
- Immediate cleaning shall be undertaken as per emergency response plan if any leakage is observed

Community Health and Safety

- Monitor any significant public health issues raised in the nearby community, identify with the help of environmental expert and address any measures for the issue.
- Set up the simple and effective grievance procedures in case of any complaints from the community in terms of odor emission or other impacts.

Workplace Air Quality

- Avoid furnace opening at the start of operation as much as practically possible.
- Provision of Dust masks, Respirators to workers in roasting and smelting lines
- Mounting warning signs to wear respective masks at respective areas
- Provide Awareness Trainings on Use of PPE
- Limited access to respective areas which may expose hazard

Heat Exposure

- Provision of water sprays, sufficient drinking water and beverage stations, heat resistant gloves
- Provision of adequate breaks from hot working environments at appropriate times throughout the day
- Making sure the workers standing at a distance of 1.5m - 2m away from the furnace
- Designating the route and final disposal area of slags

Physical Hazards

- Conduct housekeeping in a timely manner
- Fixation of storage areas of raw materials, products and by-products
- Ensure that only trained drivers are allowed to drive industrial vehicles
- Providing General Safety Trainiing

Noise

- Providing 3 m distant lines from potential noise sources
- Mounting warning signs at potential noise sources
- Placing cooled booths (fans) at least 3 m away from the noise sources
- Regular cleaning and maintenance of machineries (blower, grinding machine, generator)

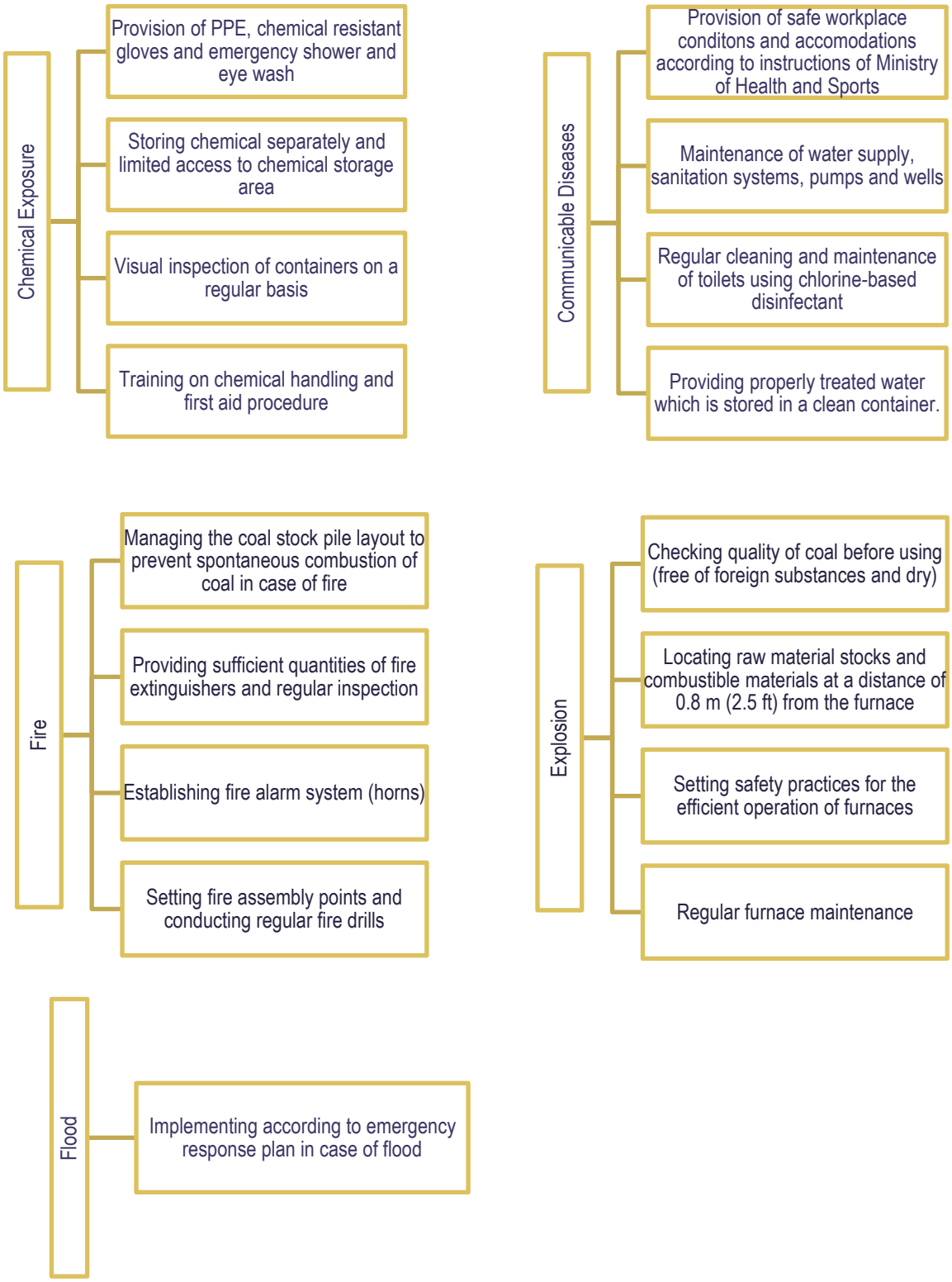


Figure 8. Major Mitigation Measures for Anticipated Impacts and Risks during Operation Phase

In addition, environmental and social management sub-plans are prepared to effectively reduce the significant impacts / risks and to provide detailed guidance and instruction in day-to-day operation for enhancing the environmental performance of the factory. The following table summarizes the descriptions about sub-plans.

Table 8. Summarized Description of Sub-Plans

Detailed Sub-Plans	Key Objective and Contents	Reference in IEE Report
Standard Operating Procedures (SOP) of Wet Scrubber	This plan was prepared with the intention to help the operators in MSS factory to evaluate the wet scrubber performance at the earliest possible stage and able to conduct the measures in time in case of any emission (e.g., odor) as needed. This document mainly focuses on the procedures which are suitable for the conventional wet scrubber like the one which is installed at MSS factory and targets the checkpoints which can easily be detectable by the operators with visual check or simple instruments (pH meter/pH paper). The contents of SOP are as follow. 1. Operational Basic Requirements (I) Estimated Amount of Soda Ash Feed (II) Scrubbing Liquid pH 2. Monitoring Indicators (I) Monitoring the pH Value of Scrubbing Liquid (with Record Form) (II) Opacity of Smoke from the Stack (with Record Form) 3. Record Keeping (Daily and Monthly Records)	Annex 5
Solid Waste Management Plan	This plan aims to set a systematic management of solid waste generated from the MSS factory particularly for the waste which is hazardous for the environment and human beings. It will also ensure and guide proper collecting, handling, storing and disposal of waste at the MSS factory by proposing the additional measures to be conducted by the MSS. In addition, this plan identifies the monitoring activities and prepare the required record form for monitoring the management of solid waste. It includes – 1. Objective and Scope 2. Responsible Team 3. Management of Industrial and Domestic Waste (I) Industrial Waste i. Waste Slug from Roasting and Smelting Line ii. Sludge from Wet Scrubber and Settling Tanks iii. Empty Chemical Containers iv. Used Machineries Part (II) Domestic Waste (III) Necessary Documents for Monitoring (IV) Waste Inventory – Record Form (V) Slag Balance Sheet (VI) Waste Disposal Record Form	Annex 9 A
Occupational Health and Safety Plan	This plan provides procedures to reduce the risks upon health and safety of workers and enhance better occupational health and safety in MSS Factory, covering the anticipated occupational hazards assessed in Chapter 6 including the following types of occupational hazards: (i) Indoor Air Quality (ii) Heat Exposure (iii) Chemical Exposure (iv) Noise (v) Physical Hazards and (vi) Communicable Diseases. The contents include - 1. Occupational Safety Policy of MSS Factory 2. Currently Practicing Safety Measures by MSS Factory 3. Structure of Occupational Health and Safety Management Team 4. Occupational Health and Safety Management Works 5. Occupational Health and Safety Monitoring Plan 6. Implementation Programs (I) Enforcement Programs (II) General Safety Training	Annex 9 B

Detailed Sub-Plans	Key Objective and Contents	Reference in IEE Report
	(III) First Aid Training (IV) Response on Occupational Hazards (V) Record Forms i. Accident Record Form ii. Illness Record Form (VI) Health Enhancement Program to prevent Covid – 19	
Emergency Response Plan	This plan specifies detailed procedures to reduce human injury and damage to property during sudden or unexpected situations including disaster. Also, it provides how to act in an emergency and who to contact. Emergency response plan provides operational management for emergency response team members with a general guideline of the expected initial response to an emergency, and an overview of their responsibilities during an emergency. It is composed of – 1. Formation of Emergency Safety Team 2. Responsibility of Emergency Safety Team Members 3. Response Procedures for Each Emergency Situation (I) Response to Fire Hazard (II) Response to Furnace Explosion (III) Response to Flood 4. Implementation Trainings (I) Fire Fighting Trainings (II) First Aid Trainings (III) Fire Drill 5. Emergency Contact	Annex 9 C
Grievance Redress Mechanism	This mechanism has established for the project proponent to be able to handle, solve and record any possible complaints in more systematic ways. The GRM includes procedures to receive complaints not only from the community but also from the factory workers. The components of GRM includes – 1. Current Practices of Managing Complaints 2. Grievance Redress Mechanism (GRM) (I) Procedures for Public Grievance Redress Mechanism (II) Procedures for Workers' Grievance Redress Mechanism 3. Announcement of GRM 4. Necessary Record Forms for GRM (I) Public Grievance Submission Form (II) Public Grievance Log Book (III) Workers' Grievance Submission Form (IV) Workers' Grievance Log Book	Annex 9 D

Source: EnvO Study Team

19. Environmental Monitoring Plan (EMoP)

To evaluate effectiveness of the implementation of EMP and other sub-plans and status of the residual impacts, regular monitoring activities will be undertaken. Based on the obtained monitoring results, EMP and sub-plans will be modified to have better and effective results in pollution control in the future. These results will be included in the monitoring report, which will be submitted to Environmental Conservation Department in every six months (bi-annually) by the project proponent. The environmental monitoring plan during the operation phase of MSS is described in the following table.

Table 9. Environmental Monitoring Plan in Operation Phase

Category	Object of monitoring	Monitoring item	Type of Record Document	Location	Frequency	Responsible organization
Air Quality	Emission Status	SO_2, NO_x (As Identified in Section 2.3.2)	1. Test Results 2. Record Photos showing of air quality measurement 3. Graphs or Charts showing the fluctuation of results during monitoring	Final Stack	Annually	3rd Party Consultant
	Workplace Air Quality	PM 2.5, PM 10 (Mandatory) CO, SO_2 (Optional if in case of poor ventilation working area)		Working areas	Annually	3rd Party Consultant
	Opacity of Smoke	Visual check of Black Smoke	1. Inspection Record Form (Annex – 5)	Final Stack	Monthly	Project Proponent
Solid Waste	Chemical Composition of Waste Slag	Laboratory Analysis of Arsenic in Slag (Pyit Sar)	1. Original Test Results 2. Laboratory Testing Methods 3. Record Photos showing slag sampling	Temporary Waste Pilling Area	Annually (Until the time when that slag is stopped using for land filling)	Project Proponent
	Control and Management of Solid Waste	Record all types of generated waste amount	1. Daily and Monthly Record Form (Annex – 9A) 2. Record photos showing storage condition, disposal condition, etc.	Waste Storage Area	Daily	Project Proponent
		Record waste disposal status and recycle status		Waste Storage Area	Monthly	Project Proponent
		Record Waste Storage Condition		Final Disposal Site	Monthly	Project Proponent
Wastewater Quality	Effluent Quality	Laboratory Analysis of – Aluminum Arsenic Cadmium Chemical Oxygen Demand Copper Fluoride Lead Mercury Nickel pH Oil and Grease Total Suspended Solids Zinc Total Nitrogen Total Phosphorus (16 Parameters as Identified in Section 2.3.3)	1. Original Test Results 2. Laboratory Testing Methods 3. Record Photos showing wastewater sampling 4. Results of measurement comparing with guideline values.	Point 1: Final Discharge Point Point 2: Earth Drain which received Effluent	Annually	3rd Party Consultant (or) Project Proponent

Category	Object of monitoring	Monitoring item	Type of Record Document	Location	Frequency	Responsible organization
Water Consumption	Amount of water consumption	Record the amount of water consumption	1. Monthly Water Consumption Record Form	Extraction point at Attaran River	Monthly	Project Proponent
Soil Contamination	Checking status of any spillage	Inspect any leakage/spillage of oil and chemical	1. Inspection Record Form 2. Record location 3. Record photos if found	Solid waste storage area, fuel storage area, any chemical storage area	Monthly	Project Proponent
Odor	Checking the odor status of surrounding area	Patrol Check	1. Inspection Record Form	Boundary of Project Site / Nearby Community Areas	Monthly & Whenever the complaint is received.	Project Proponent
Occupational Health and Safety	Checking Status of occupational health and safety measures	Record any work activities inside bag house	1. Work Permit Form 2. Record photos	Bag House	As necessary	Project Proponent
		Record housekeeping activities in workplace		Working Area	Daily	Project Proponent
		Record maintenance of machineries, water supply, sanitation systems, pumps and wells	1. Record locations, reason for maintenance 2. Record photos	Relevant Area	Occasionally	Project Proponent
		Record health and accident conditions	1. Accident Record Form (Annex – 9 B) 2. Illness Record Form (Annex – 9 B)	At Project site	Occasionally	Project Proponent
		Record the improvement of working conditions	1. Record photos of before and after making any workplace improvement	At Project site	Occasionally	Project Proponent
		Record Staff trainings	1. Record photos 2. Record the number of Attendees	At Project site	Occasionally	Project Proponent
		Record complaints raised by the workers	1. Workers' Grievance Submission Form and Grievance Log Book (Annex – 9 D)	At Project site	As necessary	Project Proponent
		Record medical inspection	1. Record the occurrence of communicable disease among workers 2. Record medical checkup results	At Project site	As necessary	Project Proponent
Community Health and Safety	Checking status of community health and safety measures	Records the complaints and comments from community	1. Community Grievance Submission Form and Grievance Log Book	Relevant Area	As necessary	Project Proponent

Category	Object of monitoring	Monitoring item	Type of Record Document	Location	Frequency	Responsible organization
			(Annex – 9 D)			
Other Social Considerations	Checking Social Contributions and Engagement with Communities	Record the CSR activities	1. Record photos 2. Record the number of participants	Relevant Area	As necessary	Project Proponent
		Record the community engagement activities	2. Record meeting minutes	Relevant Area	As necessary	Project Proponent
Emergency Risks	Checking preparedness of emergency risks	Records any emergency case and its responses	1. Record photos 2. Record situation and responses taken	At Project site	Occasionally	Project Proponent
		Record fire drill performance	1. Record photos 2. Record participants 3. Record details of the drills	At Project site	Yearly	Project Proponent
		Record and check extinguishers status	1. Visual check of any physical damage on the extinguishers 2. Record date of replacement 3. Check and record the pressure gauge	At Project site	Twice per year	Project Proponent

Source: EnvO Study Team

20. Institutional Arrangement (EMP Implementing Team)

The project proponent plans to form a main EHS team with their full-time permanent staffs, giving responsibility for each of them regarding with environmental protection management. As a main EHS Team, it takes in charge of the company's environmental protection, coordination with other organizations and fulfills environmental management and supervision of day-to-day operation. The team is targeted to be established under the direct supervision of Director of Myanmar Shing Shing Metal Company Limited. The environmental related tasks are also undertaken with the coordination and help of the other departments: Procurement, Operation and Maintenance.

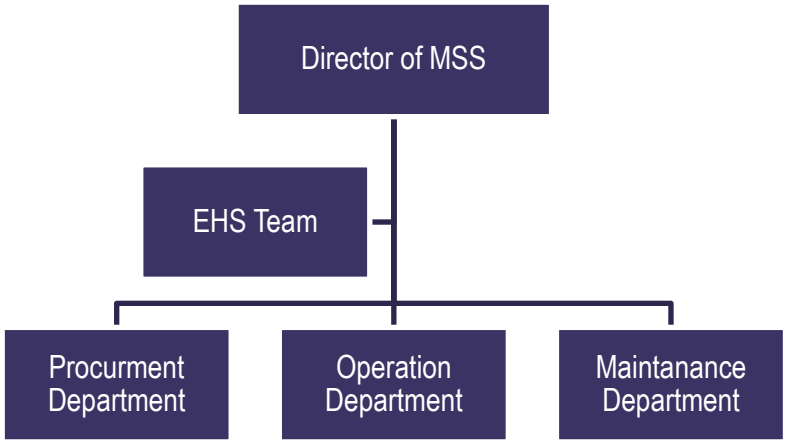


Figure 9. Institutional Framework of the MSS for EMP Implementation

EHS team will be led by the factory manager and assign EHS staffs at each shift (day shift and night shift) for monitoring and reporting the environmental, social and health and safety issues happened at respective assigned hours. In case of important environmental incidents of environmental related issues, the consultation with the external environmental expert will be conducted. Detailed responsibility of EMP implementation team as well as Emergency Safety Team are further explained in the main IEE report and the sub-plans.

21. Budget for EMP Implementation

The project proponent will allocate a separated budget for environmental and social management plan implementation, training, environmental monitoring and reporting and capacity building activities as set out in this IEE report. The budget is estimated to be US$ 25,000 per year approximately. It should be noted that the costs for built-in mitigation measures such as installation of bag fitler, wet scrubber, cost of reagent for wet scrubber operation, etc., effluent settling tanks, etc. are already included in the operation cost. In addition, separated budget will be allocated for CSR activities which will be contributed to the community development, aiming about 150 lakhs per year.

The factory is currently in operating and is projected to run for 30 years. Thus, the potential impacts and risks at the decommissioning phased are unpredictable. However, the project proponent is committed to submit the detail environmental management plan for decommissioning phase including but not limited to the decommissioning schedule, impact assessment, proposed mitigation measures, monitoring activities, estimated budget, etc. to ECD, three years prior to the decommission of this project.

Table 10. Estimated Budget for EMP Implementation

No.	Activities	Schedule	Estimated Cost (USD)
Implementation of Mitigation Measures			
1	Implementation of Sub-plans such as SOP of Wet Scrubber, Solid Waste Management Plan, Occupational Health and Safety Plan, Emergency Response Plan, Grievance Redress Mechanism, etc.	Yearly	> 5000 USD
Implementation of Monitoring Activities			
1	Measurement of emission from Stack and Workplace air quality, etc.	Yearly	> 5000 USD
2	Measurement of effluent quality and slag quality (collecting wastewater / slag sample and testing at the laboratory)	Yearly	> 1000 USD
3	Monitoring Report Preparation	Twice per Year	> 10000 USD
Implementation of Capacity Building Programs			
1	Conducting Drills and Practices	Yearly	> 1000 USD
2	Conducting Trainings for Workers such as General Safety Trainings, Fire-fighting trainings, First Aid Training, etc.	Yearly	> 3000 USD

Source: EnvO Study Team

22. Environmental and Social Commitments by MSS

The project proponent, recognizes its responsibility towards the environmental, social, health concerns and is committed to fulfill the following the key environmental and social commitments in order to manage and mitigate potential impacts throughout the project life.

Table 11. Key Environmental and Social Commitments from Project Proponent

Field	No.	Commitments	Reference Chapter in IEE
General	1.1	The information provided in this IEE report is correct.	All
Policy, Framework, Laws, Regulations, Standards and Guideline Values	2.1	MSS will fully comply the provision of the requirements as per each related sections of the related laws as described in Section 2.2.3, including - Environmental Conservation Law, ECL (2012) Environmental Conservation Rules, ECR (2014) EIA Procedures (2015) and National Environmental Quality (Emission) Guideline (2015)	Chapter 2 Section 2.2.3
	2.2	MSS will comply and adopt the environmental standards and guidelines values which are described in Section 2.3	Chapter 2 Section 2.3
Project Description	3.1	The information about the project provided in Chapter 3 is true and correct.	Chapter 3
Impact Assessment	4.1	MSS is fully aware of the impact assessed in the Chapter (5) and agree to implement the mitigation measures proposed for each impact.	Chapter 5
Risk Assessment	5.1	MSS is fully aware of the risks associated with occupational hazard, natural hazard and emergency situations assessed in the Chapter (6) and agree to implement the mitigation measures.	Chapter 6
Public Consultation and Public Disclosure	6.1	MSS will conduct the public consultation meeting as per the tentative plan in Section 7.4 when the restriction (notification1/2020) for social gathering is officially released by the government.	Chapter 7 Section 7.4
Air Quality	7.1	MSS will ensure the performance of air emission control devices such as bag houses, bag filter and wet scrubber and will carry out the regular maintenance.	Chapter 8
	7.2	MSS will ensure the performance of the wet scrubber and in order to do so, MSS will follow the measures recommended in the SOP of wet scrubber operation.	Chapter 8 Annex 5
	7.3	MSS will avoid opening the furnace door especially at the beginning of the furnace operation as much as technically possible in order to avoid dispersion of black smoke around the workplace.	Chapter 8
	7.4	MSS will monitor the emission air quality, workplace air quality and opacity of smoke as recommended in the EMoP.	Chapter 8 Section 8.6
Solid Waste	8.1	MSS will ensure the disposal of hazardous waste at Nat San Mine Site as per the regulations and guidance of concerned departments such as Mining Department and the Environmental Conservation Department.	Chapter 8
	8.2	MSS will conduct the management and mitigation measures as per the Solid Waste Management Plan.	Annex 9 A
	8.3	MSS will not directly dispose the hazardous waste slag at any land without any liner layer.	Chapter 8
	8.4	MSS will regularly monitor the status of solid waste management as recommended in EMoP and the Solid Waste Management Plan.	Chapter 8 Annex 9 A
Water Quality	9.1	MSS will not discharge any effluent generated from the wet scrubber operation to the environment.	Chapter 8
	9.2	MSS will always seek the ways to reduce the amount of pollutants which are higher than the NEQG guideline values.	Chapter 8

Field	No.	Commitments	Reference Chapter in IEE
	9.3	MSS will not use any ground water for the operation of the factory.	Chapter 8
	9.4	MSS will regularly monitor the effluent quality as per the EMoP.	Chapter 8
Odor	10.1	MSS will ensure the performance of bag filters and the wet scrubber, not to emit bad odor to the surrounding area.	Chapter 8
	10.2	MSS will conduct odor patrol check regularly and whenever the complaint about the bad odor is received.	Chapter 8
Occupational Health and Safety	11.1	MSS will provide necessary PPE (masks, respirators, heat resistant gloves, chemical resistant gloves, etc.) to all workers according to their responsible working conditions.	Chapter 8
	11.2	MSS will mount warning signs to wear masks, to remind noise exposure and chemical hazards at respective locations.	Chapter 8
	11.3	MSS will provide workers with sufficient ventilation, drinking water, electrolytes to prevent dehydration and adequate breaks from hot working environments.	Chapter 8
	11.4	MSS will regularly carry out housekeeping activities and maintenance of furnace, equipment and machineries.	Chapter 8
	11.5	MSS will conduct recommended measures from Occupational Health and Safety Plan.	Chapter 8 Annex – 9B
Emergency Preparedness	12.1	MSS will provide sufficient quantities of fire extinguishers and carry out regular inspection.	Chapter 8
	12.2	MSS will establish fire alarm system (horns), set assembly points, organize emergency safety team and conduct fire drills as per Emergency Response Plan.	Chapter 8 Annex – 9 C
Environmental Management Plan and Sub -Plans	13.1	MSS will comply and implement mitigation measures described in Environmental Management Plan and other sub-plans (SOP of wet scrubber, Solid Waste Management Plan, Emergency Response Plan, Occupational Health and Safety Plan, Grievance Redress Mechanism).	Chapter 8 Annex – 5 Annex – 9 A Annex – 9 B Annex – 9 C Annex – 9 D
EMP Budget	14.1	MSS will allocate the separated budget for the implementation of EMP and associated sub-plans.	Chapter 8 Section 8.8
Environmental Monitoring Plan	15.1	MSS will carry out monitoring actions as proposed in the Environmental Monitoring Plan (EMoP).	Chapter 8 Section 8.6
Reporting Timeline	16.1	MSS will submit the Environmental Monitoring Report to ECD (Mon State) in every six months (bi-annually).	Chapter 8 Section 8.6
Complaints Mechanism	17.1	MSS will establish the Grievance Redress Mechanism (GRM) and follow the recommended procedures to solve the complaints from community and the workers.	Annex – 9 D
Decommission	18.1	The detail environmental management plan for decommissioning phase including but not limited to the decommissioning schedule, impact assessment, proposed mitigation measures, monitoring activities, estimated budget, etc. will be submitted to ECD three years prior to the decommission of the project.	Chapter 8 Section 8.8

Source: EnvO Study Team

23. Findings and Conclusions

Possible impacts by the proposed project (MSS) were evaluated based on the operation status of antimony ingot manufacturing (antimony smelting and refinery) such as manufacturing process, installed facilities, working environment, occupational health and safety measures, surrounding environment and etc. Basically, before the IEE study, MSS has installed the required environmental control facilities, for example – air pollution control devices such as bag houses, bag filters and wet scrubber and implementing its commercial production by reducing the impact on the environment as much as possible, but the specific operational procedures, systematic recording system, monitoring activities are lacking.

This IEE report was prepared with fully considerations of mitigation measures on the possible/potential impacts. In addition, the monitoring plans including regular investigations and recording from various aspects of environmental, social, health and safety conditions are proposed to be implemented. In order to have more effective management, the details sub-plans such as SOP of Wet Scrubber, Solid Waste Management Plan, Emergency Response Plan, Occupational Health and Safety Plan, Grievance Redress Mechanism are already prepared as an output of this IEE study. If the project proponent, MSS will fully implement the mitigation measures proposed for each impact and the recommendations in the EMP and the sub-plans, it is confident that the negative environmental, social and heath and safety impacts will be well under control during the lifetime of the factory operation.

Note: : Specific project information with technical specifications and the details of mitigation measures which the project proponent is committed to comply are thoroughly described in each relevant chapter of the IEE report and therefore please refer to the full IEE report for any further information.

အစီရင်ခံစာ အကျဉ်းချုပ်

ဤအစီရင်ခံစာအကျဉ်းချုပ်သည် အဆိုပြုစီမံကိန်းနှင့် စပ်လျဉ်း၍ စီမံကိန်း၏ဆက်စပ်ပတ်သက်သူများနှင့် အများပြည်သူများ အတွက် အလွယ်တကူ နားလည်နိုင်စေသော ဖော်ပြချက်များဖြင့် အတတ်နိုင်ဆုံး ဖော်ပြထားပါသည်။ ဤအစီရင်ခံစာ အကျဉ်းချုပ်တွင် စီမံကိန်း အကြောင်းအရာ ဖော်ပြချက်များ၊ အနီးပတ်ဝန်းကျင်အကြောင်းအရာများ၊ သိသာထင်ရှားသော သက်ရောက်မှုများ၊ ၎င်းတို့ကို လျော့ပါးသက်သာစေရန်အတွက် အကြံပြုထားသည့် နည်းလမ်းများနှင့် စောင့်ကြပ်ကြည့်ရှုမှုဆိုင်ရာ လိုအပ်ချက်များကို အဓိကကျသောအချက်အလက်များ နှင့် အနှစ်ချုပ်ကိုသာ ဖော်ပြထားခြင်းဖြင့် စီမံကိန်းအပေါ် အများပြည်သူမှ ပိုမိုနားလည်ပြီး အများပြည်သူ၏ ပူးပေါင်း ပါဝင်မှုကို တိုးမြှင့်စေရန် ရည်ရွယ်ပါသည်။

၁။ စီမံကိန်းအဆိုပြုသူအကြောင်း

မြန်မာရှင်းရှင်း ခနောက်စိမ်းသန့်စင်စက်ရုံ (ယခုမှစ၍ မြန်မာရှင်းရှင်း ဟု သုံးနှုန်းသွားပါမည်) သည် မော်လမြိုင်စက်မှုဇုန်တွင် တည်ရှိပြီး ခနောက်စိမ်းသတ္တုရိုင်းကို သန့်စင်ခြင်းဖြင့် ခနောက်စိမ်းဘလောက်တုံး ထုတ်လုပ်သည့် လုပ်ငန်းအား ဆောင်ရွက်လျက်ရှိပါသည်။ စက်ရုံကို ယခင် (၂၀၁၃ ခုနှစ်) က ကောင်းကင်ကြယ်ခြောက်ပွင့် ကုမ္ပဏီမှ ပိုင်ဆိုင်လည်ပတ်ခဲ့ပြီးနောက် ၂၀၁၆ ခုနှစ်တွင် ယခု စီမံကိန်းအဆိုပြုသူ (မြန်မာရှင်းရှင်း) မှ လက်လွှဲရယူခဲ့ပါသည်။ ၂၀၁၇ ခုနှစ်တွင် စက်ရုံ ပြုပြင်ရေး နှင့် အဆင့်မြှင့်တင်ရေး လုပ်ငန်းအမျိုးမျိုးဆောင်ရွက်ပြီးချိန်တွင် စီးပွားဖြစ် ထုတ်လုပ်မှုလုပ်ငန်းအား ၂၀၁၈ ခုနှစ် အစောပိုင်းတွင် စတင် ဆောင်ရွက်ခဲ့ပါသည်။ ၎င်းအချိန်မှအစပြု၍ စက်ရုံမှထွက်ရှိလာသော ထုတ်ကုန်များကို ပြည်ပ (ဥရောပ နှင့် အာရှနိုင်ငံများ) သို့ တင်ပို့ ရောင်းချလျက်ရှိပါသည်။

ဇယား (၁) - စီမံကိန်းအဆိုပြုသူ၏ အချက်အလက်များ

စီမံကိန်း အဆိုပြုသူ	ကုမ္ပဏီ	မြန်မာရှင်းရှင်းမက်တယ်ကုမ္ပဏီလီမိတက်
	လုပ်ငန်း	သန့်စင်ပြီးဖြစ်သော ခနောက်စိမ်း ဘလောက်တုံး ထုတ်လုပ်ခြင်းလုပ်ငန်း
လိပ်စာ		အမှတ် (၃၂၅၊ ၃၂၆၊ ၃၂၇၊ ၃၂၈၊ ၃၂၉၊ ၃၃၀)၊ ရွှေမြို့တော် ၁ လမ်း၊ မော်လမြိုင်စက်မှုဇုန် ညောင်ပင်ဆိပ် ကျေးရွာစု၊ ကျိုက်မရော မြို့နယ်၊ မွန်ပြည်နယ်။
ဆက်သွယ်ရန်ပုဂ္ဂိုလ်		ဒေါ်ရတနာလင်းအောင် (မန်နေဂျင်း ဒါရိုက်တာ) - ၀၉-၄၅၀၀၃၄၅၃၃
		ဦးခင်မောင်လတ် (စက်ရုံ မန်နေဂျာ) - ၀၉-၄၄ဖ၆၀၈၈၄၀

၂။ ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်ခြင်း (IEE) လေ့လာမှုဆိုင်ရာ နောက်ခံဇာတ်ကြောင်း နှင့် လေ့လာသည့် နယ်ပယ်အတိုင်းအတာ

စက်ရုံအား ယခင် ကောင်းကင်ကြယ်ခြောက်ပွင့်ကုမ္ပဏီလီမိတက်မှ ပိုင်ဆိုင်ခဲ့သည့်အချိန်တွင် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း (EIA) လေ့လာမှုကို Lucky Bird Environmental Studies & Geo-Informatic Solutions Group မှ ၂၀၁၄ ခုနှစ်၊ ဇွန်လတွင် ဆောင်ရွက်ခဲ့ပါသည်။ ထို့နောက် ၂၀၁၅ ခုနှစ်၊ ဒီဇင်ဘာလတွင် သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ဝန်ကြီးဌာန (MONREC) မှ ပတ်ဝန်းကျင်ဆိုင်ရာ လေ့လာမှုများအား တိကျစွာဆောင်ရွက်နိုင်ရန် လမ်းညွှန်ချက်များ အနေဖြင့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း (EIA Procedures) အား ထုတ်ပြန်ခဲ့ပါသည်။ ၎င်း လုပ်ထုံးလုပ်နည်း၏ နောက်ဆက်တွဲ (၁) အရ အဆိုပြုစီမံကိန်းဖြစ်သော ခနောက်စိမ်းသတ္တုသန့်စင်ခြင်း လုပ်ငန်းသည် လုပ်ငန်းအမျိုးအစား (၁၃ဖ) - ဘေးအန္တရာယ်ဖြစ်စေသောဓာတုပစ္စည်းများ သုံးစွဲခြင်းမပြုဘဲ တွင်းထွက်သတ္တုရိုင်းများ ပြုပြင်သန့်စင်ခြင်း လုပ်ငန်းဖြစ်ပြီး တစ်နှစ်လျှင်ထုတ်လုပ်မှုတန်ချိန် ၅၀,၀၀၀ အောက် ဖြစ်သည့်အတွက် ကနဦးပတ်ဝန်းကျင် ဆန်းစစ်မှု (IEE) ဆောင်ရွက်ရန် လိုအပ်သော စီမံကိန်းအမျိုးအစား ဖြစ်ပါသည်။ ထို့ကြောင့် ၂၀၁၈ ခုနှစ်၊ သြဂုတ်လတွင် ပတ်ဝန်းကျင်

ထိန်းသိမ်းရေး ဦးစီးဌာနမှ စာအမှတ် (အီးအိုင်အေ - ၁/၄(က) (၉၇၁/၂၀၁၈) ဖြင့် ဤစီမံကိန်းအား ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) ဆောင်ရွက်၍ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနသို့ ပြန်လည်တင်ပြရန်အတွက် သဘောထားမှတ်ချက်များ ပေးခဲ့ပါသည်။

ယခု IEE အစီရင်ခံစာတွင် စီမံကိန်းဆောင်ရွက်ခြင်းနှင့်စပ်လျဉ်းသော ရုပ်ပိုင်းဆိုင်ရာ၊ ဇီဝဗေဒဆိုင်ရာ၊ လူမှုစီးပွားဘဝဆိုင်ရာ၊ ကျန်းမာရေးနှင့်ဘေးကင်းလုံခြုံရေးဆိုင်ရာ သက်ရောက်မှုများကို ထည့်သွင်းစဉ်းစားပြီး ဆန်းစစ်အကဲဖြတ်ထားပါသည်။ ထို့အပြင် ဤ IEE အစီရင်ခံစာတွင် ခနောက်စိမ်း သတ္တုအရည်ကျိုသန့်စင်ခြင်း လုပ်ငန်းမှ ဖြစ်ပေါ်နိုင်သည့် ပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှုများကို ခန့်မှန်းဖော်ထုတ်ခြင်း၊ အကဲဖြတ်သုံးသပ်ခြင်းနှင့် ၎င်းသက်ရောက်မှုများကို အမှန်တကယ် လျှော့ကျစေနိုင်ရန်အတွက် လျော့ပါးသက်သာစေရေး နည်းလမ်းများကို အကြံပြုခြင်းများအပါအဝင် စီမံကိန်းသက်တမ်းတလျှောက်တွင် လိုက်နာဆောင်ရွက်ရန်အတွက် ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှုအစီအစဉ် (EMP) ကိုလည်း ရေးဆွဲထားပြီးဖြစ်ပါသည်။ ထို့အပြင် စီမံကိန်းမှ ဆောင်ရွက်သည့် သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ အောင်မြင်မှုရှိ၊ မရှိအား အကဲဖြတ်သုံးသပ်နိုင်ရန်နှင့် EMP အား ထပ်မံဖြည့်စွက်ရန် လို၊ မလို သိရှိနိုင်ရန်အတွက် စီမံကိန်းဆောင်ရွက်စဉ် တလျှောက်လုံးတွင်လုပ်ဆောင်ရမည့် စောင့်ကြပ်ကြည့်ရှုရေး အစီအစဉ်များ (EMoP) လည်း အစီရင်ခံစာတွင် ရေးဆွဲထားပြီး ဖြစ်ပါသည်။

၃။ ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) ပြုလုပ်ရာတွင်ပါဝင်သော ပတ်ဝန်းကျင်နှင့်လူမှုဆိုင်ရာ အကြံပေး အဖွဲ့ဝင်များ

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း (၂၀၁၅) အရ ဤကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှုအား ပတ်ဝန်းကျင်ဆိုင်ရာ တတိယအဖွဲ့အစည်းဖြစ်သော EnvO Environmental Management Consulting Services Co., Ltd မှ တာဝန်ယူဆောင်ရွက်ခဲ့ပါသည်။ ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်ခြင်းအစီရင်ခံစာတွင် ပါဝင်သော အဆိုပြုစီမံကိန်းမှ ဖြစ်ပေါ်နိုင်ခြေရှိသော ပတ်ဝန်းကျင်၊ လူမှုဆိုင်ရာနှင့် ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေးဆိုင်ရာ သက်ရောက်မှုများကို ဖော်ထုတ်ခြင်း၊ စိစစ်ခြင်းနှင့် လျော့ပါးစေရေးနည်းလမ်းများ ဖော်ထုတ်ရာတွင် စီမံကိန်းအဆိုပြုသူဖြစ်သော မြန်မာရှင်းရှင်းမက်တယ် ကုမ္ပဏီလီမိတက်သည် EnvO နှင့် ယုံကြည်စွာပူးပေါင်းဆောင်ရွက်ခဲ့ပါသည်။ စီမံကိန်းအဆိုပြုသူမှ မှန်ကန်တိကျသော စီမံကိန်းဆိုင်ရာ အချက်အလက်များကို ထောက်ပံ့ပေးရန် တာဝန်ယူခဲ့ပြီး အကြံပေးအဖွဲ့မှ ရရှိလာသည့် အချက်အလက်များအပေါ် အခြေခံ၍ နည်းပညာပိုင်းဆိုင်ရာ စိစစ်သုံးသပ်ချက်များနှင့် စီမံကိန်းမှ ဖြစ်ပေါ်နိုင်သော ပတ်ဝန်းကျင်၊ လူမှုဆိုင်ရာနှင့် ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေးဆိုင်ရာ သက်ရောက်မှုများကို ပိုမိုကောင်းမွန်စွာ စီမံခန့်ခွဲနိုင်ရန်အတွက် နည်းပညာပိုင်းဆိုင်ရာ အကူအညီများ ပေးခြင်း လုပ်ငန်းများအား တာဝန်ယူဆောင်ရွက်ခဲ့ပါသည်။ EnvO အကြံပေးအဖွဲ့တွင် အောက်ပါအဖွဲ့ဝင်များဖြင့် ပါဝင်ဖွဲ့စည်းထားပါသည်။

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၄။ ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) လေ့လာပြင်ဆင်ခြင်း ကာလအပိုင်းအခြား

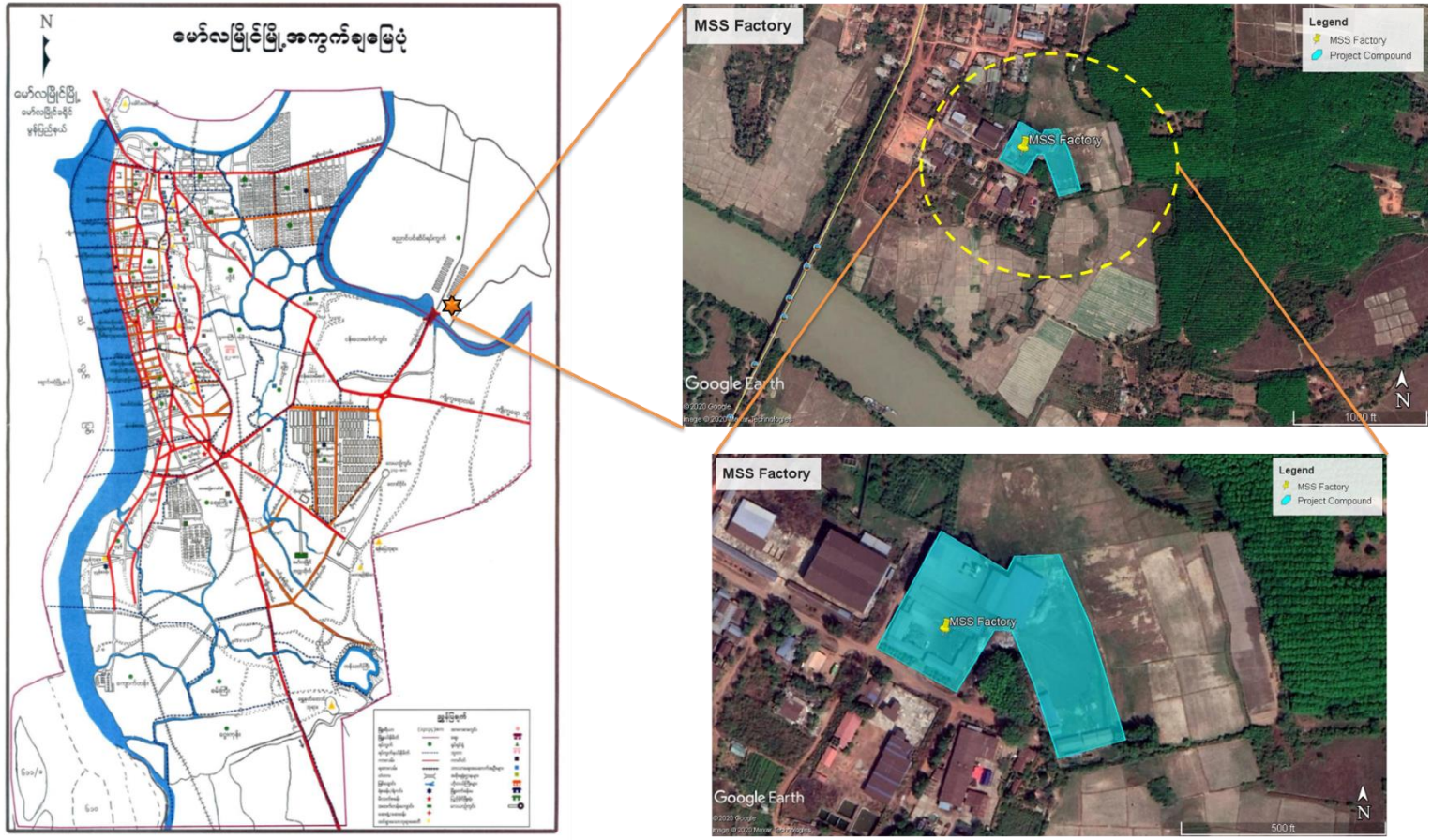
အစီရင်ခံစာပြင်ဆင်ရန်အတွက် ၇ လ မှ ၈ လအထိ အချိန်ယူခဲ့ပြီး စွန့်ထုတ်ရေ၊ ဆူညံသံနှင့် လုပ်ငန်းခွင်လေအရည်အသွေး တိုင်းတာမှုများ ပြီးစီးရန်အတွက် ၁ လ မှ ၂ လ အထိ ကြာမြင့်ခဲ့ပါသည်။ IEE အစီရင်ခံစာပြင်ဆင်သည့် အချိန်အတွင်း ကမ္ဘာ့ကပ်ရောဂါ Covid – 19 မှာ နိုင်ငံအတွင်း ပြန့်နှံ့လျက်ရှိပြီး နိုင်ငံတော်အစိုးရမှ တနေရာနှင့်တနေရာအသွားအလာကန့်သတ်ခြင်း၊ လူစုလူဝေးဖြင့် ဆောင်ရွက်ရမည့် လုပ်ငန်းများ၊ ပွဲများကို ကန့်သတ် ထားသည့်အတွက် IEE လေ့လာမှုအား အချိန်အတိုင်းအတာ တစ်ခုအထိ ခေတ္တရပ်နားထားခဲ့ရပါသည်။ ထို့အတူ အများပြည်သူနှင့် တွေ့ဆုံဆွေးနွေးခြင်းလုပ်ငန်းများမှာလည်း လူစုလူဝေးဖြင့် ဆောင်ရွက်ခွင့် ပြုသည့် အချိန်အတိုင်းအတာတစ်ခုအထိ ရွှေ့ဆိုင်းထားခဲ့ရပါသည်။ IEE လေ့လာပြင်ဆင်သည့် အချိန်ကာလကို အောက်ပါဇယားတွင် ဖော်ပြထားပါသည်။

ဇယား (၂) - ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်ခြင်း လေ့လာချိန် အချိန်ဇယား

စဉ်		အဓိကလုပ်ဆောင်ချက်များ	အချိန်ဇယား (ရက်သတ္တပတ်)									မှတ်ချက်
			မတ်လ - ၂၀၂၀	ဧပြီလ - ၂၀၂၀	မေလ - ၂၀၂၀	ဇွန်လ - ၂၀၂၀	ဇူလိုင်လ - ၂၀၂၀	ဩဂုတ်လ - ၂၀၂၀	အောက်တိုဘာ ၂၀၂၀ - မေ ၂၀၂၁	ဇွန်လ - ၂၀၂၁	နိုဝင်ဘာလ - ၂၀၂၁	
			၁ ၂ ၃ ၄	၁ ၂ ၃ ၄	၁ ၂ ၃ ၄	၁ ၂ ၃ ၄	၁ ၂ ၃ ၄	၁ ၂ ၃ ၄	ရပ်နားထားသော လများ	၁ ၂ ၃ ၄	၁ ၂ ၃ ၄	
၁)		**EIA Procedures နှင့်အညီ IEE အစီရင်ခံစာအား ပြင်ဆင်ခြင်း။**										
	(က)	စီမံကိန်းတည်ရှိရာသို့ သွားရောက်လေ့လာခြင်း၊ စစ်ဆေးခြင်းနှင့် လိုအပ်သော အချက်အလက်များ ကောက်ယူခြင်း။										
	(ခ)	ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှု (IEE) အစီရင်ခံစာ ပြင်ဆင်ခြင်း။										
	(ဂ)	အစီရင်ခံစာအကျဉ်းချုပ်အား မြန်မာဘာသာသို့ ပြန်ဆိုခြင်း။										
	(ဃ)	အပြီးသတ်ခြင်းနှင့် ECD သို့ IEE အစီရင်ခံစာ တင်ပြခြင်း။										
၂)		**ကွင်းဆင်းတိုင်းတာမှုများနှင့် ဓာတ်ခွဲစမ်းသပ်မှုများ ဆောင်ရွက်ခြင်း။**										
	(က)	အမျိုးသားပတ်ဝန်းကျင်ထုတ်လွှတ်မှုလမ်းညွှန်ချက်များ (NEQG) နှင့်အညီ ရေနမူနာကောက်ယူခြင်းနှင့် ဓာတ်ခွဲစမ်းသပ်ခြင်း။										
	(ခ)	စီမံကိန်းလုပ်ငန်းခွင်အတွင်း ဆူညံသံတိုင်းတာခြင်း။										
	(ဂ)	စီမံကိန်းလုပ်ငန်းခွင်အတွင်း လေအရည်အသွေးတိုင်းတာခြင်း။										
၃)		**အများပြည်သူနှင့်တွေ့ဆုံဆွေးနွေးခြင်းနှင့် သတင်းအချက်အလက် ထုတ်ပြန်ခြင်း။**										ကမ္ဘာ့ကပ်ရောဂါ Covid - 19 ဖြစ်ပွားလျက်ရှိသောကြောင့် ရွှေ့ဆိုင်းခဲ့ရပါသည်။
	(က)	အများပြည်သူနှင့်တွေ့ဆုံဆွေးနွေးခြင်းနှင့် သတင်းအချက်အလက် ထုတ်ပြန်ခြင်း လုပ်ငန်းများ လုပ်ဆောင်ခြင်း။										
	(ခ)	အများပြည်သူထံမှ သဘောထားမှတ်ချက်များ ရယူခြင်းနှင့် IEE အစီရင်ခံစာတွင် ပြန်လည်သုံးသပ်ဖော်ပြခြင်း။										

၅။ စီမံကိန်း၏ တည်နေရာ

စက်ရုံသည် ပုံ (၁) တွင် ပြထားသည့်အတိုင်း အမှတ် (၃၂၅၊ ၃၂၆၊ ၃၂၇၊ ၃၂၈၊ ၃၂၉၊ ၃၃၀)၊ ရွှေမြို့တော် ၁ လမ်း၊ မော်လမြိုင်စက်မှုဇုန်၊ ညောင်ပင်ဆိပ် ကျေးရွာစု၊ ကျိုက်မရော မြို့နယ်၊ မွန်ပြည်နယ် တွင် တည်ရှိပါသည်။

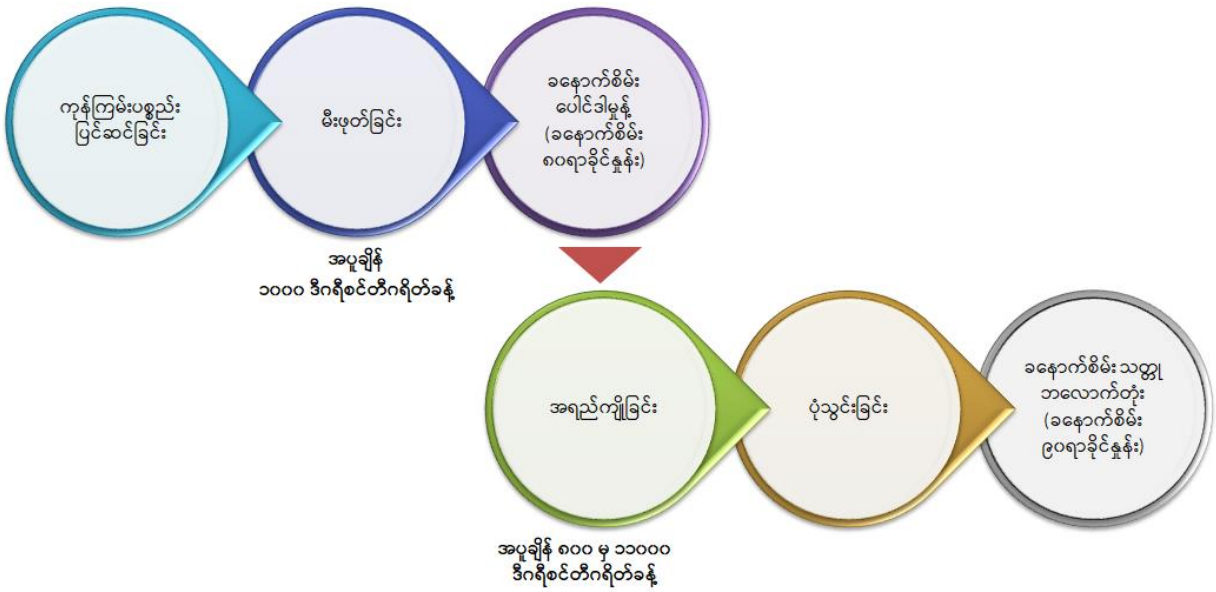


ပုံ (၁) - မော်လမြိုင်စက်မှုဇုန်အတွင်းရှိ MSS စက်ရုံ၏ တည်နေရာပြ ဂြိုလ်တုဓာတ်ပုံ

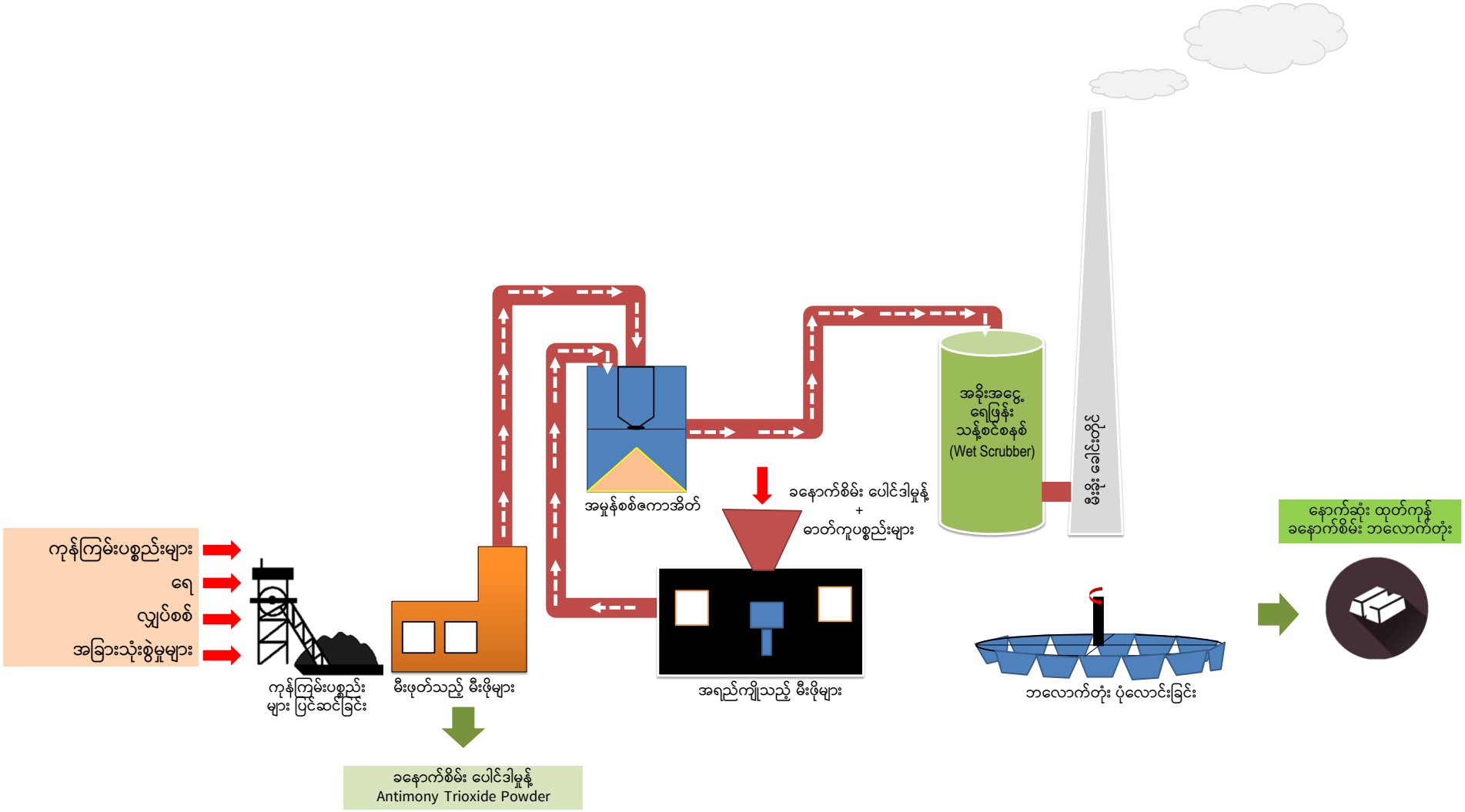
၆။ စီမံကိန်း၏ ထုတ်လုပ်မှုလုပ်ငန်းစဉ်အကျဉ်း

ယေဘုယျအားဖြင့် ခနောက်စိမ်းထုတ်လုပ်ရာတွင် မြင့်မားသောအပူချိန်၌ သန့်စင်ထုတ်လုပ်သည့် သတ္တုဗေဒနည်းပညာ (Pyrometallurgy) နှင့် အရည်ပျော်ပစ္စည်းအား အသုံးပြု၍ သန့်စင်ထုတ်လုပ်ခြင်းသတ္တုဗေဒနည်းပညာ (Hydrometallurgy) စသည့် နည်းလမ်းနှစ်မျိုးဖြင့် ထုတ်လုပ်လေ့ရှိပါသည်။ သန့်စင်သည့်နည်းစနစ်သည် ခနောက်စိမ်းပါဝင်နှုန်း ၁.၅ ရာခိုင်နှုန်းမှ ၆၀ ရာခိုင်နှုန်းကျော်အထိ ခနောက်စိမ်းသတ္တုရိုင်း၏ အခြေအနေနှင့် အမျိုးအစားပေါ်မူတည်ပါသည်။ မြန်မာရှင်းရှင်းတွင် အသုံးပြုသော ခနောက်စိမ်းသတ္တုရိုင်းသည် မီးဖုတ်၍အရည်ဖျော်သည့် နည်းစနစ် (တနည်းအားဖြင့်) အပူချိန်အမြင့်၌ သန့်စင်ထုတ်လုပ်သည့် သတ္တုဗေဒနည်းပညာ (Pyrometallurgy) နည်းဖြင့်ပိုမိုသင့်တော်၍ ၎င်းနည်းအား အသုံးပြု၍ ထုတ်လုပ်လျက် ရှိပါသည်။ ထုတ်လုပ်မှုလုပ်ငန်းစဉ်အကျဉ်းချုပ်အား ပုံ (၂) နှင့် ပုံ (၃) တို့တွင် ရေးဆွဲဖော်ပြထားပါသည်။
ပထမအဆင့်အနေဖြင့် အသုံးပြုမည့် ကုန်ကြမ်းပစ္စည်းများကိုရောနှောပြင်ဆင်ရပါသည်။ ထို့နောက် ခနောက်စိမ်းသတ္တုရိုင်းများကို ကုတ်မီးသွေး၊ ကျောက်မီးသွေးများနှင့်အတူ မီးဖုတ်သည့်မီးဖိုထဲတွင်ထည့်၍ အပူချိန် ၁၀၀၀ ဒီဂရီစင်တီဂရိတ်ဝန်းကျင်၌ မီးဖုတ်ရသည်။ ခနောက်စိမ်းသတ္တုရိုင်း (Stibnite) ကို မီးဖုတ်လိုက်သောအခါ Antimony Trioxide အဖြစ်သို့ အင်္ဂေ့အနေဖြင့် ပြောင်းလဲပြီးနောက် ၎င်းတို့ကို အအေးခံပိုက်လိုင်းများ၊ စစ်ထုတ်ဇကာအိတ်များမှ ဖြတ်သန်းစေ၍ အစိုင်အခဲ (အမှုန့်) အနေဖြင့် ပြန်လည်စစ်ထုတ်ပါသည်။ ခနောက်စိမ်းသိပ်သည်းဆ (၈၀) ရာခိုင်နှုန်းခန့် အထိ ပါဝင်သည့် ခနောက်စိမ်းပေါင်ဒါမှုန့်များကို ရရှိလာသည်။

ထို့နောက် ရရှိလာသည့် ခနောက်စိမ်းပေါင်ဒါမှုန့်များကို ဆိုဒါအက်ရ်လိုက်နှင့် မိုနိုအမိုနီယမ်ဖော့စဖိတ် ကဲ့သို့သော ဓာတ်ကူပစ္စည်း (Fluxing Agent) အကူအညီဖြင့် အပူချိန် ၈၀၀ မှ ၁,၁၀၀ ဒီဂရီစင်တီဂရိတ်ခန့်ရှိ အရည်ကျိုမီးဖို၌ အရည်ပျော် စေသည်။ ဂုရက်မှ ၁၀ရက်ခန့်ကြာ အရည်ကျိုပြီးနောက် သန့်စင်ပြီးခနောက်စိမ်းသတ္တုရည်များကို ပုံစံငယ်ဘလောက်တုံးများဖြင့် ပုံလောင်းခြင်းလုပ်ငန်းအား ဆောင်ရွက်ပါသည်။ ရရှိလာသော ခနောက်စိမ်းဘလောက်တုံးများတွင် ခနောက်စိမ်း ပါဝင်မှုပမာဏအား ဓာတ်ခွဲခန်းတွင် စစ်ဆေးပြီး ထုတ်ကုန်အရည်အသွေးစံနှုန်းနှင့်ကိုက်ညီပါက ထုပ်ပိုးပြီးတင်ပို့ရန် အဆင်သင့်ပြုလုပ်ရသည်။ ထုတ်ကုန်ဖြစ်သော ခနောက်စိမ်းဘလောက်တုံးများသည် ခနောက်စိမ်းပါဝင်နှုန်း (၉၀) ရာနှုန်းကျော် ဖြစ်ပါသည်။ ထုတ်လုပ်ရေးလုပ်ငန်းများ (မီးဖုတ်ခြင်းနှင့် အရည်ကျိုခြင်း) တို့မှ ထွက်ရှိလာသော အခိုးအငွေ့များအား အမှုန်စစ်ဇကာအိတ်များ (Bag Filter / Bag House) ဖြင့် ဖမ်းယူပြီးနောက် အခိုးအငွေ့ရေဖြန်းသန့်စင်စနစ် (Wet Scrubber) တွင် သန့်စင်ပြီးမှ မီးခိုးခေါင်းတိုင်မှတဆင့် ပြင်ပသို့ထုတ်လွှတ်စေပါသည်။



ပုံ (၂) - ခနောက်စိမ်းဘလောက်တုံး ထုတ်လုပ်မှုလုပ်ငန်းစဉ် အကျဉ်းချုပ်



ပုံ (၃) - ခနောက်စိမ်းသတ္တု ကျိုချက်ခြင်းနှင့် သန့်စင်ခြင်းလုပ်ငန်းစဉ်ပြ ရှုပ်ပုံကားချပ်

၇။ စီမံကိန်းအရွယ်အစားနှင့် ထုတ်လုပ်မှုပမာဏ

မြန်မာရှင်းရှင်းစက်ရုံသည် တလလျှင် တန် ၂၀ ပျမ်းမျှထုတ်လုပ်လျက်ရှိပြီး တပ်ဆင်ထားသော စက်ယန္တရားများ စွမ်းရည်ပြည့် လည်ပတ်ပါက တလလျှင် တန် ၅၀ (တနှစ်လျှင် အများဆုံး တန် ၅၀၀ ခန့်) နှင့် အနည်းဆုံးအနေဖြင့် တလလျှင် ၁၀ တန်ခန့် ထုတ်လုပ်နိုင်ပါသည်။ သို့ရာတွင် အချိန်နှင့်အမျှ ခနောက်စိမ်းသတ္တုရိုင်း ရရှိနိုင်မှုအပေါ်တွင်မူတည်၍ ထုတ်လုပ်နိုင်မှု ပမာဏသည် ပြောင်းလဲပါသည်။

၈။ စက်ရုံလည်ပတ်မှုအခြေအနေ

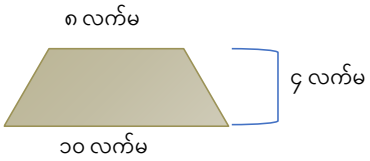
မြန်မာရှင်းရှင်း စက်ရုံသည် တပတ်လျှင် (၇) ရက်၊ တရက်လျှင် (၂၄)နာရီ၊ အဆိုင်း (၃)ဆိုင်း (တစ်ဆိုင်းလျှင် ၈ နာရီ) ဖြင့် လည်ပတ်လျက်ရှိပါသည်။ သို့သော် အုပ်ချုပ်ရေးနှင့် ရုံးပိုင်းဆိုင်ရာလုပ်ငန်းများသည် တနလင်္ဂနေ့မှ စနေနေ့အထိ (နံနက် ၈နာရီမှ ညနေ ၅နာရီအထိ) သာ ဆောင်ရွက်ပါသည်။ စုစုပေါင်းအားဖြင့် လုပ်သား (၈၀) ခန့် ခန့်အပ်ထားရှိပြီး လုပ်ငန်းအား လည်ပတ်လျက်ရှိပါသည်။ ထုတ်လုပ်ရေးဝန်ထမ်းများမှာ တပတ်လျှင် ဝိတ်ရက် (၁) ရက် တလလျှင် ဝိတ်ရက် (၄) ရက်နှင့် အစိုးရ ပြန်တမ်းဝင် ရုံးပိတ်ရက်များအား ခံစားခွင့်ရှိပါသည်။
ခနောက်စိမ်းကုန်ကြမ်းများရှားပါးချိန်တွင် စက်ရုံအပြည့်အဝလည်ပတ်နိုင်ခြင်း မရှိပါ။ တနှစ်လျှင်စက်ယန္တရားများ ပြင်ဆင်၊ မွမ်းမံရန်အတွက် မိုးရာသီကာလအတွင်း (၂) လမှ (၃) လအထိ ရပ်နားလေ့ရှိပါသည်။ တစ်နှစ်လျှင် ခန့်မှန်းခြေ ၂၂၃ ရက်ခန့် စက်ရုံ လည်ပတ်ပါသည်။

၉။ ကုန်ကြမ်းပစ္စည်းများ

ထုတ်လုပ်ရေးလုပ်ငန်းအတွက် အဓိက ကုန်ကြမ်းမှာ ခနောက်စိမ်းပါဝင်မှုမတူညီသော အရည်အသွေးအမျိုးမျိုးရှိသော ခနောက်စိမ်းသတ္တုရိုင်းနှင့် (မြေစာ၊ အမှုန့်နှင့် အခဲဟူ၍) ပုံသဏ္ဌာန်အမျိုးအစား သုံးမျိုး ရှိသော ခနောက်စိမ်း သတ္တုရိုင်း ဖြစ်ပါသည်။ မြန်မာရှင်းရှင်းစက်ရုံတွင် အသုံးပြုသည့် ခနောက်စိမ်းသတ္တုရိုင်းမှာ မွန်ပြည်နယ်၊ ကျိုက်မရောမြို့နယ်၊ နတ်စမ်းကျေးရွာနှင့် အခြား သတ္တုမိုင်းများမှထွက်ရှိသော သတ္တုရိုင်းအမျိုးအစားဖြစ်ပါသည်။ တလလျှင်အများဆုံး အသုံးပြုသည့် ပမာဏမှာ တန် (၆၀) ခန့် ဖြစ်ပါသည်။
ကုတ်မီးသွေးနှင့် ကျောက်မီးသွေးကို သတ္တုရိုင်းမီးဖုတ်ရာနှင့်အရည်ကျိုရာတွင် လောင်စာအဖြစ်အသုံးပြုပါသည်။ ကျောက်မီးသွေး သုံးစွဲသည့်ပမာဏမှာ စုစုပေါင်းလောင်စာ၏ ၂၅% မှ ၅၀% ခန့်ဖြစ်ပြီး မကွေးတိုင်း၊ ကလေးဝမြို့နယ်မှ ဝယ်ယူသော ကျောက်မီးသွေး အမျိုးအစားဖြစ်ကာ တစ်လလျှင် ပျမ်းမျှ ၆၇ တန်ခန့် အသုံးပြုပါသည်။ တရုတ်နိုင်ငံမှ တင်သွင်းသော ကုတ်မီးသွေးအား လောင်စာ၏ ၅၀% မှ ၇၅ % အထိ အသုံးပြုလေ့ရှိပြီး လစဉ်ပျမ်းမျှ ၁၃၃ တန်ခန့် သုံးစွဲပါသည်။
ဓာတ်ကူပစ္စည်းများအဖြစ် Soda Ash Light နှင့် Mono Ammoonium Phosphate တို့ကို အရည်ကျိုသည့်လုပ်ငန်းနှင့် အခိုးအငွေ့ ရေဖြန်းသန့်စင်စနစ် လည်ပတ်ရာတွင် အသုံးပြုပြီး လစဉ်အသုံးပြုမှု ပမာဏမှာ Soda Ash Light - တလလျှင် ပျမ်းမျှ ၇ တန်နှင့် Mono Ammoonium Phosphate - တလလျှင် ပျမ်းမျှ ၆ တန်ခန့် ဖြစ်ပါသည်။

၁၀။ ကုန်ချောထုတ်ကုန် - ခနောက်စိမ်းဘလောက်တုံး

စက်ရုံမှ ခနောက်စိမ်းသတ္တုရိုင်းအား သတ္တုစင်အဖြစ်ရောက်ရှိစေရန် သန့်စင်ခြင်းနှင့် အရည်ကျိုခြင်းလုပ်ငန်းများပြီးဆုံးသည့်အခါ တစ်တုံးလျှင် ၂၅ ကီလိုဂရမ် အလေးချိန်ရှိသည့် ခနောက်စိမ်းသတ္တုစင် ဘလောက်တုံးများ ထုတ်လုပ်ရရှိပါသည်။ ၎င်းမှာ ခနောက်စိမ်းပါဝင်နှုန်း ၉၇ ရာခိုင်နှုန်းအထိရှိပြီး တနှစ်လျှင်အများဆုံး တန် ၅၀၀ ခန့် ထုတ်လုပ်ရောင်းချလျက်ရှိပါသည်။ စက်ရုံမှ ထုတ်လုပ်သော ခနောက်စိမ်းဘလောက်တုံးများကို ဥရောပနှင့် အာရှနိုင်ငံများသို့တင်ပို့ပြီး ၎င်းအားအသုံးပြု၍ မီးလောင်မှု လျှော့ချသည့် ပစ္စည်းများ၊ ဘက်ထရီ၊ ပလက်စတစ်၊ ဖန်၊ တစ်ပိုင်းလျှပ်ကူးပစ္စည်းများ၊ သတ္တုစပ်အစရှိသည့် ထုတ်ကုန်များ ထုတ်လုပ်ရာတွင် အသုံးပြုနိုင်ပါသည်။



ပုံ (၄) - ထုတ်ပိုးပြီး ခနောက်စိမ်းဘလောက်တုံးများနှင့် ၎င်း၏အတိုင်းအတာ

၁၁။ စီမံကိန်းအနီးပတ်ဝန်းကျင်ဆိုင်ရာ အနှစ်ချုပ်ဖော်ပြချက်

စီမံကိန်းသည် မော်လမြိုင်မြို့နယ်နှင့် ကျိုက်မရောမြို့နယ် ထိစပ်ရာနေရာမှာ တည်ရှိနေသည့်အတွက် ယခု ကနဦးပတ်ဝန်းကျင် ဆန်းစစ်ခြင်း (IEE) အစီရင်ခံစာတွင် ယင်းမြို့နယ်နှစ်ခုလုံးအား စီမံကိန်း၏ အနီးပတ်ဝန်းကျင်ဆိုင်ရာ အစိတ်အပိုင်းများ အဖြစ် ထည့်သွင်း စဉ်းစားထားပါသည်။ အနီးပတ်ဝန်းကျင်ဆိုင်ရာ အချက်အလက်များကို မှတ်တမ်းတင်ပြုစုထားပြီး ဖြစ်သည့် အချက်အလက်များနှင့် အခြားစိတ်ချရသည့် အကိုးအကားများမှ အခြေခံကာ အောက်ဖော်ပြပါဇယားတွင် ထုတ်နှုတ်တင်ပြ ထားပါသည်။ ကနဦးပတ်ဝန်းကျင် ဆန်းစစ်ခြင်း အစီရင်ခံစာ၏ အခန်း (၄) တွင် သက်ဆိုင်ရာအချက်အလက်များကို ရုပ်ပုံကားချပ် များ၊ ဇယားများဖြင့် အသေးစိတ်ထည့်သွင်းဖော်ပြထားပါသည်။

ဇယား (၃) - စီမံကိန်းအနီးပတ်ဝန်းကျင်ဆိုင်ရာ အချက်အလက်အကျဉ်းချုပ်

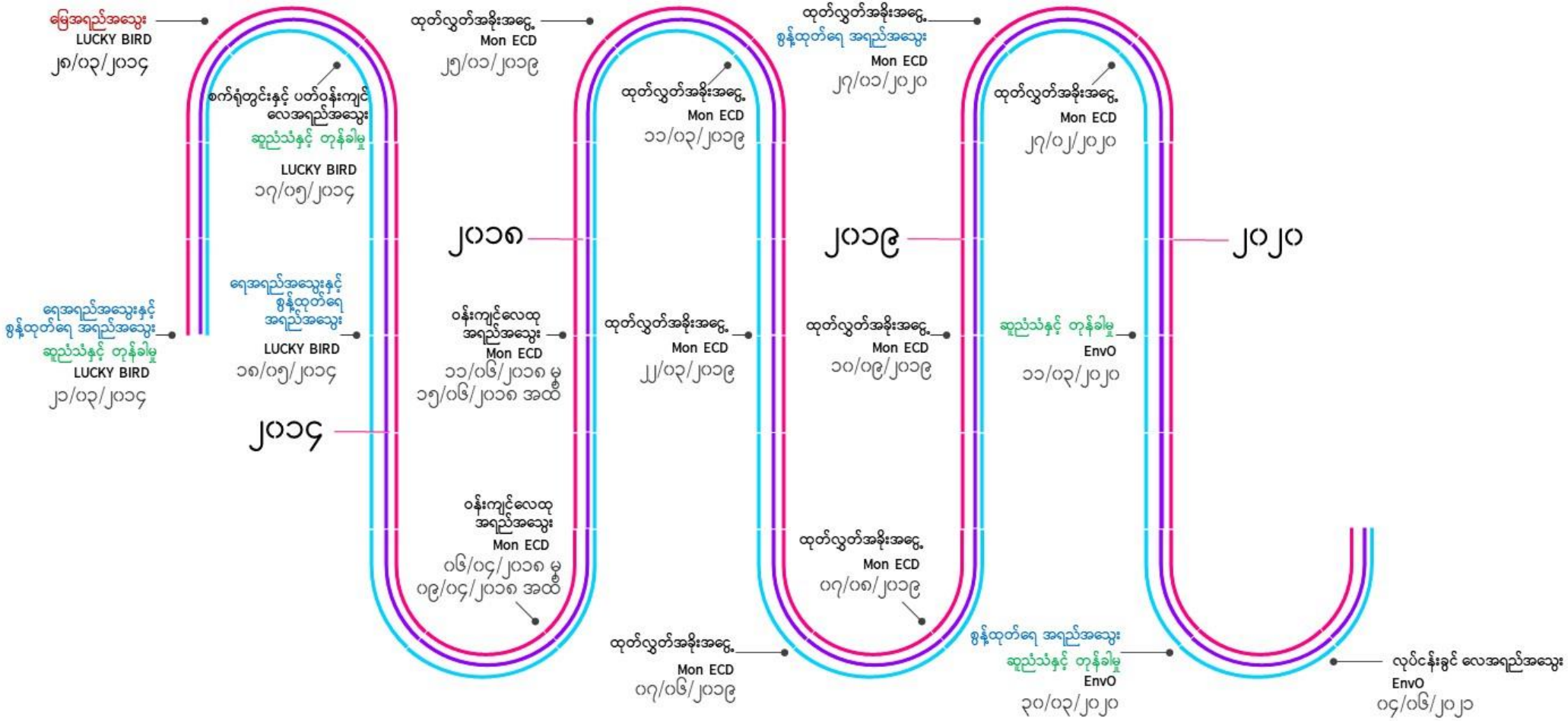
နယ်ပယ်	ရှင်းလင်းချက်
သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ အချက်အလက်များ	
ဥတုရာသီနှင့် မိုးလေဝသ	စီမံကိန်းတည်ရှိရာ မော်လမြိုင်မြို့နယ်သည် ပူအိုက်စိုစွတ်သော ရာသီဥတုရှိပြီး အမြင့်ဆုံး အပူချိန် ၃၉.၆ ဒီဂရီစင်တီဂရိတ် နှင့် အနိမ့်ဆုံး အပူချိန် ၁၁.၄ ဒီဂရီစင်တီဂရိတ် ရှိပါသည်။ ကျိုက်မရော မြို့နယ်သည် အမြင့်ဆုံးအပူချိန် ၃၉.၅ ဒီဂရီစင်တီဂရိတ် နှင့် အနိမ့်ဆုံး အပူချိန် ၁၇ ဒီဂရီစင်တီဂရိတ် ရှိပါသည်။
ဇလဗေဒ	မြစ်ချောင်းများပေါများပြီး အတ္တရံမြစ်၊ ဂျိုင်းမြစ် နှင့် သံလွင်မြစ်တို့သည် မော်လမြိုင်နှင့် ကျိုက်မရော မြို့နယ်တို့ကို ဖြတ်သန်း စီးဆင်းလျက်ရှိသည်။ ရေအရင်းအမြစ် အများစု သည် ရေချိုများဖြစ်ပြီး စိုက်ပျိုးရေးအတွက် အဓိကထားအသုံးပြုကြသည်။ စီမံကိန်းမှ ၄၅၀ မီတာခန့်အကွာတွင် အတ္တရံမြစ် စီးဆင်းလျက်ရှိပြီး ၎င်းအား ဒေသတွင်း ရေလမ်းပို့ဆောင် ဆက်သွယ်ရေးအတွက် အများဆုံး အသုံးပြုလေ့ရှိပါသည်။
မြေမျက်နှာသွင်ပြင်နှင့် ပထဝီအနေအထား	မော်လမြိုင်မြို့နယ်နှင့် ကျိုက်မရောမြို့နယ်တို့သည် ပင်လယ်ရေ မျက်နှာပြင်အထက် ၁၈ ပေ တွင် တည်ရှိနေပြီး မြို့၏အနောက်ဘက်တွင် တောင်ညိုတောင်တန်း တည်ရှိ လျက်ရှိသည်။ များသော အားဖြင့် နီညိုရောင် သစ်တောမြေများ၊ lateritic မြေများနှင့် meadow မြေများ ရှိသည်။ မြေဆီလွှာမှာ ရွှံ့ဆန်ပြီး အပေါ်ယံ ညိုဝါရောင် မြေဆီလွှာမှာ စပါးစိုက်ပျိုးရန် အတွက် အသုံးဝင်သည်။
သဘာဝဘေးအန္တရာယ် များ	မွန်ပြည်နယ်သည် "Hazard Profile of Myanmar" အရ ရေကြီးရေလျှံ ဖြစ်တတ်သော နေရာဒေသတွင်ပါဝင်ပြီး နှစ်စဉ်မိုးရာသီတိုင်းတွင် မြစ်တစ်လျှောက်တွင် ရေကြီးရေလျှံ ဖြစ်လေ့ရှိသည်။ ဒီရေအတက်အကျ၊ မိုးရွာသွန်းမှု၊ မြေမျက်နှာသွင်ပြင်နှင့် ရေစီးရေလာ မကောင်းမွန်မှု စသည်တို့အပေါ် မူတည်၍ ဇွန်၊ ဇူလိုင်နှင့် ဩဂုတ်လများ၌ မြေနိမ့်ပိုင်း ဒေသများတွင် ရေကြီးရေလျှံ ဖြစ်တတ်သည်။

နယ်ပယ်	ရှင်းလင်းချက်
ဇီဝဗေဒဆိုင်ရာ အချက်အလက်များ	
ဂေဟဇုန်များ၊ အဓိကအရေးပါသော ဇီဝမျိုးကွဲ တည်ရှိနယ်မြေများ နှင့် ကာကွယ်ထားသော နေရာများ	မော်လမြိုင်မြို့နယ်နှင့် ကျိုက်မရောမြို့နယ်ရှိ ဂေဟစနစ်အား သစ်တောဇရိယာများ၊ စိုက်ခင်းများ၊ ရေတိမ်ဒေသများ၊ မြစ်ချောင်းများနှင့် မြို့ပြဇရိယာများဟူ၍ ခွဲခြားနိုင် ပါသည်။ မော်လမြိုင်မြို့နယ်၏ တောင်ပိုင်းကုန်းမြင့်ဒေသများအား အဓိက အရေးပါ သောဇီဝမျိုးကွဲများအဖြစ် သတ်မှတ်ထားပါသည်။ သို့ရာတွင် မော်လမြိုင်မြို့နယ်နှင့် ကျိုက်မရော မြို့နယ်နယ်နိမိတ်အတွင်းတွင် ဥပဒေအရ ကာကွယ်ထားသော နေရာများ မရှိပါ။
လူမှုစီးပွားရေးဆိုင်ရာ အချက်အလက်များ	
လူဦးရေပြန့်နှံ့နေထိုင်မှုနှင့် လူမျိုးများ	၂၀၁၉ ခုနှစ် စစ်တမ်းရလဒ်များအရ မော်လမြိုင်မြို့၌ လူဦးရေ ၂၆၉,၀၀၅ ယောက် နေထိုင်ပြီး ကျိုက်မရောတွင် ၂၂၈,၃၅၈ ယောက်နေထိုင်ကြသည်။ ဗမာလူမျိုး မှာ ၅၆.၇ ရာခိုင်နှုန်းနှင့် မော်လမြိုင်တွင် အများဆုံးနေထိုင်လျက်ရှိကြပြီး မွန်လူမျိုး ၄၈.၉ ရာခိုင်နှုန်းနှင့် ကျိုက်မရောတွင် နေထိုင်လျက်ရှိကြသည်။
ဒေသစီးပွားရေးနှင့် အသက်မွေးဝမ်းကျောင်းမှု	မော်လမြိုင်သည် မွန်ပြည်နယ်၏ မြို့တော်ဖြစ်သည့်အတွက် ဖွံ့ဖြိုးတိုးတက်သည်။ စိုက်ပျိုးရေးနှင့် ဝန်ဆောင်မှု လုပ်ငန်းများကို မှီတည်၍ အသက်မွေးကြသည်။ ကျိုက်မရောမြို့နယ်မှာမူ စီးပွားရေး တိုးတက်မှုမှာ မော်လမြိုင်လောက် မရှိပေ။ ဒေသခံ အများစုမှာ စိုက်ပျိုးရေးလုပ်ငန်းဖြင့် အသက်မွေးဝမ်းကျောင်းမှုများ ပြုလုပ်ကြသည်။
စက်မှုဇုန်များ	မော်လမြိုင်မြို့နယ် အတွင်းတွင် မော်လမြိုင်စက်မှုဇုန် (၁၇၁.၀၄ ဧက) နှင့် ကျောက်တန်းစက်မှုဇုန် (၂၅၄ ဧက) ဟူ၍ စက်မှုဇုန် နှစ်ခုရှိပါသည်။ ယခုအဆိုပြု စီမံကိန်းမှာ မော်လမြိုင်စက်မှုဇုန်အတွင်းတွင် တည်ရှိပါသည်။
လူမှုဆိုင်ရာအဆောက်အအုံ များနှင့် ဝန်ဆောင်မှုများ	လမ်းပန်းဆက်သွယ်ရေး - မော်လမြိုင်နှင့် ကျိုက်မရောမြို့နယ်တို့သည် ကုန်းလမ်းသာမက ရေလမ်းခရီးပါ ပေါက်ရောက်သည်။ ကုသရေးဆိုင်ရာ အဆောက်အအုံများ - မော်လမြိုင်တွင် အစိုးရဆေးရုံ ခြောက်ခု ရှိပြီး ကျိုက်မရောမြို့နယ်တွင် သုံးခု ရှိပါသည်။ ရေပေးဝေမှု - မော်လမြိုင်မြို့တွင် အမြင့်ပိုင်းမှမြေနိမ့်ဒေသများသို့ အလိုအလျောက် ရေပေးဝေမှု စနစ်သာမက ပန့်များဖြင့် ရေတွန်းတင်ခြင်း စနစ်ကိုသုံးကာ ရေဖြန့်ဝေ ပေးလျက်ရှိသည်။ သို့ရာတွင် မော်လမြိုင်စက်မှုဇုန်အတွင်းရှိ စက်ရုံများမှာမူ အတ္တရုံမြစ် (သို့) အဝီစိတွင်းရေကိုသာ ရရှိသဖြင့် ၎င်းမှ ထုတ်ယူအသုံးပြုကြသည်။ လျှပ်စစ်ဓာတ်အားပေးဝေမှု - မော်လမြိုင်စက်မှုဇုန်တွင် ပင်မ ဓာတ်အားလိုင်းမှ ၆၆ kV ဓာတ်အားလိုင်းဖြင့် လျှပ်စစ်ဓာတ်အား ဖြန့်ဝေပေးလျက်ရှိသည်။ မိလ္လာရေဆိုးနှင့် စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုစနစ် - လူနေအိမ်များ၊ စီးပွားရေးလုပ်ငန်းများ နှင့် အုပ်ချုပ်မှုဆိုင်ရာ အဆောက်အအုံများတွင် မိလ္လာရေဆိုးကို မိမိတို့ အဆောက်အအုံရှိ မိလ္လာကန် (Septic Tank) များတွင်သာ စွန့်ပစ်လေ့ ရှိကြသည်။ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု အား သက်ဆိုင်ရာ စည်ပင်သာယာရေးအဖွဲ့များမှ ဆောင်ရွက်လျက်ရှိပြီး နောက်ဆုံး အမှိုက်စွန့်ပစ်ရာနေရာ (ဟင်းလင်းပြင်အမှိုက်ပုံတွင်) စွန့်ပစ်ကြပါသည်။
မြို့နယ် ဖွံ့ဖြိုးတိုးတက်ရေး အစီအစဉ်များ	မော်လမြိုင်နှင့် ကျိုက်မရော နှစ်မြို့နယ်လုံးတွင် အစိုးရမှ နှစ်သုံးဆယ် မြို့နယ်ဖွံ့ဖြိုး တိုးတက်ရေး အစီအစဉ်များအား ချမှတ်ထားပြီး အခြားဖွံ့ဖြိုးတိုးတက်ရေး စီမံကိန်း များ (ဥပမာ - မြစ်မိုးရောင် စီမံကိန်း) တွင်လည်း ပါဝင်လျက်ရှိကြောင်း သိရှိရပါသည်။
ယဉ်ကျေးမှုနှင့် အမြင်ပသာဒဆိုင်ရာ အချက်အလက်များ	
ရှေးဟောင်းအဆောက်အအုံများ၊ ပုထိုးများနှင့် သမိုင်းဝင် အထိမ်းအမှတ်များ	စီမံကိန်းတည်ရှိရာ မော်လမြိုင်စက်မှုဇုန်အတွင်းနှင့် ဇုန်ပတ်ဝန်းကျင် ၄ ကီလိုမီတာ (၂ မိုင်ခွဲ) ပတ်ပတ်လည်တွင် မည်သည့် ရှေးဟောင်းအဆောက်အအုံများ၊ ပုထိုးများနှင့် သမိုင်းဝင် အထိမ်းအမှတ်များ မတွေ့ရှိရပါ။
ရှုမျှော်ခင်း	စီမံကိန်းတည်ရှိရာ မော်လမြိုင်စက်မှုဇုန်အနီးတွင် အမြင်ပသာဒဖြစ်စေသော တောင်တန်းများ၊ ကိုလိုနီခေတ် အဆောက်အအုံများ၊ ထုံးကျောက်ဂူများနှင့် ရေပူစမ်း များ အစရှိသည့် ရှုမျှော်ခင်းဆိုင်ရာ အစိတ်အပိုင်းများ မတွေ့ရှိရပါ။

၁၂။ ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်အလက် ကောက်ယူတိုင်းတာမှု မှတ်တမ်းများ

အောက်ပါပုံ (၅) တွင် စီမံကိန်းနှင့် စီမံကိန်းအနီးပတ်ဝန်းကျင်၌ ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်အလက် ကောက်ယူတိုင်းတာမှုများကို ကောက်ယူခဲ့သည့် နှစ်အလိုက် ရေးဆွဲဖော်ပြထားပါသည်။ ၂၀၁၄ ခုနှစ်တွင် ယခင်ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း EIA ဆောင်ရွက်ခဲ့သည့် Lucky Bird Environmental Studies & Geo-Informatic Solutions Group မှ ရေအရည်အသွေး၊ စွန့်ပစ်ရေအရည်အသွေး၊ ဆူညံသံနှင့်တုန်ခါမှု၊ မြေအရည်အသွေး၊ စက်ရုံတွင်းနှင့် စက်ရုံဝန်းကျင် လေအရည်အသွေးတိုင်းတာမှုများအား ဆောင်ရွက်ခဲ့ပါသည်။ ၂၀၁၈ ခုနှစ်မှ စတင်ကာ မွန်ပြည်နယ်၊ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနမှလည်း စက်ရုံနှင့် စက်ရုံအနီးတဝိုက် ပတ်ဝန်းကျင်ဆိုင်ရာ စမ်းဆေးတိုင်းတာမှုများ ဆောင်ရွက်ခြင်းဖြင့် ဝန်းကျင်လေထုအရည်အသွေး၊ ထုတ်လွှတ်အခိုးအငွေ့နှင့် စွန့်ထုတ်ရေအရည်အသွေးများကို တိုင်းတာစစ်ဆေးခဲ့ကြောင်း သိရှိရပါသည်။ ၎င်းနှင့် ပတ်သက်၍ တိုင်းတာချက် ရလဒ်များ၊ သက်ဆိုင်ရာလမ်းညွှန်ချက်တန်ဖိုးများနှင့် နှိုင်းယှဉ်စစ်ဆေးမှုများ၊ တွေ့ရှိချက်နှင့် ပညာရပ်ပိုင်းဆိုင်ရာ သုံးသပ်ချက်များကို IEE အစီရင်ခံစာ၏ နောက်ဆက်တွဲ (၃) တွင် အသေးစိတ် ရေးသားဖော်ပြထားပါသည်။ ၎င်းရလဒ်များအပေါ် အခြေခံ၍ ဆက်လက်ဆောင်ရွက်သွားရမည့် တိုင်းတာမှုများအတွက် အကြံပြုချက်များကိုလည်း ထည့်သွင်းဖော်ပြထားပြီး ဖြစ်ပါသည်။

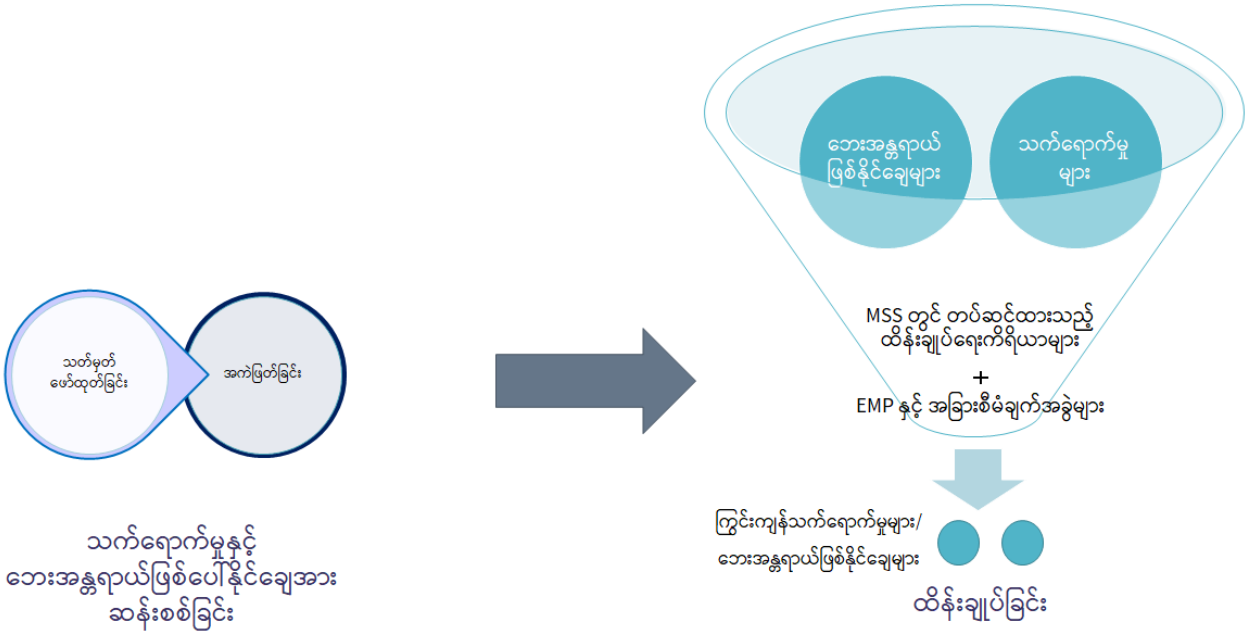
၂၀၂၀ နှင့် ၂၀၂၁ ခုနှစ်တွင် Env0 လေ့လာရေးအဖွဲ့မှ ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှုလုပ်ငန်းများ ဆောင်ရွက်နေစဉ်အတွင်းတွင် လုပ်ငန်းခွင်လေအရည်အသွေး၊ ဆူညံသံနှင့် စွန့်ထုတ်ရေအရည်အသွေး တိုင်းတာမှုလုပ်ငန်းများအား ထပ်မံဆောင်ရွက်ခဲ့ပါသည်။ စွန့်ထုတ်ရေ နမူနာကောက်ယူခြင်း၊ တိုင်းတာခြင်းနှင့် ဓာတ်ခွဲစမ်းသပ်ခြင်းလုပ်ငန်းများအား IEE အစီရင်ခံစာ၏ နောက်ဆက်တွဲ (၆) တွင် လည်းကောင်း၊ ဆူညံသံတိုင်းတာမှုနှင့် ရလဒ်များအားလမ်းညွှန်ချက်တန်ဖိုးများနှင့် နှိုင်းယှဉ်ဖော်ပြချက်များအား နောက်ဆက်တွဲ (၈) တွင်လည်းကောင်း၊ လုပ်ငန်းခွင်လေအရည်အသွေး တိုင်းတာချက်ရလဒ်များအား နောက်ဆက်တွဲ (၁၀) တွင် လည်းကောင်း ဆွေးနွေးချက်များဖြင့် အသေးစိတ် ထည့်သွင်းဖော်ပြထားပါသည်။



ပုံ (၅) - စီမံကိန်းနှင့် အနီးတဝိုက် ပတ်ဝန်းကျင်ဆိုင်ရာ တိုင်းတာမှုများ ဆောင်ရွက်ခဲ့သည့် မှတ်တမ်း

၁၃။ သက်ရောက်မှုနှင့် ဘေးအန္တရာယ်ဖြစ်နိုင်ချေ အခြေအနေအား ဆန်းစစ်မှု လုပ်ငန်းစဉ်

အဆိုပြုစီမံကိန်းမှ စီမံကိန်းသက်တမ်းတလျှောက်တွင် ဖြစ်ပေါ်နိုင်သော ကောင်းကျိုးနှင့် ဆိုးကျိုးသက်ရောက်မှုများအား သတ်မှတ်ဖော်ထုတ်ခြင်း၊ ဆိုးကျိုးသက်ရောက်မှုများကို လျှော့ပါးစေရေး နည်းလမ်းများအား ရှာဖွေခြင်းနှင့် တစ်ဖက်တစ်လမ်းမှ ကောင်းကျိုးသက်ရောက်မှုများကို တိုးမြှင့်ပေးနိုင်ရန် ရည်ရွယ်ချက်ဖြင့် သက်ရောက်မှုဆန်းစစ်ခြင်း လုပ်ငန်းစဉ်အား ဆောင်ရွက်ရခြင်း ဖြစ်ပါသည်။ ထိုသက်ရောက်မှုဆန်းစစ်ခြင်းလုပ်ငန်းမှာ စီမံကိန်းအဆိုပြုသူ နှင့် စီမံကိန်း၏ ပတ်ဝန်းကျင် ဆိုင်ရာထိန်းချုပ်မှုလုပ်ငန်းများ ဆောင်ရွက်မည့် အစိုးရဌာနဆိုင်ရာများအတွက် အဆိုပြုစီမံကိန်းမှ ဖြစ်ပေါ်လာနိုင်သော သက်ရောက်မှု များအား အဖက်အဖက်မှ နားလည်သဘောပေါက်စေပြီး ပတ်ဝန်းကျင်ဆိုင်ရာ ကိစ္စရပ်များကို စီမံခန့်ခွဲရာတွင် အထောက်အကူပြုစေရန် ရည်ရွယ်ပါသည်။ သက်ရောက်မှုနှင့် ဘေးအန္တရာယ်ဖြစ်နိုင်ချေအား ဆန်းစစ်ပြီးနောက် ဖော်ထုတ် ထားသော သက်ရောက်မှုနှင့် ဘေးအန္တရာယ်များကို မြန်မာရှင်းရှင်း စက်ရုံတွင် တပ်ဆင်ထားသော ထိန်းချုပ် ကိရိယာများအား အသုံးပြု၍လည်းကောင်း၊ ပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှု အစီအစဉ်နှင့် စီမံချက်ခွဲများတွင် ရေးဆွဲထားသော သက်ရောက်မှု လျှော့ပါးစေရေးနည်းလမ်းများကို အကောင်အထည်ဖော် ဆောင်ရွက်ခြင်း အားဖြင့်သော်လည်းကောင်း အတိုင်းအတာတစ်ခု အထိလျှော့ချနိုင်မည်ဖြစ်ကြောင်း သဘောတရားအား အောက်ပါပုံတွင် ရေးဆွဲဖော်ပြထား ပါသည်။



ပုံ (၆) - သက်ရောက်မှုနှင့် ဘေးအန္တရာယ်ဖြစ်နိုင်ချေ အခြေအနေအား ဆန်းစစ်မှု လုပ်ငန်းစဉ်

၁၄။ ဖြစ်နိုင်ချေရှိသော သက်ရောက်မှုနှင့် ဘေးအန္တရာယ် အကျဉ်းချုပ်

ခနောက်စိမ်းသတ္တုရိုင်းအား သတ္တုစင်အဖြစ် သန့်စင်ရာတွင် ကုန်ကြမ်းအားပြင်ဆင်ခြင်း၊ မီးဖုတ်ခြင်း၊ ထွက်ရှိလာသော ခနောက်စိမ်း ပေါင်ဒါမှုန့်များကို ရယူခြင်း၊ အရည်ကျိုသန့်စင်ခြင်း၊ ပုံလောင်းခြင်း အစရှိသည့် အဆင့်များကို တဆင့်ပြီးတဆင့် ဆောင်ရွက်ရပါသည်။ ၎င်းထုတ်လုပ်ရေးအဆင့်ဆင့်မှ လေထုအတွင်းသို့ ညစ်ညမ်းစေသောအငွေ့များ ထုတ်လွှတ်ခြင်းနှင့် ထွက်ရှိလာသော စွန့်ပစ်ပစ္စည်းများမှ ပတ်ဝန်းကျင်၊ အလုပ်သမားများနှင့် စီမံကိန်းအနီးရှိနေထိုင်သူများအပေါ် သက်ရောက်မှုများ ဖြစ်ပေါ်စေနိုင်ပါသည်။

စီမံကိန်း၏ လုပ်ငန်းသဘောသဘာဝများနှင့် အနီးပတ်ဝန်းကျင်၏ အခြေအနေများအပေါ် အခြေခံ၍ ထိခိုက်မှုဆန်းစစ်သည့်အခါ မတူညီသော ပတ်ဝန်းကျင်၊ လူမှုဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေးဆိုင်ရာ သက်ရောက်မှုများနှင့် ဘေးအန္တရာယ်ဖြစ်ပေါ်နိုင်ခြေများကို တွေ့ရှိရပါသည်။ အောက်ပါဇယားတွင် အဆိုပြုစီမံကိန်းမှ ဖြစ်ပေါ်လာနိုင်သော သက်ရောက်မှုများနှင့် ဘေးအန္တရာယ်ဖြစ်နိုင်ခြေများကို ကောက်နှုတ်ဖော်ပြထားပါသည်။ သက်ရောက်မှုဆန်းစစ်ချက်နှင့် ပတ်သက်သော အသေးစိတ်အချက်အလက်များအား IEE အစီရင်ခံစာ၏ အပိုဒ်ခွဲ ၅.၂ ၅.၃ နှင့် ၆.၃ တို့တွင် သက်ဆိုင်ရာ ကဏ္ဍအလိုက် ဖော်ပြထားပါသည်။

ဇယား (၄) - ဖြစ်ပေါ်နိုင်ချေရှိသော သက်ရောက်မှုနှင့် ဘေးအန္တရာယ်ဖြစ်နိုင်ချေများ

ပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှုများ	လူမှုဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေးဆိုင်ရာ သက်ရောက်မှုများ	လုပ်ငန်းခွင်အတွင်း ဘေးအန္တရာယ် ဖြစ်နိုင်ခြေများ	အရေးပေါ် ဘေးအန္တရာယ် ဖြစ်နိုင်ခြေများ	သဘာဝ ဘေးအန္တရာယ် ဖြစ်နိုင်ခြေများ
၁။ လေထုညစ်ညမ်းမှု ၂။ အစိုင်အခဲ စွန့်ပစ်ပစ္စည်း ၃။ ရေညစ်ညမ်းမှု ၄။ မြေဆီလွှာ ညစ်ညမ်းမှု ၅။ ဆူညံသံ ၆။ အနံ့ဆိုး	၁။ ဒေသတွင်း စီးပွားရေး ၂။ ဒေသတွင်း အရင်းအမြစ်များ ၃။ အလုပ်သမားများ ၏ လူမှုဖူလုံရေး ၄။ ဒေသခံလူထု၏ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး	၁။ လုပ်ငန်းခွင်လေထု အရည်အသွေး ၂။ အပူနှင့် ထိတွေ့ခြင်း ၃။ ဓာတုပစ္စည်းများနှင့် ထိတွေ့ခြင်း ၄။ လုပ်ငန်းခွင်အတွင်း ဆူညံသံ ခံစားရမှု ၅။ ရုပ်ပိုင်းဆိုင်ရာ ဘေးအန္တရာယ် ဖြစ်နိုင်မှုများ ၆။ ကူးစက်နိုင်သော ရောဂါများ	၁။ မီးလောင်မှု ၂။ ပေါက်ကွဲမှု	၁။ ရေကြီး ရေလွှမ်းခြင်း ၂။ ငလျင်ဒါဏ်

၁၅။ အဆိုပြုစီမံကိန်းတွင် တပ်ဆင်ထားသော ညစ်ညမ်းမှုထိန်းချုပ်ကိရိယာများ

အဆိုပြုစီမံကိန်းသည် ၎င်းမှ ဖြစ်ပေါ်လာနိုင်သော ပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှုများကို သိရှိထားပြီးဖြစ်ပြီး အဆိုပါ သက်ရောက်မှုများကို နည်းနိုင်သမျှနည်းစေရန်အတွက် အောက်ဖော်ပြပါ ညစ်ညမ်းမှုထိန်းချုပ်ကိရိယာများကို တပ်ဆင်ထားရှိပါသည်။

အမှုန်စစ်ဇကာအိတ်အိမ်

၎င်းသည် **လေထုညစ်ညမ်းမှု**ကို မဖြစ်ပေါ်စေရန် မည်မျှထိရောက်စွာ ကာကွယ်နိုင်သနည်း။

တပ်ဆင်ထားလျှင်→ မြန်မာရှင်းရှင်းတွင် တပ်ဆင်ထားသော အမှုန်စစ်ဇကာအိတ်အိမ်(၂)ခုနှင့် သီးခြား အမှုန်စစ်ဇကာအိတ်စနစ်များသည် ခနောက်စိမ်းအောက်ဆိုဒ်အမှုန်များဖမ်းယူရန်နှင့် လေထုညစ်ညမ်းမှုမဖြစ်ပေါ်စေရန် လုပ်ဆောင်သည့် စနစ်ဖြစ်ပါသည်။ ခနောက်စိမ်း သန့်စင်သည့် လုပ်ငန်းစဉ် တလျောက်မှ ထွက်ရှိသောအခိုးအငွေ့များတွင် ပါဝင်သည့် အမှုန်များကို ဖမ်းယူစစ်ထုတ်ဖယ်ရှား ခြင်းကို လုပ်ဆောင်ပါသည်။

တပ်ဆင်ထားခြင်းမရှိလျှင်→လုပ်ငန်းခွင်တွင် အမှုန်များသိသိသာသာ ပျံ့နှံ့ပြီး စက်ရုံအနီး ပတ်ဝန်းကျင်ရှိ လေထုတွင် အမှုန်အမွှားများပျံ့နှံ့စေသည့်သက်ရောက်မှုများ ဖြစ်ပေါ်စေနိုင်ပါသည်။

အခိုးအငွေ့ရေဖြန်းသန့်စင်စနစ်

၎င်းသည် **လေထုညစ်ညမ်းမှု**ကို မဖြစ်ပေါ်စေရန် မည်မျှထိရောက်စွာ ကာကွယ်နိုင်သနည်း။

တပ်ဆင်ထားလျှင်→ ၎င်းသည် အမှုန်စစ်ဇကာအိတ်အိမ်နှင့်စနစ်များမှ ဖြတ်သန်းထွက်ရှိလာသော အခိုးအငွေ့များကို သန့်စင်သည့်စနစ်အဖြစ်လုပ်ဆောင်ပါသည်။ ၄င်းစနစ်ကို အခိုးအငွေ့တွင် ပါဝင်သည့် ဆာလဖာဒိုင်အောက်ဆိုဒ်ကို ဖယ်ရှားသန့်စင်သည့်စနစ် အဖြစ်လည်း သတ်မှတ်ထားပါသည်။ ၎င်းသည် ဆာလဖာဒိုင်အောက်ဆိုဒ်ကို ထိရောက်စွာ လျှော့ချသန့်စင်ပေးနိုင်စွမ်းရှိပြီး လေထုဝန်းကျင်အပေါ် သိသာထင်ရှားစွာ သက်ရောက်မှုကို လျှော့နည်းစေပါသည်။

တပ်ဆင်ထားခြင်းမရှိလျှင်→ နိုင်ငံ၏လမ်းညွှန်သတ်မှတ်ထားသည့် ကန့်သတ်ချက် ပမာဏထက် ကျော်လွန်သည့် ဆာလဖာဒိုင်အောက်ဆိုဒ်ဓာတ်ငွေ့ ပမာဏထုတ်လွှတ်မှု ဖြစ်ပေါ်စေနိုင်ပါသည်။

အနည်ထိုင်ကန်များ

၎င်းသည် **ရေထုညစ်ညမ်းမှု**ကို မဖြစ်ပေါ်စေရန် မည်မျှထိရောက်စွာ ကာကွယ်နိုင်သနည်း။

တပ်ဆင်ထားလျှင်→ ၎င်းသည် စွန့်ထုတ်ရေအတွင်း ပါဝင်သောအနည်အနှစ် အမှုန်များ (ခနောက်စိမ်းအောက်ဆိုဒ် စသည်ဖြင့်)တို့ကို စက်ရုံပြင်ပသို့မစွန့်ထုတ်မီ အတိုင်းအတာတစ်ခုအထိ အနည်ထိုင်ကာလျှော့ချစေသည်။

တပ်ဆင်ထားခြင်းမရှိလျှင်→စွန့်ထုတ်ရေများသည် သန့်စင်မှု မရှိဘဲ အနီးပတ်ဝန်းကျင်ရေထုထဲသို့ တိုက်ရိုက်စီးဆင်းမှုကြောင့် ရေထဲရှိသေးငယ်သောဇီဝသက်ရှိများအပေါ် သက်ရောက်မှုရှိစေနိုင်ပါသည်။

အအေးခံကန်များ

၎င်းသည် **ရေထုညစ်ညမ်းမှု**ကို မဖြစ်ပေါ်စေရန် မည်မျှထိရောက်စွာ ကာကွယ်နိုင်သနည်း။

တပ်ဆင်ထားလျှင်→ ၎င်းသည် ထုတ်လုပ်မှုလိုင်းတွင် အသုံးပြုခဲ့သော ရေ၏အပူချိန်ကို အအေးခံရန်အတွက်နှင့် အအေးခံပြီးသားရေကို ထုတ်လုပ်မှုလိုင်းများတွင် ပြန်လည်အသုံးပြုရန်အတွက် အထောက်အကူပြုပါသည်။ ထို့ပြင်ရေထဲတွင်ပါဝင်သော ဆိုင်းကြွအနည်အမှုန်များကိုလည်း လျှော့ချပေးပါသည်။

တပ်ဆင်ထားခြင်းမရှိလျှင်→ စွန့်ပစ်ရေပူသည် အနီးပတ်ဝန်းကျင်ရေထုထဲသို့ တိုက်ရိုက်စီးဆင်းမှုကြောင့် ရေထဲရှိသေးငယ်သောဇီဝသက်ရှိများအပေါ် သက်ရောက်မှုရှိစေနိုင်ပါသည်။ ထို့ပြင် ရေများကို စုဆောင်းပြီးပြန်လည်အသုံးမပြုနိုင်သောကြောင့် ထုတ်လုပ်မှုလုပ်ငန်းစဉ်အတွက် အသုံးပြုသော ရေပမာဏ အဆပေါင်းများစွာ ပိုမိုများပြားလာမည်ဖြစ်သည်။

ပုံ (၇) – MSS တွင် တပ်ဆင်တည်ဆောက်ထားသော ညစ်ညမ်းမှုထိန်းချုပ်ခြင်းဆိုင်ရာ ကိရိယာများ

၁၆။ သက်ရောက်မှုဆန်းစစ်ရန်အတွက် ဆောင်ရွက်ခဲ့သော ပတ်ဝန်းကျင်ဆိုင်ရာ တိုင်းတာမှုများ

EnvO လေ့လာရေးအဖွဲ့အနေဖြင့် ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်မှုလုပ်ငန်းများ ဆောင်ရွက်နေစဉ်အတွင်း ဖြစ်ပေါ်နိုင်ချေရှိသော သက်ရောက်မှုများကို အကဲဖြတ်ရာတွင် အထောက်အကူပြုစေရန်အတွက် အောက်ဖော်ပြပါ ပတ်ဝန်းကျင်ဆိုင်ရာ တိုင်းတာမှု လုပ်ငန်းများအား ဆောင်ရွက်ခဲ့ပါသည်။ တိုင်းတာမှုရလဒ်များကို သက်ရောက်မှုများကို အကဲဖြတ်ခြင်းနှင့် စိစစ်သုံးသပ်ခြင်း လုပ်ငန်းများဆောင်ရွက်ရာတွင် ထည့်သွင်းစဉ်းစားထားပါသည်။ ၎င်းရလဒ်များအပေါ် ဆွေးနွေးချက်များနှင့် ထည့်သွင်းစဉ်းစား ထားမှုများကို IEE အစီရင်ခံစာ၏ အခန်း (၅) နှင့် အခန်း (၆) တို့၏ သက်ဆိုင်ရာ အပိုဒ်ခွဲများတွင် ထည့်သွင်းဖော်ပြထားပြီး တိုင်းတာမှုဆောင်ရွက်ခဲ့ပုံများ၊ ရလဒ်များအပေါ် အသေးစိတ်သုံးသပ်ချက်များနှင့် သက်ဆိုင်ရာ ဓာတ်ပုံမှတ်တမ်းများကို အစီရင်ခံစာ နောက်ဆက်တွဲ (၆) စွန့်ထုတ်ရေ နမူနာကောက်ယူခြင်းနှင့် ဓာတ်ခွဲစမ်းသပ်ချက်ရလဒ်များ၊ နောက်ဆက်တွဲ (၇) ဆူညံသံတိုင်းတာခြင်းနှင့် ရလဒ်များနှင့် နောက်ဆက်တွဲ (၁၀) လုပ်ငန်းခွင်လေအရည်အသွေး တိုင်းတာချက်ရလဒ်များ အစရှိသည့် နောက်ဆက်တွဲများတွင် အသေးစိတ် ရှင်းလင်းဖော်ပြထားပါသည်။

ဇယား (၅) - သက်ရောက်မှုဆန်းစစ်ရန်အတွက် ဆောင်ရွက်ခဲ့သော ပတ်ဝန်းကျင်ဆိုင်ရာ တိုင်းတာမှုများ

တိုင်းတာသည့် အရာ	ရည်ရွယ်ချက်	တိုင်းတာသည့်နေရာ	ရလဒ် အကျဉ်းချုပ်
လုပ်ငန်းခွင်လေအရည်အသွေး	မီးဖိုများလည်ပတ်ရာမှ ထွက်ရှိ သော အဓိကထုတ်လွှတ်မှု ဖြစ်သော အမှုန်အမွှားများသည် အလုပ်သမားများ၏ ကျန်းမာရေးကို ထိခိုက်စေနိုင် သဖြင့် လုပ်ငန်းခွင်လေအရည် အသွေးအား စစ်ဆေးရန်နှင့် တိုင်းတာချက် ရလဒ်များကို သက်ရောက်မှုဆန်းစစ်ရာတွင် ထည့်သွင်းစဉ်းစားပြီး ပိုမိုကောင်းမွန်သော ထိန်းချုပ်မှုများကို လိုအပ်သလို ဆောင်ရွက်နိုင်စေရန်။	လုပ်ငန်းခွင်အရည်အသွေးအား အောက်ဖော်ပြပါ နေရာ (၂) နေရာတွင် တိုင်းတာခဲ့ပါသည်။ (i) IAQ-1 (မီးဖုတ်သည့် မီးဖိုများအနီး) (ii) IAQ-2 (အရည်ကျိုသည့် မီးဖိုများအနီးတွင်)	IAQ-1 တွင် တိုင်းတာချက်ရလဒ်များအရ အမှုန်အမွှား များဖြစ်သော PM 2.5 နှင့် PM 10 တို့မှာ အများအားဖြင့် “ကောင်း” သည့် အနေအထားတွင်ရှိနေပြီး နာရီ အလိုက် ပျှမ်းမျှတန်ဖိုးများမှာ “ကောင်း” သည့် နယ်ပယ် အတွင်းတွင်ရှိကြောင်း တွေ့ရှိရပါသည်။ IAQ-2 နာရီ အလိုက် ပျှမ်းမျှတန်ဖိုးများအရ PM 2.5 သည် “ထိခိုက်လွယ်သော အုပ်စုများအတွက် သင့်တော်မှုမရှိ” သည့်အခြေအနေကို ဖော်ပြပြီး PM 10 တန်ဖိုးမှာ “အသင့်အတင့်” အခြေအနေကို ဖော်ပြလျက် ရှိပါသည်။ ထိုကဲ့သို့ဖြစ်ပေါ်ရခြင်းမှာ အရည်ကျိုသည့် မီးဖိုများအတွင်းမှ ချော်ရည်များ ထုတ်ယူသည့် အချိန်တွင် ၎င်းနှင့်အတူ အမှုန်အမွှားများထွက်ရှိသည့် သဘော သဘာဝကြောင့်ဟု ယူဆရပါသည်။
စွန့်ထုတ်ရေ အရည်အသွေး	စက်ရုံမှ ပတ်ဝန်းကျင်သို့ စွန့်ထုတ်လျက်ရှိသော စွန့်ထုတ်ရေအရည်အသွေးအား စစ်ဆေးရန်နှင့် ဓာတ်ခွဲစမ်းသပ် ချက် ရလဒ်များကို သက်ရောက်မှုဆန်းစစ်ရာတွင် ထည့်သွင်းစဉ်းစားပြီး ပိုမိုကောင်းမွန်သော ထိန်းချုပ်မှုများကို လိုအပ်သလို ဆောင်ရွက်နိုင်စေရန်။	ရေနမူနာအား အောက်ဖော်ပြပါ နေရာ (၃) နေရာတွင် ကောက်ယူခဲ့ပြီး ဓာတ်ခွဲစမ်းသပ်မှုများ ဆောင်ရွက်ခဲ့ပါသည်။ (i) MSS-1 (အနည်ထိုင်ကန်), (ii) MSS-2 (အအေးခံကန်) နှင့် (iii) MSS-3 (မြေသားမြောင်း)	ရေနမူနာကောက်ယူသော နေရာ (၃) နေရာရှိ စုစုပေါင်း ပါရာမီတာ (၁၆) ခုမှ ဖော်ပြပါ ပါရာမီတာ (၃) ခု - အာဆင်းနစ် (As) ၊ ဓာတုဆိုင်ရာအောက်စီဂျင် လိုအပ်ချက် (COD) နှင့် ဆိုင်းကြွေအနည် (TSS) တန်ဖိုးများမှာ NEQG သတ်မှတ်တန်ဖိုးများထက် ကျော်လွန်လျက် ရှိကြောင်း တွေ့ရှိရပါသည်။ MSS – 2 နေရာရှိ စွန့်ထုတ်ရေ၏ အပူချိန်မှာ အခြား နေရာများထက်ပိုမိုများပြားလျက် ရှိကြောင်း တွေ့ရှိရပါသည်။ MSS – 3 နေရာရှိ စွန့်ထုတ်ရေတွင် ပါဝင်သော အာဆင်းနစ် ပမာဏမှာ သတ်မှတ်တန်ဖိုးထက်

တိုင်းတာသည့် အရာ	ရည်ရွယ်ချက်	တိုင်းတာသည့်နေရာ	ရလဒ် အကျဉ်းချုပ်
			ဆယ်ဆခန့်များပြားလျက်ရှိကြောင်း တွေ့ရှိရပြီး ၎င်းမှာ မီးဖိုမှထွက်ရှိသော ပစ်စာများကို အနီးရှိ မြေကွက်လပ်တွင် မြေဖို့ခြင်းကြောင့် ဖြစ်နိုင်ကြောင်း စိစစ်တွေ့ရှိရပါသည်။
ဆူညံသံ	လုပ်ငန်းခွင်နှင့် စက်ရုံပတ်ပတ်လည်ရှိ ဆူညံသံ အခြေအနေ အား စစ်ဆေးရန် နှင့် ၎င်း ရလဒ်များကိုသက်ရောက်မှုဆန်းစစ်ရာတွင် ထည့်သွင်းစဉ်းစားပြီး ပိုမိုကောင်းမွန်သော ထိန်းချုပ်မှုများကို လိုအပ်သလို ဆောင်ရွက်နိုင်စေရန်။	ဆူညံသံအား မြန်မာရှင်းရှင်းစက်ရုံ အတွင်းနှင့် ပတ်ပတ်လည် တို့တွင် တိုင်းတာမှုများ ဆောင်ရွက်ခဲ့ပါသည်။ (i) စက်ရုံပတ်ပတ်လည် တိုင်းတာမှု - ၁၂ နေရာ (ii) စက်ရုံတွင်းတိုင်းတာမှု - ၁၁ နေရာ	စက်ရုံပတ်ပတ်လည်ဆူညံသံ တိုင်းတာချက်ရလဒ်များမှာ NEQG ၏ စက်ရုံ၊ အလုပ်ရုံအတွက် သတ်မှတ်တန်ဖိုး (၇၀ dB(A)) အတွင်းတွင် ရှိကြောင်း တွေ့ရှိရပါသည်။ စက်ရုံအတွင်းတိုင်းတာမှုရလဒ်များတွင် (၄) နေရာသည် IFC မှ အကြီးစားစက်မှုလုပ်ငန်းများ အတွက် သတ်မှတ်ထားသည့် (၈၅ dB(A)) ထက် ကျော်လွန်နေကြောင်း တွေ့ရှိရပါသည်။ ကျော်လွန်နေသည့်နေရာများမှာ ကျောက်မီးသွေးကြိတ်ခွဲစက်နှင့် လေမှုတ်စက်များ အနီးတွင် ဖြစ်ကြောင်း တွေ့ရှိရပါသည်။

၁၇။ သက်ရောက်မှုနှင့် အန္တရာယ်ဖြစ်နိုင်ခြေ ဆန်းစစ်ချက် အကျဉ်းချုပ်

ဖြစ်ပေါ်နိုင်ခြေရှိသော သက်ရောက်မှုများအား ဖော်ထုတ်သည့်အခါ အဓိကအားဖြင့် သိပ္ပံနည်းကျ အထောက်အထားများ၊ ကွင်းဆင်းလေ့လာမှုရလဒ်များ၊ သုတေသနစာတမ်းများ၊ ဒေသတွင်းနှင့် နိုင်ငံတကာလမ်းညွှန်ချက်များနှင့် EnvO အဖွဲ့မှ အတွေ့အကြုံရှိ ကျွမ်းကျင်ပညာရှင်များ၏ ပညာရပ်ပိုင်းဆိုင်ရာသုံးသပ်မှုများအပေါ် အခြေခံ၍ ဆန်းစစ်ဖော်ထုတ်ခဲ့ပါသည်။ သက်ရောက်မှုများကို အဆင့်သတ်မှတ်ရာတွင် (မပြောပလောက်၊ အနည်းငယ်၊ အသင့်အတင့်၊ အဓိက) စသည်ဖြင့် အဆင့်ခွဲ၍ အကဲဖြတ်သတ်မှတ်ပါသည်။ ဘေးအန္တရာယ်ဖြစ်နိုင်ခြေများကို ၎င်းတို့၏ ဖြစ်နိုင်ခြေနှင့် အကျိုးဆက်ပေါ် အခြေခံ၍ ဆန်းစစ်အကဲဖြတ်၍ ဘေးအန္တရာယ်အမျိုးအစားတစ်ခုချင်းစီကို (နည်း၊ အသင့်အတင့်၊ မြင့်၊ အလွန်မြင့်မား) ဟူ၍ သတ်မှတ်ပါသည်။ အောက်ဖော်ပြပါ ဇယားတွင် ဆိုးကျိုးသက်ရောက်မှုတစ်ခုချင်းစီအား ဆန်းစစ်ချက်ရလဒ်များနှင့် လျှော့ပါးစေရေးနည်းလမ်းများကိုအသုံးပြု၍ မည်မျှထိန်းချုပ်လျှော့ချနိုင်ကြောင်း တွေ့ရှိနိုင်ပါသည်။ ထို့အပြင် ထိန်းချုပ် ဆောင်ရွက်ရာတွင် လိုအပ်သော စီမံချက်အခွဲများနှင့် နောက်ဆုံးကျန်ရစ်မည့် ကြွင်းကျန်သက်ရောက်မှုများ၏ အဆင့်ပမာဏများကိုလည်း ဖော်ပြထားသည်။

ဇယား (၆) - သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ အကောင်အထည်မဖော်မီနှင့် ဖော်ပြီးနောက် သက်ရောက်မှုများ၏ အဆင့်သတ်မှတ်ချက်

သက်ရောက်မှု အမျိုးအစား	စီမံကိန်းဆောင်ရွက်ချက်များ	သက်ရောက်မှု အဆင့်	လျော့ပါးစေရေး နည်းလမ်းများ (EMP)	MSS ရှိထိန်းချုပ်ရေး နည်းလမ်းများ	အဆိုပြု စီမံချက်အခွဲများ	ကြွင်းကျန် သက်ရောက်မှု၏ အဆင့်
လေထုညစ်ညမ်းမှု	မီးဖုတ်သည့် မီးဖိုနှင့် အရည်ကျိုဖိုများလည်ပတ်ခြင်း	အဓိက	EMP ၏ အဓိကလျော့ပါးစေရေးနည်းလမ်းများကို နောက်တွင် ဖော်ပြထားသည်။ အသေးစိတ်အစီအစဉ်များကို IEE အစီရင်ခံစာတွင် အကျယ်တဝင့် ဖော်ပြထားပါသည်။	အမှုန်စစ်ဇကာ အိတ် အိမ်များနှင့် အခိုးအငွေ့ ရေဖြန်းသန့်စင်စနစ် (Wet Scrubber)	အခိုးအငွေ့ ရေဖြန်းသန့်စင်စနစ် (Wet Scrubber) လည်ပတ်ခြင်းဆိုင်ရာ စံလုပ်ထုံးလုပ်နည်း	အသင့်အတင့်
အစိုင်အခဲစွန့်ပစ္စည်း (အန္တရာယ်ရှိသောနှင့် အန္တရာယ်မရှိသော)	မီးဖုတ်ခြင်း	အဓိက		-	အစိုင်အခဲ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု အစီအစဉ်	အသင့်အတင့်
	အရည်ကျိုခြင်း	အဓိက				အသင့်အတင့်
	အခိုးအငွေ့ ရေဖြန်းသန့်စင်စနစ် (Wet Scrubber) လည်ပတ်ခြင်း	အသင့်အတင့်				အနည်းငယ်
	အနည်ထိုင်ခြင်း	အနည်းငယ်				မပြောပလောက်
	အခြားလုပ်ငန်းများ	အနည်းငယ်				မပြောပလောက်
ရေထုညစ်ညမ်းခြင်း (စွန့်ပစ်ရေ)	ဓာတ်ငွေ့အအေးခံစနစ်	အသင့်အတင့်		အနည်ထိုင်ကန်များနှင့် အအေးခံကန်များ	-	အနည်းငယ်
	အမှုန်စစ်ဇကာအိတ်များ ဆေးကြောခြင်း	အနည်းငယ်				အနည်းငယ်
	အခိုးအငွေ့ ရေဖြန်းသန့်စင်စနစ် (Wet Scrubber) လည်ပတ်ခြင်း	အသင့်အတင့်				အနည်းငယ်
	အသေးစားဓာတ်ခွဲစမ်းသပ်ခန်း	မပြောပလောက်				မပြောပလောက်
မြေထုညစ်ညမ်းခြင်း	စီမံကိန်းဧရိယာအတွင်း စွန့်ပစ်ပစ္စည်းများ စုပုံထားခြင်း	အသင့်အတင့်		-	အစိုင်အခဲ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု အစီအစဉ်	အနည်းငယ်
	ကုန်ကြမ်းနှင့် လောင်စာဆီများ သိုလှောင်ခြင်း၊ အသုံးပြုခြင်း	အနည်းငယ်				အနည်းငယ်
	ပစ်စာများဖြင့် မြေဖို့ခြင်း	အဓိက				အသင့်အတင့်
ဆူညံသံ*	လုပ်ငန်းလည်ပတ်ခြင်း၊ လေမှုတ်စက်များ လည်ပတ်ခြင်းနှင့် စက်ယန္တရားများ မောင်းနှင်ခြင်း	မပြောပလောက်		-	-	မပြောပလောက်

သက်ရောက်မှု အမျိုးအစား	စီမံကိန်းဆောင်ရွက်ချက်များ	သက်ရောက်မှု အဆင့်	လျော့ပါးစေရေး နည်းလမ်းများ (EMP)	MSS ရှိထိန်းချုပ်ရေး နည်းလမ်းများ	အဆိုပြု စီမံချက်အခွဲများ	ကြွင်းကျန် သက်ရောက်မှု၏ အဆင့်
အနံ့	မီးဖုတ်ခြင်းနှင့် အရည်ကျိုခြင်းလုပ်ငန်းများ	အသင့်အတင့်		-	ထိခိုက်နစ်နာမှု ဖြေရှင်းခြင်း ယန္တရား	အနည်းငယ်
ဒေသတွင်းအရင်းအမြစ်များ*	အတ္တရံမြစ်မှ ရေရယူသုံးစွဲခြင်း	မပြောပလောက်		-	-	မပြောပလောက်
ဒေသခံလူထု၏ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေး	မီးဖုတ်ခြင်းနှင့် အရည်ကျိုခြင်းလုပ်ငန်းများ	အသင့်အတင့်		-	ထိခိုက်နစ်နာမှု ဖြေရှင်းခြင်း ယန္တရား	အနည်းငယ်

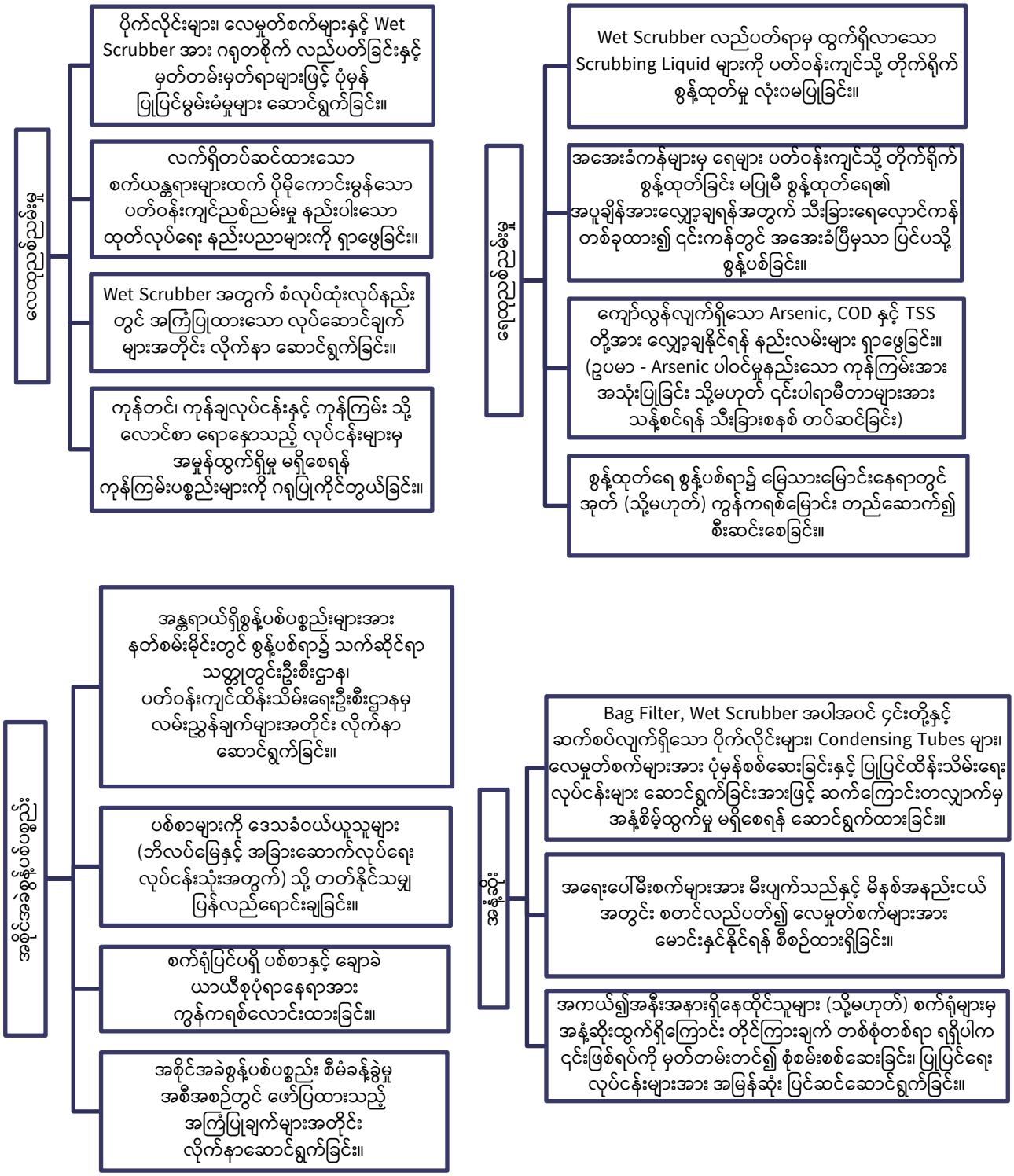
မှတ်ချက်။ * ဤသက်ရောက်မှုများသည် မပြောပလောက်သောကြောင့် သက်ရောက်မှုကို ထပ်မံလျှော့ချရန်အတွက် လျော့ပါးစေမည့် နည်းလမ်းများ မလိုအပ်ပါ။

ဇယား (၇) - လျော့ပါးသက်သာစေရေးနည်းလမ်းများ မဆောင်ရွက်မီနှင့် ဆောင်ရွက်ပြီး ဘေးအန္တရာယ်ဆန်းစစ်ခြင်း အဆင့်သတ်မှတ်ချက်

ဘေးအန္တရာယ်များ	ဘေးအန္တရာယ်များ၏ ရင်းမြစ်	သက်ရောက်မှု အဆင့်	လျော့ပါးစေရေး နည်းလမ်းများ (EMP)	MSS ရှိထိန်းချုပ်ရေး နည်းလမ်းများ	အဆိုပြု စီမံချက်အခွဲများ	ကြွင်းကျန် သက်ရောက်မှု၏ အဆင့်
လုပ်ငန်းခွင်ဆိုင်ရာ ဘေးအန္တရာယ်များ (စက်ရုံလည်ပတ်မှုပိုင်းဆိုင်ရာ)	လုပ်ငန်းခွင်လေထုအရည်အသွေး	အလွန်မြင့်မား	-	EMP ၏ အဓိကလျော့ပါးစေရေးနည်းလမ်းများကို နောက်တွင် ဖော်ပြထားသည်။ အသေးစိတ်အစီအစဉ်များကို IEE အစီရင်ခံစာ၏ အပိုဒ်ခွဲ ၈.၃ တွင် အကျယ်တဝင့် ဖော်ပြထားပါသည်။	လုပ်ငန်းခွင်ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေးအစီအစဉ်	အသင့်အတင့်
	အပူနှင့်ထိတွေ့မှု	မြင့်				အသင့်အတင့်
	ဓာတုပစ္စည်းများနှင့်ထိတွေ့မှု	မြင့်				နည်း
	လုပ်ငန်းခွင်ဆူညံသံ	မြင့်				နည်း
	ရုပ်ပိုင်းဆိုင်ရာဘေးအန္တရာယ်များ	မြင့်				နည်း
	ကူးစက်တတ်သောရောဂါများ	မြင့်				အသင့်အတင့်
အရေးပေါ်ဘေးအန္တရာယ်များ	မီးလောင်မှု	မြင့်	-		အရေးပေါ်အခြေအနေ တုံ့ပြန်မှုအစီအစဉ်	အသင့်အတင့်
	ပေါက်ကွဲမှု	မြင့်				အသင့်အတင့်
သဘာဝဘေးအန္တရာယ်များ	ရေကြီးမှု	မြင့်	-		အရေးပေါ်အခြေအနေ တုံ့ပြန်မှုအစီအစဉ်	အသင့်အတင့်
	ငလျင်	နည်း				နည်း

၁၈။ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်နှင့် စီမံချက်အခွဲများ

စီမံကိန်းအဆိုပြုသူမှ လိုက်နာဆောင်ရွက်သွားရမည့် သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများကို ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ် (EMP) တွင် ဖော်ပြထားပါသည်။ ဖော်ထုတ်ထားသော သက်ရောက်မှုနှင့် ဘေးအန္တရာယ်များအတွက် အဓိက လျော့ပါးစေရေးနည်းလမ်းများကို အောက်ပါပုံများတွင် ဖော်ပြထားပါသည်။ (လျော့ပါးစေရေးနည်းလမ်းများ အပြည့်အစုံကို IEE အစီရင်ခံစာ အပိုဒ်ခွဲ ၈.၂ နှင့် ၈.၃ တို့တွင် အသေးစိတ်ဖော်ပြထားပါသည်။)



မြေထည်စည်းခြင်း

- စွန့်ပစ်ပစ္စည်းများအား မြေပေါ်တွင် တိုက်ရိုက်စုပုံမှုအား ရှောင်ရှားခြင်း။
- လောင်စာဆီနှင့် ဓာတ်တုပစ္စည်း များအား ဖိတ်စင်ခြင်း၊ ယိုစိမ့်ခြင်းများ မရှိစေရန် စနစ်တကျ ကိုင်တွယ်ခြင်း၊ သိုလှောင်ခြင်းနှင့် ပုံးခွံများအား သေချာစွာ စွန့်ပစ်ခြင်း။
- အကယ်၍ ယိုစမ့်ခြင်းဖြစ်ပါက အရေးပေါ် တုန့်ပြန်ရေးစီမံချက်တွင် ဖော်ပြ ထားသည့်အတိုင်း သန့်ရှင်းရေး လုပ်ငန်းများအား ချက်ချင်းဆောင်ရွက်ခြင်း။

အများပြည်သူ၏ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး

- အနီးပတ်ဝန်းကျင်ရှိ ဒေသခံလူထုအကြား ပြည်သူ့ကျန်းမာရေးဆိုင်ရာကိစ္စရပ်များ ရှိ၊ မရှိ ဂရုပြုရန် နှင့် လိုအပ်ပါက ပြင်ပမှ ပညာရှင်၏ အကူအညီရယူ၍ ဖော်ထုတ်ဆောင်ရွက်ရန်။
- အနှံ့ဆိုးနှင့် အခြားသက်ရောက်မှုများအတွက် ဒေသခံများထံမှ တိုင်ကြားချက်များအား လက်ခံနိုင်ရန် "မကျေနပ်ချက် တိုင်ကြားဖြေရှင်းခြင်း အစီအစဉ်" အား ဆောင်ရွက်သွားရန်။

လုပ်ငန်းခွင် လေအရည်အသွေး

- မီးဖိုများစတင်ချိန်တွင် ဖိုတံခါးများ ကို ဖွင့်ခြင်းအားရှောင်ရှားရန်နှင့် တတ်နိုင်သလောက် ပိတ်ထားခြင်း။
- မီးဖိုအနီးနှင့် ကျောက်မီးသွေးကြိတ်ရာ နေရာ အနီးရှိ အလုပ်သမားများအား နှာခေါင်းစည်းများ ဝတ်ဆင်စေခြင်း။
- သက်ဆိုင်ရာလုပ်ငန်းခွင်တွင် နှာခေါင်းစည်း အသုံးပြုရန် သတိပေးဆိုင်းဘုတ်အား ချိတ်ဆွဲထားခြင်း။
- တစ်ကိုယ်ရည်သုံးကာကွယ်ရေးပစ္စည်းများ အသုံးပြုခြင်းနှင့် ပတ်သက်သည့် သင်တန်းများ ပေးခြင်း။
- အန္တရာယ်ရှိသော လုပ်ငန်းခွင်နေရာများအား အဝင်အထွက်ကန့်သတ်ထားခြင်း။

အပူနှင့်ထိတွေ့မှု

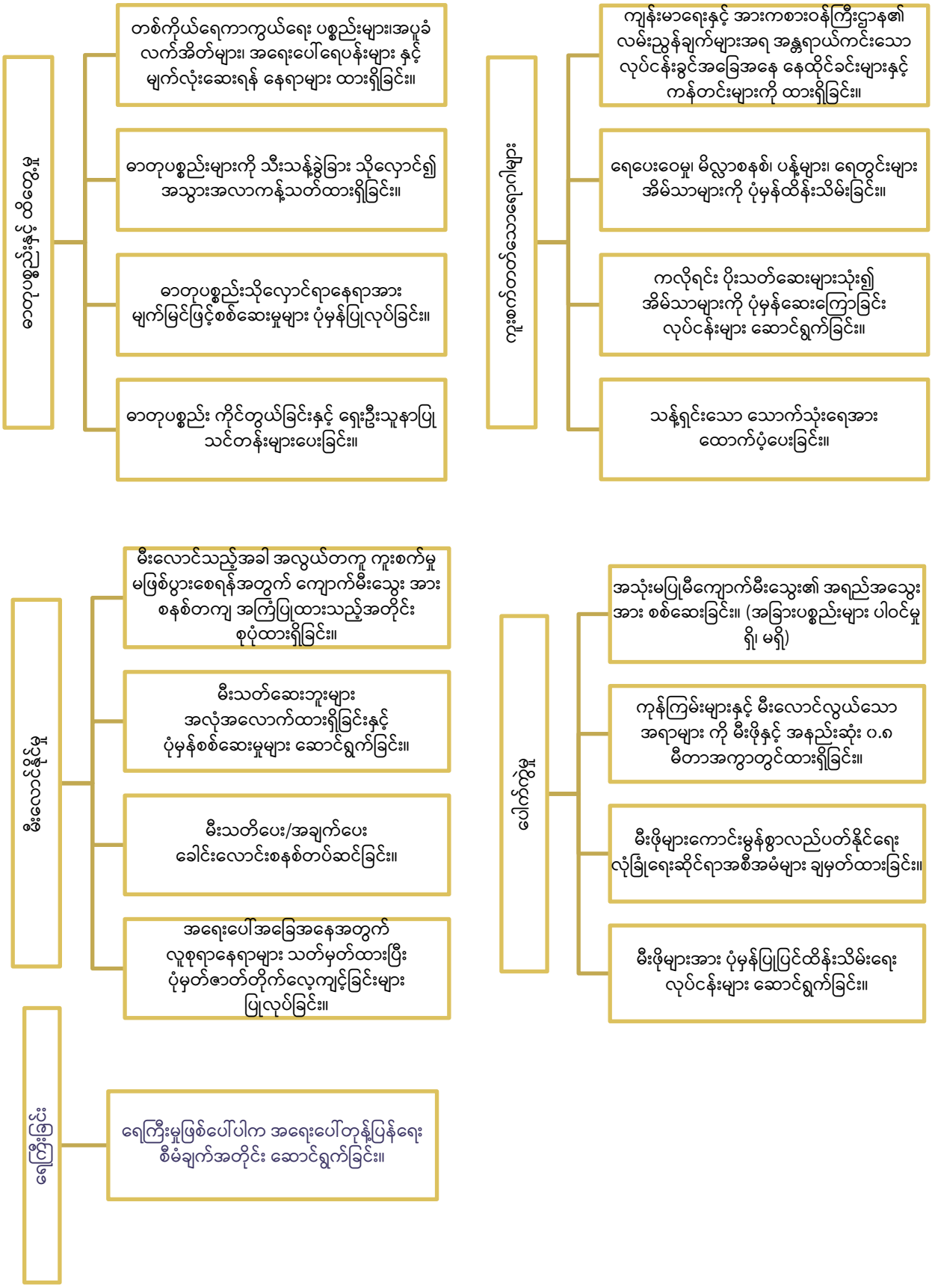
- ကောင်းမွန်သော လေဝင်လေထွက်ရရှိစေခြင်း၊ သောက်သုံးရေနှင့် ဓာတ်ဆားများ၊ အပူကာလက်အိတ်များကို လုံလောက်စွာ ထားရှိခြင်း။
- နေ့တနေ့အတွက် လုံလောက်သော အနားယူချိန်များ သတ်မှတ်ထားရှိခြင်း။
- အလုပ်သမားများအား မီးဖိုမှ ၁.၅ - ၂ မီတာ အကွာအဝးတွင် အလုပ်လုပ်စေခြင်း။
- ပစ်စာ/ချော်ခဲများ စွန့်ပစ်သည့်လမ်းကြောင်းနှင့် နောက်ဆုံးစွန့်ပစ်သည့်နေရာကို စနစ်တကျသတ်မှတ်ထားခြင်း။

ရုပ်ပိုင်းဆိုင်ရာ ဘေးအန္တရာယ်များ

- စက်ရုံသန့်ရှင်းရေးလုပ်ငန်းများအား ပုံမှန်ဆောင်ရွက်ခြင်း။
- ကုန်ကြမ်းပစ္စည်းများ၊ ထုတ်ကုန်များ၊ By-Products များအား စနစ်တကျ သိုလှောင်ထားရှိခြင်း။
- လေ့ကျင့်ထားသော ယာဉ်မောင်းများကိုသာ လုပ်ငန်းသုံး ယာဉ်များ မောင်းနှင်စေခြင်း။
- အထွေထွေ ဘေးအန္တရာယ်ကင်းရှင်းရေး သင်တန်းများပေးခြင်း။

ဆူညံသံ

- ဆူညံသံထွက်ရှိရာ နေရာများမှ ၃ မီတာ အကွာအဝေးလိုင်းများ တားထားခြင်းဖြင့် ၃ မီတာအကွာမှ အလုပ်လုပ်စေခြင်း။
- ဆူညံသံထွက်ရှိရာ နေရာများတွင် သတိပေးဆိုင်းဘုတ် ထားရှိခြင်း။
- အအေးခံ လေပန်ကာများထားရှိရာတွင် ဆူညံသံထွက်ရှိရာနေရာမှ အနည်းဆုံး ၃ မီတာအကွာတွင် ထားရှိခြင်း။
- လေမှုတ်စက်များ၊ ကြိတ်ခွဲစက်များ၊ မီးစက်များအား ပုံမှန်ဆေးကြော၊ ပြုပြင်မှုများ ဆောင်ရွက်ထားရှိခြင်း။



ပုံ (၈) - သက်ရောက်မှုနှင့် ဘေးအန္တရာယ်ဖြစ်နိုင်မှုတို့အတွက် အဓိက လျော့ပါးစေရေး နည်းလမ်းများ

၎င်းအပြင် နေ့စဉ်လည်ပတ်ရာတွင် တိကျသော လမ်းညွှန်ချက်များ ပေးနိုင်ရန်နှင့် သိသာထင်ရှားသော သက်ရောက်မှုများအား ပိုမိုထိရောက်စွာ နည်းစနစ်တကျ လျှော့ချခြင်းဖြင့် စက်ရုံ၏ ပတ်ဝန်းကျင်ဆိုင်ရာ လုပ်ဆောင်ချက်များကို တိုးမြှင့်ဖော်ဆောင်နိုင်ရန်အတွက် ပတ်ဝန်းကျင်နှင့် လူမှုဆိုင်ရာ စီမံချက်အခွဲများကို ပြင်ဆင်ရေးဆွဲထားပြီး ဖြစ်ပါသည်။ ထိုစီမံချက်အခွဲများ အကြောင်းအား အောက်ပါဇယားတွင် အကျဉ်းချုံးဖော်ပြထားပါသည်။

ဇယား (၈) စီမံချက်အခွဲများအကြောင်း အကျဉ်းချုံးဖော်ပြချက်များ

စီမံချက်အခွဲများ	အဓိကရည်ရွယ်ချက်နှင့် မာတိကာ အကျဉ်း	IEE အစီရင်ခံစာ ရည်ညွှန်း
အခိုးအငွေ့ရေဖြန်းသန့်စင်စနစ်အတွက် စံလုပ်ထုံးလုပ်နည်းများ (Standard Operating Procedures for Wet Scrubber)	ဤစီမံချက်သည် မြန်မာရှင်းရှင်းစက်ရုံရှိ စက်ယန္တရားမောင်းနှင်သူများအား Wet Scrubber ၏ လုပ်ဆောင်ချက်ကို မြန်မြန်ဆန်ဆန် အကဲဖြတ်နိုင်ရန်နှင့် ထုတ်လွှတ်မှုများ ဖြစ်ပေါ်ပါက အချိန်မီပြုပြင်ဆောင်ရွက်နိုင်စေရန် ရည်ရွယ်ချက်ဖြင့် ရေးဆွဲထားခြင်းဖြစ်ပါသည်။ ၎င်းသည် မြန်မာရှင်းရှင်းတွင်အသုံးပြုသည့် သမရိုးကျ Wet Scrubber အမျိုးအစားအတွက် သင့်တော်မှုရှိပြီး စက်ယန္တရားမောင်းနှင်သူမှ အမြင်အရသော်လည်းကောင်း၊ ရိုးရှင်းသော ပစ္စည်း (pH မီတာ/ လစ်တမတ်စက္ကူ) များ အသုံးပြု၍ သော်လည်းကောင်း လွယ်ကူစွာ စစ်ဆေးနိုင်မည် ဖြစ်ပါသည်။ စံလုပ်ထုံးလုပ်နည်းများတွင် ပါဝင်သော မာတိကာမှာ အောက်ပါအတိုင်းဖြစ်သည်။ ၁။ လုပ်ငန်းလည်ပတ်ရာတွင် အဓိကလိုအပ်ချက်များ (က) ဆိုဒါအက်ရှ်ပမာဏ ခန့်မှန်းတွက်ချက်ခြင်း (ခ) Scrubbing Liquid ၏ pH ပမာဏ ၂။ စောင့်ကြပ်ကြည့်ရှုရမည့် အချက်များ (က) Scrubbing Liquid ၏ pH ပမာဏအား စောင့်ကြပ်ကြည့်ရှုခြင်း (မှတ်တမ်းပုံစံဖြင့်) (ခ) ခေါင်းတိုင်မှထွက်သော မီးခိုးသိပ်သည်းဆအား စောင့်ကြပ်ကြည့်ရှုခြင်း (မှတ်တမ်းပုံစံဖြင့်) ၃။ မှတ်တမ်းသိမ်းဆည်းခြင်း (နေ့စဉ်နှင့် လစဉ်မှတ်တမ်း)	နောက်ဆက်တွဲ (၅)
အစိုင်အခဲ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု အစီအစဉ် (Solid Waste Management Plan)	ဤအစီအစဉ်သည် မြန်မာရှင်းရှင်းစက်ရုံမှ ထွက်ရှိသော အစိုင်အခဲ စွန့်ပစ်ပစ္စည်းများ၊ အထူးသဖြင့် အန္တရာယ်ရှိသော စွန့်ပစ်ပစ္စည်းများ ကို စနစ်တကျစီမံခန့်ခွဲနိုင်စေရန် ရည်ရွယ်ချက်ဖြင့် ရေးဆွဲထားခြင်းဖြစ်ပါသည်။ ထို့အပြင် စွန့်ပစ်ပစ္စည်းများအား စုဆောင်းခြင်း၊ ကိုင်တွယ်ခြင်း၊ သိမ်းဆည်းခြင်းနှင့် စွန့်ပစ်ခြင်းလုပ်ငန်းများတွင် ကောင်းမွန်စွာ ဆောင်ရွက်နိုင်စေရန် ထပ်မံဆောင်ရွက်ရမည့် လုပ်ငန်းများကို ရေးဆွဲဖော်ပြထားပါသည်။ ထို့အပြင် စောင့်ကြပ်ကြည့်ရှုမှုဆိုင်ရာ လုပ်ငန်းများနှင့် မှတ်တမ်းတင်ထားရမည့် မှတ်တမ်းပုံစံများကိုလည်း ရေးဆွဲဖော်ပြထားပါသည်။ ၎င်းတွင် - ၁။ ရည်ရွယ်ချက်နှင့် နယ်ပယ် ၂။ တာဝန်ရှိအဖွဲ့ ၃။ စက်ရုံထွက်နှင့် မီးဖိုချောင်ထွက်စွန့်ပစ်ပစ္စည်းများ စီမံခန့်ခွဲခြင်း (က) စက်ရုံထွက်စွန့်ပစ်ပစ္စည်းများ	နောက်ဆက်တွဲ (၉-က)

စီမံချက်အခွဲများ	အဓိကရည်ရွယ်ချက်နှင့် မာတိကာ အကျဉ်း	IEE အစီရင်ခံစာ ရည်ညွှန်း
	i. မီးဖုတ်ဖိုနှင့် အရည်ကျိုဖိုမှထွက်ရှိလာသည့် ပစ်စာနှင့် ချော်ခဲများ ii. Wet Scrubber နှင့် အနည်ထိုင်ကန်များမှ အနယ်အနှစ်များ iii. ဓာတုပစ္စည်းပုံးခွံအဟောင်းများ iv. အသုံးပြုပြီးသော စက်ယန္တရား အစိတ်အပိုင်းများ (ခ) မီးဖိုချောင်ထွက်စွန့်ပစ်ပစ္စည်းများ (ဂ) စောင့်ကြပ်ကြည့်ရှုရန် လိုအပ်သော စာရွက်စာတမ်းများ (ဃ) စွန့်ပစ်ပစ္စည်းထွက်ရှိမှု မှတ်တမ်းပုံစံ (c) ပစ်စာ/ချော်ခဲထွက်ရှိမှု မှတ်တမ်းပုံစံ (စ) စွန့်ပစ်ပစ္စည်းစွန့်ပစ်မှု မှတ်တမ်းပုံစံ တို့ပါဝင်ပါသည်။	
လုပ်ငန်းခွင် ကျန်းမာရေး နှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေး စီမံချက် (Occupational Health and Safety Plan)	ဤစီမံချက်သည် မြန်မာရှင်းရှင်းစက်ရုံတွင် အလုပ်လုပ်ကိုင်လျက်ရှိသည့် အလုပ်သမားများအပေါ် ဘေးအန္တရာယ်ဖြစ်ပွားမှုများကို လျှော့ချနိုင်ရန်နှင့် လုပ်ငန်းခွင်ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေး ဆောင်ရွက်ချက်များ ပိုမိုကောင်းမွန်စွာ လုပ်ဆောင်နိုင်စေရန် ရည်ရွယ်ပါသည်။ ၎င်းသည် IEE အစီရင်ခံစာ အခန်း (၆) တွင် ဆန်းစစ်ဖော်ထုတ်ထားသော (၁) လုပ်ငန်းခွင် လေအရည်အသွေး (၂) အပူနှင့်ထိတွေ့မှု (၃) ဓာတုပစ္စည်းနှင့်ထိတွေ့မှု (၄) ဆူညံသံ (၅) ရုပ်ပိုင်းဆိုင်ရာ ဘေးအန္တရာယ်များနှင့် (၆) ကူးစက်တက်သော ရောဂါများ စသည့် လုပ်ငန်းခွင်ဆိုင်ရာ ဘေးအန္တရာယ်များအား ထည့်သွင်းစဉ်းစားထားပါသည်။ စီမံချက်တွင် - ၁။ မြန်မာရှင်းရှင်းစက်ရုံ၏ လုပ်ငန်းခွင်ဘေးအန္တရာယ်ကင်းရှင်းရေး မူဝါဒ ၂။ မြန်မာရှင်းရှင်းစက်ရုံ၏ လက်ရှိ ဘေးအန္တရာယ်ကင်းရှင်းရေး ဆောင်ရွက်ချက်များ ၃။ လုပ်ငန်းခွင်ကျန်းမာရေးနှင့်ဘေးအန္တရာယ်ကင်းရှင်းရေးအဖွဲ့ ဖွဲ့စည်းပုံ ၄။ လုပ်ငန်းခွင်ကျန်းမာရေးနှင့်ဘေးအန္တရာယ်ကင်းရှင်းရေး စီမံခန့်ခွဲမှု လုပ်ငန်းများ ၅။ လုပ်ငန်းခွင်ကျန်းမာရေးနှင်ဘေးအန္တရာယ်ကင်းရှင်းရေးဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုမှု အစီအစဉ်များ ၆။ အကောင်အထည်ဖော်ဆောင်ရွက်မည့် အစီအစဉ်များ (က) စည်းကမ်းတကျဆောင်ရွက်မည့် အစီအစဉ်များ (ခ) အထွေထွေဘေးအန္တရာယ်ကင်းရှင်းရေးသင်တန်း (ဂ) ရေးဦးသူနာပြုသင်တန်း (ဃ) လုပ်ငန်းခွင်ဘေးအန္တရာယ်များအပေါ် တုန့်ပြန်ဆောင်ရွက်ခြင်း။ (c) မှတ်တမ်းပုံစံများ i. မတော်တဆမှု မှတ်တမ်းပုံစံ ii. ဖျားနာမှုမှတ်တမ်းပုံစံ (စ) Covid – 19 ကမ္ဘာ့ကပ်ရောဂါအား ကာကွယ်ရန် အစီအစဉ်များ	နောက်ဆက်တွဲ (၉-ခ)

စီမံချက်အခွဲများ	အဓိကရည်ရွယ်ချက်နှင့် မာတိကာ အကျဉ်း	IEE အစီရင်ခံစာ ရည်ညွှန်း
အရေးပေါ်တုန့်ပြန်ရေးစီမံချက် (Emergency Response Plan)	ဤစီမံချက်သည် ရုတ်တရက် သို့မဟုတ် သဘာဝဘေးအန္တရာယ် အပါအဝင် မျှော်လင့်မထားသော အရေးပေါ်အခြေအနေများ ပေါ်ပေါက်လာချိန်တွင် လူသားများအပေါ် ထိခိုက်မှုများအား လျှော့ချနိုင်ရန် ရည်ရွယ်ချက်ဖြင့် ရေးဆွဲထားခြင်းဖြစ်ပါသည်။ ထို့အပြင် အရေးပေါ်ကိစ္စတစ်စုံတစ်ရာဖြစ်ပါက ဆက်သွယ်ရမည့် ဖုန်းနံပါတ်များနှင့် တုန့်ပြန်ဆောင်ရွက်ချက်များကိုလည်း ထည့်သွင်းရေးဆွဲထားပါသည်။ စီမံချက်တွင် အရေးပေါ်တုန့်ပြန်မှုအဖွဲ့အတွက် စီမံခန့်ခွဲမှုကိစ္စရပ်များ အပါအဝင် အရေးပေါ်ကိစ္စ တစ်စုံတစ်ရာ ပေါ်ပေါက်လာပါက ကနဦးတုန့်ပြန်ဆောင်ရွက်ချက်များနှင့် အဖွဲ့ဝင်များ၏ လုပ်ငန်းတာဝန်များကိုလည်း အသေးစိတ် ထည့်သွင်းရေးဆွဲထားပါသည်။ ၎င်းတွင် - ၁။ အရေးပေါ်လုံခြုံရေးအဖွဲ့ဖွဲ့စည်းခြင်း ၂။ အရေးပေါ်လုံခြုံရေးအဖွဲ့ဝင်များ၏ တာဝန်ဝတ္တရားများ ၃။ အရေးပေါ်အခြေအနေများအတွက် တုန့်ပြန်မှု အစီအစဉ်များ (က) မီးဘေးဆိုင်ရာ အရေးပေါ်တုန့်ပြန်မှု (ခ) မီးဖိုပေါက်ကွဲမှုဆိုင်ရာ အရေးပေါ်တုန့်ပြန်မှု (ဂ) ရေဘေးဆိုင်ရာအရေးပေါ်တုန့်ပြန်မှု ၄။ သင်တန်းပေးခြင်း (က) မီးငြိမ်းသတ်ရေး သင်တန်းများ (ခ) ရေးဦးသူနာပြုသင်တန်းများ (ဂ) မီးဘေးအန္တရာယ်ဇာတ်တိုက်လေ့ကျင့်မှုများ ၅။ အရေးပေါ်ဆက်သွယ်ရမည့် လိပ်စာနှင့်ဖုန်းနံပါတ်များ	နောက်ဆက်တွဲ (၉-ဂ)
မကျေနပ်မှု တိုင်ကြားဖြေရှင်းခြင်း အစီအစဉ် (Grievance Redress Mechanism)	ဤအစီအစဉ်သည် စီမံကိန်းအဆိုပြုသူမှ လက်ခံရရှိလာသည့် တိုင်ကြားချက်များကို ပိုမိုစနစ်တကျရှိစွာဖြင့် ကိုင်တွယ်ခြင်း၊ ဖြေရှင်းခြင်းနှင့် မှတ်တမ်းတင်ခြင်းများ လုပ်ဆောင်နိုင်ရန်အတွက် ရေးဆွဲထားခြင်း ဖြစ်ပါသည်။ ၎င်းတွင် အများပြည်သူထံမှ တိုင်ကြားချက်များသာမက အလုပ်သမားများထံမှ တိုင်ကြားချက်များရရှိပါက ဖြေရှင်းဆောင်ရွက်နိုင်မည့် လုပ်ထုံးလုပ်နည်းများလည်း ထည့်သွင်းရေးဆွဲထားပါသည်။ ဤအစီအစဉ်တွင် - ၁။ လက်ရှိတိုင်ကြားချက်များကို စီမံခန့်ခွဲသည့် နည်းလမ်းများ ၂။ မကျေနပ်မှု တိုင်ကြားဖြေရှင်းခြင်း အစီအစဉ် (က) အများပြည်သူအတွက် မကျေနပ်မှုတိုင်ကြားဖြေရှင်းခြင်း (ခ) အလုပ်သမားများအတွက် မကျေနပ်မှုတိုင်ကြားဖြေရှင်းခြင်း ၃။ မကျေနပ်မှုတိုင်ကြားဖြေရှင်းခြင်းအစီအစဉ်အား ထုတ်ပြန်ကြေငြာခြင်း ၄။ မကျေနပ်မှုတိုင်ကြားဖြေရှင်းခြင်းအစီအစဉ် မှတ်တမ်းပုံစံများ (က) အများပြည်သူမှထိခိုက်နစ်နာမှုတိုင်ကြားရန်ပုံစံ (ခ) အများပြည်သူမှထိခိုက်နစ်နာမှုတိုင်ကြားချက်မှတ်တမ်း (ဂ) အလုပ်သမားများမှထိခိုက်နစ်နာမှုတိုင်ကြားရန်ပုံစံ (ဃ) အလုပ်သမားများမှထိခိုက်နစ်နာမှုတိုင်ကြားချက်မှတ်တမ်း	နောက်ဆက်တွဲ (၉-ဃ)

၁၉။ ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုမှု အစီအစဉ် (EMoP)

ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ် (EMP) နှင့် အခြားစီမံချက်အခွဲများအား ထိရောက်စွာဆောင်ရွက်နိုင်မှု ရှိ/ မရှိ နှင့် ကြွင်းကျန်သက်ရောက်မှုများ၏ အခြေအနေအား စိစစ်သုံးသပ်နိုင်ရန်အတွက် ပုံမှန်စောင့်ကြပ်ကြည့်ရှုမှု လုပ်ငန်းများအား ဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။ စောင့်ကြပ်ကြည့်ရှုမှု ရလဒ်များကို အခြေခံ၍ နောင်အနာဂတ်တွင် ပိုမိုထိရောက်ကောင်းမွန်သော ညစ်ညမ်းမှုထိန်းချုပ်စနစ်များ ရရှိနိုင်စေရန် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်နှင့် စီမံချက်အခွဲများအား လိုအပ်သလို မွမ်းမံဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။ အဆိုပါစောင့်ကြပ်ကြည့်ရှုမှု ရလဒ်များကို ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနသို့ စီမံကိန်းအဆိုပြုသူမှ ခြောက်လတစ်ကြိမ် အစီရင်ခံတင်ပြသွားမည့် စောင့်ကြပ်ကြည့်ရှုမှုအစီရင်ခံစာတွင် ထည့်သွင်းဖော်ပြသွားမည် ဖြစ်ပါသည်။ မြန်မာရှင်းရှင်းစက်ရုံ စီမံကိန်းလည်ပတ်နေစဉ်အတွင်း ဆောင်ရွက်သွားမည့် ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုမှုလုပ်ငန်းများအား အောက်ပါဇယားတွင် ထည့်သွင်းဖော်ပြထားပါသည်။

ဇယား (၉) စီမံကိန်းလည်ပတ်စဉ်အတွင်း ဆောင်ရွက်မည့် ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုမှုလုပ်ငန်းများ

အမျိုးအစား	စောင့်ကြပ်ကြည့်ရှုမည့် အရာ	စောင့်ကြပ်ကြည့်ရှုမည့် ပါရာမီတာ	မှတ်တမ်းတင်ရမည့် အချက်အလက်များ	နေရာ	အကြိမ်အရေအတွက်
လေ အရည်အသွေး	ထုတ်လွှတ်အခိုးအငွေ့	SO_2, NO_x (အပိုဒ်၆ ၂.၃.၂ တွင် ဖော်ပြထားသည့် အတိုင်း)	၁။ တိုင်းတာချက်ရလဒ်များ ၂။ လေအရည်အသွေး တိုင်းတာမှု လုပ်ငန်းများ ဆောင်ရွက်နေသည့် ဓာတ်ပုံ မှတ်တမ်းများ ၃။ တိုင်းတာချက်ရလဒ်များ၏ အတက်အကျ ရလဒ်များကို ဖော်ပြထားသော ရုပ်ပုံကားချပ်များနှင့် ဇယားများ	မီးခိုးခေါင်း တိုင်	နှစ်စဉ်
	လုပ်ငန်းခွင် လေအရည်အသွေး	PM 2.5, PM 10 (အဓိက တိုင်းတာရန်) CO, SO_2 (အကယ်၍ အလုပ်လုပ်သည့် ဧရိယာ သည် လေဝင်လေထွက် မကောင်းပါက တိုင်းတာနိုင်သည်။)		လုပ်ငန်းခွင် ဧရိယာ	နှစ်စဉ်
	မီးခိုးသိပ်သည်းဆ	မီးခိုးသိပ်သည်းဆအား အမြင်ဖြင့် စစ်ဆေးခြင်း။	၁။ မီးခိုးသိပ်သည်းဆအား စစ်ဆေးသည့် မှတ်တမ်းပုံစံ (နောက်ဆက်တွဲ - ၅ တွင် ပါရှိပါသည်။)	မီးခိုးခေါင်း တိုင်	လစဉ်
အစိုင်အခဲ စွန့်ပစ်ပစ္စည်း	ပစ်စာတွင် ပါဝင်သော ဓာတုဆိုင်ရာ ပါဝင်နှုန်း	ပစ်စာတွင်ပါဝင်သော အာဆင်းနစ် ပမာဏအား ဓာတ်ခွဲစမ်းသပ်ခြင်း။	၁။ ဓာတ်ခွဲစမ်းသပ်ချက်ရလဒ် (မူရင်းများ) ၂။ ဓာတ်ခွဲစမ်းသပ်သည့် နည်းလမ်းများ ၃၊ ပစ်စာ နမူနာကောက်ယူ နေသည့် ဓာတ်ပုံမှတ်တမ်းများ	ယာယီ စုပုံရာ နေရာ	နှစ်စဉ် (ပစ်စာများ အား မြေဖို့ခြင်း မပြုတော့သည့် အချိန်အထိ)

အမျိုးအစား	စောင့်ကြပ်ကြည့်ရှုမည့် အရာ	စောင့်ကြပ်ကြည့်ရှုမည့် ပါရာမီတာ	မှတ်တမ်းတင်ရမည့် အချက်အလက်များ	နေရာ	အကြိမ် အရေအတွက်
	အစိုင်အခဲစွန့်ပစ်ပစ္စည်း ထိန်းချုပ်မှုနှင့် စီမံခန့်ခွဲမှု	ထွက်ရှိသည့် စွန့်ပစ်ပစ္စည်း အမျိုးအစား အားလုံးအား မှတ်တမ်းတင်ခြင်း။	၁။ နေ့စဉ်နှင့် လစဉ် စွန့်ပစ်ပစ္စည်း ထွက်ရှိမှုနှင့် စွန့်ပစ်မှု မှတ်တမ်းပုံစံ (နောက်ဆက်တွဲ - ၉-က တွင် ပါရှိပါသည်။) ၂။ စွန့်ပစ်ပစ္စည်း သိုလှောင်ထားရှိသည့် အခြေအနေ၊ စွန့်ပစ် သည့် အခြေအနေအား ရိုက်ကူး ထားသော ဓာတ်ပုံမှတ်တမ်းများ	စွန့်ပစ်ပစ္စည်း သိုလှောင်ရာ နေရာ	နေ့စဉ်
		စွန့်ပစ်သည့် ပမာဏနှင့် ပြန်လည်အသုံးပြုသည့် ပမာဏအား မှတ်တမ်းတင်ခြင်း။		စွန့်ပစ်ပစ္စည်း သိုလှောင်ရာ နေရာ	လစဉ်
		စွန့်ပစ်ပစ္စည်း သိုလှောင်သည့် အခြေအနေအား မှတ်တမ်းတင်ခြင်း။		နောက်ဆုံး စွန့်ပစ်သည့် နေရာ	လစဉ်
စွန့်ပစ်ရေ အရည်အသွေး	စွန့်ထုတ်ရေ အရည်အသွေး	အောက်ဖော်ပြပါ ပါရာမီတာ များအား ဓာတ်ခွဲစမ်းသပ်ခြင်း။ ၁။ Aluminum ၂။ Arsenic ၃။ Cadmium ၄။ Chemical Oxygen Demand ၅။ Copper ၆။ Fluoride ၇။ Lead ၈။ Mercury ၉။ Nickel ၁၀။ pH ၁၁။ Oil and Grease ၁၂။ Total Suspended ၁၃။ Solids ၁၄။ Zinc ၁၅။ Total Nitrogen ၁၆။ Total Phosphorus (အပိုဒ်ခွဲ ၂.၃.၃ တွင် ဖော်ပြထားသည့်အတိုင်း)	၁။ ဓာတ်ခွဲစမ်းသပ်ချက်ရလဒ် (မူရင်းများ) ၂။ ဓာတ်ခွဲစမ်းသပ်သည့် နည်းလမ်းများ ၃၊ စွန့်ထုတ်ရေ နမူနာ ကောက်ယူနေသည့် ဓာတ်ပုံမှတ်တမ်းများ ၄။ တိုင်းတာချက်ရလဒ် များအား လမ်းညွှန်ချက်တန်ဖိုး များနှင့် နှိုင်းယှဉ်ဖော်ပြချက် များ	အမှတ် ၁ - နောက်ဆုံး စွန့်ထုတ် သည့် နေရာ အမှတ် ၂ - စွန့်ထုတ်ရေ စီးဝင်သည့် မြောင်း	နှစ်စဉ်
ရေသုံးစွဲမှု	ရေသုံးစွဲသည့် ပမာဏ	ရေသုံးစွဲမှုပမာဏအား မှတ်တမ်းတင်ခြင်း။	၁။ လစဉ်ရေသုံးစွဲမှု မှတ်တမ်းပုံစံ	မြစ်ရေရယူသည့် နေရာ	လစဉ်
မြေထု ညစ်ညမ်းမှု	ယိုဖိတ်မှု ရှိ/မရှိ	ဆီနှင့် ဓာတုပစ္စည်း ယိုစိမ့်မှု ရှိ၊ မရှိအား စစ်ဆေးခြင်း။	၁။ ဆီနှင့် ဓာတုပစ္စည်း ယိုစိမ့်မှု စောင့်ကြည့် မှတ်တမ်းပုံစံ ၂။ ယိုစိမ့်မှုဖြစ်ပွားသည့်နေရာ	အစိုင်အခဲ စွန့်ပစ်ပစ္စည်း သိုလှောင်ရာ ဧရိယာ၊ ဆီ သိုလှောင်	လစဉ်

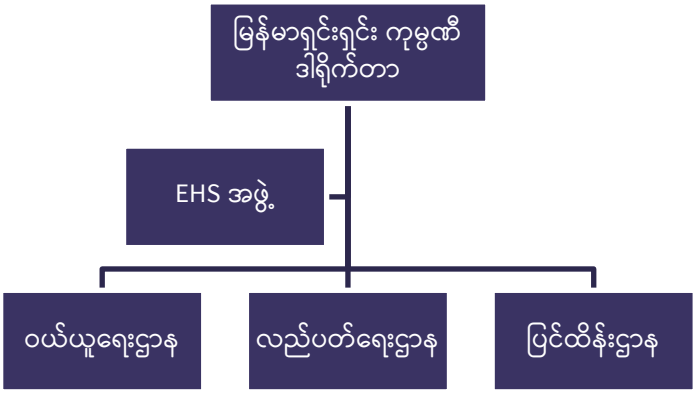
အမျိုးအစား	စောင့်ကြပ်ကြည့်ရှုမည့် အရာ	စောင့်ကြပ်ကြည့်ရှုမည့် ပါရာမီတာ	မှတ်တမ်းတင်ရမည့် အချက်အလက်များ	နေရာ	အကြိမ် အရေအတွက်
			၃။ ဓာတ်ပုံမှတ်တမ်းများ	သည့်ဧရိယာ၊ ဓာတုပစ္စည်း သိုလှောင် သည့် ဧရိယာ	
အနံ့ဆိုး	အနီးပတ်ဝန်းကျင် တွင် အနံ့ဆိုးထွက်ရှိမှု ရှိ/ မရှိ	ပတ္တရောင်လှည့် စစ်ဆေးခြင်း။	၁။ အနံ့ဆိုးထွက်ရှိမှု ရှိ/မရှိ စစ်ဆေးမှု မှတ်တမ်းပုံစံ	စီမံကိန်း အနီး တဝိုက်နှင့် အနီး ပတ်ဝန်းကျင်ရှိ အများ ပြည်သူ နေထိုင်ရာ ဧရိယာများ	လစဉ် နှင့် အများပြည်သူ ထံမှ တိုင်ကြားချက် ရရှိသည့် အခါတိုင်း
လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး	လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး ဆိုင်ရာ ဆောင်ရွက်ချက်များ	အမှုန်စစ်ဧကာအိတ်အိမ် (Bag House) အတွင်း ဝင်ရောက် အလုပ်လုပ်ကိုင်မှုများအား မှတ်တမ်းတင်ခြင်း။	၁။ အလုပ်လုပ်ခွင့် မှတ်တမ်းပုံစံ ၂။ ဓာတ်ပုံမှတ်တမ်းများ	အမှုန်စစ် ဧကာ အိမ်	လိုအပ်သလို
		လုပ်ငန်းခွင်အတွင်း သန့်ရှင်းရေး ဆောင်ရွက်ချက်များ အား မှတ်တမ်းတင်ခြင်း။		လုပ်ငန်းခွင် ဧရိယာ	နေ့စဉ်
		စက်ကိရိယာများ၊ ရေပေးဝေမှုစနစ်၊ မိလ္လာ စနစ်၊ ပန့်များ အစရှိသည့် ပြင်ဆင်မှုလုပ်ငန်း များအား မှတ်တမ်းတင်ခြင်း။	၁။ ပြင်ဆင်မှု ဆောင်ရွက်သည့် နေရာနှင့် ပြင်ဆင်ရသည့် အကြောင်းအရင်းများအား မှတ်တမ်းတင်ခြင်း။ ၂။ ဓာတ်ပုံမှတ်တမ်းများ	သက်ဆိုင်သည့် ဧရိယာ	လုပ်ဆောင်သည့် အချိန်တိုင်း
		ကျန်းမာရေးနှင့် မတော်တဆ ဖြစ်ပွားမှု အခြေအနေများအား မှတ်တမ်းတင်ခြင်း။	၁။ မတော်တဆဖြစ်ပွားမှု မှတ်တမ်းပုံစံ (နောက်ဆက်တွဲ - ၉-ခ တွင် ပါရှိပါသည်။) ၂။ ဖျားနာမှု မှတ်တမ်းပုံစံ (နောက်ဆက်တွဲ - ၉-ခ တွင် ပါရှိပါသည်။)	စီမံကိန်း ဧရိယာ	ဖြစ်ပွားသည့် အချိန်တိုင်း
		လုပ်ငန်းခွင် တိုးတက်မှု အခြေအနေများအား မှတ်တမ်းတင်ခြင်း။	၁။ လုပ်ငန်းခွင်အခြေအနေ တိုးတက်မှု လုပ်ငန်းများ မဆောင်ရွက်မီ အခြေအနေ နှင့် ဆောင်ရွက်ပြီး အခြေအနေအား ရိုက်ကူးထားသည့် မှတ်တမ်း ဓာတ်ပုံများ။	စီမံကိန်း ဧရိယာ	ဆောင်ရွက်သည့် အချိန်တိုင်း

အမျိုးအစား	စောင့်ကြပ်ကြည့်ရှုမည့် အရာ	စောင့်ကြပ်ကြည့်ရှုမည့် ပါရာမီတာ	မှတ်တမ်းတင်ရမည့် အချက်အလက်များ	နေရာ	အကြိမ် အရေအတွက်
		ဝန်ထမ်းများအား သင်တန်းပေးမှု အခြေအနေအား မှတ်တမ်းတင်ခြင်း။	၁။ မှတ်တမ်းဓာတ်ပုံများ။ ၂။ တက်ရောက်သည့် ဝန်ထမ်း အရေအတွက်မှတ်တမ်းများ။	စီမံကိန်း ဧရိယာ	သင်တန်းပေး သည့်အချိန် တိုင်း
		အလုပ်သများများထံမှ တိုင်ကြားချက်များကို မှတ်တမ်းတင်ခြင်း။	၁။ အလုပ်သမားများမှ ထိခိုက် နစ်နာမှု တိုင်ကြားရန် ပုံစံနှင့် မှတ်တမ်းပုံစံများ (နောက်ဆက်တွဲ - ၉-ဃ တွင် ပါရှိပါသည်။)	စီမံကိန်း ဧရိယာ	လိုအပ်သလို
		ကျန်းမာရေး စစ်ဆေးမှု လုပ်ငန်းများကို မှတ်တမ်းတင်ခြင်း။	၁။ အလုပ်သမားအကြား ကူးစက်ရောဂါဖြစ်ပွားမှု အခြေအနေအား မှတ်တမ်းတင်ခြင်း။ ၂။ ကျန်းမာရေးစစ်ဆေးချက် များအား မှတ်တမ်းတင်ခြင်း။	စီမံကိန်း ဧရိယာ	လိုအပ်သလို
ဒေသခံလူထု၏ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး	ဒေသခံလူထု၏ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး ဆိုင်ရာ ဆောင်ရွက်ချက်များ	ဒေသခံပြည်သူများထံမှ သဘောထားမှတ်ချက် များ နှင့် တိုင်ကြားချက် များကို မှတ်တမ်းတင်ခြင်း။	၁။ အများပြည်သူမှ ထိခိုက် နစ်နာမှု တိုင်ကြားရန် ပုံစံနှင့် မှတ်တမ်းပုံစံများ (နောက်ဆက်တွဲ - ၉-ဃ တွင် ပါရှိပါသည်။)	သက်ဆိုင်သည့် ဧရိယာ	လိုအပ်သလို
အခြား လူမှုဆိုင်ရာ စောင့်ကြပ် ကြည့်ရှုမှုများ	ဒေသခံများနှင့် ဆွေးနွေးခြင်း၊ လူမှုအကျိုးပြု လုပ်ငန်း ဆောင်ရွက်မှုများ	လူမှုအကျိုးပြုလုပ်ငန်း များအား မှတ်တမ်းတင်ခြင်း။	၁။ မှတ်တမ်းဓာတ်ပုံများ ၂။ အစည်းအဝေး တက်ရောက်သူ အရေအတွက်များ။ ၃။ အစည်းအဝေး မှတ်တမ်းများ	သက်ဆိုင်သည့် ဧရိယာ	လိုအပ်သလို
		ဒေသခံလူထုနှင့် ဆွေးနွေး ညှိနှိုင်းမှုလုပ်ငန်းများ အား မှတ်တမ်းတင်ခြင်း။		သက်ဆိုင်သည့် ဧရိယာ	လိုအပ်သလို
အရေးပေါ် ဘေးအန္တရာယ်	အရေးပေါ် ဘေးအန္တရာယ် တုန့်ပြန်ရေး အစီအစဉ်များ	အရေးပေါ်ဖြစ်ရပ် များနှင့် တုန့်ပြန်မှုလုပ်ငန်းများ (ရှိပါက) မှတ်တမ်းတင်ခြင်း။	၁။ မှတ်တမ်းဓာတ်ပုံများ ၂။ အရေးပေါ်အခြေအနေနှင့် ဆောင်ရွက်ခဲ့သည့် တုန့်ပြန်မှု အစီအစဉ် မှတ်တမ်းများ	စီမံကိန်း ဧရိယာ	ဖြစ်ပွားသည့် အခါတိုင်း
		မီးဘေးအန္တရာယ် ဇာတ်တိုက်လေ့ကျင့်မှု လုပ်ငန်းများအား မှတ်တမ်းတင်ခြင်း။	၁။ မှတ်တမ်းဓာတ်ပုံများ ၂။ ဇာတ်တိုက်လေ့ကျင့်သူ အရေအတွက်များ ၃။ ဇာတ်တိုက်လေ့ကျင့်မှု လုပ်ငန်းအသေးစိတ်	စီမံကိန်း ဧရိယာ	နှစ်စဉ်

အမျိုးအစား	စောင့်ကြပ်ကြည့်ရှုမည့် အရာ	စောင့်ကြပ်ကြည့်ရှုမည့် ပါရာမီတာ	မှတ်တမ်းတင်ရမည့် အချက်အလက်များ	နေရာ	အကြိမ် အရေအတွက်
		မီးသတ်ဆေးဘူးများ အား စစ်ဆေး၍ မှတ်တမ်းတင်ခြင်း။	၁။ မီးသတ်ဆေးဘူးများ ပြင်ပ ထိခိုက်မှု တစ်စုံတစ်ရာ ရှိ၊ မရှိ စစ်ဆေး၍ မှတ်တမ်းတင်ခြင်း။ ၂။ လဲရမည့် နေ့ရက်အား မှတ်တမ်းတင်ခြင်း။ ၃။ မီးသတ်ဆေးဘူးရှိ လေဖိအားပြကိရိယာအား စစ်ဆေး၍ မှတ်တမ်းတင်ခြင်း။	စီမံကိန်း ဧရိယာ	တနှစ်နှစ်ကြိမ်

၂၀။ EMP အား အကောင်အထည်ဖော် ဆောင်ရွက်မည့် အဖွဲ့

EMPအား အကောင်ထည်ဖော်ဆောင်ရွက်ရန်အတွက် စီမံကိန်းအဆိုပြုသူမှ ပတ်ဝန်းကျင်၊ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေး (EHS အဖွဲ့) ကို လက်ရှိတာဝန်ထမ်းဆောင်လျက်ရှိသည့် ဝန်ထမ်းများဖြင့် ဖွဲ့စည်းမည်ဖြစ်ပြီး ၎င်းတို့၏မူလတာဝန်များအပြင် ပတ်ဝန်းကျင် ထိန်းသိမ်းစောင့်ရှောက်ရေးနှင့် စီမံခန့်ခွဲရေးတာဝန်များကိုပါ ထမ်းဆောင်စေမည် ဖြစ်ပါသည်။ အဓိက EHS အဖွဲ့သည် ကုမ္ပဏီ၏ ပတ်ဝန်းကျင်ဆိုင်ရာ ထိန်းသိမ်းရေးလုပ်ငန်းများတွင် ဦးစီးဆောင်ရွက်ခြင်း၊ သက်ဆိုင်ရာ အခြားအဖွဲ့အစည်းများနှင့် ပူးပေါင်းဆောင်ရွက်ခြင်းနှင့် စက်ရုံ၏နေ့စဉ်လုပ်ငန်းလည်ပတ်ရာတွင် ပတ်ဝန်းကျင်ဆိုင်ရာစီမံခန့်ခွဲမှုလုပ်ငန်းများအား ကြီးကြပ်ဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။ ၎င်းအဖွဲ့သည် မြန်မာရှင်းရှင်းကုမ္ပဏီ ဒါရိုက်တာ၏ တိုက်ရိုက် စီမံခန့်ခွဲမှုအောက်တွင် ထားရှိမည်ဖြစ်ပါသည်။ အခြားဌာနများဖြစ်သော ဝယ်ယူရေးဌာန၊ လည်ပတ်ရေးဌာနနှင့် ပြင်ထိန်းဌာန တို့နှင့်အတူ ပူးပေါင်း၍လည်း ပတ်ဝန်းကျင်ဆိုင်ရာ လုပ်ငန်းတာဝန်များကို အကောင်အထည်ဖော် ဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။



ပုံ (၉) - မြန်မာရှင်းရှင်း၏ EMP အကောင်အထည်ဖော်ဆောင်ရွက်မည့် အဖွဲ့ ဖွဲ့စည်းပုံ

EHS အဖွဲ့အား စက်ရုံမန်နေဂျာမှ ဦးဆောင်ဖွဲ့စည်းသွားမည်ဖြစ်ပြီး နေ့ဆိုင်းနှင့် ညဆိုင်း အလုပ်သမားများကို သက်ဆိုင်ရာ EHS ဝန်ထမ်းအဖြစ် တာဝန်ပေး၍ ၎င်းတို့တာဝန်ကျရာအဆိုင်း (အချိန်) တွင် ဆောင်ရွက်ရမည့် ပတ်ဝန်းကျင်ဆိုင်ရာ၊ လူမှုဆိုင်ရာနှင့် ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေးဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုမှုများ၊ အစီရင်ခံမှုများကို ဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။ အကယ်၍ ပတ်ဝန်းကျင်ဆိုင်ရာ အရေးကြီးကိစ္စရပ်များ ပေါ်ပေါက်လာပါက ပြင်ပမှ ပတ်ဝန်းကျင်ဆိုင်ရာ အကြံပေးပညာရှင်များနှင့် တိုင်ပင်ဆွေးနွေး၍ ဖြည့်ဆည်းဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။ EMP အကောင်အထည်ဖော် ဆောင်ရွက်မည့် အဖွဲ့အပါအဝင် ဖွဲ့စည်းထားရှိမည့် အရေးပေါ်လုံခြုံရေးအဖွဲ့တို့၏ လုပ်ငန်းတာဝန်များကို IEE အစီရင်ခံစာနှင့် သက်ဆိုင်ရာ စီမံချက်အခွဲများတွင် အသေးစိတ်ဖော်ပြထားပါသည်။

၂၁။ EMP အကောင်အထည်ဖော်ရန် ဘဏ္ဍာငွေလျာထားချက်

စီမံကိန်းအဆိုပြုသူသည် IEE အစီရင်ခံစာတွင် ဖော်ပြထားသည့် ပတ်ဝန်းကျင်နှင့်လူမှုဆိုင်ရာ စီမံခန့်ခွဲမှုအစီအစဉ်များကို အကောင်အထည်ဖော်ဆောင်ရွက်ခြင်း၊ သင်တန်းများပေးခြင်း၊ ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုမှုလုပ်ငန်းများ၊ အစီရင်ခံတင်ပြမှုလုပ်ငန်းများနှင့် စွမ်းဆောင်ရည် တိုးမြှင့်ခြင်းလုပ်ငန်းများအား ဆောင်ရွက်ရာတွင် သီးခြားဘဏ္ဍာငွေဖြင့် လျာထားဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။ ဘဏ္ဍာငွေလျာထားချက်မှာ တနှစ်လျှင် အမေရိကန်ဒေါ်လာ ၂၅,၀၀၀ (နှစ်သောင်းခွဲခန့်) ရှိမည်ဟု ခန့်မှန်းထားပါသည်။ စီမံကိန်းအတွက်လျှော့ပါးသက်သာစေရေး နည်းလမ်းများဖြစ်သော အမှုန်စစ်ဇကာအိတ်များ တပ်ဆင်ခြင်း၊ အခိုးအငွေ့ရေဖြန်းသန့်စင်စနစ်အား တပ်ဆင်ခြင်း၊ ၎င်းစနစ်အား လည်ပတ်ရာတွင်ကုန်ကျသည့် ဓာတုပစ္စည်းများ၊ အစရှိသည့် နည်းလမ်းများအတွက် ကုန်ကျစရိတ်များသည် စီမံကိန်း၏ လည်ပတ်ရေးအတွက် ကုန်ကျစရိတ်တွင် ပါဝင်ပြီး ဖြစ်ပါသည်။ ထို့အပြင် အများပြည်သူ၏ ဖွံ့ဖြိုးတိုးတက်မှုလုပ်ငန်းများဆောင်ရွက်ရာတွင် လုပ်ဆောင်မည့် လူမှုတာဝန်သိ (CSR) အစီအစဉ်များအတွက် တစ်နှစ်လျှင် သိန်း (၁၅၀) ခန့် သုံးစွဲရန် ခန့်မှန်းထားပါသည်။

စီမံကိန်းမှာလက်ရှိလည်ပတ်လျက်ရှိပြီး စီမံကိန်းလည်ပတ်မည့် ကာလမှာ နှစ် (၃၀) ခန့်ရှိမည်ဟု ခန့်မှန်းထားပါသည်။ ထို့ကြောင့် စီမံကိန်းပိတ်သိမ်းချိန်တွင် ဖြစ်ပေါ်နိုင်မည့် သက်ရောက်မှုနှင့် ဘေးအန္တရာယ်များမှာ ယခုအချိန်တွင်မခန့်မှန်းနိုင်သေးပါ။ သို့သော်လည်း စီမံကိန်းအဆိုပြုသူအနေဖြင့် စီမံကိန်းပိတ်သိမ်းခြင်း မပြုမီ ၃ နှစ်အလိုတွင် ပိတ်သိမ်းမည့်လုပ်ငန်းများ၊ အချိန်ဇယားများ၊ သက်ရောက်မှုဆန်းစစ်ချက်များ၊ ဆောင်ရွက်သွားမည့် လျှော့ပါးစေရေးနည်းလမ်းများ၊ စောင့်ကြပ်ကြည့်ရှုမှုအစီအစဉ်များနှင့် ခန့်မှန်းဘဏ္ဍာ ငွေလျာထားချက်များ အစရှိသည့် အချက်အလက်များပါဝင်သော စီမံကိန်းပိတ်သိမ်းခြင်းလုပ်ငန်းအတွက် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်အား ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနသို့ တင်ပြသွားမည်ဖြစ်ကြောင်း ကတိကဝတ်ပြု ဖော်ပြထားပါသည်။

ဇယား (၁၀) ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်အကောင်အထည်ဖော်ရန် ခန့်မှန်းကုန်ကျစရိတ်

စဉ်	ဆောင်ရွက်ချက်များ	အချိန်ကာလ	ခန့်မှန်းကုန်ကျစရိတ် (USD)
	သက်ရောက်မှုလျှော့ပါးစေရေးနည်းလမ်းများအား အကောင်အထည်ဖော်ခြင်း		
၁။	အခိုးအငွေ့ရေဖြန်းသန့်စင်စနစ်အတွက် စံလုပ်ထုံးလုပ်နည်းများ၊ အစိုင်အခဲ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု အစီအစဉ်၊ လုပ်ငန်းခွင် ကျန်းမာရေး နှင့် ဘေးအန္တရာယ်ကင်းရှင်ရေး စီမံချက်၊ အရေးပေါ်တုန့်ပြန်ရေးစီမံချက်၊ မကျေနပ်မှု တိုင်ကြားဖြေရှင်းခြင်း အစီအစဉ် အစရှိသည့် စီမံချက်အခွဲများအား အကောင်အထည်ဖော် ဆောင်ရွက်ခြင်း။	နှစ်စဉ်	> ၅၀၀၀ USD
	စောင့်ကြပ်ကြည့်ရှုမှုလုပ်ငန်းများအား အကောင်အထည်ဖော်ခြင်း		
၁။	မီးခိုးခေါင်းတိုင်မှ အခိုးအငွေ့ထုတ်လွှတ်မှု တိုင်တာခြင်း နှင့် လုပ်ငန်းခွင် လေအရည်အသွေး တိုင်းတာခြင်း အစရှိသဖြင့်	နှစ်စဉ်	> ၅၀၀၀ USD
၂။	စွန့်ထုတ်ရေအရည်အသွေးနှင့် ပစ်စာ၏ ဓာတုပစ္စည်း ပါဝင်နှုန်းအား တိုင်းတာခြင်း။ (စွန့်ထုတ်ရေနှင့် ပစ်စာနမူနာ ကောက်ယူ၍ ဓာတ်ခွဲခန်းတွင် ဓာတ်ခွဲစမ်းသပ်ခြင်း)	နှစ်စဉ်	> ၁၀၀၀ USD
၃။	စောင့်ကြပ်ကြည့်ရှုမှု အစီရင်ခံစာပြင်ဆင်ခြင်း။	တစ်နှစ်လျှင် နှစ်ကြိမ်	> ၁၀၀၀၀ USD
	စွမ်းဆောင်ရည်တိုးမြှင့်ခြင်းလုပ်ငန်းများအား အကောင်အထည်ဖော်ခြင်း		
၁။	ဇာတ်တိုက်လေ့ကျင့်မှုများ ဆောင်ရွက်ခြင်း။	နှစ်စဉ်	> ၁၀၀၀ USD
၂။	အထွေထွေ ဘေးအန္တရာယ်ကင်းရှင်းရေး သင်တန်းများ၊ မီးငြိမ်းသတ် သင်တန်းများ၊ ရှေးဦးသူနာပြုသင်တန်းများ အစရှိသည့် သင်တန်းများ ပေးခြင်း။	နှစ်စဉ်	> ၃၀၀၀ USD

၂၂။ မြန်မာရှင်းရှင်း၏ ပတ်ဝန်းကျင်နှင့်လူမှုဆိုင်ရာ ကတိကဝတ်များ

စီမံကိန်းအဆိုပြုသူသည် ပတ်ဝန်းကျင်၊ လူမှုဆိုင်ရာနှင့် ကျန်းမာရေးနှင့်ပတ်သက်သော ၎င်းတို့၏ တာဝန်ဝတ္တရားများကို သိရှိနားလည်ပြီး စီမံကိန်းလည်ပတ်စဉ်ကာလတလျှောက် ဖြစ်ပေါ်လာနိုင်သော သက်ရောက်မှုများကို လျှော့ချရန်နှင့် ထိန်းချုပ်ရန်အတွက် အောက်ဖော်ပြပါ အချက်အလက်များကို ဖြည့်ဆည်းဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း ကတိကဝတ်ပြုပါသည်။

ဇယား (၁၁) စီမံကိန်းအဆိုပြုသူ၏ ပတ်ဝန်းကျင်နှင့်လူမှုဆိုင်ရာ အဓိက ကတိကဝတ်များ

နယ်ပယ်	စဉ်	ကတိကဝတ်များ	IEE အစီရင်ခံစာ ရည်ညွှန်းချက်
အထွေထွေ	၁.၁	ဤကနဦးပတ်ဝန်းကျင်ဆန်းစစ်ခြင်း (IEE) အစီရင်ခံစာတွင် ဖော်ပြထားသော အချက်အလက်များ မှန်ကန်ပါသည်။	IEE အစီရင်ခံစာ
မူဝါဒ၊ မူဘောင်များ၊ ဥပဒေ၊ နည်းဥပဒေ၊ စံနှုန်းများ နှင့် စံချိန်စံညွှန်းများ	၂.၁	မြန်မာရှင်းရှင်းသည် အောက်ဖော်ပြပါ ဥပဒေများ အပါအဝင် အစီရင်ခံစာ အပိုဒ်ခွဲ (၂.၂.၃) တွင် ဖော်ပြထားသော သက်ဆိုင်ရာဥပဒေများနှင့် သက်ဆိုင်ရာ ပုဒ်မများအတိုင်း လိုက်နာဆောင်ရွက်သွားပါမည်။ - ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ (၂၀၁၂) - ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနည်းဥပဒေ (၂၀၁၄) - ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ထုံးလုပ်နည်း (၂၀၁၅) - အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာအရည်အသွေး(ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်များ (၂၀၁၅)	အခန်း (၂) အပိုဒ်ခွဲ (၂.၂.၃)
	၂.၂	မြန်မာရှင်းရှင်းသည် အောက်ဖော်ပြပါ ဥပဒေများ အပါအဝင် အစီရင်ခံစာ အပိုဒ်ခွဲ (၂.၂.၃) တွင်ဖော်ပြထားသော ပတ်ဝန်းကျင်ဆိုင်ရာ စံနှုန်းများနှင့် စံချိန်စံညွှန်းများအတိုင်း လိုက်နာဆောင်ရွက်ပါမည်။	အခန်း (၂) အပိုဒ်ခွဲ (၂.၃)
စီမံကိန်းအကြောင်းအရာ ဖော်ပြချက်	၃.၁	အခန်း (၃) တွင်ဖော်ပြထားသော စီမံကိန်းအကြောင်းအရာများမှာ ပြည့်စုံမှန်ကန်ပါသည်။	အခန်း (၃)
သက်ရောက်မှု ဆန်းစစ်ခြင်း	၄.၁	မြန်မာရှင်းရှင်းသည် အခန်း (၅) တွင် ဆန်းစစ်ဖော်ထုတ်ထားသော သက်ရောက်မှုများကို ကောင်းမွန်စွာ သိရှိပြီး ၎င်းသက်ရောက်မှုတစ်ခုချင်းအတွက် အကြံပြုထားသော လျော့ပါးစေရေးနည်းလမ်းများအတိုင်း လိုက်နာဆောင်ရွက်ရန် သဘောတူပါသည်။	အခန်း (၅)
ဘေးအန္တရာယ်ဆန်းစစ်ခြင်း	၅.၁	မြန်မာရှင်းရှင်းသည် အခန်း (၆) တွင် ဆန်းစစ်ဖော်ထုတ်ထားသော လုပ်ငန်းခွင်ဆိုင်ရာ ဘေးအန္တရာယ်များ၊ သဘာဝဘေးအန္တရာယ်များနှင့် အရေးပေါ်အခြေအနေများကို ကောင်းမွန်စွာ သိရှိပြီး အကြံပြုထားသော လျော့ပါးစေရေးနည်းလမ်းများအတိုင်း လိုက်နာဆောင်ရွက်ရန် သဘောတူပါသည်။	အခန်း (၆)
အများပြည်သူနှင့် တိုင်ပင်ဆွေးနွေးခြင်းနှင့် သတင်းအချက်အလက် ထုတ်ပြန်ကြေငြာခြင်း	၆.၁	မြန်မာရှင်းရှင်းသည် နိုင်ငံတော်အစိုးရမှ လူစုလူဝေးကန့်သတ်ချက် (အမိန့်ကြော်ငြာစာ ၁/၂၀၂၀) အား တရားဝင်ပယ်ဖျက်သည့် အချိန်တွင် အခန်း (၇) အပိုဒ်ခွဲ (၇.၄) တွင် ဖော်ပြထားသော အစီအစဉ်အတိုင်း အများပြည်သူနှင့် တွေ့ဆုံဆွေးနွေးခြင်းလုပ်ငန်းများကို ဆောင်ရွက်ပါမည်။	အခန်း (၇) အပိုဒ်ခွဲ (၇.၄)
လေအရည်အသွေး	၇.၁	မြန်မာရှင်းရှင်းသည် အခိုးအငွေ့ထုတ်လွှတ်မှုထိန်းချုပ်ကိရိယာများ ဖြစ်သော အမှုန်စစ်ဇကာအိတ် အိမ်များနှင့် ရေဖြန်း၍ အခိုးအငွေ့ သန့်စင်စနစ်တို့၏ စွမ်းဆောင်ရည်ကောင်းမွန်မှုရှိစေရန် အာမခံပြီး ပုံမှန် ပြုပြင်ထိန်းသိမ်းရေး လုပ်ငန်းများကို ဆောင်ရွက်သွားပါမည်။	အခန်း (၈)
	၇.၂	မြန်မာရှင်းရှင်းသည် ရေဖြန်း၍အခိုးအငွေ့ သန့်စင်စနစ်၏ စွမ်းဆောင်ရည် ကောင်းမွန်မှုရှိစေရန် အတွက် နောက်ဆက်တွဲ (၅) ရေဖြန်း၍အခိုးအငွေ့	အခန်း (၈) နောက်ဆက်တွဲ (၅)

နယ်ပယ်	စဉ်	ကတိကဝတ်များ	IEE အစီရင်ခံစာ ရည်ညွှန်းချက်
		သန့်စင်စနစ်၏ စံလုပ်ထုံးလုပ်နည်းများတွင် အကြံပြုထားသော လုပ်ဆောင်ချက်များအတိုင်း လိုက်နာဆောင်ရွက်ပါမည်။	
	၇.၃	မြန်မာရှင်းရှင်းသည် လုပ်ငန်းခွင်အတွင်း အခိုးအငွေ့ (မီးခိုးမဲ) များ ပြန့်နှံ့မှု မရှိစေရန်အတွက် မီးဖိုများစတင်ချိန်တွင် ဖိတံခါးများဖွင့်ခြင်းကို အတတ်နိုင်ဆုံး ရှောင်ကြဉ်ပါမည်။	အခန်း (၈)
	၇.၄	မြန်မာရှင်းရှင်းသည် ပတ်ဝန်းကျင်စောင့်ကြပ်ကြည့်ရှုမှု အစီအစဉ်တွင် အကြံပြုထားသည့်တိုင်း ထုတ်လွှတ်အခိုးအငွေ့၊ လုပ်ငန်းခွင် လေအရည်အသွေးနှင့် မီးခိုးသိပ်သည်းဆတို့ကို စောင့်ကြပ်ကြည့်ရှုခြင်းလုပ်ငန်းများ ဆောင်ရွက်သွားပါမည်။	အခန်း (၈) အပိုဒ်ခွဲ (၈.၆)
အစိုင်အခဲ စွန့်ပစ်ပစ္စည်း	၈.၁	မြန်မာရှင်းရှင်းသည် အန္တရာယ်ရှိစွန့်ပစ်ပစ္စည်းများအား ကျိုက်မရော မြို့နယ်ရှိနတ်စမ်းမိုင်းတွင် စွန့်ပစ်ရာတွင် သက်ဆိုင်ရာဌာနများဖြစ်သော သတ္တုတွင်းဦးစီး ဌာနနှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနတို့၏ နည်းဥပဒေများ၊ လမ်းညွှန်ချက်များနှင့်အညီ ဆောင်ရွက်သွားပါမည်။	အခန်း (၈)
	၈.၂	မြန်မာရှင်းရှင်းသည် အစိုင်အခဲစွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှုအစီအစဉ်တွင် ဖော်ပြထားသည့် စီမံခန့်ခွဲမှုများနှင့် သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများကို လိုက်နာဆောင်ရွက်သွားပါမည်။	နောက်ဆက်တွဲ (၉-က)
	၈.၃	မြန်မာရှင်းရှင်းသည် ထုတ်လုပ်ရေးလုပ်ငန်းမှထွက်ရှိသော မည်သည့် အန္တရာယ်ရှိစွန့်ပစ်ပစ္စည်းကိုမဆို မည်သည့်မြေပေါ်တွင် အလွှာ (Liner Layer) မခံပဲ တိုက်ရိုက်စွန့်ပစ်ခြင်း မပြုပါ။	အခန်း (၈)
	၈.၄	မြန်မာရှင်းရှင်းသည် အစိုင်အခဲစွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှုအစီအစဉ်နှင့် ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုမှုအစီအစဉ်တွင် အကြံပြု ထားသည့် အစိုင်အခဲစွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုအခြေအနေများအပေါ် စောင့်ကြပ်ကြည့်ရှုရေးလုပ်ငန်းများ ဆောင်ရွက်သွားပါမည်။	အခန်း (၈) နောက်ဆက်တွဲ (၉-က)
ရေအရည်အသွေး	၉.၁	မြန်မာရှင်းရှင်းသည် ရေဖြန်း၍အခိုးအငွေ့သန့်စင်စနစ်မှ ထွက်ရှိလာမည့် မည်သည့် စွန့်ထုတ်ရေကိုမဆို ပတ်ဝန်းကျင်သို့ စွန့်ပစ်မည်မဟုတ်ပါ။	အခန်း (၈)
	၉.၂	မြန်မာရှင်းရှင်းသည် NEQG လမ်းညွှန်ချက်တန်ဖိုးများထက် ကျော်လွန်နေသော ပါရာမီတာများကို လျှော့ချနိုင်မည့် နည်းလမ်းများ ရှာဖွေဖော်ထုတ်၍ လိုက်နာဆောင်ရွက်သွားပါ့မည်။	အခန်း (၈)
	၉.၃	မြန်မာရှင်းရှင်းသည် စက်ရုံလည်ပတ်ရန်အတွက် မည်သည့်မြေအောက်ရေ အရင်းအမြစ်ကိုမှ ထုတ်ယူသုံးစွဲမည် မဟုတ်ပါ။	အခန်း (၈)
	၉.၄	မြန်မာရှင်းရှင်းသည် စွန့်ထုတ်ရေအရည်အသွေးအား ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုမှုအစီအစဉ် အတိုင်း စောင့်ကြပ်ကြပ်ရှုသွားပါမည်။	အခန်း (၈)
အနှံ	၁၀.၁	မြန်မာရှင်းရှင်းသည် အနီးပတ်ဝန်းကျင်သို့ အနှံဆိုးများထွက်ရှိမှု မရှိစေရန် အမှုန်စစ်ဇကာအိတ်နှင့် ရေဖြန်း၍ အခိုးအငွေ့သန့်စင်စနစ်တို့၏ စွမ်းဆောင်ရည်ကောင်းမွန်စေရန် အမြဲဆောင်ရွက်သွားပါမည်။	အခန်း (၈)
	၁၀.၂	မြန်မာရှင်းရှင်းသည် အနှံထွက်ရှိမှုရှိ/မရှိအား ပုံမှန်စစ်ဆေးခြင်းအပြင် အများပြည်သူထံမှ တိုင်ကြားချက်တစ်စုံတစ်ရာရရှိသည့်အခါ စစ်ဆေးခြင်း လုပ်ငန်းများကို ဆောင်ရွက်သွားပါမည်။	အခန်း (၈)
လုပ်ငန်းခွင်ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေး	၁၁.၁	မြန်မာရှင်းရှင်းသည် လုပ်ငန်းခွင်သဘောသဘာဝအပေါ်မူတည်၍ လိုအပ်သော တစ်ကိုယ်ရည်သုံးအကာအကွယ်ပစ္စည်းများ (ဥပမာ - နှာခေါင်းစည်း၊ အသက်ရှူကိရိယာ၊ အပူကာလက်အိတ်၊ ဓာတုပစ္စည်း	အခန်း (၈)

နယ်ပယ်	စဉ်	ကတိကဝတ်များ	IEE အစီရင်ခံစာ ရည်ညွှန်းချက်
		ကိုင်တွယ်သည့် လက်အိတ် စသည်ဖြင့်) ကို အလုပ်သမားအားလုံး အတွက် လုံလောက်စွာထားရှိပါမည်။	
	၁၁.၂	မြန်မာရှင်းရှင်းသည် သက်ဆိုင်ရာနေရာများတွင် နှာခေါင်းစည်းတပ်ရန်၊ ဆူညံသံသတိပြုရန်၊ ဓာတုပစ္စည်းသတိပြုရန် အစရှိသည့် သတိပေး ဆိုင်းဘုတ်များ တပ်ဆင်ပါမည်။	အခန်း (၈)
	၁၁.၃	မြန်မာရှင်းရှင်းသည် အလုပ်သမားများ ရေဓာတ်ဆုံးရှုံးမှုမှ ကာကွယ်ရန် အတွက် လုံလောက်သော လေဝင်လေထွက်စနစ်၊ သောက်သုံးရေများ၊ ဓာတ်ဆားများကို ထားရှိခြင်းနှင့် ပူသောအလုပ်ခွင်မှ လုံလောက်သော အနားယူမှုများ ရရှိစေရန် စီစဉ်ဆောင်ရွက်ပေးပါမည်။	အခန်း (၈)
	၁၁.၄	မြန်မာရှင်းရှင်းသည် စက်ရုံတွင်းသန့်ရှင်းရေးလုပ်ငန်းများနှင့် မီးဖိုများ၊ စက်ကိရိယာနှင့် စက်ယန္တရားများအား ပုံမှန်ပြုပြင်ရေးလုပ်ငန်းများ ဆောင်ရွက်သွားပါမည်။	အခန်း (၈)
	၁၁.၅	မြန်မာရှင်းရှင်းသည် လုပ်ငန်းခွင်ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေး စီမံချက်တွင် အကြံပြုထားသော အစီအစဉ်များအတိုင်း လိုက်နာ ဆောင်ရွက်သွားပါမည်။	အခန်း (၈) နောက်ဆက်တွဲ (၉-ခ)
အရေးပေါ်တုန့်ပြန်ဆောင်ရွက်မှု	၁၂.၁	မြန်မာရှင်းရှင်းသည် မီးသတ်ဆေးဘူးများအလုံအလောက်ထားရှိပြီး ပုံမှန် စစ်ဆေးမှုလုပ်ငန်းများအား ဆောင်ရွက်သွားပါမည်။	အခန်း (၈)
	၁၂.၂	မြန်မာရှင်းရှင်းသည် အရေးပေါ်တုန့်ပြန်ရေးစီမံချက်တွင် ဖော်ပြထားသည့် အတိုင်း (မီး) အရေးပေါ်အချက်ပေးအသံ ထားရှိခြင်း၊ လူစုဝေးရာ နေရာများအား သတ်မှတ်ထားရှိခြင်း၊ ဘေးအန္တရာယ်ကင်းရှင်းရေး အဖွဲ့ ဖွဲ့စည်းထားရှိခြင်းနှင့် မီးအန္တရာယ်ဇာတ်တိုက်လေ့ကျင့်မှုလုပ်ငန်း များအား ဆောင်ရွက်သွားပါမည်။	အခန်း (၈) နောက်ဆက်တွဲ (၉-ဂ)
ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်နှင့် အခြားစီမံချက်အခွဲများ	၁၃.၁	မြန်မာရှင်းရှင်းသည် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်နှင့် စီမံချက်အခွဲများ ဖြစ်သော အခိုးအငွေ့ရေဖြန်းသန့်စင်စနစ်အတွက် စံလုပ်ထုံးလုပ်နည်းများ၊ အစိုင်အခဲ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု အစီအစဉ်၊ လုပ်ငန်းခွင် ကျန်းမာရေး နှင့် ဘေးအန္တရာယ်ကင်းရှင်ရေး စီမံချက်၊ အရေးပေါ်တုန့်ပြန်ရေးစီမံချက်၊ မကျေနပ်မှု တိုင်ကြားဖြေရှင်းခြင်း အစီအစဉ်တို့တွင် ဖော်ပြထားသော သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများအတိုင်း လိုက်နာ ဆောင်ရွက် သွားပါမည်။	အခန်း (၈) နောက်ဆက်တွဲ (၅) နောက်ဆက်တွဲ (၉-က) နောက်ဆက်တွဲ (၉-ခ) နောက်ဆက်တွဲ (၉-ဂ) နောက်ဆက်တွဲ (၉-ဃ)
ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်အတွက် ဘဏ္ဍာငွေ လျာထားချက်	၁၄.၁	မြန်မာရှင်းရှင်းသည် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်နှင့် ဆက်စပ် စီမံချက်အခွဲများအား အကောင်အထည်ဖော်ဆောင်ရွက်ရန် သီးခြား ဘဏ္ဍာငွေလျာထား၍ ထားရှိပါမည်။	အခန်း (၈) အပိုဒ်ခွဲ (၈.၈)
ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုမှု အစီအစဉ်	၁၅.၁	မြန်မာရှင်းရှင်းသည် ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုမှု အစီအစဉ် တွင်ဖော်ပြထားသည့် အစီအစဉ်များအတိုင်း လိုက်နာဆောင်ရွက် သွားပါမည်။	အခန်း (၈) အပိုဒ်ခွဲ (၈.၆)
အစီရင်ခံစာ တင်ပြမည့် အချိန်ကာလ	၁၆.၁	မြန်မာရှင်းရှင်းသည် ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုမှု အစီအစဉ် အစီရင်ခံစာအား ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနသို့ ခြောက်လလျှင် တစ်ကြိမ် အစီရင်ခံ တင်ပြပါမည်။	အခန်း (၈) အပိုဒ်ခွဲ (၈.၆)
မကျေနပ်မှု ဖြေရှင်းခြင်း	၁၇.၁	မြန်မာရှင်းရှင်းသည် အများပြည်သူနှင့် အလုပ်သမားများမှ မကျေနပ်မှု တစ်စုံတစ်ရာရှိပါက ဖြေရှင်းနိုင်ရန်အတွက် မကျေနပ်မှု တိုင်ကြားဖြေရှင်းခြင်း အစီအစဉ်အား စတင်၍ အကြံပြုချက်များအတိုင်း လိုက်နာဆောင်ရွက်ပါမည်။	နောက်ဆက်တွဲ (၉-ဃ)

နယ်ပယ်	စဉ်	ကတိကဝတ်များ	IEE အစီရင်ခံစာ ရည်ညွှန်းချက်
စီမံကိန်းပိတ်သိမ်းခြင်း	၁၈.၁	စီမံကိန်းပိတ်သိမ်းခြင်း မပြုမီ (၃) နှစ်အလိုတွင် ပိတ်သိမ်းမည့်လုပ်ငန်းများ၊ အချိန်ဇယားများ၊ သက်ရောက်မှုဆန်းစစ်ချက်များ၊ ဆောင်ရွက်သွားမည့် လျော့ပါးစေရေးနည်းလမ်းများ၊ စောင့်ကြပ်ကြည့်ရှုမှုအစီအစဉ်များနှင့် ခန့်မှန်းဘဏ္ဍာ ငွေလျာထားချက်များ အစရှိသည့် အချက်အလက်များ ပါဝင်သော စီမံကိန်းပိတ်သိမ်းခြင်းလုပ်ငန်းအတွက် ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု အစီအစဉ်အား ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနသို့ တင်ပြသွားပါမည်။	အခန်း (၈) အပိုဒ်ခွဲ (၈.၈)

၂၃။ တွေ့ရှိချက်များနှင့် နိဂုံးချုပ်

အဆိုပြုစီမံကိန်းမှ ဖြစ်ပေါ်နိုင်သော သက်ရောက်မှုများကို ဆန်းစစ်သုံးသပ်ရာတွင် ထုတ်လုပ်ရေးလုပ်ငန်းများ၊ တပ်ဆင်ထားသော စက်ယန္တရားများ၊ လုပ်ငန်းခွင်အခြေအနေ၊ လုပ်ငန်းခွင်ကျန်းမာရေးနှင့်ဘေးအန္တရာယ်ကင်းရှင်းရေးဆိုင်ရာ ဆောင်ရွက်ချက်များ၊ အနီးပတ်ဝန်းကျင်အခြေအနေများ စသည့် ခနောက်စိမ်းသတ္တုစင် ထုတ်လုပ်ရေးလုပ်ငန်း (သတ္တုရိုင်းများကို မီးရှို့ခြင်းနှင့် အရည်ကျိုခြင်းလုပ်ငန်း) ၏ လည်ပတ်မှုအခြေအနေများအပေါ်မူတည်၍ သုံးသပ်ထားပါသည်။ ဤကနဦးပတ်ဝန်းကျင် ဆန်းစစ်ခြင်း (IEE) မစတင်မီကပင် မြန်မာရှင်းရှင်း စက်ရုံသည် ထုတ်လွှတ်မှုထိန်းချုပ်ကိရိယာများ - (ဥပမာ - အမှုန်စစ်ဇကာများ၊ အခိုးအငွေ့ ရေဖြန်းသန့်စင်စနစ်များ အစရှိသဖြင့်)အား တပ်ဆင်ထားပြီး စက်ရုံလည်ပတ်ခြင်းမှ ပတ်ဝန်းကျင်အပေါ် သက်ရောက်မှုများ နည်းသထက်နည်းအောင် ဆောင်ရွက်လျက် ရှိပါသည်။ သို့ရာတွင် သီးခြားစံလုပ်ထုံးလုပ်နည်းများ၊ စနစ်တကျ မှတ်တမ်းထားရှိမှုများနှင့် စောင့်ကြပ်ကြည့်ရှုမှုဆိုင်ရာ လုပ်ငန်း များအား ဆောင်ရွက်ထားနိုင်ခြင်း မရှိသေးပါ။

ဤကနဦးပတ်ဝန်းကျင်ဆန်းစစ်ခြင်း (IEE) အစီရင်ခံစာတွင် ဖြစ်ပေါ်နိုင်သော/ ဖြစ်ပွားနိုင်ချေရှိသော သက်ရောက်မှုများအတွက် လျော့ပါးစေရေးနည်းလမ်းများကို အပြည့်အဝထည့်သွင်းစဉ်းစား၍ ပြင်ဆင်ထားပါသည်။ ထို့အပြင် ပတ်ဝန်းကျင်ဆိုင်ရာ၊ လူမှုဆိုင်ရာနှင့် ကျန်းမာရေးနှင့်ဘေးအန္တရာယ်ကင်းရေးစသည့် ရှုထောင့်ပေါင်းစုံမှ ထည့်သွင်းစဉ်းစားထားသည့် ပုံမှန်ဆောင်ရွက်ရမည့် စစ်ဆေးမှုများနှင့် မှတ်တမ်းတင်မှုလုပ်ငန်းများပါဝင်သော စောင့်ကြပ်ကြည့်ရှုမှုအစီအစဉ်အား အကောင်အထည်ဖော် ဆောင်ရွက်သွားရန် အကြံပြုတင်ပြထားပြီး ဖြစ်ပါသည်။ ပိုမိုကောင်းမွန်သော ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုစနစ်အားရရှိစေရန်အတွက် အသေးစိတ် စီမံချက်အခွဲများဖြစ်သည့် အခိုးအငွေ့ရေဖြန်းသန့်စင်စနစ် (Wet Scrubber) အတွက် စံလုပ်ထုံးလုပ်နည်းများ၊ အစိုင်အခဲ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု အစီအစဉ်၊ လုပ်ငန်းခွင် ကျန်းမာရေး နှင့် ဘေးအန္တရာယ်ကင်းရှင်ရေး စီမံချက်၊ အရေးပေါ် တုန့်ပြန်ရေးစီမံချက်၊ မကျေနပ်မှု တိုင်ကြားဖြေရှင်းခြင်း အစီအစဉ် စသည့် စီမံချက်အခွဲများကိုလည်း ဤ IEE လေ့လာမှု၏ ရလဒ်တစ်ခု အနေဖြင့် ဖော်ထုတ်ရေးဆွဲထားပြီး ဖြစ်ပါသည်။

အကယ်၍ စီမံကိန်းအဆိုပြုသူဖြစ်သော မြန်မာရှင်းရှင်းကုမ္ပဏီမှ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်နှင့် စီမံချက်အခွဲများတွင် တင်ပြထားသည့် လျော့ပါးစေရေးနည်းလမ်းများအတိုင်း အပြည့်အဝအကောင်အထည်ဖော်ဆောင်ရွက်နိုင်မည် ဆိုပါက စီမံကိန်း သက်တမ်းတလျှောက် ဖြစ်ပေါ်နိုင်ချေရှိသော ပတ်ဝန်းကျင်၊ လူမှုဆိုင်ရာနှင့် ကျန်းမာရေးနှင့်ဘေးအန္တရာယ်ကင်းရှင်းရေးဆိုင်ရာ ဆိုးကျိုးသက်ရောက်မှုများအား ကောင်းမွန်စွာထိန်းချုပ်နိုင်မည်ဖြစ်ကြောင်း တင်ပြ၍နိဂုံးချုပ်အပ်ပါသည်။

မှတ်ချက်။ ။ နည်းပညာပိုင်းဆိုင်ရာ အသေးစိတ်အချက်အလက်များနှင့် စီမံကိန်းအဆိုပြုသူမှ အတိအကျလိုက်နာ ဆောက်ရွက်ရမည့်အချက်အလက်များကို အစီရင်ခံစာ၏ သက်ဆိုင်ရာ အခန်းအလိုက်တွင် အပြည့်အစုံဖော်ပြထားပြီး ဖြစ်ပါသောကြောင့် ပိုမိုသိရှိလိုပါက အစီရင်ခံစာ အပြည့်အစုံတွင် ရှာဖွေဖတ်ရှုနိုင်ပါသည်။

CHAPTER (1) INTRODUCTION

1.1 The Project Proponent

Myanmar is one of the largest producers of antimony in the world, contributing to 6,000 tons[1] per annual in year 2010. Among them, the proposed project is one of the producers of antimony in Myanmar. Myanmar Shing Shing Antimony Smelting & Refinery Factory (Hereinafter referred to as MSS) located inside the Mawlamyine Industrial Zone is manufacturing antimony ingots by refining and smelting antimony ore. The factory was previously owned by Kaung Kin Kyal Chout Pwint Company Limited since 2013 and it was bought and handed over by Myanmar Shing Shing Metal Company Limited in 2016. After implementing a series of renovation in 2017, MSS started its commercial operation in early months of 2018. Since then, the company's products are being exported to Europe for the further multiple use.

Responsible Person of Company	Daw Yadanar Lin Aung (Managing Director)
Contact of MSS Factory	U Khin Maung Latt (Factory Manager)
Address	Plot No. (325,326,327,328,329,330), Shwe Myo Taw 1st street, Mawlamyine Industrial Zone, Nyaune Pin Seik Village Tract, Kyiek Mayaw Township, Mon State.
Contact Number	Daw Yadanar Lin Aung – 09 450034533 U Khin Maung Latt – 09 446608840

1.2 Organization for Preparation of IEE

In accordance with the EIA Procedures (2015), the IEE study is conducted by the third-party consultant, study Team of EnvO Environmental Management Consulting Services Co., Ltd so called as "EnvO". The project proponent, Shing Shing Metal Co., Ltd, trustfully cooperates with "EnvO" for the preparation of an IEE report to assess, mitigate and address all potential environmental, social and health and safety impacts which could be raised by the proposed project activities.

"EnvO" is founded with the diverse background of environmental and social experts and submitted third-party consultancy firm registration to ECD on 5th March 2020. The persons in-charge of this IEE Study Team and detail information of the experts are presented in the following Table 1-1. The detail Professional Resume of each expert is described in ANNEX – 1.

Table 1-1 Responsible Organization for IEE Study

Responsible Third-Party Consultant	Contact	Organization Registration Status
EnvO Environmental Management Consulting Services Co., Ltd.	envo.info@gmail.com	Submitted to ECD since 5th March 2020

[1] Antimony Uses, Production and Prices Primer Archived, 25 October 2012 at the Wayback Machine

Table 1-2 Members of IEE Study Team

Name	Position	Years of Experience	Registration Status	Responsibility
Dr. Ei Ei Mon Ph.D. (Environmental Science and Infrastructure Engineering, Japan) M.E (Civil and Environmental Engineering, Japan) B.E (Civil Engineering, YTU, Myanmar) eem.envo@gmail.com	Team Leader/ Environmental and Social Specialist	14 years	Registered Number: 00229	Overall Technical Management, Quality Control, Review on Environment and Social Impact Assessments, Review on Environment, Social, Health & Safety Management Plans, Technical Supervision, Consulting with Project Proponent and Discussion with ECD for EMP Implementation, Public Consultation, etc.
Mr. Hein Zaw Htet M.E (Civil and Environmental Engineering, Japan) B.E (Civil Engineering, YTU, Myanmar) hzawt24@gmail.com	Environmental and Social Expert	14 years	To be submitted	Overall Project Management, Site Inspection and Investigation, Environmental Monitoring, Facilitation of Public Consultation, etc.
Mr. Htet Wai Yan Aung B.E (Port and Harbor Eng., MMU, Myanmar) Diploma in GIS and RS (YU, Myanmar) waiyan.envo@gmail.com	Deputy Team Leader/ Senior Environmental Consultant	5 years	Application of Consultant Registration was submitted to ECD on 17th May 2018	Law Assessment, Environmental Impact Evaluation and Assessment, Risk Evaluation and Assessment, Environmental Monitoring, Environmental Management Plans, Public Consultation, etc.
Ms. Win Thiri Lwin B.E (Civil Engineering, YTU) winthiri.envo@gmail.com	Environmental Expert	2 years	To be submitted	Project Related Studies, Engagement with Client and Relevant Ministries, Environmental Monitoring, Preliminary Impact Assessment, Preliminary Environmental Management Plans, Public Consultation, etc.
Ms. Ei Thinzar Myo B.E (Civil Engineering, YTU) eithinzarmyo.envo@gmail.com	Junior Environmental Expert	1 year	To be submitted	Environmental Baseline Studies, Coordination with Client and Relevant Ministries, Preliminary Risk and Emergency Assessment, Public Consultation and Public Disclosure, Assisting Experts to implement Necessary Works, etc.

Source: EnvO Study Team

1.3 Background and Objectives of IEE Study

1.3.1 Background

When this factory was owned by the previous company, Kaung Kin Chout Pwint Company Limited, an EIA study has been conducted by Lucky Bird Environmental Studies & Geo-Informatic Solutions Group in June, 2014. Later, EIA Procedures, the precise guidelines for EIA implementation, was enacted by the Ministry of Natural Resources and Environmental Conservation (MONREC) in December, 2015. According to the EIA Procedure (2015) of Annex 1, under the category of number (136) - Refining of Metal Mineral Ore (without using hazardous chemicals), the proposed project is required to conduct IEE, which production is under 50,000 tons per annual. In August 2018, ECD instructed the project proponent to prepare as an IEE report and resubmit to ECD as per the letter number of (EIA – 1/4Ka (971/2018). Hence, this IEE study is conducted as per the instructions of EIA Procedure (2015) and also, it covers the considerations upon the initial comments given by the ECD.

1.3.2 Objectives of IEE

The objectives of Initial Environmental Examination (IEE) study for this proposed project are – to comply with the rules and regulations enforced by the relevant ministries and departments, to examine potential environmental, social and health and safety impacts which are likely to be happened from the proposed project activities, to suggest mitigations measures for the adverse impacts and enhancement measures for beneficial impacts, to prepare required environmental management plans based on the result of IEE study, to hear public advices from environment and social viewpoint and lastly, to provide information to the project proponent regarding further actions and about the environmental implications to be implemented throughout the project life.

1.4 Scope of Initial Environmental Examination (IEE)

In this IEE study, various components such as physical, biological, socio-economic, health and safety related impacts and etc. are considered and assessed. This IEE covers all the anticipated environmental impacts which might be resulted from the smelting and refinery process, assesses and thoroughly proposes the applicable mitigation measures for those impacts and prepares the Environmental Management Plan (EMP) to use throughout the project life. Comprehensive monitoring plan is also included in the EMP to enable the evaluation of the success or failure of environmental mitigation measures applied by the project proponent and to conduct the modification of the EMP, if necessary.

Besides Environmental Management Plan (EMP), in order to properly manage the anticipated impacts due to the process and nature of the proposed project, the Environmental Management Sub-Plans: (i) Solid Waste Management Plan, (ii) Occupational Health and Safety Plan, (iii) Social Development Plan, (iv) Emergency Response Plan and (v) Grievance Redress Plan, are also prepared specifically.

1.4.1 Structure of IEE

The structure of IEE report is organized as per the following chapters and annexes.

- Chapter (1) Introduction
- Chapter (2) Policy, Legal and Institutional Framework
- Chapter (3) Project Description
- Chapter (4) Environmental and Social Baseline
- Chapter (5) Impact Assessment and Mitigation Measures
- Chapter (6) Risk Assessment and Mitigation Measures
- Chapter (7) Public Consultation and Information Disclosure
- Chapter (8) Environmental Management Plan During Operation Stage
- Chapter (9) Key Findings and Conclusions
  - Annex 1: Professional Resumes of EnvO Study Team
  - Annex 2: Comment Response Sheet
  - Annex 3: Environmental Baseline Measurements
  - Annex 4: Air Quality Assessment Related Calculations
  - Annex 5: Standard Operating Procedures (Wet Scrubber)
  - Annex 6: Wastewater Sampling and Measurement Results
  - Annex 7: Noise Measurement and Results
  - Annex 8: MSDS of Chemicals
  - Annex 9: Detailed Environmental Management Sub-Plans
    - (A) Solid Waste Management Plan

(B) Occupational Health and Safety Plan
(C) Emergency Response Plan
(D) Grievance Redress Mechanism (GRM)
Annex 10: Indoor Air Quality Monitoring Results
Annex 11: Factory Layout Plan

1.4.2 Timeframe of IEE

The major activity, report preparation takes about 7 - 8 months and the survey measurements of effluent, noise and workplace air quality took about one to two months to complete. During the time of IEE preparation, Covid-19 virus is spreading all over the country and social gathering events are strictly prohibited by the Government. Moreover, there was a political crisis happened in the earlier months of 2021 and IEE study was suspended for a certain period. Therefore, public consultation and public disclosures were postponed until the time when public gathering is allowed back at all. The timeframe of IEE Study is presented in the below table.

Table 1-3 Timeframe of IEE Study

No.		Major Works for IEE Preparation	Schedule (Week)																																		Note
			Mar-20				Apr-20				May-20				Jun-20				Jul-20				Aug-20				Sep-20- May-21				Jun-21				Nov-21				
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	Suspended weeks				1	2	3	4	1	2	3	4	
1)		Preparing IEE report in line with EIA Procedures																																					
	(i)	Site Visit, Investigation and Data Collection at Project Site																																					
	(ii)	IEE Report Preparation																																					
	(iii)	Translation of Exceutive Summary into Myanmar																																					
	(iv)	Finalization and Submission of IEE Report to ECD																																					
2)		Conducting required Field Measurement & Laboratory Analysis																																					
	(i)	Wastewater sampling and analysis in accordance with NEQG																																					
	(ii)	Onsite Noise Measurement																																					
	(iii)	Indoor Air Quality Measurement																																					
3)		Public Consultation Meeting (PCM) and Public Disclosure																																					Temporarily postponed due to Covid 19 Occurrence in Myanmar during IEE Preparation.
	(i)	Public Disclosure (PD)																																					
	(ii)	Conducting Public Consultation Meeting (PCM)																																					
	(iii)	Recollecting the comments (PD+PCM) and Reflecting back in IEE																																					

Source: EnvO Study Team

1.4.3 Instructions of ECD to MSS

Because of the complaints and concerns of the community, ECD (Mon State) has been monitoring the emissions from the stacks and continually giving instructions starting from 2018 to this date of IEE preparation. The monitoring results of emissions are further discussed in ANNEX 3. ECD gave altogether seven instruction notices that Myanmar Shing Shing factory shall implement. The most recent instructions that have given to this project are as follows;

i. To set up Auto Transfer Switch System which makes generator to operate immediately when the electricity breaks out in order to continuously run the wet scrubber (spray tower) system.
ii. To add reagents (lime, caustic soda) in an appropriate amount and time interval and to keep daily, weekly, monthly records.
iii. To maintain wet scrubber system from time to time and keep record of maintenance in daily, weekly and monthly manner.
iv. To measure emissions in a daily basis and report to ECD (Mon State) in a weekly manner.
v. To store antimony ores and coals under shelter, with cover and flooring to prevent ground water and soil contamination.
vi. To dispose solid wastes in selected location systematically to prevent impact on air, water and soil.
vii. To build wastewater collecting tanks, treatment system and recycle for the use of factory and to report the status of completion to ECD (Mon State).
viii. For the records, to include sign of responsible person and to define the amount of reagent. (lime, caustic soda); the amount in a bag and the time interval these are added.

ix. To plant trees beside the factory in the rainy season.
x. To provide PPEs to workers.
xi. To explain the above instructions to workers.

These instructions from ECD (Mon State) are moderately fulfilled by the project proponent at the time of IEE preparation and some key practices are appropriately considered in this report.

CHAPTER (2) POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

2.1 Overview of Policy and Institutional Framework

At Union Level, there are 24 ministries under the Office of the President (As of January, 2021). The leading ministry in-charge of environmental and social considerations is the Ministry of Natural Resources and Environmental Conservation (MONREC), which was reorganized with the former Ministry of Environmental Conservation and Forestry (MOECAF) and Ministry of Mines in April, 2016. The MONREC is acting as a focal ministry for the preparation of environmental related laws/ rules/ procedures/ policies and guidance, the management of environmental issues, and the development of sustainable projects in Myanmar.

Environmental Conservation Department (ECD) is the environmental protection branch of MONREC which was established in 2012, the same year as the first comprehensive law on the environment (Environmental Conservation Law) was enacted. ECL gives MONREC a range of duties and powers to implement ECD, including the implementation of Myanmar's environmental conservation policies, laying down of national and regional work plans concerning environmental management, the development and implementation of a system for EIA, issuing of ECC, and issuing and enforcing of environmental regulations.

One of the leading authorities for environmental control of base metal smelting and refinery industries in Mon State is ECD under MONREC. Departments under Directorate or Industrial Supervision and Inspection (DISI) such as Industrial Inspection Department, Boiler Inspection Department, Electrical Inspection Department, etc. regularly carry out inspections for the safety of machineries, boilers and electric wiring. ECD (Mon State) cooperate with related departments as described above for any investigations as necessary.

2.2 Applicable Laws and Regulations in Myanmar

2.2.1 Relevant Laws and Regulations in Myanmar

The following Table 2-1 describes the list of laws and regulations which are related to environmental, social, health and safety and emergency preparedness in Myanmar.

Table 2-1 Environmental and Social Related Laws and Regulations in Myanmar

No.	Applicable Laws and Regulations as of August 2020
Specific Laws and Regulations indirectly Related to the Proposed Project	
1	Myanmar Mines Law (1994, Amended in 2015)
2	Myanmar Mines Rules (2018, Amended in 2019)
Environmental Framework	
1	The National Environment Policy (1994)
2	Myanmar Agenda 21 (1997)
3	National Sustainable Development Strategy (2009)
4	The Environmental Conservation Law (2012)
5	The Environmental Conservation Rules (2014)
6	The National Environment Policy (2019)
7	Myanmar Climate Change Policy (2019)
EIA/Environmental Standards	
1	EIA Procedures (2015, Amended in 2019)
2	National Environmental Quality (Emission) Guidelines (2015)
Water Environment	
1	The Yangon Water-works Act (1885)
2	The Water Power Act (1927)
3	The Underground Water Act (1930)
4	The Territorial Sea and Maritime Zone Law (1977)

No.	Applicable Laws and Regulations as of August 2020
5	The Law on Aquaculture (1989)
6	The Conservation of Water Resources and Rivers Law (2006, Amended in 2017)
7	The Conservation of Water Resources and Improvement of River Systems Rules (2013)
Forestry/ Agriculture/Biodiversity	
1	The Embankment Act (1909)
2	The Forest Law (2018)
3	The Plant Pest Quarantine Law (1993)
4	The Animal Health and Development Law (1994)
5	The Forest Rules (1995)
6	The Fertilizer Law (2002)
7	The Pesticide Law (2016)
8	The New Plant Variety Protection Law (2019)
9	Protection of Biodiversity and Protected Area Law (2018)
Land Use	
1	The Land Acquisition Act (1894)
2	The Farmland Law (2012, Amended in 2020)
3	The Farmland Rules (2012)
4	The Vacant, Fallow and Virgin Lands Management Law (2012)
5	The Vacant, Fallow and Virgin Lands Management Rules (2012)
Heritage	
1	The Protection of Preservation of Cultural Heritage Regions Law (1998, Amended in 2019)
2	The Protection and Preservation of Ancient Monuments Law (2015)
3	The Protection and Preservation of Antique Objects Law (2015)
Health and Safety	
1	The Public Health Law (1972)
2	The National Drug Law (1992)
3	The Narcotic Drugs and Psychotropic Substances Law (1993)
4	The Traditional Drug Law (1996)
5	The National Food Law (1997)
6	The Control of Smoking and Consumption of Tobacco Product Law (2006)
7	The Prevention and Control of Communicable Diseases Law (1995, Amended in 2011)
8	The Law related to Private Health Care Services (2007, Amended in 2013)
9	Occupation Safety and Health Law (2019)
10	The Penal Code of Offences Affecting the Public Health, Safety Convenience, Decency and Morals (1961) (Amended in 2019)
Social	
1	Ethnic Right Protection Law (2015)
2	The Protection of Citizen Individual Rights and Personal Security Law (2017)
Economic Development	
1	The Export and Import Law (2012)
2	Myanmar Special Economic Zone Law (2014)
3	Myanmar Special Economic Zone Rules (2014)
4	The Foreign Investment Law (2012/Amendment in 2015))
5	The Foreign Investment Rules (2013)
6	Small and Medium Enterprises Development Law (2015)
7	Small and Medium Enterprises Development Rules (2016)
8	Economic Policy (2016)
9	Investment Policy (2016)
10	Myanmar Investment Law (2016)
11	Myanmar Investment Rules (2017)
12	The Myanmar Company Law (2017)
13	The Industrial Zone Law (2020)
Factory and Industry	
1	The Factories Act (1951)
2	The Private Industrial Enterprise Law (1990)
3	The Prevention of Hazard from Chemicals and Related Substances Law (2013)
4	The Business for Ozone Depleting Substances: Notification No.37/2014
5	The Prevention of Hazard from Chemicals and Related Substances Rules (2016)
6	The Industrial Use Explosive Substances Law (2018)

No.	Applicable Laws and Regulations as of August 2020
Working Environment	
1	The Worker's Compensation Act (1923)
2	The Payment of Wages Act (1936)
3	The Occupational Safety Plan (Standing Order 1/95)
4	The Occupational Health Plan (Standing Order 2/95)
5	The Labour Organization Law (2011)
6	The Labour Organization Rule (2012)
7	The Social Security Law (2012)
8	The Employment and Skill Development Law (2013)
9	The Minimum Wage Law/Rules (2013)
10	The Leave and Holiday Act (1951, partially Amended in 2014)
11	The Social Security Rules (2014)
12	The Factory Act (1951/Amendment in 2016)
13	The Shops and Establishment Act (2016)
14	The Settlement of Labor Dispute Law and Rules (2012/Amended in 2016)
15	The Payment of Wage Law (2016)
16	The Leave and Holiday Rules (2018)
Infrastructure Development/ Administration	
1	The Myanmar Hotel and Tourism Law (1993)
2	The Myanmar Insurance Law (1993)
3	The Constitution of the Union of Myanmar (2008)
4	The Electricity Law (2014)
5	The Boiler Law (2015)
6	The Ward or Village Tracts Administration Law (2012/ Amended in 2012/2016)
Livestock and Fisheries	
1	The Law relating to the Fishing Rights of Foreign Fishing Vehicles (1989, Amended in 1993)
2	The Law relating to Aquaculture (1989)
3	The Myanmar Marine Fisheries Law (1990, Amended in 1993)
4	The Freshwater Fisheries Law (1991)
5	The Animal Health and Development Law (1993)
Transportation	
1	The Obstruction in Fairways Act (1881)
2	The Canal Act (1905)
3	The Yangon Port Act (1905)
4	The Defile Traffic Act (1907)
5	The Ports Act (1908)
6	The Inland Steam Vessels Act (1917)
7	The Myanmar Aircraft Act (1934)
8	The Emergency Provision Act (1950)
9	The Motor Vehicles Law (2015)
10	The Highways Law (2000) (Amended in 2015)
11	The Utilization of Roads and Bridges Law (1985, Amended in 2015)
12	The Rail Carriers Law (2016)
13	The Road Carriers Law (2016)
Emergency	
1	The Natural Disaster Management Law (2013)
2	The Myanmar Fire-brigade Law (2015)

Source: EnvO Study Team

2.2.2 Myanmar's Agreed International Conventions and Treaties

The relevant international conventions to which Myanmar is a signatory are listed in Table 2-2. If the business activities taken under the proposed project fall under those agreements ratified by Myanmar, the project proponent shall follow the instructions as well as restrictions in accordance with relevant international agreements and treaties.

Table 2-2 Key International Conventions and Treaties Ratified by Myanmar

No.	International Agreements and Treaties	Date Ratified
1	Ramsar Convention (Convention on Wetlands of International Importance Especially as Waterfowl Habitat), 1971	2005
2	Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, D.C., 1973; and this convention as amended in Bonn, Germany, 1979	1997
3	Vienna Convention for the Protection of the Ozone Layer, 1985	1993
4	Basel Convention, 1989 on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	2015
5	Montreal Protocol on Substances that Deplete the Ozone Layer, 1989	1993
6	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London, 1990	1993
7	United Nations Framework Convention on Climate Change (UNFCCC), New York, 1992	1994
8	Convention on Biological Diversity, Rio de Janeiro, 1992	1994
9	Stockholm Convention on Persistent Organic Pollutants (POPs), 2001	2004 (Accession)

Source: The Republic of the Union of Myanmar, National Biodiversity Strategy and Action Plan (2011), Website of the Basel Convention (http://www.basel.int/Countries/StatusofRatifications/PartiesSignatories/tabid/4499/Default.aspx)

2.2.3 Myanmar's Legislation Applicable to the Proposed Project

The following table presents a summary of the project related laws and regulations which are currently in force as well as the responsibility of Project Proponent specifically for environmental, social and health and safety issues in accordance with each legislation. The project proponent is fully understood to follow the relevant sections of laws and regulations as listed in Table 2-3.

Table 2-3 Laws and Regulations Relevant to the Proposed Project

No	Name of Laws and Regulations	Content	Related Sections for Project Proponent
Specific Laws and Regulations indirectly Related to the Proposed Project			
1	Myanmar Mines Law (1994, Amended in 2015)	The 2015 amended Myanmar Mines Law is the main piece of legislation governing the mining and minerals sector in the country. It sets out the mining licensing framework and provides more detail on the small-, medium- and large-scale production of minerals.	In accordance with **Section 4,** A person or organization, desirous of carrying out any of the following operations, shall apply to the Ministry in accordance with the stipulations for obtaining permit: - (b) Prospecting, exploration and testing, feasibility studying, large scale production and processing, or buying and selling of mineral, industrial mineral or stones which involves citizen investment. In accordance with **Section 12**, The holder of the permit shall abide by the provisions of this law, rulers, orders and directives made thereunder, abide by the conditions contained in the permit, pay prescribed royalty and other fees payable under this law either by the cash or the mineral proportion in accordance with the stipulation. In accordance with **Section 13**, The holder of the permit shall make provisions for the environmental conservation works that may have detrimental effects due to the operation; ensure not to harm to the socioeconomic of local people and to minimize the environmental damages and reserve a fund for annual environmental conservation.

No	Name of Laws and Regulations	Content	Related Sections for Project Proponent
2	Myanmar Mines Rules (2018, Amended in 2019)	The Mining Rules lay down details of applying permit, and duties of permit holders, as well as rules related to mine closure, safety, labour, accidents, inspection and etc.	In accordance with **Chapter 10,** At the time of mineral processing permit application, Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) Report in accordance with Environmental Conservation Law, Rules and Environmental Impact Assessment (EIA) Procedures shall already be submitted for the relevant project. In accordance with **Section 192**, The holder of the permit shall be responsible for all expenses related to the environmental conservation.
Environmental Framework			
3	The Environmental Conservation Law (ECL) (2012)	The ECL provides the mandate for EIA and assigns the duty and power the MONREC (formerly MOECAF) to develop and implement "a system of environmental and social impact assessment as to whether or not a project or activity to be undertaken by any Government department, organization or person may cause a significant impact on the environment".	In accordance with **Section 14**, The Project Proponent shall treat, emit, discharge and deposit the substances which cause pollution in the environment in accordance with stipulated environmental quality standards. In accordance with **Section 15**, The Project Proponent 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. In accordance with **Section 29**, The Project Proponent shall not violate any prohibition contained in the rules, notifications, orders, directives and procedures issued under ECL. In accordance with **Section 30**, Without permission of the MONREC, the Project Proponent shall not import, export, produce, store, carry or trade any material which causes impact on the environment prohibited by the Ministry.
4	Environmental Conservation Rules (ECR) (2014)	The ECRs outlines guidance to integrate environmental conservation in sustainable development, ministry's responsibility to develop relevant guideline and regulation, setup of a monitoring system, waste management and conservation of natural resource and cultural heritage.	In accordance with **Section 54**, The Project Proponent shall conduct and submit required environmental impact assessment to the MONREC and shall submit that environmental impact assessment is intended to conduct by which third party or an organization to the MONREC in advance. In accordance with **Section 55**, The Project Proponent is responsible to conduct required environmental assessment (i.e. IEE for the proposed project) and shall prepare and submit environmental management plan to the MONREC. Consequently, it shall be implemented with stipulated terms and conditions approved by the MONREC within the time stipulated by the Ministry. In accordance with **Section 67**, The Project Proponent shall obtain the approval of the MONREC concerning the environment impacts. In accordance with **Section 69**, The Project Proponent shall not emit, ask to emit, dispose, ask to dispose, pile and ask to pile, by any

No	Name of Laws and Regulations	Content	Related Sections for Project Proponent
			means, hazardous waste or hazardous substances stipulated by notification according to any rules in this rule at any place which may affect the public directly or indirectly.
EIA/Environmental Standards			
5	EIA Procedures (2015, Amended in 2019)	The procedures set out specific requirements for scoping, Environmental Impact Assessment (EIA), Initial Environmental Examination (IEE) and Environmental Management Plan (EMP); defining roles and responsibilities of the ECD and the project proponent and specifying penalties for violating the requirements. Annex A of EIA Procedures provide the project categorization screening to determine the need for the development of an EIA, IEE or EMP for the proposed project.	In accordance with the **Sections specified in Chapter IV, Section 31 to Section 43** The Project Proponent shall make sure that IEE shall be prepared in accordance with the instructions specified in Chapter IV of EIA Procedures and submit it to the ECD. In accordance with **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. In accordance with **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. In accordance with **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.
6	National Environmental Quality (Emission) Guideline (NEQG) (2015)	NEQG 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.	The project proponent shall follow General Guidelines and Industrial Specific Guidelines for Base Metal Smelting and Refining Industry specified by NEQG.
Water Environment			
7	The Conservation of Water Resources and Rivers Law (2016, Amended in 2017)	This law is under the jurisdiction of the Ministry of Transport and Communication and focuses on transportation safety and its development. The law aims to – a) conserve and protect the water resources and river system for the beneficial utilization of the public; (b) enable smooth and safe waterways navigation along rivers and creeks; (c) contribute to the development of the state economy through improving water resources and river system; and (d) protect environmental impact.	In accordance with **Section 8**, The Project Proponent shall not cause the wastage of water resources willfully. In accordance with **Section 10**, The Project Proponent shall not – (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. In accordance with **Section 19**, The Project Proponent shall not dispose of any substance into the river-creek that may cause

No	Name of Laws and Regulations	Content	Related Sections for Project Proponent
			damage to waterway or change of watercourse from the bank.
8	The Conservation of Water Resources and Improvement of River Systems Rules (2013)	The rules specified detailed instructions and restrictions for various activities which are mainly related to river systems and water resources such as inland water transportation, construction of bridge, gold mining, sand extraction, etc.	In accordance with **Section 8**, The Project Proponent shall follow the disciplines regarding disposing sewage, oil, chemicals, toxic materials, hazardous materials, radioactive materials and others not to impact on water resources.
Heritage			
9	The Protection and Preservation of Ancient Monuments Law (2018)	Provisions to protect and preserve ancient monuments from any adverse impacts due to industrialization, tourism and urbanization.	In accordance with **Section 12**, If the project proponent found an ancient monument for one hundred years old or 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, it shall be promptly informed to the relevant Ward or Village-Tract Administrative Office.
10	The Protection and Preservation of Antique Objects Law (2015)	Provisions to protect and preserve antique objects so as not to deteriorate due to natural disaster or man-made destruction.	In accordance with **Section 12**, If the Project Proponent found any object which has no owner or custodian, it shall be promptly informed to the relevant Ward or Village-Tract Administrative Office if it seems reasonable to assume that the said object is antique object.
Health and Safety			
11	The Control of Smoking and Consumption of Tobacco Product Law (2006)	Regulating smoke free places; tobacco advertising, promotion and sponsorship; and packaging and labeling of tobacco products.	In accordance with **Section 7 and 9**, The Project Proponent shall arrange the specific place where smoking is allowed and make sure that no one shall smoke inside the factory which is specified as non-smoking area. Moreover, smoking area and non-smoking area signs shall be marked and captioned.
12	The Prevention and Control of Communicable Diseases Law (2011)	Describes measures to be taken in relation to prevention and control of communicable diseases, environmental sanitation, reporting and control of outbreaks of epidemics and penalties for those failing to comply.	In accordance with **Section 8**, The Project Proponent shall carry out the environmental sanitation measures under the supervision of the Health Officer of the relevant area for prevention of the outbreak of communicable disease and effective control of communicable disease when it occurs.
13	Occupation Safety and Health Law (2019)	The law is set to play a pivotal role in preventing workplace injuries, diseases and deaths with the aim to provide a framework for coordinated action across the different sectors.	In accordance with **Section 8,** The Project Proponent shall apply to the Factories and General Labour Laws Inspection Department for registration to enable to conduct occupational safety and health matters. In accordance with **Section 9,** If the Project Proponent wants to operate the following actions; it shall be notified to the Department for the purpose of Occupational Safety and Health. (a) building, extending or demolishing a factory or building; or (b) placing, installing, extending or changing the use of machines in accordance with the process. In accordance with **Section 10,** Notice shall be delivered do the Department if any registered Industries or Businesses are closed or come to an end, or they are relocated, or their nature of businesses or Employers are changed. In accordance with **Section 12**, The Project Proponent shall –

No	Name of Laws and Regulations	Content	Related Sections for Project Proponent
			(a) Appoint the person in-charge for Occupational Safety and Health to closely supervise safety and health of workers and (b) form the respective Occupational Safety and Health Committee comprising equal number of employer and worker representatives to become safe and healthy workplace on condition that the number of workers in the factory exceeds the number determined by the Ministry of Labour, Immigration and Population. In accordance with **Section 26,** The Project Proponent shall acknowledge the responsibilities of the Employer stated in **Section 26** and implement as practically as possible as per instructions of the Ministry. In accordance with **Section 28**, If any worker who has been injured due to an Occupational Accident or contacted with Occupational Disease which is not covered under the Social Security Law 2012, the Project Proponent shall pay for medical expenses to check the extent of capacity reduction and class of disability of such worker. In accordance with **Section 34**, (a) The Project Proponent shall inform the Department in case of an occupational accident, hazardous event of major and serious occupational Accident. (b) If a worker is in contact with a stipulated occupational disease or contaminated or likely to be contaminated due to materials or process used, the Project Proponent shall send a report to the Department together with a medical report prepared by the recognized doctor.
Economic and Investment			
14	The Export and Import Law (2012)	The law aims to implement the economic principles of the State successfully, to lay down the policies to export and import that support the development of the State; and that are to be in conformity with the international trade standards.	In accordance with **Section 5,** The project proponent shall not export or import restricted, prohibited and banned goods. In accordance with **Section 6**, Without obtaining license, the project proponent shall not export or import the specified good which requires permission. In accordance with **Section 7**, The project proponent shall not violate the conditions contained in the license.
15	Myanmar Investment Law (2016)	The law provides the overall legal framework for the investors and one of the main objectives of this law is to develop responsible investment businesses which do not cause harm to the natural environment and social environment.	In accordance with **Section 51**, The project proponent - (a) may appoint of any citizen who is a qualified person as senior manager, technical and operational expert, and advisor in his investment within the Union in accordance with the Laws; (b) shall appoint them to replace, after providing for capacity building programs in order to be able to appoint citizens to different level positions of management, technical and operational experts, and advisors; (c) shall appoint only citizens for works which does not require skill;

No	Name of Laws and Regulations	Content	Related Sections for Project Proponent
			(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 salary, leave, holiday, overtime fee, damages, compensation of the workman, social welfare, and other insurance relating 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. In accordance with **Section 65**, The project proponent - (a) shall respect and comply with the customs, traditions and traditional culture of the ethnic groups in the Union; (d) shall 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 government organizations, or to carry out registration; (e) shall immediately inform to the Investment Commission if it is found that natural mineral resources or antique objects and treasure trove are 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; (f) shall not make any significant alteration of topography or elevation of the land on which he is entitled to lease or to use, without the approval of the Commission; (g) shall abide by 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;

No	Name of Laws and Regulations	Content	Related Sections for Project Proponent
			(l) shall supervise foreign experts, supervisors and their families, who employ in their investment, to abide by the applicable laws, rules, orders and directives, and the culture and traditions of Myanmar; shall respect and comply with the labor laws; (o) shall pay effective compensation for loss incurred to the victim, if there are 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.
16	Industrial Zone Law (2020)	This law has been recently developed with the objective to assist the emergence of new industrials zones in accordance with national development framework. It describes requirements for establishing industrial zones, the permitted uses, responsibilities and duties of investors, land uses, environmental conversations and incentives for investors as well.	In accordance with **Section 39**, The project proponent shall implement Pollution Control Management and Energy Management in line with the regulations stipulated by the relevant Ministries. In accordance with **Section 40**, In existing industrial zones, where centralized waste collection and treatment system is not yet installed, the project proponent shall install by its own arrangement within specified time frame. In accordance with **Section 58**, The project proponent shall not dispose wastes with unsystematic methods, block wastewater drains, store raw materials and fuels in unsystematic ways, park vehicles or pile things up disorderly on roads.
Factory and Industry			
17	The Private Industrial Enterprise Law (1990)	This law defines the need of registration of private owned enterprises and describe the duties and responsibilities of the investor.	In accordance with **Section 4**, The project proponent shall register its private industrial enterprise which is three horsepower and above or manpower of ten wage-earning workers and above. In accordance with **Section 13,** The project proponent – (b) shall abide by the terms and conditions of the registration certificate; (e) shall accept the inspection of the person or inspection body assigned by the Directorate or Supervisory Body; (f) shall shift the place of enterprise, change the nature of enterprise, amalgamate enterprises and split up enterprises only with the approval of the Directorate; (g) shall abide by the orders and directives issued from time to time by the Ministry and the Directorate; In accordance with **Section 27,** The project proponent - (a) shall not distribute or sell the goods that has been produced without a trade mark: (b) shall not violate any provision of section 13: (c) shall not fail to comply with any order or decision passed by the Minister and the Director General:
18	Prevention of Hazard from Chemicals and Related Substances Law (2013)	This law aims to protect people, animals and the environment from hazardous chemicals; ensure chemicals and related substances businesses have licenses to operate safely; and ensure occupational safety,	In accordance with **Section 33,** The project proponent shall not produce, treat and formulate, use, possess, store, distribute, sell, transport, import or export the chemical or related substances prohibited by the Central Leading Board.

No	Name of Laws and Regulations	Content	Related Sections for Project Proponent
		health and environmental conservation for sustainable development.	In accordance with **Section 35,** The project proponent shall not use the chemical or the related substances which are unregistered or annulled from the registered list or not met to the quality and norm in the chemical and related substance business.
19	The Prevention of Hazard from Chemicals and Related Substances Rules (2016)	The rules specify the duties and powers for the different authorities and regulate how license holders and applicants shall comply with these.	In accordance with **Chapter XII, XIII, XIV, XV, XVI, XVII, XVIII** of the Prevention of Hazard from Chemicals and Related Substances Rules, the project proponent shall follow relevant regulations regarding to chemical safety during transporting, storing, using, discharging and use in laboratory.
Working Environment			
20	The Social Security Law (2012)	The law stipulates the formation and implementation of social security systems with the purposes of supporting the development of the State's economy through the development of production by causing to enjoy more security in social life and health care by the workers.,	In accordance with **Section 16,** The project proponent shall make insurance for the workers to enable to enjoy social security benefits by contributing to the social security fund.
21	The Employment and Skill Development Law (2013)	The law is implemented for the purposes of easy opportunities and jobs to assist in the job seeker to select job suitable to his age, capability, to get the job, to be stable in the job and to develop in the skill, to assist in the employer to get the suitable and compatible with the job.	In accordance with **Section 5 (a),** The project proponent shall conclude an employment agreement within thirty days after appointing a worker to do any work. In accordance with **Section 14,** The project proponent shall carry out training programs for increasing employment skill of the workers who are intended to appoint or who are working presently in his work in accord with the policy of the Skill Development Body according to the requirement of the work.
22	The Leave and Holiday Act and Rules (2014)	This act defines the public holidays that every employee shall be granted with full payment. It also defines the rules of leaves for workers including medical leave, earned leave and maternity leave.	In accordance with **this act and rules**, The project proponent shall grant the employees weekly day off, gazette holidays, earn leaves, casual leave, medical leave and maternity leave in accordance with specified rules and regulations.
23	The Minimum Wage Law/Rules (2013)	The law provides a framework for minimum wage determination for the workers.	In accordance with **the Minimum wage law and rules**, The project proponent shall pay required wages to the workers in line with terms and conditions defined in this law and rules.
24	The Settlement of Labor Dispute Law (2012, Amended in 2016)	This law was enacted for safeguarding the right of workers or having good relationship between employer and workers and making peaceful workplace or obtaining the rights fairly, rightfully and quickly by settling the dispute of employer and worker justly.	In accordance with **Section 14,** In any trade in which more than 30 workers are employed, the project proponent, with the view to negotiating and concluding collective agreement, shall: (a) if there is any labour organization, form the Workplace Coordinating Committee with the view to make a collective bargaining as follows: (i) two representatives of workers nominated by each of the labour organizations; (ii) an equivalent number of representatives of employer; (b) if there is no labour organization, form the Workplace Coordinating Committee as follows: (i) two representatives of workers elected by them;

No	Name of Laws and Regulations	Content	Related Sections for Project Proponent
			(ii) two representatives of employer.
25	The Factory Act (1951, Amended in 2016)	The Act stipulates the work condition of the workers in the factory such as working hours, worksite safety and health measures.	In accordance with **Chapter III, IV, V, VI, VII, VIII,** The project proponent shall implement in accordance with the regulations set out in the abovementioned chapters especially regarding to the occupational health and safety, wealth fare, and working time related issues.
26	The Payment of Wage Law (2016)	The law defines the payment obligation to the workers employed in the factories.	In accordance with **Chapter II, Section 3, 4, 5,** The project proponent shall pay wages in line with terms and conditions for payment method and time stipulated in abovementioned sections. In accordance with **Chapter III, Section 7, 8, 9, 10, 11, 12,** The project proponent shall make deduction from wages in accordance with terms and conditions stipulated in abovementioned sections. In accordance with **Chapter IV, Section 14,** When the workers work over time, the project proponent shall pay overtime wages stipulated by the law.
Emergency			
27	The Myanmar Fire-brigade Law (2015)	The law was enacted with the purposes to take precautionary and preventive measures against destruction and lose of properties; to organize fire brigades systematically and to serve when fire disaster, natural disaster, epidemic disease or any kind of sudden danger occurs.	In accordance with **Section 25,** The project proponent shall, in accord with the directive of the Department of Fire Services: (a) not fail to form the Reserve Fire Brigade; (b) not fail to provide fire safety equipment.
State Government's Laws and Regulations			
28	Mon State Municipal Law	Mon State Parliament enacted this law in June 2017, by describing the duties, responsibilities and administration of Municipal Committee.	In accordance with **Chapter (19), Section 83, 84, 85, 86, 87, 88, 89, 90, 91,** The project proponent shall not violate any restrictions described in abovementioned sections.
29	Mon State Fisheries Law	Mon State Parliament enacted this law in April 2014, with the objectives to reduce fish extinction and to protect fisheries sites.	In accordance with **Section (46),** In any fishing area, the project proponent shall not make any disturbance and demolition of fishes, aquatic creatures, living or non-living resources or water pollution.

Source: EnvO Study Team

2.3 Applicable Standards and Guidelines Values

In this section, the environmental, health and safety standards and guideline values which the project proponent will ensure the compliance during the operation of the proposed project are described.

2.3.1 Ambient Air Quality

If it is required to measure the ambient air quality, the NEQG guidelines values shown in the Table 2-4 will be set as the target value.

Table 2-4 Target Values of Ambient Air Quality

Parameters	Averaging Period	Value	Unit
SO_2	24 hours	0.02	mg/m^3
	10 min	0.5	mg/m^3
NO_2	1 year	0.04	mg/m^3
	1 hour	0.2	mg/m^3
Ozone	8 hours daily maximum	0.1	mg/m^3
PM10	1 year	0.02	mg/m^3
	24 hours	0.05	mg/m^3
PM2.5	1 year	0.01	mg/m^3
	24 hours	0.025	mg/m^3

Source: Myanmar National Environmental Quality (Emission) Guideline (29 Dec 2015)

2.3.2 Emission Air Quality

There is no specific emission standard or guideline values set out for antimony processing in Myanmar and only the guideline values for smelting and refining of base metals such as Lead, Zinc, Copper, Nickel and Aluminum are specified in NEQG.

Therefore, it is challenging to propose target values for antimony processing industry. Based on best available references, EnvO study team identified and proposed parameters and target values to be applied for smelting and refining of antimony. Basically, contaminants in air emission depend on the type of metal compositions, and the type of production processes. Referred to national and international guidelines such as NEQG guideline, IFC guideline for base metal smelting and refining and Good International Industrial Practices (GIIP), six parameters and target values which the proposed project shall follow during the operation phase have been set up as shown in Table 2-5.

Table 2-5 Target Parameters and Target Values of Air Emissions

Target Parameters	Level of Contaminant [a]	Target Values	Unit	Reference
Dust	Moderately Significant	1-5	mg/m^3	NEQG, IFC EHS guideline for Base Metal Smelting and Refining
Nitrogen Oxides	Significant	100-300	mg/m^3	
Sulphur Oxide	Significant	<50-200	mg/m^3	
Mercury*	Insignificant	0.02	mg/m^3	
Total Organic Carbon**	Insignificant	5-50	mg/m^3	
Dioxins**	Insignificant	0.1-0.5	ng TEQ [b]/ m^3	

Note: a: Level of contaminant is determined based on the type of production process used in the proposed project.
b: Toxicity Equivalence Factor
*: As monitoring technology and capable laboratory to analyze mercury content in flue gas is not available yet in Myanmar, it is added as a reference value for compliance and recommended to monitor when those become available in the future.

**: No specific evidence about the emission of TOC and Dioxin from antimony smelting but from non-ferrous metals or base metal smelting process. Therefore, it is added only as a reference value and recommended to monitor if the production capacity of the factory is to be considerably increased in the future.

2.3.3 Effluent Water Quality

In NEQG, there is only effluent guideline values for smelting and refining of base metals such as Lead, Zinc, Copper, Nickel and Aluminum and no specific values for antimony processing. In order to cover the properties of wastewater (effluent) generated from the proposed project, NEQG guideline values and some significant parameters defined in "BAT Guidance Note on Non-ferrous Metals and Galvanizing" prepared by Ireland, EPA are adopted as target effluent levels to be followed by the proposed project during the operation phase.

Table 2-6 Target Effluent Levels for Antimony Smelting and Refining

No	Test Parameter	NEQG Guideline Value	BAT Emission Level*	Unit
1	Aluminium	0.2		mg/l
2	Arsenic	0.05		mg/l
3	Cadmium	0.05		mg/l
4	Chemical Oxygen Demand	50		mg/l
5	Copper	0.1		mg/l
6	Fluoride	5		mg/l
7	Hydrogen Carbon	5**		mg/l
8	Lead	0.1		mg/l
9	Mercury	0.01		mg/l
10	Nickel	0.1		mg/l
11	pH	6-9		S.U.
12	Temperature Increase	<3***		ºC
13	Total Suspended Solids	20		mg/l
14	Zinc	0.2		mg/l
15	Oil and Grease		10	mg/l
16	Total Nitrogen		5-25	mg/l
17	Total Phosphorus		2	mg/l

Note: * "BAT Guidance Note on Non-ferrous Metals and Galvanizing" prepared by Ireland, EPA, 1st Edition,
** Laboratory Analysis for Hydrogen Carbon is not available yet in Myanmar.
*** At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity: when the zone is not defined, use 100 meters from the point of discharge.

Source: Myanmar National Environmental Quality (Emission) Guideline (29 Dec 2015), Effluent Levels for Nickel, Copper, Lead, Zinc and Aluminum Smelting and Refining

2.3.4 Ambient Noise Levels

Regarding the noise level during operation phase, target levels are set in compliance with guideline values shown in the NEQG, as shown in Table 2-7. Noise impacts which would be raised by the proposed project should not exceed the levels shown below, or result in a maximum increase in background levels of three (3) decibels at the nearest receptor location off-site.

Table 2-7 Target Noise Level in Operation Phase

Receptor	One Hour LA_{eq} dB(A) *	
	Day time 7:00-22:00 (10:00-22:00 for Public holidays)	Night time 22:00-7:00 (22:00-10:00 for Public holidays)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Note: * Equivalent continuous sound level in decibels
Source: Myanmar National Environmental Quality (Emission) Guideline (29 Dec 2015)

2.3.5 Odor

In accordance with NEQG guidelines, the proposed project shall control odors to ensure that odors that are offensive or unacceptable to neighbors do not occur. Generally, odor levels should not exceed five to ten odorant units[2] at the edge of populated areas in the vicinity of a project.

2.3.6 Occupational Health and Safety and Community Health and Safety

In Myanmar, the occupational safety plan (standing order 1/95) and occupation health plan (standing order 2/95), the factory act amended in 2016 are available to refer for occupational health and safety control. Moreover, occupational safety and health law was enacted by the Union Parliament in 2019 and it will become legitimate shortly. Hence forward, the project proponent shall follow the existing laws, rules and regulations related with health and safety issues and will adopt OHS and CHS practices guided by the International Finance Corporation (IFC).

(1) Noise Limits in Working Environment

For noise levels for working environment in operation phase, the parameters set out in IFC general guideline values shall be followed. The target level is shown in Table 2-8. No employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection.

Table 2-8 Target Noise Level for working environment in Operation Phase

Location/activity	Equivalent Level LA_{eq} dB (A), 8 hr *	Maximum LA_{max} dB (A), fast
Heavy Industry (no demand for oral communication)	85	110

Note: Equivalent continuous sound level in decibels
Source: IFC Environmental, Health, and Safety General Guideline

(2) No Approach Zones for High Voltage Power Lines

All energized electrical devices and lines shall be marked with warning signs. Besides, “No Approach” zones around or under high voltage power lines in conformance with Table 2-9 shall be established.

Table 2-9 No Approach Zones for High Voltage Power Lines

Nominal phase-to-phase voltage rating	Minimum Distance (Meters)
750 or more volts, but no more than 150,000 volts	3 m
More than 150,000 volts, but no more than 150,000 volts	4.5 m
More than 250,000 volts	6 m

Note: Equivalent continuous sound level in decibels
Source: IFC Environmental, Health, and Safety General Guideline

(3) Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) provides additional protection to workers exposed to workplace hazards in conjunction with other facility controls and safety systems. PPE is considered to be a last resort that is above

[2] The detectability of an odor is a sensory property that refers to the minimum concentration that produces an olfactory response or sensation. An odorant unit is defined as the amount of odorant mixtures which distributed in one cubic meter of air results in odor intensities corresponding to a defined threshold value. The odorant unit is therefore defined by a physiologically measured amount of substance. In practice, offensive odor can only be judged by public reaction to the odor, with the nuisance level being as low as two odorant units and as high as ten odorant units for less offensive odors. An odor assessment criterion of five to ten odorant units is likely to represent the level below which offensive odors should not occur.

and beyond the other facility controls and provides the worker with an extra level of personal protection. Table 2-10 presents general examples of occupational hazards and types of PPE available for different purposes.

Table 2-10 Summary of Recommended PPE According to Hazard

Objective	Workplace Hazards	Suggested PPE
Eye and Face Protection	Flying Particles, molten metal, liquid chemicals, gases or vapors, light radiation.	Safety glasses with side-shields protective shades, etc.
Head Protection	Falling objects, inadequate height clearance, and overhead power cords.	Plastic helmets with top and side impact protection.
Hearing Protection	Noise, ultra-sound	Hearing protectors (ear plugs or ear muffs).
Foot Protection	Falling or rolling objects, pointed objects, Corrosive or hot liquids.	Safety shoes and boots for protection against moving and falling objects, liquids and chemicals.
Hand Protection	Hazardous materials, cuts or lacerations, vibrations, extreme temperatures,	Gloves made of rubber or synthetic materials (Neoprene), leather, steel, insulating materials, etc.
Respiratory Protection	Dust, fogs, fumes, mists, gases, smokes, vapors	Facemasks with appropriate filters for dust removal and air purification (chemicals, mists, vapors and gases). Single or multi-gas personal monitors, if available.
	Oxygen Deficiency	Portable or supplied air (fixed lines). On-site rescue equipment.
Body/leg Protection	Extreme temperatures, hazardous materials, biological agents, cutting and laceration.	Insulting clothing, body suits, aprons, etc. for appropriate materials.

Source: IFC Environmental, Health, and Safety General Guideline

2.4 Institutional Arrangement and Environmental and Social Policies of the Company

2.4.1 Institutional Arrangement of Myanmar Shing Shing Factory

Under the management of Managing Director and Director, the operation manager takes the overall responsibility of operating the whole factory by leading three sections namely: Maintenance Section, Operation Section and Admin Section. Technical Group consisting of Twelve (12) Chinese National Experts supports MD and Director as well as operation manager by providing technical input for day to day factory operations. The following diagram shows the organization structure of MSS Factory as of June 2021.

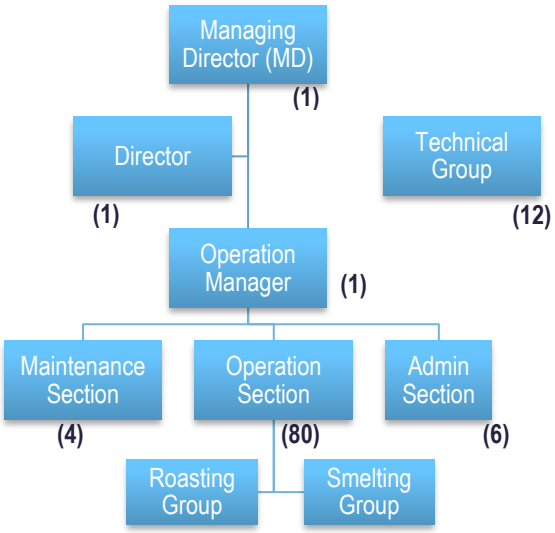


Figure 2-1 Organization Structure of MSS Factory

Source: Project Proponent
Note: (--) shows the numbers of staffs under each management role.

Duties and responsibilities of each functional role during the operation of the proposed project is summarized in Table 2-11.

Table 2-11 Duties and Responsibilities According to Function Role

Functional Role	Description of Responsibility
MD and Director	Policy Making, Decision Making, Overall Management, Interaction with Government Departments, Procurement of Raw Materials, etc.
Technical Group	Providing technical inputs to factory operation, advising MD and Director, Day to Day Quality Control and Supervision, etc.
Operation Manager	Overall Management of daily work, Close Supervision, Troubleshooting, Solving Complaints, etc.
Maintenance Department	Regular inspection and maintenance of all the machineries, equipment, vehicles, etc.
Operation Department	Operating with two divisions: Roasting Group and Smelting Group which implement the production of antimony ingot.
Admin Department	Administrating, Securing Factory and Workers' Accommodation, Preparing Meal for Workers, Cleaning, etc.

Source: Project Proponent

Previously, at the time of IEE preparation, there is no specific team specifically formed for environmental control. In Chapter (8), Environmental Management Plan, it is proposed to establish Environmental, Health and Safety (EHS) team using personnel from current organization structure in order to effectively manage the environmental, social and health and safety issues.

2.4.2 Environmental, Social and Health and Safety Policy

The project proponent is committed to protect and maintain the environment, to enhance the health and safety performance of the factory, and to consider social responsibility upon the local community. The basic policies to be applied in day-to-day factory operation are described below.

1. The company contributes the scope of its capabilities to improve economic, environmental and social conditions through its business activities.
2. Worker's safety and health is the top priority of the company and every worker shall strictly follow the specified regulations in every stage of the production.
3. The by-effects of factory shall not disturb or interrupt the surrounding environment especially including nearby factories and residents, and the worker's accommodations.
4. The company shall always give precedence to the concerns and complaints raised by the local community, arrange methods to receive and solve understandably in a timely manner.
5. The company shall reduce negative loads on the environment in every stage of the production starting from raw materials intake till the final product export.
6. The company shall follow the environmental related regulations, environmental standards and instructions by implementing the continuous improvement in environmental performance of the factory.
7. The company shall respect the national laws concerning with forced labor and ensure that there is no child labor in its value chain.
8. The factory shall respect all the rules and regulations enacted by the Union Government and the Mon State Government.

CHAPTER (3) PROJECT DESCRIPTION

3.1 Project Rationale and Background

3.1.1 Project Background

Myanmar Shing Shing Metal Company Limited started its operation in 2018 as Myanmar Shing Shing Antimony Smelting & Refinery Factory which was built in 2013 and previously owned by Kaung Kin Chout Pwint Company Limited. A series of upgrading the existing infrastructures, machineries, and control system such as longitudinal sections, bag houses, wet scrubbers, stack height, and etc. have been additionally implemented after handing over by the previous company.

3.1.2 Project Size & Scale

(1) Production Capacity

The average annual production of MSS factory is 20 tons/month while full production capacity of installed facilities is 50 tons/month (approximately 500 tons/year) and minimum is 10 tons/month. However, it would be varied on the availability of raw materials (antimony ore) from time to time.

(2) Infrastructures and Facilities

Infrastructures in MSS factory include office rooms, main building for antimony ingot production, raw materials storage areas, generator room, chemical store room, mini-laboratory and workers' accommodation, etc. The following table describes the areas of respective location inside the factory compound, whereas layout plan is illustrated in Figure 3-4.

Table 3-1 Infrastructures and Facilities in MSS Factory

No	Components	Area (sqm)	Note
1	Office Rooms	17.7	
2	Food Store	18.7	
3	Worker's Accommodation	513.9	
4	Living Room	19.4	
5	Food Store	18.7	
6	Dining Room and Hall	60.3	
7	Overhead Tank	66.3	
8	Breaker Room	30.8	
9	Workshop	62.1	
10	Mini-Laboratory Room	33.3	
11	Chemical Store Room	83.5	
12	Raw Material Temporary Storage Area	353.9	
13	Antimony Ingot Production Area	619.4	(Including Bag House, Store Room, Hot Water Tank, Cooling Tanks, Sedimentation Tanks, Wet Scrubbing Towers)
14	Product Storage Area	245.9	
15	Raw Material Storage Area	848.1	
16	Coal Temporary Storage Area	1513.7	At the time of IEE preparation, the low-lying open up area is filling with slags generated from the production process.
17	Canteen	170.6	

Source: Project Proponent

(3) Main Production Facilities

Machineries used in antimony refining and smelting processes and vehicles used for supportive activities are summarized in Table 3-2.

Table 3-2 Descriptions of Equipment and Machineries used in MSS

No	Item	Specification	Quantity
Raw Material Preparing			
1	Crushing Machine	Capacity – 2 Tons / hr	2
Roasting Process			
1	Shaft Furnace	Roasting Capacity – 2.5 Tons/batch Material Consumption – 1.4 Tons/batch (coke) (Approximately) - 0.7 Tons/batch (coal) - 0.5 Tons/batch (Antimony Ores)	3
2	Condensing Pipes	Diameter – 900 cm Height – 3 m (10 ft)	3
3	Blower	Air Flow Rate – 1440 rpm	16
4	Bag Houses	Numbers of Filter Bags – 484 + 400 = 884 Bags Filter Materials – Fabric Filtration Capacity – > 99% Height – 3.7 m (12 ft)	2
5	Bag Filter	Filter Materials – Fabric Filtration Capacity – > 99%	1
Smelting Process			
1	Smelting Furnace	Smelting Capacity – 50 Ton/batch (antimony oxide powder) Fuel Consumption – 1000 Gal/batch (Diesel)	1
Vehicles used for Transportation			
1	Forklift		2
2	Wheel Loader		1

Note: * Smelting process takes place 7 to 10 days and only two batches are running in a month.
Source: Project Proponent

3.2 Project Location, Overview Map and Site Layout Maps

3.2.1 Location

The MSS factory is located at Plot No. (325,326,327,328,329,330), Shwe Myo Taw 1st Street, Mawlamyine Industrial Zone, Nyaung Pin Seik Village Tract, Kyaikmaraw Township, Mon State as shown in Figure 3-1.

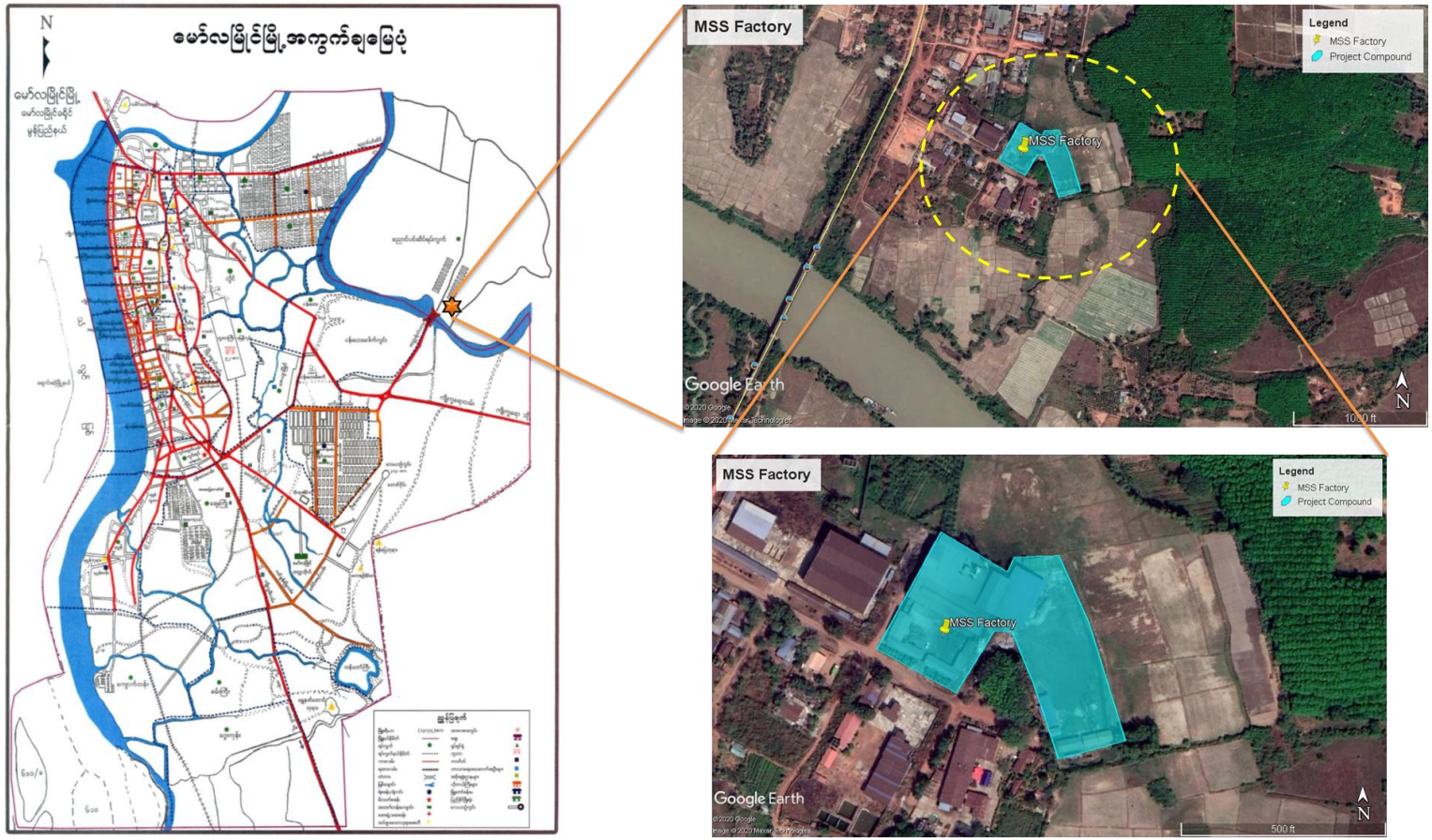


Figure 3-1 Satellite Photos showing Project Location in Mawlamyine Industrial Zone

Source: EnvO Study Team

3.2.2 UTM Map

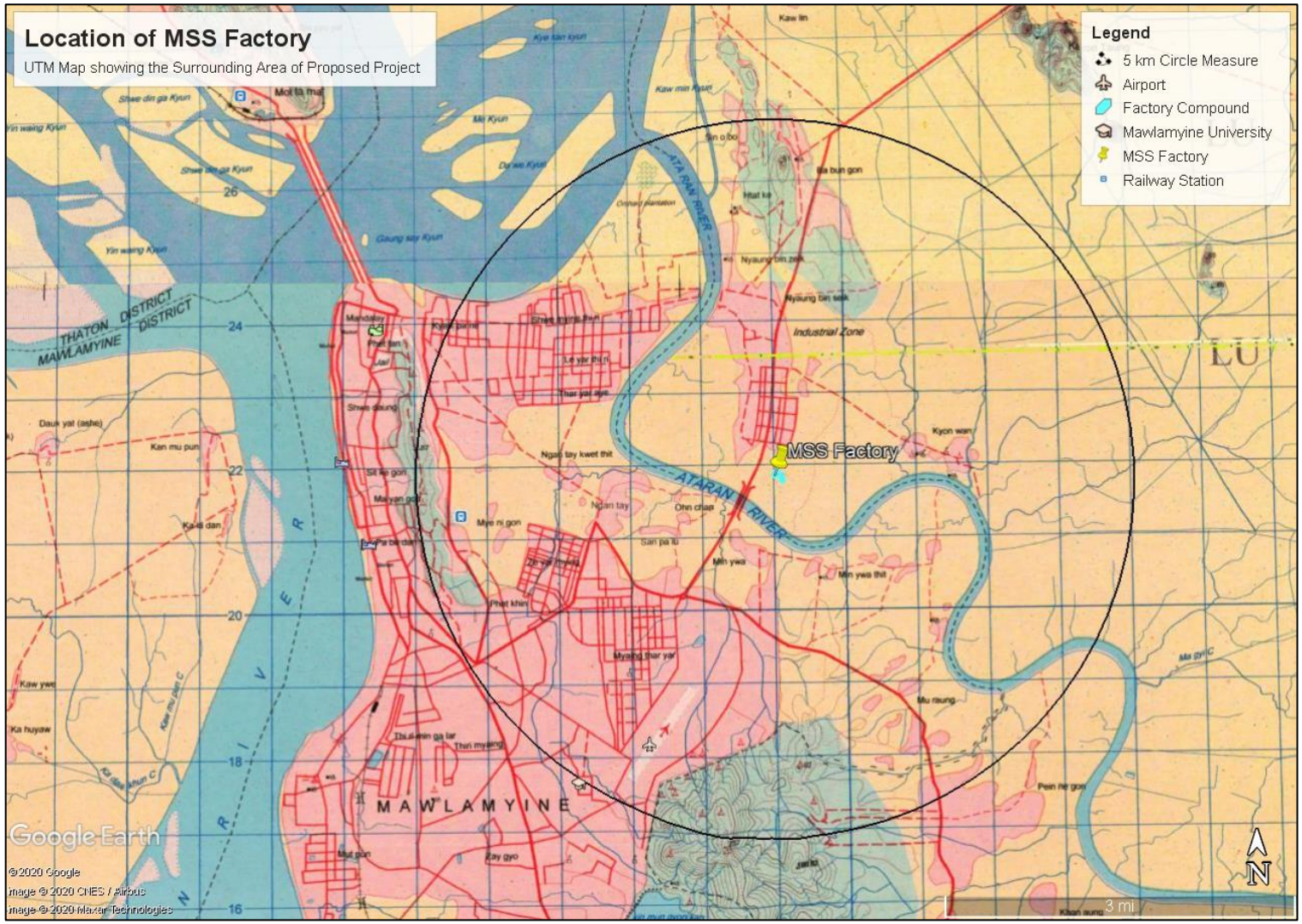


Figure 3-2 UTM Map Showing the Surrounding Areas of the Project

Source: Base UTM maps are illustrated by Survey Department, MOALI, First Edition 2006 / Image Overlaid in Google Earth Pro by EnvO Study Team

3.2.3 Land Use Coverage of Nearby Project Site

As per visual perception from google earth, the factory's north east part is covered with land use for Industrial purpose. Most of the surroundings lands are the farmland areas. At the north west of the Factory, there is a broad area of land use for rubber plantation. The land use coverage of the Factory's surroundings is presented in Figure 3-3.

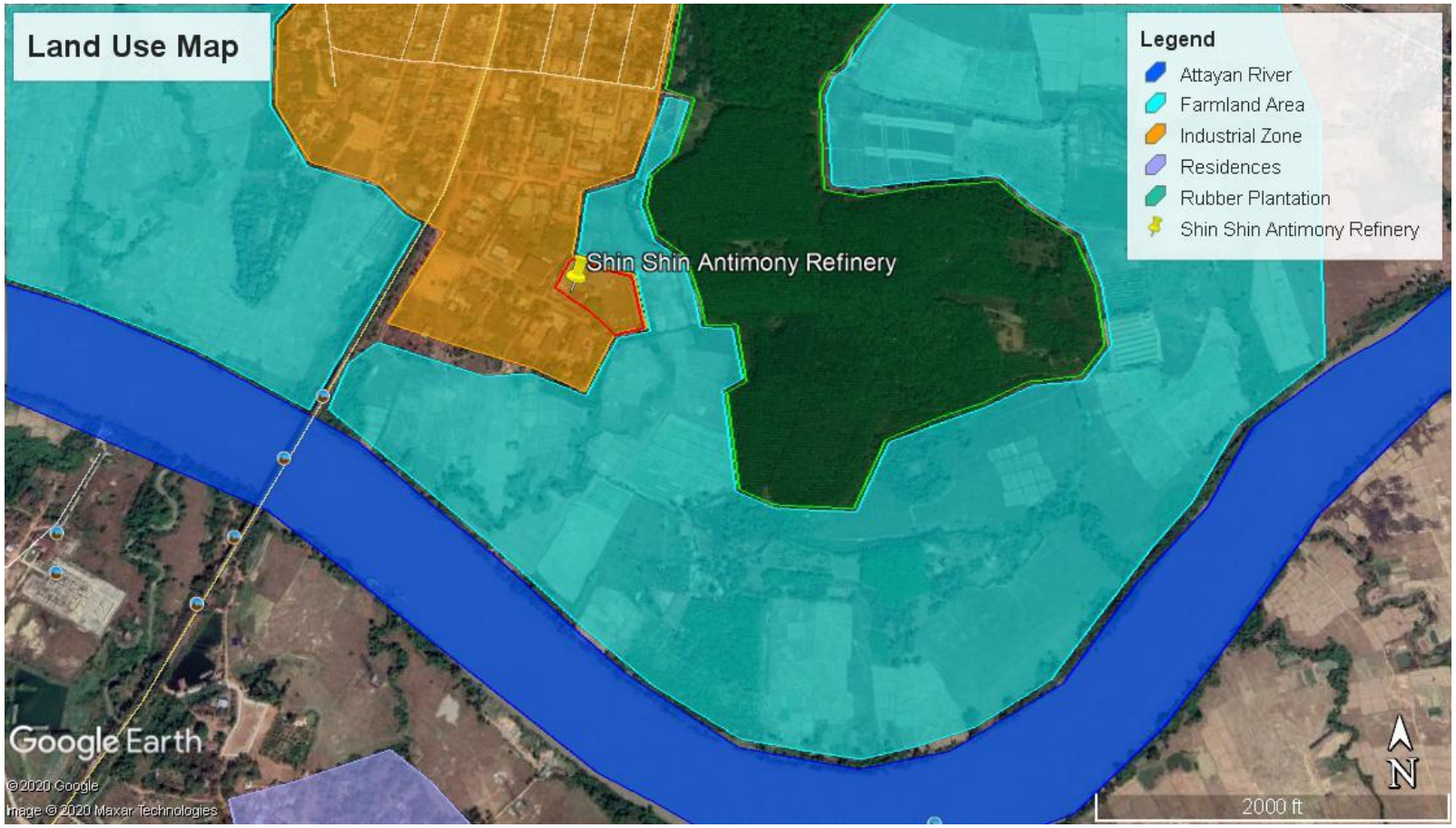


Figure 3-3 Map Showing the Land Use Status of Factory's Surroundings

Source: EnvO Study Team

3.2.4 Layout Plan

Figure 3-4 Layout Plan of MSS Factory

Source: Project Proponent (Note: Clear Version of Layout Map in A-3 size is attached in the Annex 11.)

3.3 Project Operation Status

MSS factory normally operates 24 hours a day and 7 days a week with respective assigns alternatively. However, the factory shuts down its operation during Thingyan Festivals and occasional shut-down occurs when there is a shortage of raw materials. Detail operational status of MSS factory is described in Table 3-3.

Table 3-3 Operation Status of MSS Factory

Types of work	Working days	Working Hours	Provided Holidays	Notes
Office and Administration	From Monday to Saturday	8 am to 5 pm	4 days per month + Deserted Holidays	Overtime fees are provided as per government's regulations.
Factory Operation	Weekdays and Weekends*	8 hours for each shift (3 shifts per day)		
Approximate Maximum Annual Operation Days = 190 to 220 Days per year Generally, factory operation is annually paused in rainy season (about two to three months) for factory maintenance.				

Note: * Weekends and public holidays are off in 2020 and 2021, during the time of covid-19 crisis.
Source: Project Proponent

3.4 Raw Materials and Products

3.4.1 Input Materials / Raw Materials

The major raw material used in the production process is the antimony ore which includes different types of form such as soil, granular and solid stone. Other input materials are also shown in the following table with detailed descriptions.

Table 3-4 Summarized List of Raw Materials Used in MSS Factory

No	Raw Materials	Uses of Raw Materials	Source	Average Amount (Ton per Month)	Characteristics
1	Coal (Anthracite Coal)	Use as fuel in roasting furnace (25%-50% of fuel)	Kalaewa Township, Magway Region* China Import	67	Sulphur Content – 0.5%
2	Coke	Use as fuel in roasting furnace (50%-75% of fuel)	China Import	133	Sulphur Content – 0.73%
3	Antimony Ore	Major Raw Material for Production use in roasting furnace	Near Nat San Village, Kyeikmayaw Township, Mon State and Other Mines	60	The following 3 Types of Antimony ore are used in accordance with the availability of each material. Sulphur content in antimony ore is about 0.8 percent.

No.	Antimony Type	Antimony Grade	Form
1.	Yellowish Antimony Rich Soil (around 20-30% of Antimony)	Medium Grade	Soil
2.	Antimony Ore (around 15% of Antimony)	Medium Grade	Granular
3.	Antimony Ore (around 25% of Antimony)	High Grade	Solid Stone

No	Raw Materials	Uses of Raw Materials	Source	Average Amount (Ton per Month)	Characteristics
4	Soda Ash Light	Used as fluxing agent in smelting Process	China and India Import	6	Soda ash light contains sodium carbonate which is white granular solid with no odor.
		Used as reagent in Wet Scrubber Operation		0.9**	
5	Mono Ammonium Phosphate	Used as fluxing agent in smelting Process	China Import	6	It is white powder solid with odorless. It is soluble in water and stable under normal handling and storage conditions.

Note: * Local coal from Kalewa Mine is currently unused and only the hard coal (anthracite coal) from china import is in use.
** 0.9 ton per month of Soda Ash is used when the operation is running with full capacity.
Source: Project Proponent

3.4.2 Products

(1) Semi-Product (Antimony Oxides Powder)

Antimony oxide powder is resulted from the roasting line. It has nearly 80% percent of purified antimony. This can be also called as the primarily purified raw material to make the antimony ingots. Powder is either kept in the baghouse or temporarily stored by packing with jumbo bag until it is smelted in the furnace.

Figure 3-5 Antimony Oxide Powder packed with the Jumbo Bag

(2) Final Product

The factory refines and smelts the impure antimony ore into the pure antimony base metal and manufactured as a form of antimony ingot, each of which has a weight of 25 kg. It is 97 % pure antimony, base metal, with the maximum production capacity, 500 tons per annually. All manufactured ingots are all exported to European and Asian Countries for further use in products such as flame retardants, batteries, plastics, glass, semiconductors and alloys. The physical properties of antimony ingot produced from MSS factory are as follows:

Table 3-5 Compositions of Metals in Antimony Ingot

Category	Percentage (%)									
	Sb	Pb	As	Cu	Fe	Bi	Ag	Sn	Se	Te
Antimony Ingot	97.27	1.90	0.81	0.004	0.004	0.001	0.007	0.0008	0.0008	0.0008

Source: Project Proponent

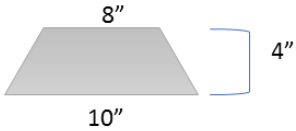


Figure 3-6 Antimony Ingots and its Dimensions

3.4.3 Raw Materials Storage

(1) Storage of Antimony Ores, Coal and Coke

Raw materials such as antimony ores, coal and coke used are stored in various location within and outside of the Factory. Locations for storage of raw materials are illustrated in Figure 3-7. Coal is transported from Kalaewa and Sagaing to the factory. It is usually carried out by the 10 wheeled trucks covered with sheet. Coke is imported from China via ships and via trucks from Port to the Factory. Antimony ores are transported from Nat San Village, Kyaikmayaw with 40 kg packed bags via trucks.

Figure 3-7 Location of Raw Materials Storage

(2) Storage of Chemicals

The main chemicals used in the operation processes, smelting and wet scrubber operation of MSS factory, the Soda Ash Light and Mono Ammonium Phosphate are separately stored in a chemical store inside the factory. Storage conditions and the location of chemical store can be seen in the following Figure 3-8.

Figure 3-8 Storage Condition of Soda Ash Light and Location of Chemical Store

3.4.4 Quality Control

(1) Mini Laboratory

As the quality of the product could be variable based on the factors such as processing temperature, volume of air and quality of the raw materials, the laboratory always makes tests on the quality of raw materials, products and other generated materials from production line such as skimmed mineral layers and slags from roasting furnace.

Coal, coke and different antimony ores are tested when it arrives to the factory for its technical specification such as sulfur content, antimony concentrate percentage and carbon content. Slags from roasting furnace are tested to know the content of the antimony presented left and if the antimony percent is exceeding 0.01%, they are roasted back in the furnace. Skimmed layer is also tested and smelted back in the furnace if there is any antimony present.

Figure 3-9 Photos of Quality Control Mini-Laboratory

3.5 Production Processes

3.5.1 Process Overview

Generally, antimony can be processed by using two ways: pyrometallurgy and hydrometallurgy techniques. Pyrometallurgical process separate desired antimony metal from other less desirable or undesirable materials in the molten state at very high temperature (around 1000 ºC). Hydrometallurgy differs from pyrometallurgical process in that the desired metals are separated from undesirable using techniques that utilize acid or basic solutions at temperatures generally below 300 ºC.

The processing method depends on whether the ore is sulfide, an oxide, or a complex ore, and on the grade, which ranges widely from about 1.5 percent to more than 60 percent antimony by weight. The ore which is used in MSS factory is favorable to use roasting and smelting method in other words, pyrometallurgy technique for the primary production of antimony. The production process is illustrated in Figure 3-10 and Figure 3-11 respectively.

As a very first step, the raw materials are prepared to be added into the production process. Roasting stage started to take place by roasting antimony ore with coke and coal around 1000 degree Celsius in the roasting furnace. When stibnite is heated, oxidation occurs with formation of the volatile antimony trioxide and those are recovered by the bag filter and bag houses after passing through the condensing pipes. The roasting stage results the antimony trioxide powder that is nearly 80 percent concentrated.

Then the resulted antimony trioxide powder is melted in the smelting furnace with the help of fluxing agent such as soda ash light and mono ammonium phosphate by heating at the temperature around 800 to 1100 degree Celsius. After smelting for 7 to 10 days, the smelted antimony is casted out. The manufactured antimony ingots are tested at the laboratory for the content of antimony presented. If it reaches the products quality standard, they are packed and ready to be exported. The antimony ingots contain about 97 percent of antimony. The flue gas emitted from both roasting and smelting processes are filtered by the bag filter/bag house and then treated in the wet scrubber before emitting from the stack.

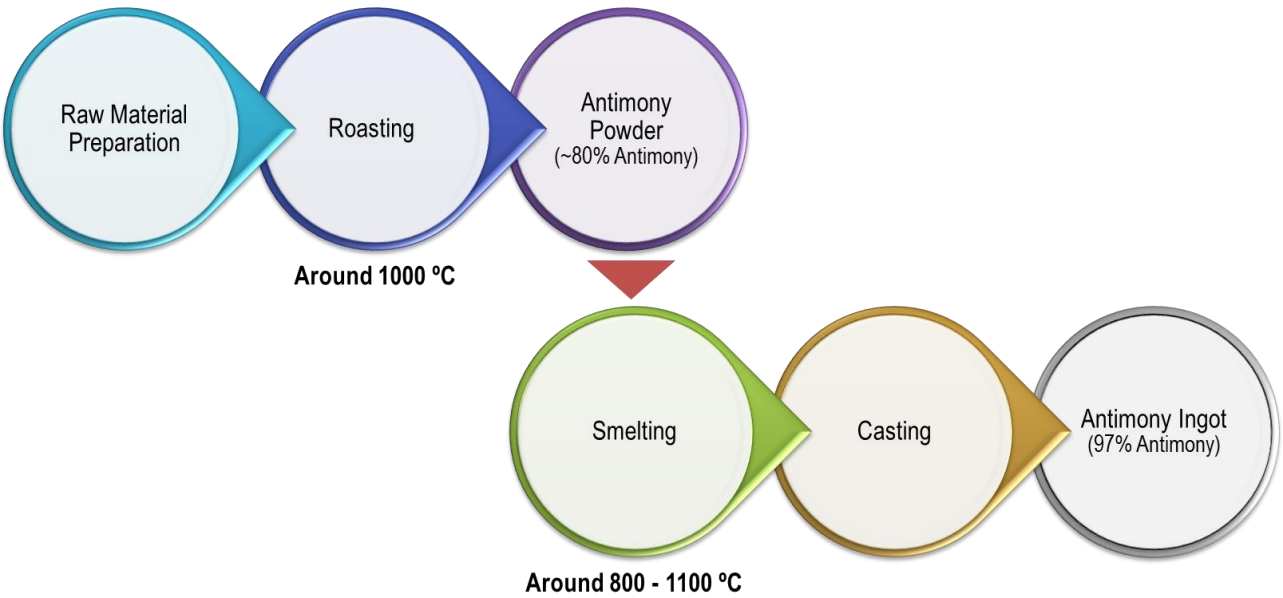


Figure 3-10 Overview Process of Antimony Production in MSS Factory

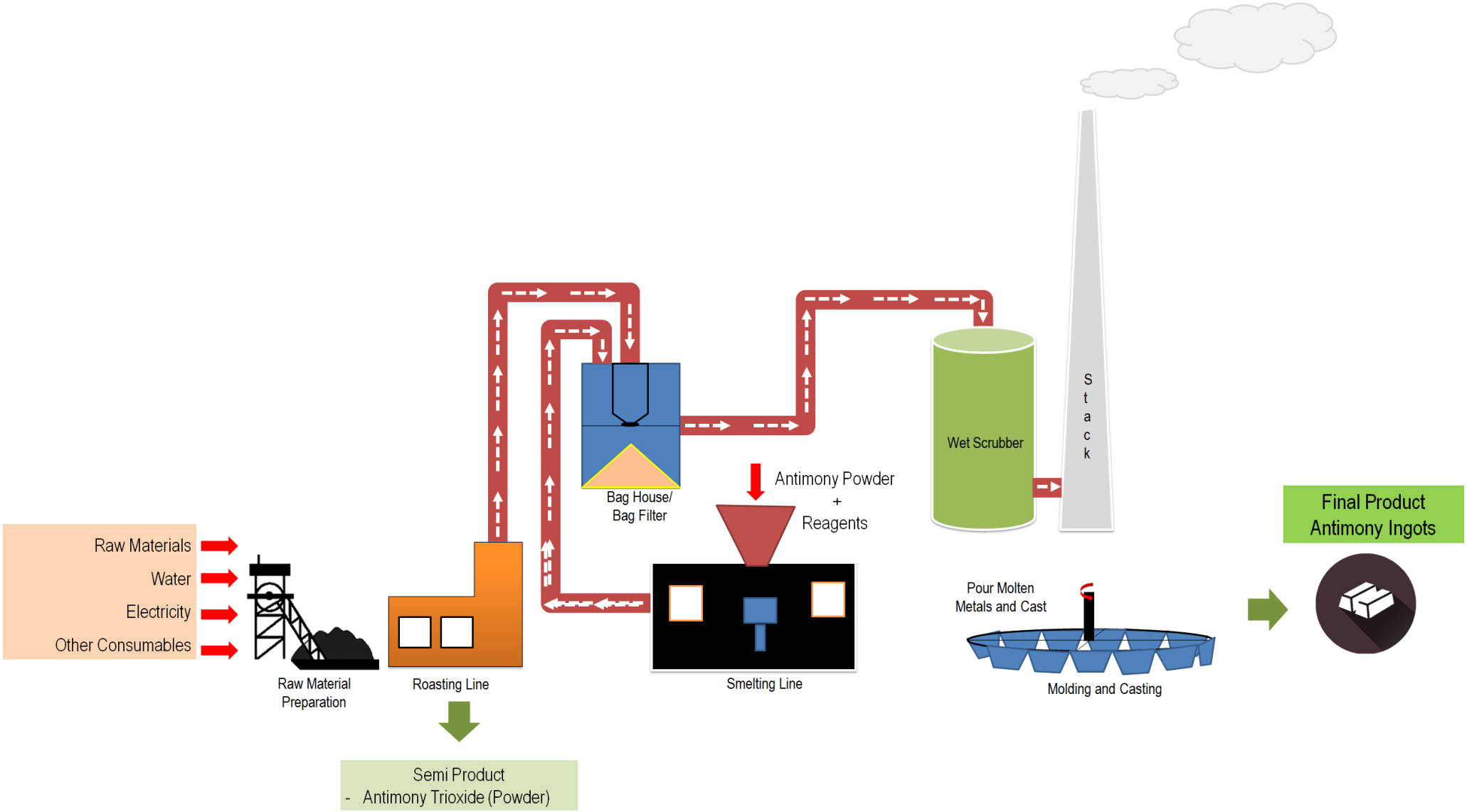


Figure 3-11 Antimony Refining and Smelting Process Illustration

3.5.2 Detailed Processes

(1) Raw Material Preparing

Different grades of antimony ores are mixed manually before putting into the shaft furnace to be roasted as shown in Figure 3-12 (a). The composition of each grades of ores varies as per the specifications of ores, burning temperatures and other situations. Therefore, proportion of mixture is determined by the technical support of Chinese experts. Coal to be used are crushed into the suitable size which in convenient to use in roasting and smelting furnaces. The crushed coal is also mixed with coke to get better calorific value for required temperature.

(a) Pile of Mixture of Antimony Ores

(b) Crushing Coal

Figure 3-12 Raw Material Preparation and Pilling before Using in Production

(2) Roasting (Volatilization Roasting)

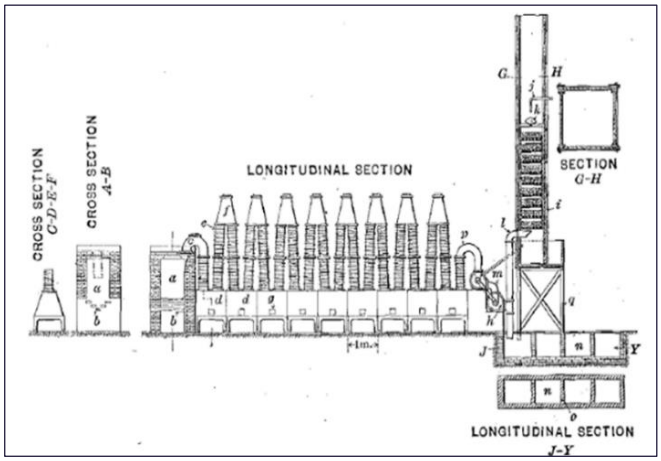
Figure 3-13 Roasting Process Flow

Roasting process is the conventional technique used in the pyrometallurgical processing where the antimony ore is heated/dried and oxidized. During roasting, the sulphur in antimony ore is removed by adding air and simultaneously heating and drying to achieve sulphur content favorable for smelting. The sulphur is released as Sulphur dioxide in the flue gas and later it is removed by off-gas treatment facility (Wet Scrubber) installed at the factory.

As the first step, coal and coke mixture is put into the shaft furnace. It takes the fuel (mixture of coal and coke, 1:1 or 2:1 ratio) to get burnt for 2 hours to 3 hours to reach the desire temperature (around 1000 degree delicious) for roasting. When it reaches the desire temperature, the prepared mixture of antimony ores is added over the flamed fuel.

The antimony ores get roasted and volatilized into the gases (antimony oxides) and Sulphur dioxide (SO_2) is produced as an off-gas as per the following equation. And then, hot gas is sucked by the blowers to recover the antimony powder by using the bag filters after passing through the condensing tubes. This stage typically takes round about 5 hours for converting of antimony ores into antimony powder.

Figure 3-14 Chemical Reaction of Antimony Roasting



(a) Conceptual Layout of Roasting Antimony Ore[3]

(b) Shaft Furnace for Roasting

(c) Feeding Raw Materials into the Roasting Furnace

(d) Condensing Pipes for Antimony Trioxide Recovery

[3] https://www.911metallurgist.com/blog/antimony-smelting

(e) Collecting Antimony Oxide Powder through the Openings of Condensing Pipes

(f) Bag Filter for Final Catching of Antimony Trioxide Powder

Figure 3-15 Machineries used in Roasting Process

The deposited antimony trioxide powder is finally caught by the bag filter and bag houses before emitting outside through the stack. The residual powder which stuck at the bag filters is cleaned and taken out once in every two weeks from the openings through the pipelines. The gas is finally emitted through the stack after passing the wet scrubber.

(3) Smelting

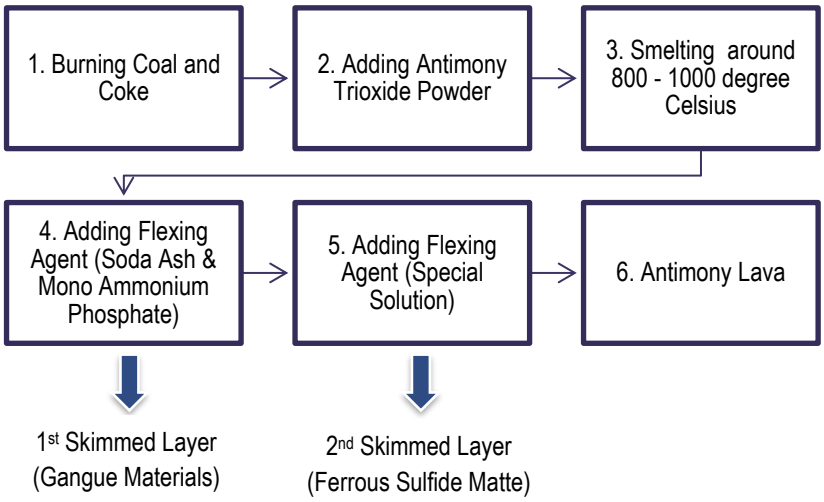


Figure 3-16 Smelting Process Flow

Smelting serves two functions: first, to melt the antimony concentrates to a molten state, and second, to separate the metal of value (antimony) from other less desirable metals, impurities and gangue materials. Antimony powder are fed to the furnace along with fluxing agents (Soda Ash & Mono Ammonium Phosphate). High temperature (800 to 1100 degree Celsius) cause the feed materials to melt.

During smelting, the coal and coke serves as reducing agent for oxides, while the soda ash combines with any sulfur present or serves as a slagging agent for the gangue materials. The sodium sulfide formed in the melt will combine with any iron present to form a matte, which is lighter than the metal (antimony melt) is removed from the smelting furnace as a first skimmed layer.

The special reductant is required to add drops by drops to remove lead if the lead content is discovered to be so high in the first skimmed layer. The whole smelting process typically takes 7 to 10 days to cast out the antimony ingots. The hot gas emitted from the smelting process is passing through the condensing tubes and entered the bag house in order to recover the valuable content, antimony powder. Then it is finally emitted from the stack after getting treated by the wet scrubber.

(a) Smelting Furnace

(b) Feeding fuels to the Smelting Furnace

(c) Condensing Tubes connecting with Furnace

(d) End of Condensing Tubes connected to the Bag House

(e) Bag House

(f) Filter Bags inside the Bag House (Washed and Dried Outside of the Baghouse)

Figure 3-17 Machineries used in Smelting Process

(4) Casting

After 7 to 10 days, when liquid antimony is finally achieved, the metal liquid is poured from the furnace into the molds which are in the dimension of the final product, antimony ingots. The circular pivot which has a capability of altogether 34 molds as shown in the below figures.

Figure 3-18 Circular Pivot Casting Molds

3.6 Resource Utilization

3.6.1 Water Consumption

Water is mainly used in the MSS factory for cooling of condensing pipes and wet scrubber operation. Water used for those operation purposes is obtained from the Attaran River, by pumping up from the riverbank and connected to the water tank at the factory. River water is also used for other general purposes such as washing of filter bags and cleaning purposes.

There are three tube wells within the factory compound which are only used for cooking and other domestic use for the workers (averagely 80 workers) such as bathing, washing, cleaning, watering, etc. Estimated monthly water consumption amount is summarized in the Table 3-6.

Table 3-6 Monthly Water Consumption of MSS Factory

Items	Monthly Water Consumption (Gal/ Month)
Use in Factory Operation (Attaran River)	
Water Use for Cooling	~ 6000 Gallons per Month
Water Use in Wet Scrubber	
General Use	
Domestic Use (Tube Well)	
General Use	For Averagely 80 Workers

The following Figure 3-19 illustrates the location of tube wells inside the factory compound and the pump house at the Attaran River bank. Besides, relevant photos of water intake point and the tube wells are described in Figure 3-19.

Figure 3-19 Water Intake Point from Attaran River and Location of Tube Well

(a) Water Intake Point (Pump House)

(b) Water Motor Installed at Pump House

(c) Tube Well – 1 Near the Office

(d) Tube – 2 & 3 Near the Canteen of Workers' Accommodation

Figure 3-20 Photos Showing Water Intake Point and Tube Wells

3.6.2 Electricity Consumption

The factory obtains its required electricity from the National Grid. For the factory operation, the main units which use electricity are the blowers installed in furnace and for the wet scrubber operation. As the electricity is not reliable in Mawlamyine Industrial Zone, two back-up generators are arranged in MSS factory.

Table 3-7 Summary of Electricity Facilities Installed

Sources	Capacity	Quantity
Regular Use		
Transformer	250 kV	1
	500 kV	1
Temporary Use (In case of Electricity Cut-off)		
Back-Up Generator - 1	300 kV	1
Back- Up Generator - 2	300 kV	1

Figure 3-21 Transformer

Figure 3-22 Backup Generator

3.6.1 Fuel Consumption (Diesel)

Fuel is used in the smelting furnace, back-up generators and the motor vehicles (wheel loaders, forklifts and etc.) used at the MSS factory. The detail consumption for each use is presented below. Storage location of diesel at site can be seen in Figure 3-23.

Table 3-8 Monthly Fuel Consumption at MSS Factory

Purpose	Monthly Consumption (gallons per month)
Smelting Furnace	2,000 Galloons
Back-up generators	100 Galloons
Motor Vehicles	500 Galloons
Total	2,600 Galloons

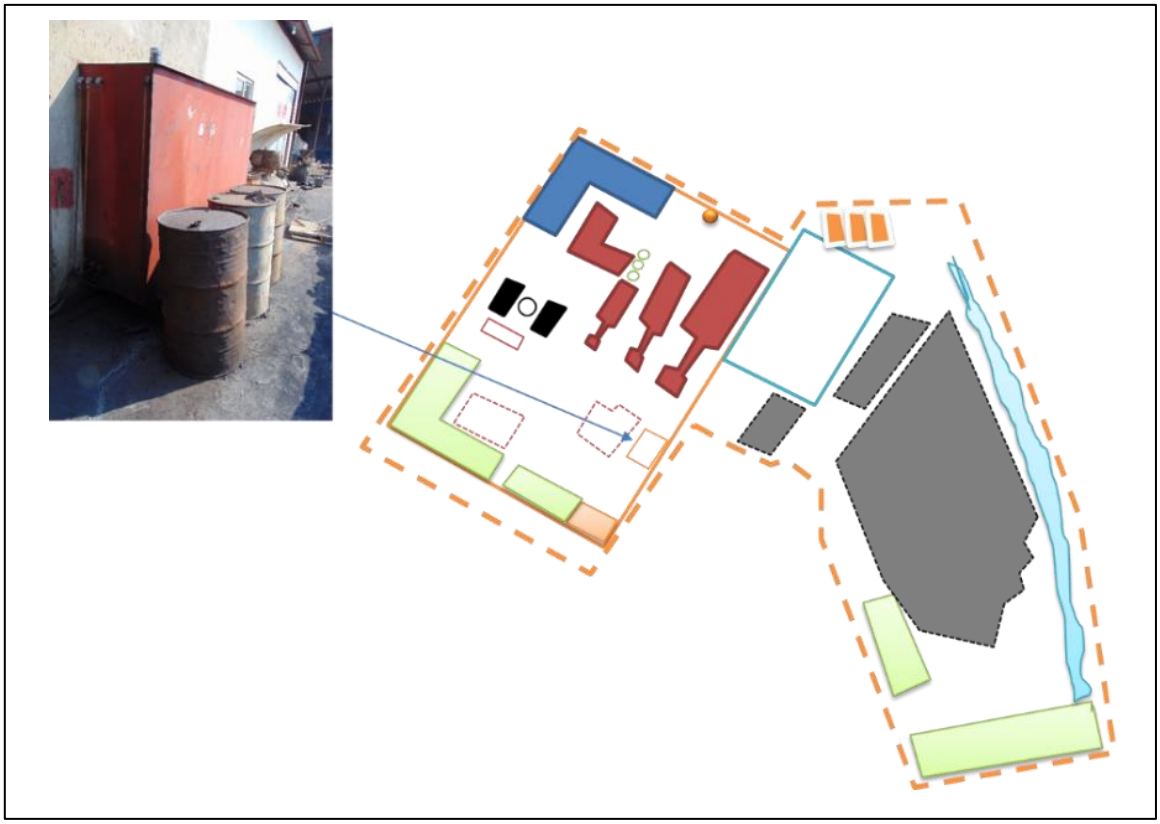


Figure 3-23 Location of Fuel Storage

3.7 Current Pollution Control Measures

3.7.1 Typical Environmental Impacts from Antimony Processing Industry

The typical environmental impacts which could be potentially arise from the antimony processing include – air pollution, odor, soil pollution and water pollution due to the relevant operation processes as illustrated in the following Figure 3-24. In order to prevent the potential impacts, MSS factory have implemented preventive and management measures as described in the following sections.

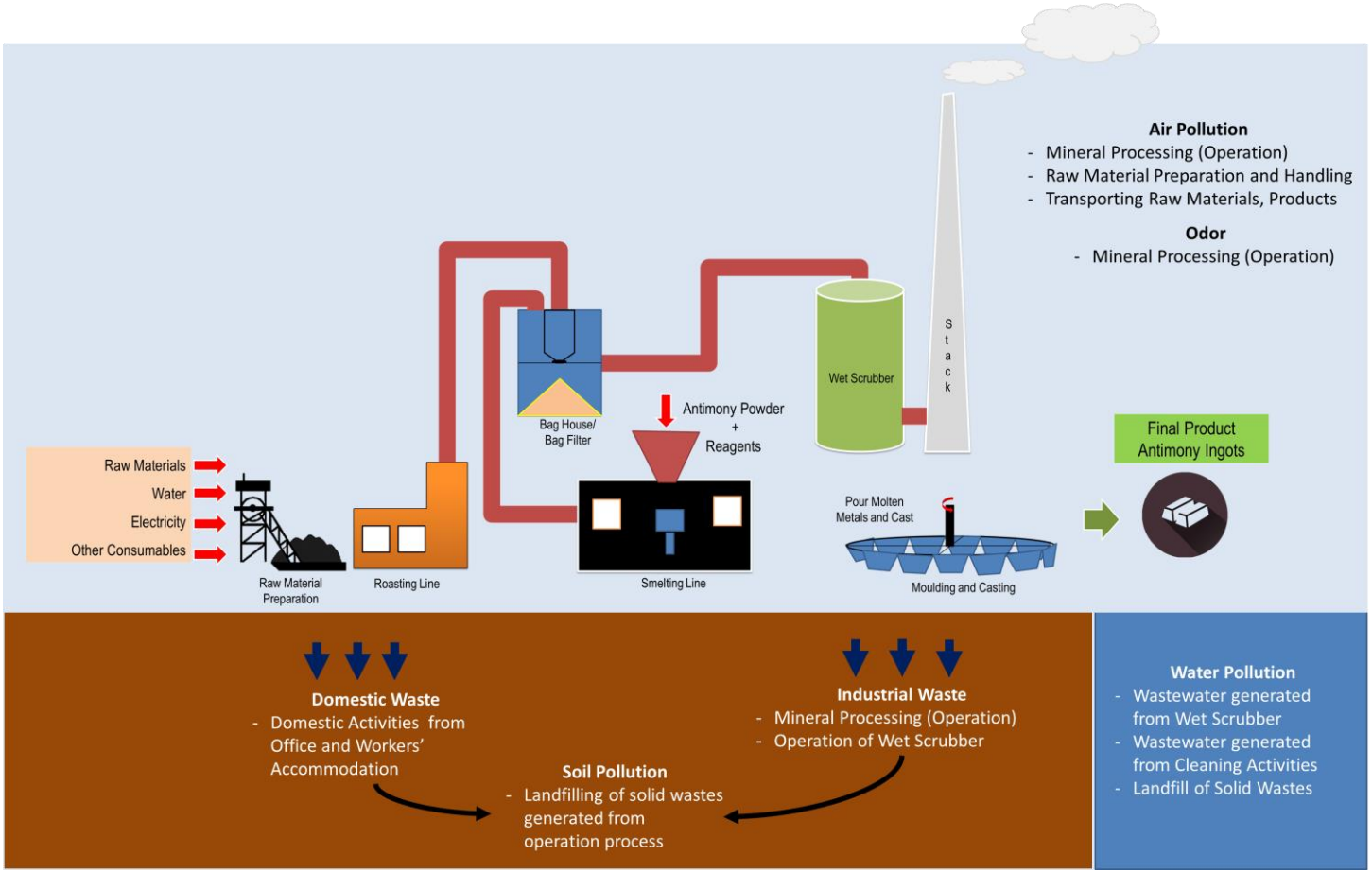


Figure 3-24 Typical Environmental Impacts from Antimony Processing Industry

3.7.2 Air Emission Management

(1) Air Emission

Sulphur Dioxide and particulate matters are the major air contaminants generated during roasting and smelting of antimony ore. Sulphur presented in coal and coke are oxidized when burning and this formed SO_2. As the antimony ore used in MSS factory is sulphur rich ore, Sb_2S_3, when it is roasted, it also releases SO_2 due to its chemical reaction.

(2) Air Quality Management

As the processing system used in MSS factory is enclosed system, which does not let to leak out the gas outside, the emission will be emitted only from the stack. Because of the water-cooling system, leakage of gas from cracked condensing tubes due to the result of high temperature can be prevented. In the system, two bag houses and one bag filter are installed to catch the volatized antimony oxide which is attached with particulate matters in the flue gas.

Moreover, off-gas treatment facility, wet scrubber is installed to treat Sulphur dioxide contains in the flue gas in accordance with the instruction from ECD. That facility can reduce not only SO_2 but also NO_x and other minor contaminants such as mercury, metal oxides and etc. Finally, flue gas is emitted though 120 ft height stack which is renovated from previous 70 ft height stack.

(a) Enclosed Condensing Pipelines

(b) Bag Filter

(c) Wet Scrubber

(d) 120- feet Stack

Figure 3-25 Air Emission Management Measures

3.7.3 Solid Waste Management

(1) Solid Waste Generation

(A) Domestics Waste

Non-hazardous waste from the project is mainly generated as domestic waste from the office, canteen and workers' accommodation. The office wastes include used masks by workers, paper, electrolyte powder sacks, plastics, and decomposable kitchen waste is generated from kitchen and worker's accommodation. The maximum amount of generated domestic waste is estimated 960 kg[4] per month.

(B) Industrial Waste

Different types of wastes are generated from the processing process of antimony. Roasted wastes (Pyit-sar) which mainly composed of burnt coke and coal are generated from roasting line. From the smelting line, the impure skimmed layers (Chor-Khal) are generated. The skimmed minerals are mainly composed of arsenic, iron, lead and as according to the composition of the raw antimony ores. Sludges generated from the wet scrubber operation are dewatered and dried. A small numbers of discarded filter bags are removed from the bag houses and bag filter as a regular practice.

Most of the industrial wastes generated from the production processes are re-cycled back in the operation as it contains the valuable content, antimony. Therefore, different types of recycling methods are used. For example, the content of antimony present in the wastes such as pyit sar, chor khal and sluges are tested in the laboratory and if antimony is present to certain amount, those are reused in the roasting process for the recovery. The average amount of each waste type generated from the processing lines are tabulated as follow.

Table 3-9 Summarized Industrial Waste Generation Amount

No.	Item	Monthly Generation Amount	Source of Generation
1	Slag (Pyit Sar)	4.5 Ton	Roasting Line
2	Slag (Chor Khal)	2.5 Ton	Smelting Line
3	Sludge from Clarifiers and Scrubbing Tower	1.8 Ton	Wet Scrubber Operation
4	Used Filter Bags	< 10 Bags	Bag Houses and Bag Filter

Note*: Sludge collecting from the wet scrubbing towers and settling tanks is usually made once per two months.

(2) Solid Waste Management

(A) Domestic Waste Management

Collection, Storage, Disposal

A sufficient number of waste bins are provided within the factory compound and workers' accommodation for temporary storage of the domestic solid waste. Then the waste is collected and temporarily piled at the at the elongated hole in front of the factory compound. Then when it becomes full, they are burnt in the hole.

[4] Waste generation per capita per day is approximated 0.4 kg per person and 960 kg per month estimated for averagely 80 workers for 30 days.

(B) Industrial Waste Management

(i) Solid Wastes from Roasting Line

Collection, Storage, Disposal

From roasting line, the roasted wastes are left behind when all the antimony ores are burnt and volatized into the gases. The wastes are carried out and left cool at the open yard of the factory compound. The remaining wastes are tested for the composition of antimony at the quality control laboratory. If the antimony content is still greater than 0.01 percent in the waste, they are used back in roasting to recover the antimony remained in the waste. If it is less than 0.01 percent, those are pressed and packed to be stored at the warehouse up to the time of final disposing at Nat San Mine, where the antimony ore ares bought or selling outside to be used in cement industry.

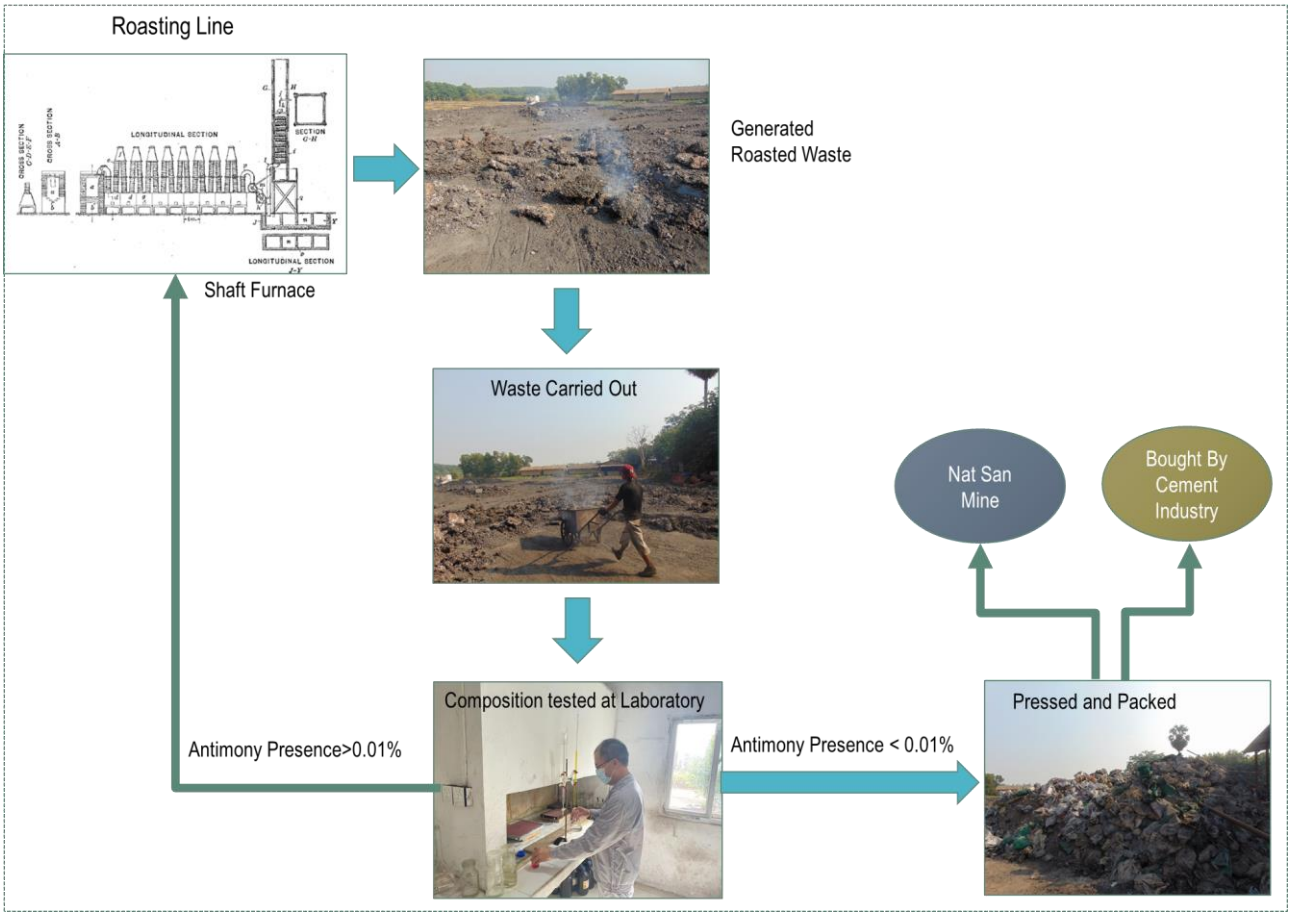


Figure 3-26 Management of Solid Waste from Roasting Line

Location of Waste Pilling

At the time of IEE preparation, the slag generated from the roasting process was filling in the vacant land inside the factory compound to raise the level of low-lying land and serve as a base layer for concreting the ground. In the below diagram, the area 1 is the temporary waste pile and the area 2 is the location where slag is laid in the plot.

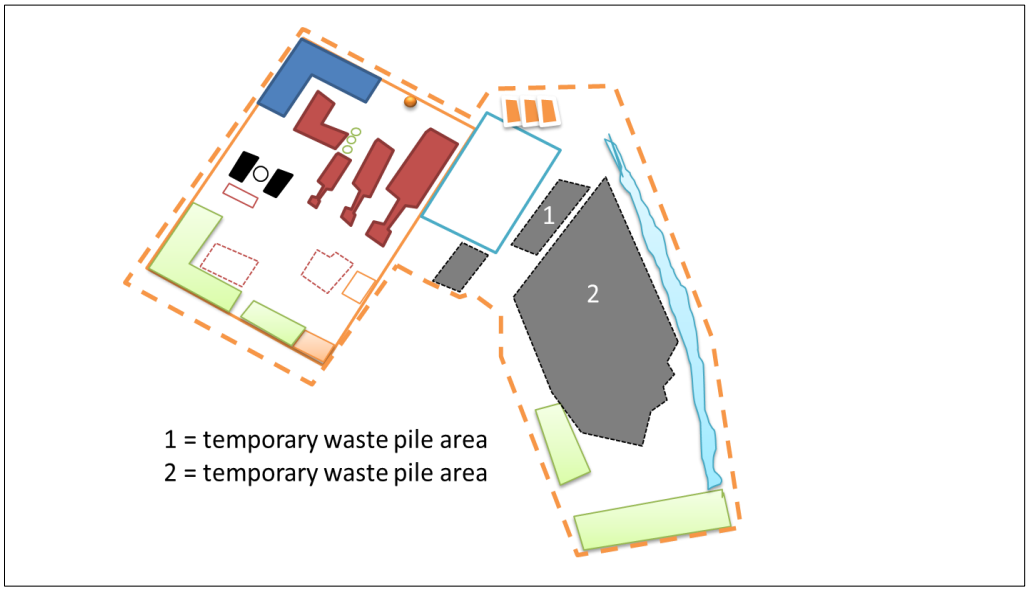


Figure 3-27 Temporary Waste Pile Area

(ii) Solid Wastes from Smelting Line

In smelting line, the impure and unwanted minerals are skimmed out layer by layer and cooled down to reduce the temperature. Like roasted wastes, the skimmed minerals blocks are also tested at the laboratory for the content of antimony presented. If there is antimony presented, they are smelted back in the furnace again. The unused blocks are temporarily stored at warehouse and finally disposed at Nat San Mine. The summarized waste management flow is described in Figure 3-28.

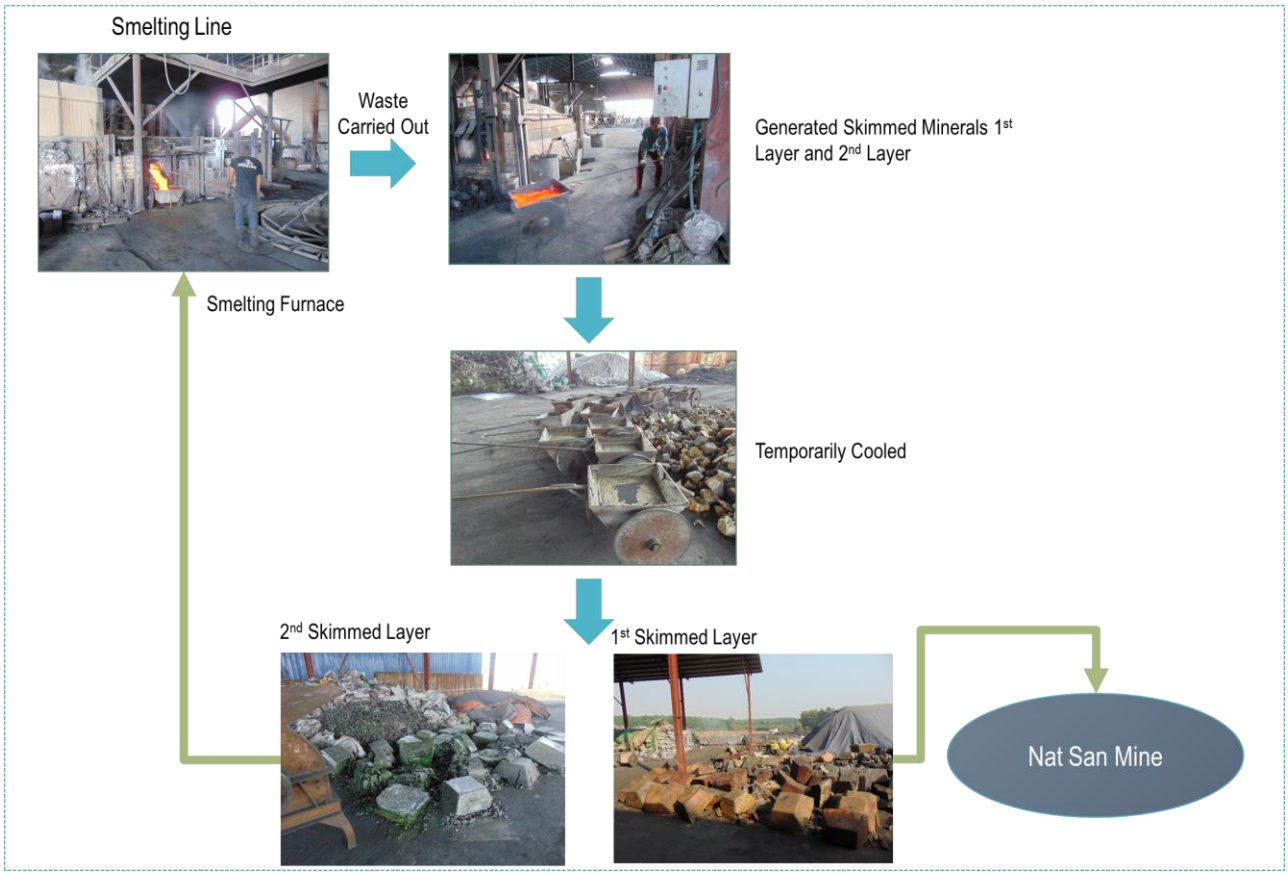


Figure 3-28 Management of Solid Waste from Smelting Line

(iii) Solid Wastes from Wet Scrubber Operation

Collection, Storage, Disposal

Inside the wet scrubber, sludge is generated by the reactions between sodium carbonate solution and gases generated from the production processes such as Sulphur Dioxide. The sludge is collected from the base of the scrubbing towers and from the clarifier tanks on a bimonthly basis. Then they are packed and dried. If the antimony is present in the sludge based on the laboratory test, it is reused back in the roasting line by mixing with the antimony ores. If not, those are stored at the warehouse up to the time of final disposal at Nat San Mine.

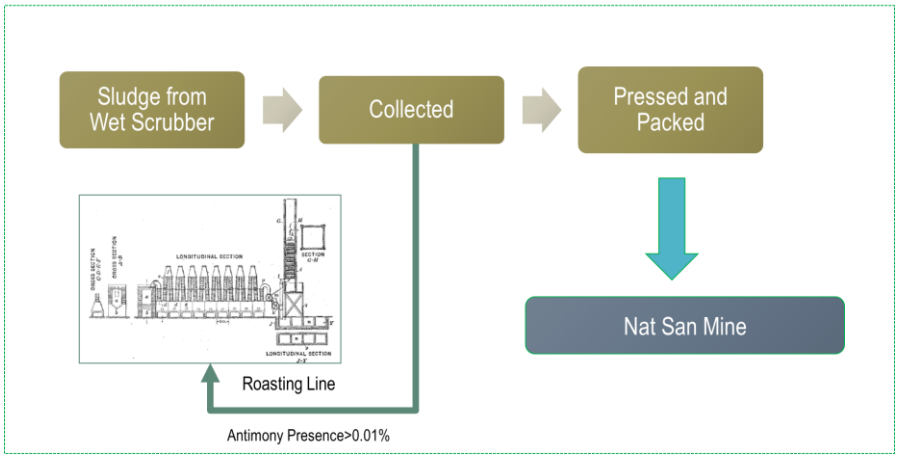


Figure 3-29 Management of Solid Waste from Wet Scrubber Operation

Figure 3-30 Removing Sludges from the Base of Wet Scrubber

Figure 3-31 Storing Solid Wastes Temporarily at Warehouse

3.7.4 Wastewater Management

(1) Wastewater Generation and its Circulating Status

Water flow chart diagram which shows water intake line, water circulation lines and wastewater stream in MSS Factory is illustrated in the Figure 3-32. Water pumped from the Attaran River is primarily stored in overhead tank and then it is mainly used for cooling condensing tubes. Water is circulating between production lines and cooling tank and only a small amount of overflow water is discharged outside.

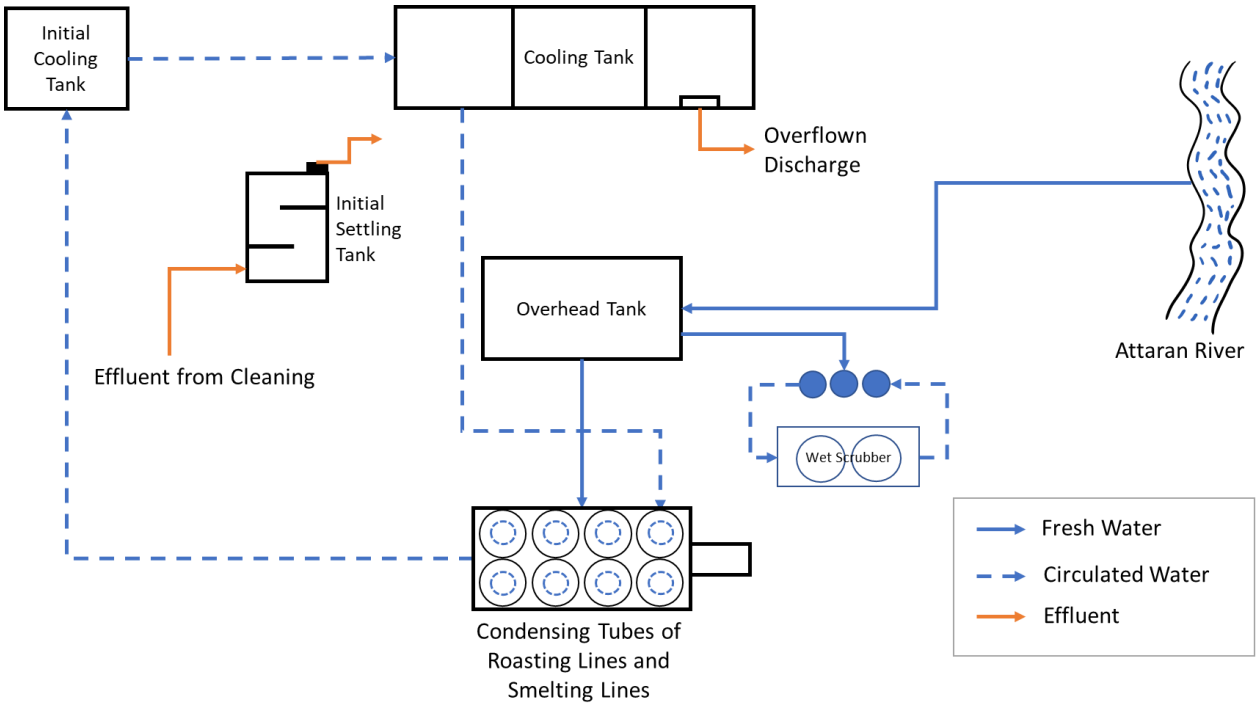


Figure 3-32 Water Flow Chart of MSS

(2) Wastewater Management

There is no specific wastewater generation from the operation process and it is re-circulating inside the production process. Effluent (wash water) generated from cleaning of working environment and washing of bag filters is initially passed the initial settling tank to recover the antimony dust and then it is connected to the drain. Only the effluent overflown from the cooling tank is mainly discharged outside.

For the time being, there is no wastewater generation from the wet scrubber operation as it is recirculating inside its system. The sludge which are settled in the clarifier tanks are dewatered, dried and disposed as solid waste. Before disposing, it is tested in the laboratory and if any antimony is found in the dried sludge, it is reused back in the roasting line. The following respective photos show the current wastewater management of MSS.

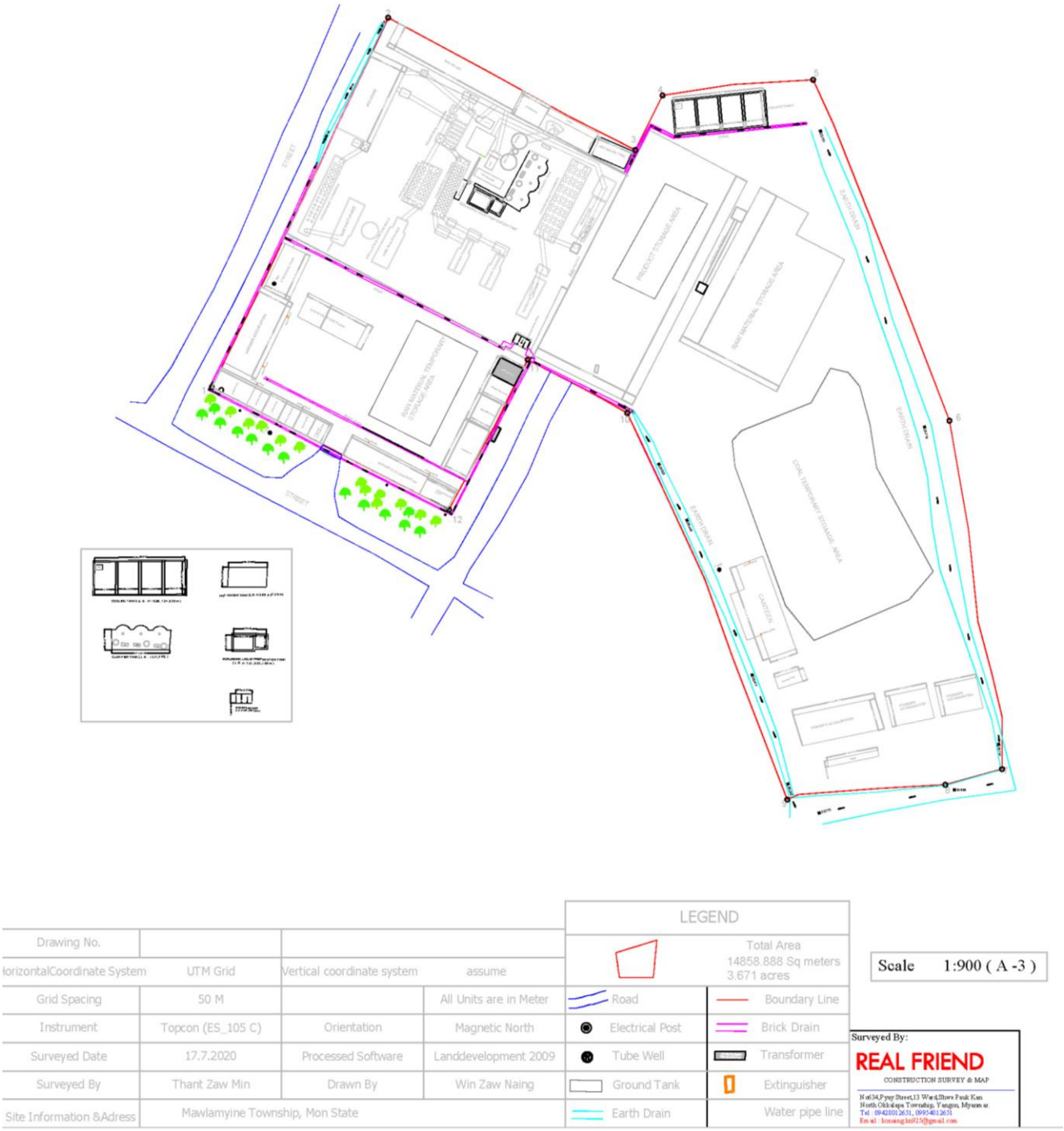
Figure 3-33 Initial Settling Tank

Figure 3-34 Initial Cooling Tank

Figure 3-35 Cooling Tank

(3) Stormwater Management

Domestic wastewater from the office use and the stormwater are directly flowed into the main drain outside of the factory. Layout of stormwater drainage is described in Figure 3-36 and the drain line outside the factory can be seen in Figure 3-37.



Drawing No.			
HorizontalCoordinate System	UTM Grid	Vertical coordinate system	assume
Grid Spacing	50 M		All Units are in Meter
Instrument	Topcon (ES_105 C)	Orientation	Magnetic North
Surveyed Date	17.7.2020	Processed Software	Landdevelopment 2009
Surveyed By	Thant Zaw Min	Drawn By	Win Zaw Naing
Site Information &Adress	Mawlamyine Township, Mon State		

Figure 3-36 Layout of Stormwater Drainage in the factory

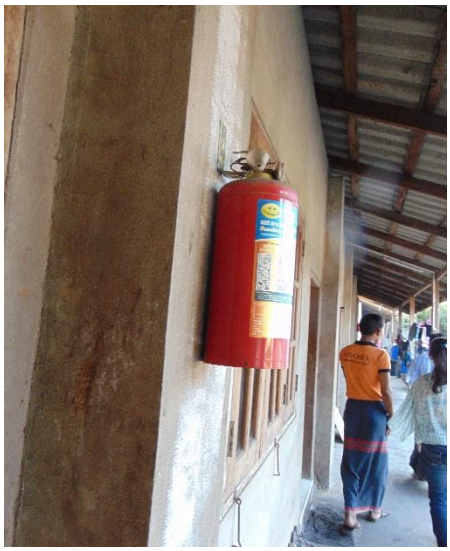
Source: Project Proponent
Note: Clear Version of Layout Map in A-3 size is attached in the Annex 11

Figure 3-37 Drainage Line at the boundary of the Factory

3.7.5 Provision of Welfare Facilities

(1) Security and Safety

Altogether eight CCTVs are equipped at the factory compounds not only for the security of the factory but also for the safety within the working environment. There are two installed at the main gate of the factory, one at the office, one at the smelting line, one at the roasting line and the others in different location of the factory. A total number of 8 fire extinguishers are installed at office rooms, canteen and workers' accommodation area as shown in the following Figure 3-38.



(a) Fire Extinguisher at office area

(b) Fire Extinguisher at Canteen

Figure 3-38 Fire Extinguishers Installed at Project Site

(2) Accommodations and Comfortability

(A) Working Environment

The factory provides cooling fans and temporary resting areas near roasting line and smelting line where the temperature is high. The factory supports respirators for the mechanics and labors who need to go into the bag house for maintenance and any other purposes. Electrolyte powder packs are arranged to be freely available for the workers with unlimited access.

Figure 3-39 Temporary Resting Area and Fans Provided for Workers

Figure 3-40 Respirators

Figure 3-41 Electrolyte Powder Packs

Figure 3-42 Toilets at MSS Factory

(B) Workers' Accommodation

The factory provides accommodations to all the workers as well as delicious meals as per their requests. Meals are cooked at canteen cleanly and safely. Separated lockers are provided to each worker for the safety of their personal belongings. Clean and purified drinking water is provided for the workers. Moreover, there is a common bathing area and toilets at the workers' accommodation.

Figure 3-43 Workers' Accommodation at Project Site

(a) Side View of Canteen

(b) Front View of Canteen

Figure 3-44 Canteen

Figure 3-45 Purified Water

Figure 3-46 Bathing Area

Figure 3-47 Lockers at Wrokers' Accommodation

(C) Greening Space and Buffer Area

Factory has its own greening spaces in front of the factory. Between workers' accommodation and the factory, there is a small wood which acts as a small buffer area for the workers. The greening areas and small buffer areas located at the project site can be seen in Figure 3-48 and Figure 3-49 respectively.

Figure 3-48 Greening Landscape in the front of MSS factory

Figure 3-49 A Small Rubber Wood near Worker's Accommodation

CHAPTER (4) ENVIRONMENTAL AND SOCIAL BASELINE

In this section, the baseline conditions of the project site and its surrounding environment in terms of physical components, biological components, socio-economic components, cultural components and visual components are thoroughly described. The project is located in Mawlamyine Industry Zone, which is situated at the border of Mawlamyine and Kyaikmaraw townships. Therefore, both townships' data mostly based on available secondary information such as township profiles by township general administration departments and other reliable references are outlined.

4.1 Physical Components

Physical environment of the surrounding area such as climate and meteorology, hydrology, topography, geological and soil conditions, township level disaster and emergency risks are described as below.

4.1.1 Climate and Meteorology (Temperature and Rainfall)

Mawlamyine township has tropical hot and wet weather with highest temperature of 39.6°C and lowest of 11.4°C with a total highest rainfall of 246.3 inches. Mawlamyine receives rainfall from both Southwest Monsoon and weather systems over the Bay of Bengal and Andaman Sea.

Table 4-1 Rainfall and Temperatures Records (2014 and 2018) (Mawlamyine Township)

No	Year	Rainfall		Temperatures	
		Rainfall (Day)	Total Rainfall (Inch)	Summer (℃)	Winter (℃)
				Highest	Lowest
1	2014	146	197	38.7	11.4
2	2018	133	246.3	39.6	14.8

Source: www.monstate.gov.mm, GAD Township Profile of Mawlamyine[5]

Kyaikmaraw township has tropical and wet climate with highest temperature of 39.5°C and lowest temperature of 17°C. The annual mean temperature and rainfall are mentioned below.

Table 4-2 Rainfall and Temperatures Records from 2015 to 2019 (Kyaikmaraw Township)

No	Year	Rainfall		Temperatures	
		Rainfall (Day)	Total Rainfall (Inch)	Summer (℃)	Winter (℃)
				Highest	Lowest
1	2015	119	172.54	39.5	18
2	2016	115	147.22	37.5	17
3	2017	116	144.87	37.5	17
4	2018	130	202.16	37.5	17
5	2019	113	222.57	37.5	17

Source: www.monstate.gov.mm, GAD Township Profile of Kyaikmaraw

[5] Only Rainfall data in 2014 and 2018 is publicly available for Mawlamyine Township.

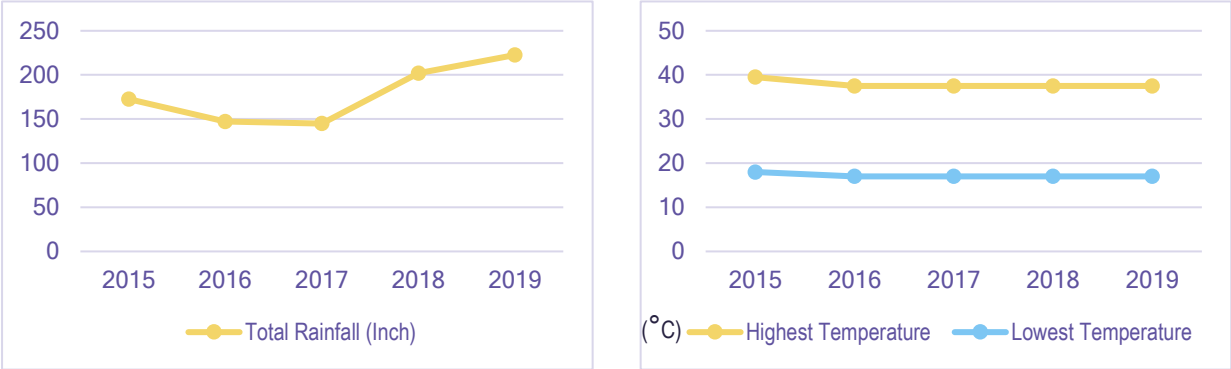


Figure 4-1 Annual Rainfall and Temperature Change in Kyaikmaraw Township (2015 - 2019)

Source: www.monstate.gov.mm, GAD Township Profile of Kyaikmaraw

4.1.2 Hydrology (River Network)

Plenty of rivers are flowing around the Mawlamyine and Kyaikmaraw township. Among them, the popular rivers are Attaran River, Gyaing River and Thanlwin River. Attaratan River is flowing from Kyar Inn Seik Kyi towards Mawlamyine; Gyaing River is flowing from Kyone Doe towards Mawlamyine and Thanlwin River is flowing near Mawlamyine township. Attaran River and Gyaing River can be used for water transportation by ships and boats. Most of the water resources are fresh water which can be used for agriculture purposes.

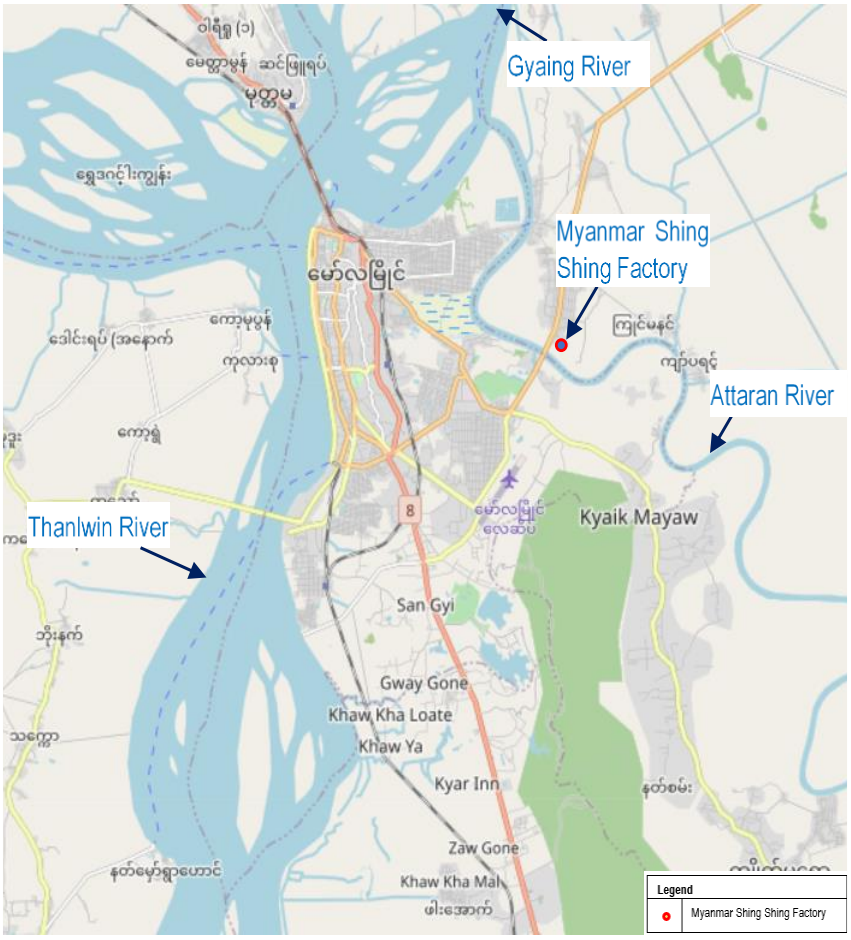


Figure 4-2 Nearby Rivers Flowing around the Project Site

Source: EnvO Study Team based on Open Street Map

4.1.3 Topography (Land Forms)[6]

Mawlamyine township is located at 18 feet above the mean sea level. The land form of Mawlamyine township is descending towards east and west. Na Ga Wi Tha mountain range is lying North to South. The popular islands in Mawlamyine township are Khaung Say Kyun and Dawei Kyun. Prominent highland areas in urban are Yankin Hill with peak of 558 feet high and Taungwaing hill in the south east with 800 feet in height. Southern section of township is predominated by Taung Nyo mountain range which is primary source for water distribution. There are two river side plains divided by central mountain range and east side of plains is known as Attaran river plain and west side Mawlamyine river plain.

Kyaikmaraw township is located at 18 feet above the mean sea level. The land form of Kyaikmaraw township is Gyaing River Basin in the North and Taung Nyo Mountain Range in the West. The shape of Kyaikmaraw township is a long shape from West North towards East South.

4.1.4 Geology and Soil Condition

Mon State mainly consists of Gleisoil which normally occurs on wide range of unconsolidated materials, mainly fluvial, marine and lacustrine sediments of Pleistocene or Holocene age. The Yankin Ridge near Mawlamyine is a continuation of Mottama Range. The common soil types found in this region are red brown forest soil, lateritic soil and meadow soil. The soil texture is mostly made up of clay alluvium. The surface yellow brown soils can be utilized for rice cultivation. The plains are mainly formed by the old alluvium deposition of Thanlwin River and its tributaries.

4.1.5 Disaster and Emergency Risks

The following table shows recent status of the natural disasters occurred in Mawlamyine and Kyaikmaraw townships during 2018 and 2019.

Table 4-3 Disaster and Emergency Records in Mawlamyine Township during 2019

Township	Items	Frequency	Deaths/Disappear	Affected Assets	Loss Value (Million Kyats)
Mawlamyine	Cyclone	-	-	-	-
	Tsunami	-	-	-	-
	Seismic	-	-	-	-
	Flood	-	-	-	-
	Fire	4	-	-	1.18
Total		4	-	-	1.18

Source: www.monstategov.mm, GAD Township Profile of Mawlamyine

Table 4-4 Disaster and Emergency Records in Kyaikmaraw Township during 2018 and 2019

Township	Items	Frequency	Deaths/Disappear	Affected Assets	Loss Value (Million Kyats)
Kyaikmaraw	Cyclone	2	-	14 housings	22.81
	Tsunami	-	-	-	-
	Seismic	-	-	-	-
	Flood	1	2	7 bridges	363.2
	Fire	5	-	1 housing, 1 school building,	111.82
Total		6	2		497.83

Source: www.monstategov.mm, GAD Township Profile of Kyaikmaraw

[6] GAD Township Profile and Mawlamyine Township Environmental Assessment

(1) Flood

As per the Hazard Profile of Myanmar, Mon State is one of the flood prone areas. The type of flood that Mon State has faced at every rainy reason is wide spread flood which occurs along the rivers. Flood and Landslide occurred in 2019 is the worst flood in 20 years. Houses were destroyed and schools had to be closed.

In Mawlamyine Township, seasonal floods are frequently occurred in June, July and August in the low-lying regions of the township depending on the tidal actions, excessive rainfall and combination of topographic and drainage system problems.

In Kyaikmaraw Township; a combination of heavy precipitation and high tide which comes up from Andaman Sea through Gyaing and Attaran River bring annual seasonal flood occurrence. The town location and its shape are also the main aspects of experiencing flood every year. Flooding usually affected to the villages located alongside the Attaran River and low-lying wards in the town.

(2) Earthquake

Among the list of historical and recent earthquake in Myanmar, there is no history of severe earthquake happened within Mon State.[7] According to the GAD Township Profile 2019 of Mawlamyine and Kyaikmaraw townships, there is no data of recent earthquake in respective township.

(3) Storm

Mawlamyine has natural protection from tsunami or high rise of sea water tropical cyclones being sheltered by Bilugyun from outer ocean. Thus, Mawlamyine is less prone to cyclones or storm surges.[8] In 2019, Kyaikmaraw township has faced storm two times with a total loss of 22.81 million kyats.

(4) Fire

As shown in Table 4-3 and Table 4-4, it can be seen that fire is one of the common hazards in both townships with loss of million kyats, buildings and rubber plantations. According to Hazard Profile of Myanmar (2009), Mon State has fallen into Medium Fire Risk Zone which means that annual fire cases happen in Mon State is between 100 and 50 on average.
It is concluded in Kyaikmaraw Township Disaster Management Plan (2015) that the high incidences of fire in this township are due to the high temperature, use of flammable construction materials, clustered settlements, stock piles of diesels and unplanned development.

4.2 Biological Components

The biological components section includes an overview forest and vegetation covers, flora, fauna, wetlands, ecoregion, key biodiversity and protected areas in Mon State.

4.2.1 Forest and Vegetation Cover

The overall forest coverage of Mawlamyine township is 6.16 %. Mawlamyine township has a reserve forest of 1095 acres which shares 1.93% of total forest area. Tropical evergreen forest and monsoon deciduous forests can be found in Mawlamyine Township. The forest coverage of Kyaikmaraw township is 22.04% which is totally covered by reserve forest comprising 72,623.30 acres.

[7] Hazard Profile of Myanmar (2009)
[8] Mawlamyine as a Commercial City in Greater Mekong Subregion, Yin Min Paik and Wityi Win

4.2.2 Flora

Types of flora species found in Mawlamyine township are Mahlwa, Phatthan, Pyinma, Thapyay, Kyee, Anan, Thaphan, Sit, Taungmayoe, Bantthway, Phankhar, Inn, Kyo, Yaymhain, Pyinkadoe, Htaukkyant, Taungthayet, Lethtokekyi, Thetyin, Myaya, Dido and Latpan.

In Kyaikmaraw township, the flora species of Inn, Htaukkyant, Thityin, Pyinkadoe, Lamu, Padauk, Thinkhan, Pyinma, Thityar, Kokko, Latpan and Pauk can be found.

4.2.3 Fauna

In Mawlamyine township, there are a number of fauna species like barking deer, jungle cat and asian golden cat while wild boar, barking deer and monkeys can be found in forest area of Kyaikmaraw township.

4.2.4 Wetlands

Northern fringe of Mawlamyine township is dominant by rivers and islands which are formed at the confluence of Thanlwin River and Gyaing River. Several wetland areas are developed in these islands. Small patches of grassland and wetlands remain in the southwest of the township and a great deal of wetlands thrive on the islands and along riverbanks in estuaries area and Mawlamyine River. There is no wetland area found inside or near the Mawlamyine Industrial Zone.

4.2.5 Ecoregion, Key Biodiversity and Protected Areas

Ecosystem in Mawlamyine generally is divided into different categories such as forest, grass land, wetland, river and urban built-up. Mawlamyine township falls within ecoregion of Myanmar Coastal Rainforest. Southern mountain range of Mawlamyine is regarded as one of the high priority key biodiversity area. However, no protected areas are found within the Mawlamyine and Kyaikmaraw township.

4.3 Socio-Economic Components

The socio-economic information of Mawlamyine township and Kyaikmaraw township such as administration and land use, population, ethnicity, religion, local economy and livelihood, industrial zones, social infrastructure and services and township development plans are described based on the available secondary data from GAD Township Profiles.

4.3.1 Administration and Land Use

The administration unit of Mawlamyine township is composed with 29 wards and 13 village tracts. For Kyaikmaraw township, there are 4 wards, 43 village tracts and 158 villages. The different types of land use in Mawlamyine and Kyaikmaraw township are described in the following Table 4-5.

Table 4-5 Types of Land Use in Mawlamyine and Kyaikmaraw Townships as of 2019

No	Types of Land Use	Area (Acre)	
		Mawlamyine	Kyaikmaraw
1	Total Land Use for Agriculture	22,128	146,179
	(1) Farm Land	14,055	54,361
	(2) Garden Land	4,824	91,818
	(3) Cultivated Land	1,879	-
	(4) Nipa Palm	1,370	-
2	Vacant Land	-	-
	(1) Farm Land	294	5,0270

No	Types of Land Use	Area (Acre)	
		Mawlamyine	Kyaikmaraw
3	Grazing Land	360.59	8,005
4	Industrial Use	545	1,496
5	Urban Area	7,765	2,912
6	Village	1,230	9,086
7	Other	23,415.41	2,635
8	Reserved/ Protected Public Forest	1,105	73,066
9	Virgin Forest	-	6,569
10	Virgin Land	-	11,347
11	Land which cannot be used for cultivation	33,316	15,959
Total		90,159	327,524

Source: www.monstate.gov.mm, GAD Township Profile of Mawlamyine & Kyaikmaraw

4.3.2 Population

Mawlamyine township has a population of 266,075 in 2018 and increases to 269,005 in 2019 with an increase rate of 1.1%. Kyaikmaraw township has a residence of 224,872 in 2018 and reach to 228,358 with an increase rate of 1.55.

Table 4-6 Population Records in Mawlamyine and Kyaikmaraw Townships as of 2019

Item	2018 Population	2019 Population	Increased Population	Increase Rate	Male	Female	Male and Female Ratio
Mawlamyine	266,075	269,005	2,930	1.1	114,533	144,472	1:1.16
Kyaikmaraw	224,872	228,358	3,486	1.55	111,702	116,656	1:1.044

Source: www.monstate.gov.mm, GAD Township Profile of Mawlamyine & Kyaikmaraw

The following figures illustrated the population pyramid of Mawlamyine and Kyaikmaraw township showing the distribution of numbers of male and female in accordance with range of ages. The male and female ratio of Mawlamyine township is 1:1.16 and 1:1.044 for Kyaikmaraw township.

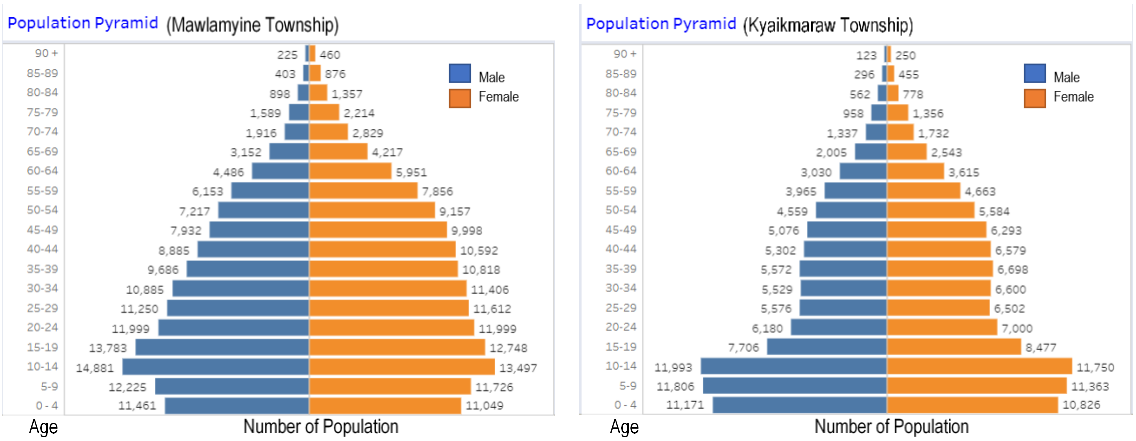


Figure 4-3 Population Pyramid of Mawlamyine and Kyaikmaraw Townships

Source: 2014 Population and Housing Census, Myanmar Information Management Unit

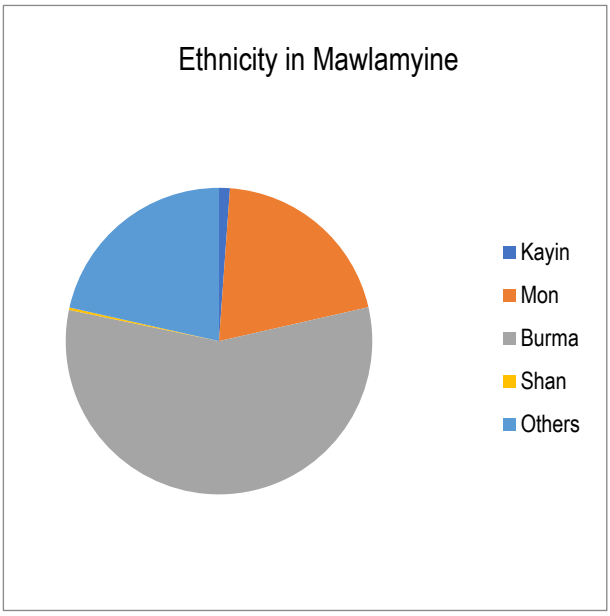
4.3.3 Ethnicity

Most of the major national races such as Kachin, Kayah, Kayin, Chin, Mon, Burma, Rakhine, Shan as well as Pa Oh live in Mawlamyine Township. The Burma ethnic majority is reported as 56.7% of the total in Mawlamyine whereas Mon ethnic group shares the majority in Kyaikmaraw with 48.19%. The following tables and charts show the occupancy of each ethnicity group.

Table 4-7 Ethnic Groups in Mawlamyine and Kyaikmaraw Township

No	Ethnicity	Mawlamyine		Kyaikmaraw	
		Living Population	% of Township Population (269,005)	Living Population	% of Township Population (269,005)
1	Kachin	14	0.01	-	-
2	Kayah	81	0.03	-	-
3	Kayin	3,073	1.14	47,230	20
4	Chin	23	0.01	-	-
5	Mon	54,506	20.26	109,426	48.19
6	Burma	152,520	56.70	29,047	13.24
7	Rakhine	239	0.09	6	0.01
8	Shan	677	0.25	1,126	0.47
9	Pa Oh	51	0.02	-	-
10	Others	57669	21.44	41,523	19.02

Source: www.monstate.gov.mm, GAD Township Profile of Mawlamyine & Kyaikmaraw Township



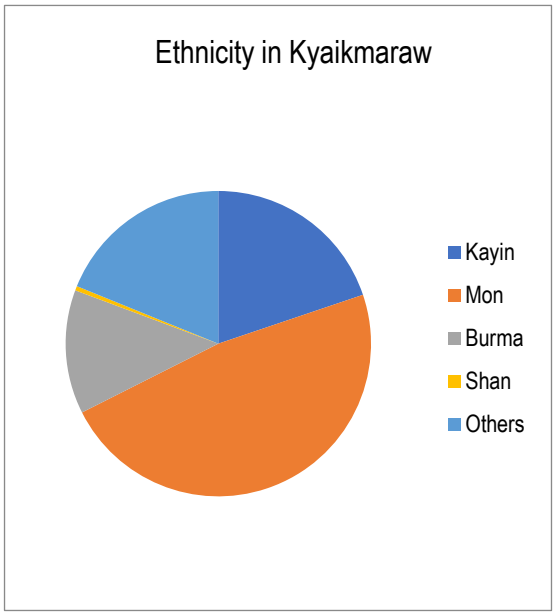


Figure 4-4 Share of Ethnicity Groups in Mawlamyine and Kyaikmaraw Townships as of 2019

Source: www.monstate.gov.mm, GAD Township Profile of Mawlamyine & Kyaikmaraw
Note: The minority of ethnicity (<0.1%) are not appeared in the pie chart due to the extremely small portion.

4.3.4 Religion

As shown in the following Table 4-8, most of the people in Mawlamyine township believe in Buddhism. Islam is the second major religion followed by Hindu and Christian. The majority of Kyaikmaraw township also believe in Buddhism. Islam is the second major religion followed by Christian and Hindu.

Table 4-8 Religion Status of Mawlamyine and Kyaikmaraw Townships

No	Township	Buddhism	Christian	Hindu	Islam	Others	Total
1	Mawlamyine	216,044	1,789	10,510	39,701	961	269,005
2	Kyaikmaraw	186,835	1,002	321	40,199	1	228,358

Source: www.monstate.gov.mm, GAD Township Profile of Mawlamyine & Kyaikmaraw

4.3.5 Local Economy and Livelihood

(1) Local Economy Development

As being the capital township of Mon State, major economic developments can be seen in Mawlamyine. The residents rely on agriculture and service business. Economic development of Kyaikmaraw is comparatively low as compared to Mawlamyine. The agriculture is a major business in Kyaimaraw.

(2) Agricultural/Livestock Products

Agricultural products of Mawlamyine are rice, peanut, sesame and beans. Rubber, Oil Pam and Cashew are planted as long-term crops. In addition, orchard crops such as durian, rambutan, mangosteen and pomelo, pineapple, citrus fruits and avocado are grown for economy. Local farms breed chicken, cows, buffalo, pigs and ducks. Rice, peanut and sesame are mainly produced in Kyaikmaraw. Moreover, various long-term crops and fruits are planted. Local farms breed chicken mainly followed by ducks and cows.

(3) GDP per Capita

The GDP per capita income (in Kyats) of Mawlamyine and Kyaikmaraw are described in the following table. It can be seen that the GDP per capita income of Mawlamyine in 2017-2018 is relatively higher than that of Kyaikmaraw.

Table 4-9 The GDP per Capita Income (in Kyats) of Mawlamyine and Kyaikmaraw Townships

No	Township	GDP Per Capita in Years			
		2018-2019	2017-2018	2016-2017	2015-2016
1	Mawlamyine	-	2,252,164	1,906,438	1,700,095
2	Kyaikmaraw	1,753,446	1,477,443	1,290389	-

Source: www.monstate.gov.mm, GAD Township Profile of Mawlamyine & Kyaikmaraw

4.3.6 Industrial Zones

There are two industrial zones in Mawlamyine township; Mawlamyine Industrial Zone and Kyauk Tan Industrial Zone. Nevertheless, 17 types of private factories are operating in Kyaikmaraw township. Majorities are Cement Factories, Timber, Rice, Oil and Furniture factories.

(1) Mawlamyine Industrial Zone

Mawlamyine industrial zone is located about 15 km east of Mawlamyine near Attaran River, at Nyaungbinseik Village, Mawlamyine township on the Mawlamyine-Hpa An Road. It started operation in 2005 with only 86 enterprises (41% of registered enterprises) which produce car accessories, lathe machine, welding, rubber, blender, fiber water storage tanks, roofing, barbed wire, rice mills, tissue paper and antimony.

Table 4-10 Basic Information of Mawlamyine Industrial Zone

Year of Establishment	2000
Area	171.04 Acres (0.7 km^2)
Plots	370*

*Two-third are not capable to operate. About 40 plots are not operated since the initial implementation of industrial zone.
Source: Pilot Assessment of Industrial Zone in Myanmar, GIZ, MDRI CESD

(2) Kyauktan Industrial Zone

There are 27 plots in Kyauktan industrial zone covering 254 Acres. It started commercial operation in March 2018 and the main products from this industrial zone are cement, roofing, concrete columns and rafters. It also features a variety of different business enterprises, including production of zinc roofing, barbed wire, ready-mix cement, food and drink production, textiles, gold purification, ice factories, shoe production facilities, furniture enterprise, plastic enterprises, cool seafood storage and car accessories.

4.3.7 Social Infrastructure and Services

(1) Education

In Mawlamyine, Mawlamyine University, Technological University (Mawlamyine), Education College and Technical and Vocational Education and Training School are existed. There are 20 high schools, 6 branch of high schools, 7 middle schools, 3 branch middle schools, 24 post primary schools, 86 primary schools and 54 preprimary schools within the township. Nine monastic schools are also providing education to the children.

There is no university in Kyaikmaraw. There are 8 high schools, 10 branch high schools, 6 middle schools, 19 branch middle schools, 1 post primary school, 69 primary schools and 45 preprimary schools throughout the Kyaikmaraw Township.

(2) Transportation

Mawlamyine and Kyaikmaraw can be reached by both land and water ways. In Mawlamyine, there is a domestic airport located in Zay Kyo Ward and access by train is also available. There are four bridges which are longer than 180 ft in Mawlamyine and one bridge in Kyaikmaraw.

Figure 4-5 List of Bridges (Longer than 180 ft) in Mawlamyine and Kyaikmaraw Townships

No	Township	Name of Bridge	Length (feet)	Type of Bridge	Constructed Year	Type of Vehicle
1	Mawlamyine Township	Attaran Bridge	1,420	Steel (Suspension)	1995	Car
2		Gyaing - Zarthapyin	2,900	Steel (Suspension)	1996	Car
3		Thanlwin Bridge	11,575	RC	2000	Car/Train
4		Bogyoke Aung San Bridge (Balukyun)	5,203	RC (Steel Box)	2015	Car
5	Kyaikmaraw Township	Attaran Bridge (Chaung Na Khwa)	900	RC	2014	Car

Source: www.monstate.gov.mm, GAD Township Profile of Mawlamyine & Kyaikmaraw

(3) Medical Facilities

In Mawlamyine, there are six government owned hospitals (total capacity of 1048 beds) and 9 private hospitals. The numbers of clinics are 141 including 8 governmental clinics, 1 organizational clinic and 132 private clinics. There are also 3 rural healthcare departments and 13 sub departments. The ratio of doctor to patents is 1: 38,429 and Tubercle Bacillus and Diarrhea are common diseases in Mawlamyine township.

In Kyaikmaraw, there are three governmental hospitals providing 57 beds for patients. There are 12 general clinics for general illness and diseases. Six rural health care departments and 30 sub-departments are providing health care in rural areas. The township can supply only a doctor who has to care for 39,881 people, a nurse for 10,879 people and an assistant health care officer for 34,184 people. Diarrhea and Dysentery are common diseases of residents in Kyaikmaraw.

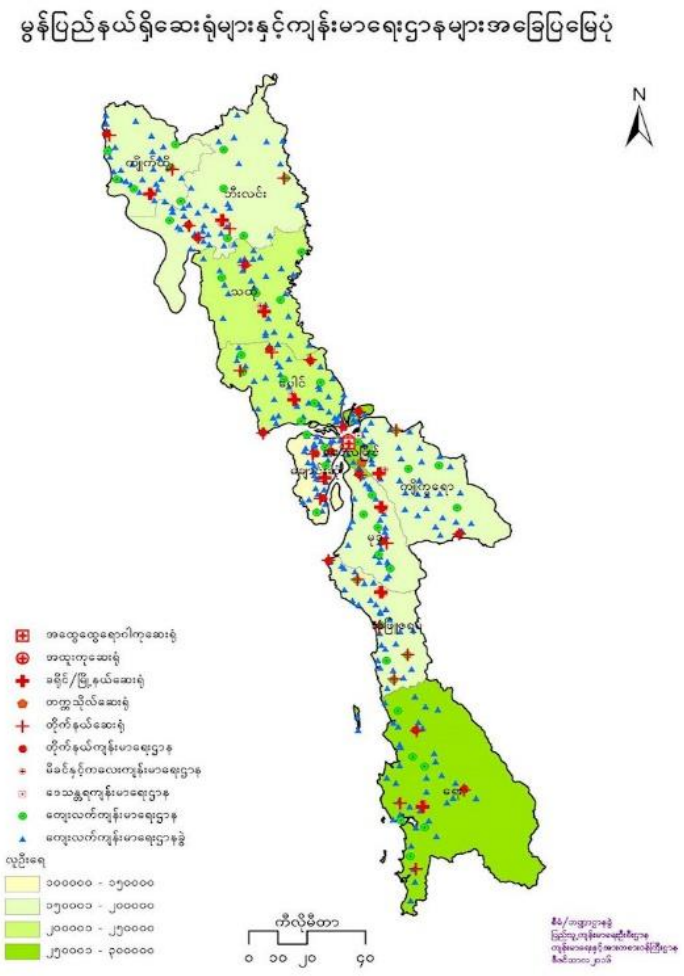


Figure 4-6 Hospitals and Health Care Department in Mon State (2016)

Source: List of Health Facilities, Ministry of Health and Sports

(4) Water Supply

In Mawlmayine, Kin Pon Chon Dam has been used as a major utility water source since 1920. Currently, there are four water resources such as Kin Pon Chon Dam, Shwe Nat Taung Dam, Attaran River Intake 1 and Attaran River Intake 2, supplying water to the public through gravity and pumping methods with a total supply of 3,300,000 gallons per day covering 13,400 households. About 1,758 households from rural areas access to water supply from drilled wells and river by 2019. Kyaikmaraw township get its water supply mainly from hand dug wells and drilled wells with a total supply of 35,000 gallons per day covering 350 households.

There is no water supply system in Mawlamyine Industrial Zone. The factories inside the industrial zone use water from Attaran River or from their own tube wells for industrial and domestic purpose.

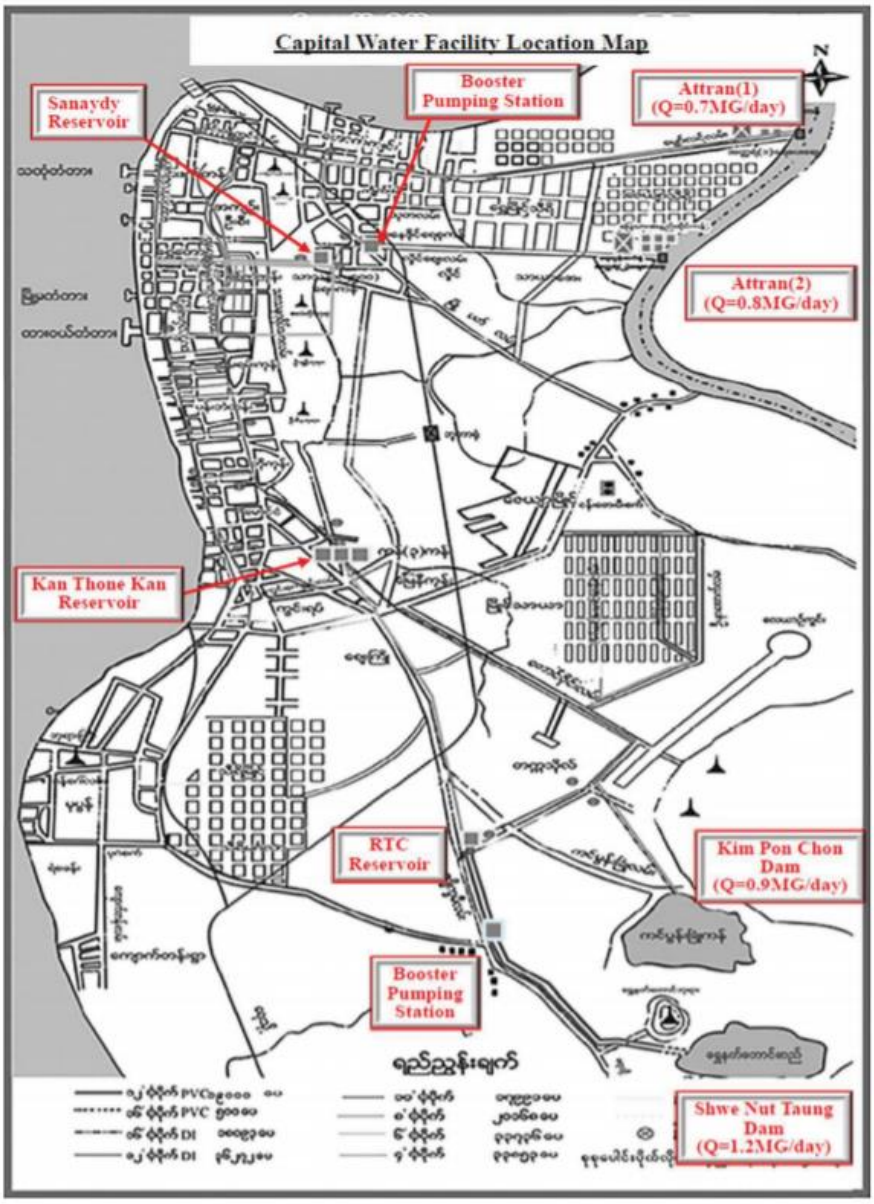


Figure 4-7 Location of Water Supply Head Works in Mawlamyine Township

Source: Myanmar Three Cities Water Supply Management Improvement Project, Final Report, Ministry of Health, Labour and Welfare of Japan,2013

(5) Electricity Supply

Mawlamyine gets electricity supply from Ngan Tay Electric Power Plant transmitted through 230 kV and 66 kV distribution lines. Kyaikmaraw township receives electricity supply of 5,000 kW from 33/11 kV Kha Yone Khwal Substation via 3,700 kW 315-KVA transformer. There are rural electrification activities utilizing solar power which are beneficial for households in rural areas. Mawlamyine Industrial Zone gets electricity supply from 66 kV transmission line.

(6) Sewage System

Wastewater from households, commercial and administrative facilities in Mawlamyine and Kyaikmaraw is deposited to pit toilet or septic tank at their own place.

(7) Solid Waste Management

There are 36 cleaning vehicles and 2 sanitary vehicles serving Mawlamyine with 152 workers and the final disposal sites are simple dumping sites without landfill liner and drainage of leachate. For Kyaikmaraw township, there are 5 cleaning vehicles with 4 workers.

(8) INGO, NGO and CSO Services

There are a number of INGO, NGO and CSO organizations working in Mawlamyine. Most of the INGOs focus on health care, human trafficking, sexual and reproduction education, woman empowerment and vocational trainings for rural communities. CSO service organizations are carrying out social development activities, charities, mon literature and tradition and health care.

4.3.8 Township Development Plans

There are two township development plans named "Ever Green Village (Mya Seinn Yaung) Project" and "Thirty Years Town Plan" in both Mawlamyine and Kyaikmaraw townships.

Ever Green Village (Mya Seinn Yaung) Project has been implementing by Department of Rural Development from 2014-2015 fiscal year for rural people to improve family income and to nourish with food security by agriculture and livestock. Eleven villages with 2,386 households from Mawlamyine township were provided about 3,300 lakhs under this project. In Kyaikmaraw township, 3,894 households from 20 villages are supported with about 6,000 lakhs.

Thirty Years Town Plan for Mawlamyine township will be implementing on 44 acres for low cost residential housings. For Kyaikmaraw township, the town plan will be established on 60 acres.

The following table shows the development policy of commercial, business and industry in Mawlamyine.

Table 4-11 Development Policy of Commercial, Business and Industry in Mawlamyine

Policy	Activities
Commercial, Business and Industry Policy	Spatial Improvement of Current Central Area
	Relocation and Functional Reform of Logistics Zone of the City
	Redevelopment in Former Railway Station Site (Sub Center Development)
	Promotion of Industrial Investment to Kyauk Tan Industrial Zone
	Construction of New CBD Area

Source: The Urban Development Plan for Mawlamyine 2040, Nippon Koei Co., Ltd., Nine Steps Corporation and International Development Center of Japan.

4.4 Cultural Components

The temples and monuments built in Mawlamyine and Kyaikmaraw townships are described in the cultural components section.

4.4.1 Historical Places, Temples and Monuments

In Mawlamyine, there are seven famous pagodas locating in the central areas of the town and in some villages. They are Kyaik Tha Lan Pagoda, Mahar Myat Mu Ni Pagoda, U Khan Ti Pagoda, Kyaik Thoat Pagoda, U Zi Na Pagoda, U Nar Out Pagoda and Kyaik Yoe Go Pagoda. Yadanar BonMyint monument established by Sein Tone Princess, the Queen of Min Tone King, is a historical place, situated in Mawlamyine township.

In Kyaikmaraw, the famous pagodas are Kyaikmaraw Pagoda, DaMatha San Taw Shin Pagoda, KhaYone Gu Pagoda, Pharbaung Pagoda and SaPal Gu Pagoda. Kyaikmaraw Pagoda is the temple built by Queen Shin Saw Pu in 1455 in the late Mon regional style. Phar baung Cave located in LaMuKho is a historical place in Kyaikmaraw township.

There is no historical place, temple and monument inside and within 4 km of the Mawlamyine Industrial Zone.

4.5 Visual Components

The landscape of the townships which has attracted locals and tourists is described in the section of visual components.

4.5.1 Landscape

Mawlamyine draws many attentions of both tourist and domestic travelers as it is rich with places and interesting hotspots to visit and enjoy. Thanlwin River and other rivers, Stupa capped hill, colonial era-buildings and other landscapes are the major tourist destinations. There are limestone caves with stalactites and stalagmites in the vicinity of Kyaikmaraw township and mineral springs in nearby Yebu (Hot Water) Village. No significant visual components of hills, colonical era-buildings, limestone caves and mineral springs near the Mawlamyine Industrial Zone is reported.

4.6 History of Environmental Baseline Measurements In and Out of Project Site

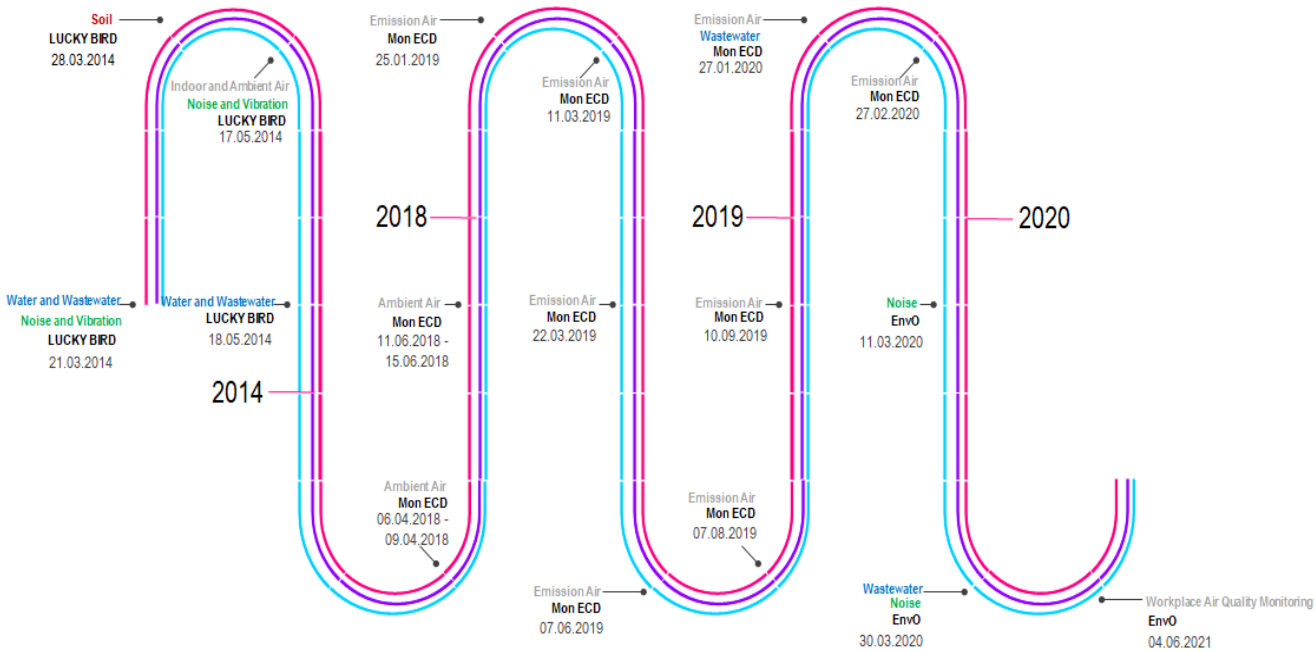


Figure 4-8 History of Environmental Baseline Measurements in and out of Project Site

In Figure 4-8, a series of environmental baseline measurements in and surrounding of the proposed project is illustrated with the timeline. In 2014, Lucky Bird Environmental Studies & Geo-Informatic Solutions Group had conducted surveys for water and wastewater, noise and vibration, soil quality, indoor and ambient air quality while performing EIA study. Since 2018, Mon State ECD has been investigating the environmental status in and surrounding of the Factory such as ambient air quality, emission air quality, and wastewater quality. In Annex-3, the detail of measurements, results and findings are discussed and recommendations are provided for further monitoring activities.

In 2020 and 2021, Envo Study team also conducted the measurements for wastewater quality, noise level and workplace air quality in the Factory. The wastewater sampling and measurements are presented in Annex - 6, noise measurements are described in Annex - 8, and workplace air quality monitoring results are reported in Annex - 10 respectively, with results and discussions.

CHAPTER (5) IMPACT ASSESSMENT AND MITIGATION MEASURES

5.1 Impact Assessment Methodology

5.1.1 Approach of Impact Assessment

Typically, the assessment methodology is developed to (1) identify the potential impacts of a proposed development/project on the environment from different aspects known as impact identification (2) quantify and predict the likely nature of such impacts known as impact prediction, and (3) evaluate the significant of the potential impacts known as impact evaluation.

5.1.2 Impact Identification

The possible impacts likely to cause by activities of the proposed project are usually identified under different categories as described in Table 5-1.

Table 5-1 Typical Impacts Considered in the Impact Assessment

Categories	Possible Impacts
I. Physical Component	(1) Air Pollution
	(2) Water Pollution (Groundwater and Effluent)
	(3) Waste Pollution (Hazardous and Non - hazardous)
	(4) Noise and Vibration Pollution
	(5) Soil Pollution
	(6) Odor
II. Natural/Biological Component	(1) Protected area
	(2) Flora and Fauna, Ecosystem
	(3) Hydrology
	(4) Topography and Geography
III. Socio-economic and Cultural Component	(1) Local Economy
	(2) Heritage and Cultural Valued Properties
	(3) Ethnicity and Intangible Cultural Value
	(4) Local resources
	(5) Work Place Environment (e.g. gender discrimination, child labor and sexual harassment, etc.)
	(6) Landscape and Greening
IV. Health Component	(1) Community Health and Safety

Source: EnvO Study Team

5.1.3 Impact Prediction

Once potential impacts have been identified, further investigation is required to predict the nature/characteristics of the impacts. The main characteristics of the impact play important role in the evaluation of the significance of the impact are the magnitude of the impact and the importance of the impact.

(1) Magnitude of the Impact

In this assessment methodology, the magnitude of the impact is considered the sum of the scores of typical characteristics which can simply reflect all characteristics of the impact. Determination of criteria for each

component representing the magnitude of the impact is referred from the research paper[9] articled in the African Journal of Environmental Assessment and Management in January 2003.

Magnitude = Type + Extent + Duration + Intensity + Reversibility

Table 5-2 Criteria for rating the magnitude of impacts

Rating	Range of Score	Criteria
Large	15-11	In case of the impact possesses more than three of the highest-level adverse characteristics (e.g. irreversible, permanent, global impacts to the environment – 1+1+3+3+3)
Medium	10-8	In case of the impact possesses more than three of the medium-level impact characteristics
Small	7-5	In case of the impact possesses at least all low-level impact characteristics

Source: EnvO Study Team

The typical criteria used for prediction of magnitude of the impacts are explained as follow:

(A) Status of the Impact

The status of the impact means that the project's activities create benefits/advantages or disadvantages to the potential/possible impact.

Table 5-3 Criteria for rating the status of impacts

Rating	Criteria
Positive	In case of causing benefits/advantages
Negative	In case of causing costs/disadvantages
Neutral	No Impact

Source: EnvO Study Team

(B) Type of the Impact

The type of the impact means the relationship of the potential/possible impact to the Project.

Table 5-4 Criteria for rating the type of impacts

Rating	Score	Criteria
Direct	3	Potential Impacts causing from a direct interaction of the Project
Indirect	2	Potential Impacts causing from an indirect interaction resulted from the subsequent interaction of the Project and its environment
Induced	1	Potential Impacts resulting from other activities which are not part of the Project that happen as a consequence of the Project

Source: EnvO Study Team

(C) Extent or Spatial Scale of the Impact

The extent/spatial scale of the impact means that the potential/possible impact is either limited in extent or affect a wide area or group of people.

Table 5-5 Criteria for rating the extent or spatial scale of impacts

Rating	Score	Criteria
High	3	Widespread, Far beyond site boundary, Regional/National/International Scale
Medium	2	Beyond site boundary, Local area
Low	1	Within site boundary

Source: EnvO Study Team

[9] Nigel Rossouw, A REVIEW OF METHODS AND GENERIC CRITERIA FOR DETERMINING IMPACT SIGNIFICANCE, African Journal of Environmental Assessment and Management 6:44, January 2003.

(D) Duration of the Impact

The duration of the impact means the time span which the potential/possible impact will exist.

Table 5-6 Criteria for rating the duration of impacts

Rating	Score	Criteria
High (Long term)	3	Permanent/ Beyond decommissioning Long term (More than 15 years)
Medium (Medium term)	2	Reversible over time/ During lifespan of the project Medium term (5-15 years)
Low (Short term)	1	Quickly reversible Less than the project lifespan Short term (0-5 years)

Source: EnvO Study Team

(E) Intensity or Severity of the Impact

The intensity or severity of the impact means the power/strength of the potential/possible impact in terms of the specific legal standards/values of the country or scientific standards/values.

Table 5-7 Criteria for rating the intensity or severity of impacts

Rating	Score	Criteria
High	3	Disturbance of pristine areas that have important conservation value or Destruction of rare or endangered species or potential to extremely exceed available country standards or international standards
Medium	2	Disturbance of areas that have potential conservation value or are of use as a resource or Complete change in species occurrence or variety or potential to increase up to available country standards or international standards
Low	1	Disturbance of degraded areas, which have little conservation value or Minor change in species occurrence or variety or potential to be less than available country standards or international standards

Source: EnvO Study Team

(F) Reversibility of the Impact

The reversibility of the impact means that the state of potential/possible impact will return its original state over a certain time.

Table 5-8 Criteria for rating the reversibility of impacts

Rating	Score	Criteria
High	3	Irreversible/ Permanent
Medium	2	Uncertain either irreversible or reversible
Low	1	Reversible

Source: EnvO Study Team

(2) Importance of the Impact

In this assessment methodology, the importance of the impact is considered in the form of level of acceptability on the potential/possible (environmental) impact in terms of legal requirements as well as the potential/possible (social) impact in terms of acceptability of affected community.

Table 5-9 Criteria for rating the importance of impacts

Rating	Criteria
High (Normally Unacceptable)	In case of possibility to exceed legal or regulatory standard/ In case of conflict with policies or land-use plans/ In case of increase level of risk to public health/ In case of loss of population of commercial biological species or extinction of biological species, loss of genetic diversity, rare or endangered species, critical habitat.
Medium (Acceptable with mitigations)	In case of some loss of threatened habitat/ avoidance of spread of biological disease, pests, feral animals or weeds/ in case of mitigable impacts to environment/social.
Low (Normally Acceptable)	In case of some loss of populations and habitats of non-threatened species/ In case of modification of landscape without downgrading special aesthetic values/ In case of emissions demonstrably less than the carrying capacity of the receiving environment/ In case of generally acceptable impact.

* Note: The judgement of importance will be also additionally based on the experiences and knowledge of study team.
Source: EnvO Study Team

5.1.4 Impact Evaluation

Once the impacts have been predicted and described in terms of both magnitudes of the impact and importance of the impact, the significance of the impact will be evaluated.

(1) Significance of the Impact

The magnitude of the impact is usually magnified with the importance of the impact. Hence, the significance of the impact is evaluated as follow:

Significance of the impact = Magnitude x Importance

Table 5-10 Criteria for rating the significance of impacts

		Importance		
		Low	**Medium**	**High**
Magnitude	**Small**	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

Source: EnvO Study Team

5.1.5 Impact Mitigation

(1) Confidence Level

Mitigation measures for all significant impacts are identified as part of the impact assessment. The impacts are ranked before and after the implementation of the mitigation measures. Consideration has also been given to the confidence level that can be placed on the successful implementation of the mitigation level.

Table 5-11 Criteria for rating the confidence level of impact mitigation

Confidence level	Criteria	Reduction of Impacts
Very High Confidence	Mitigation measures: either highly effective with expensive measures or highly effective with easy and inexpensive measures	(70% ~80% reduction of impact: 0.3 ~ 0.2)
High Confidence	Mitigation measures: either effective with expensive measures or effective with easy and inexpensive measures	(50% ~60% reduction of impact: 0.5 ~ 0.4)

Confidence level	Criteria	Reduction of Impacts
Medium Confidence	Mitigation measures: either moderately effective with expensive measures or difficult to implement	(30% ~ 40% reduction of impact: 0.7~0.6)
Low Confidence	Mitigation measures: either less effective with expensive measures or difficult to implement	(20% reduction of impact: 0.8)
Very Low Confidence	Mitigation measures: both less effective with expensive measures and difficult to implement	(10% reduction of impact: 0.9)

Source: EnvO Study Team

(2) Significance of the Impact with Mitigation Measures

The significance of the impact is finally given without and with mitigation. Consideration is given to confidence for mitigation when determining the potential to reduce the impact significance. If confidence for mitigation is low, the impact is unlikely to be reduced and this is reflected in the assessment of the significance with mitigation. If confidence for mitigation is high, the impact significance is reduced.

Table 5-12 Criteria for rating significance of impacts with Mitigation Measures

		Confidence Level				
		Very High	**High**	**Medium**	**Low**	**Very Low**
Significant of impact without Mitigation	**Negligible**	Negligible	Negligible	Negligible	Negligible	Negligible
	Minor	Negligible	Negligible	Minor	Minor	Minor
	Moderate	Minor	Minor	Minor	Moderate	Moderate
	Major	Minor	Moderate	Moderate	Major	Major

Source: EnvO Study Team

5.1.6 Degree of Certainty of the Impact

The degree of certainty of the impact can represent whether the impact is definitely or probably or possibly or uncertainly occurred or not regardless of prevention measures.

Table 5-13 Criteria for rating the degree of certainty of impacts

Rating	Criteria
Definite	More than 90% sure of a particular fact. Substantial supportive data exist to verify the assessment.
Probable	Over 70% sure of a particular fact or of the likelihood of that impact occurring.
Possible	Only over 40% sure of a particular fact or of the likelihood of an impact occurring.
Uncertain	Less than 40% sure of a particular fact or the likelihood of an impact occurring.

Source: EnvO Study Team

In this methodology, the concept of final evaluation of impact is mainly based on the Canadian Environmental Assessment Agency (1992)[10] like deciding whether the significant adverse environmental effects (significance of the impact) are likely to be occurred or not, as final evaluation of the impact.

5.2 Environmental Impacts in Operation Stage

Typically, impact assessment is generally done at every project stage; pre-construction, construction, operation and decommission. As the proposed project already finished construction activities in 2014 by the previous company and has been operating by current company since 2018, potential impacts during pre-construction and construction stage are not included in this assessment. The following table summarizes potential impacts which are likely to cause by the activities of the proposed project during the operation stage.

Table 5-14 Potential Environmental Impacts during the Operation Stage

Impact Category	Potential Impacts	Status of Impact	Reasons
Environmental Impacts			
I. Physical Component	(1) Air Pollution	Negative	Air pollution is anticipated due to the following activities: 1. Operation of roasting and smelting furnaces to extract antimony from antimony ores.
	(2) Solid Waste (Hazardous Waste and Non-Hazardous Waste)	Negative	Impact from solid waste generation is anticipated due to the following activities: 1. Generation of industrial wastes from operation of process, especially from roasting and smelting lines and operation of wet scrubber. 2. Generation of various type of domestic solid wastes from offices and workers' accommodation (such as kitchen wastes, used masks, used plastics packs, etc.)
	(3) Water Pollution	Negative	Water pollution is anticipated due to the following activities: 1. Discharge of overflown water from the operation process 2. Operation of wet scrubber 3. Cleaning and housekeeping process
	(4) Soil Contamination	Negative	Soil pollution is anticipated due to the following activities: 1. Spillage from storage of fuel and utilization of fuel 2. Slag piling, piling of raw materials and by-products within the project site
	(5) Noise and Vibration	Negative	Noise and vibration impact is anticipated due to the following activities: 1. Operation process (i.e. from blower operation and etc.) 2. Raw material preparation and handling (crushing and grinding of coal) 3. Vehicle mobilization for transporting raw materials and products
	(6) Odor	Negative	Odor is anticipated probably due to the following activities: 1. Roasting of antimony ore

[10] Canadian Environmental Assessment Agency (1992) Reference Guide: Determining Whether a Project is likely to cause significant adverse environmental effects, Quebec, Canada.

Impact Category	Potential Impacts	Status of Impact	Reasons
II. Natural/Biological Component	(1) Protected area	-	Impact on the protected area is not anticipated since the project is located in the mawlamyine industrial zone.
	(2) Flora and Fauna, Ecosystem	-	Impact on the flora and fauna, ecosystem is not anticipated since the project is already constructed since 2014 and located in the existing mawlayine industrial zone.
	(3) Hydrology	-	Impact on hydrology is not anticipated since the project will not use significant amount of water from the water sources and the project activities will not cause any impact on the hydrology.
	(4) Topography and Geography	-	Impact on the topography and geography is not anticipated since the project is already constructed since 2014 and located in the existing mawlayine industrial zone.

5.2.1 Air Pollution

(1) Project Activities

Flue gas from roasting and smelting line is emitted from the stack as source of emission as shown in the following Figure 5-1. By burning coal and coke, roasting antimony ores at the roasting line and smelting antimony powder at the smelting line are the major project activities for the source emission.

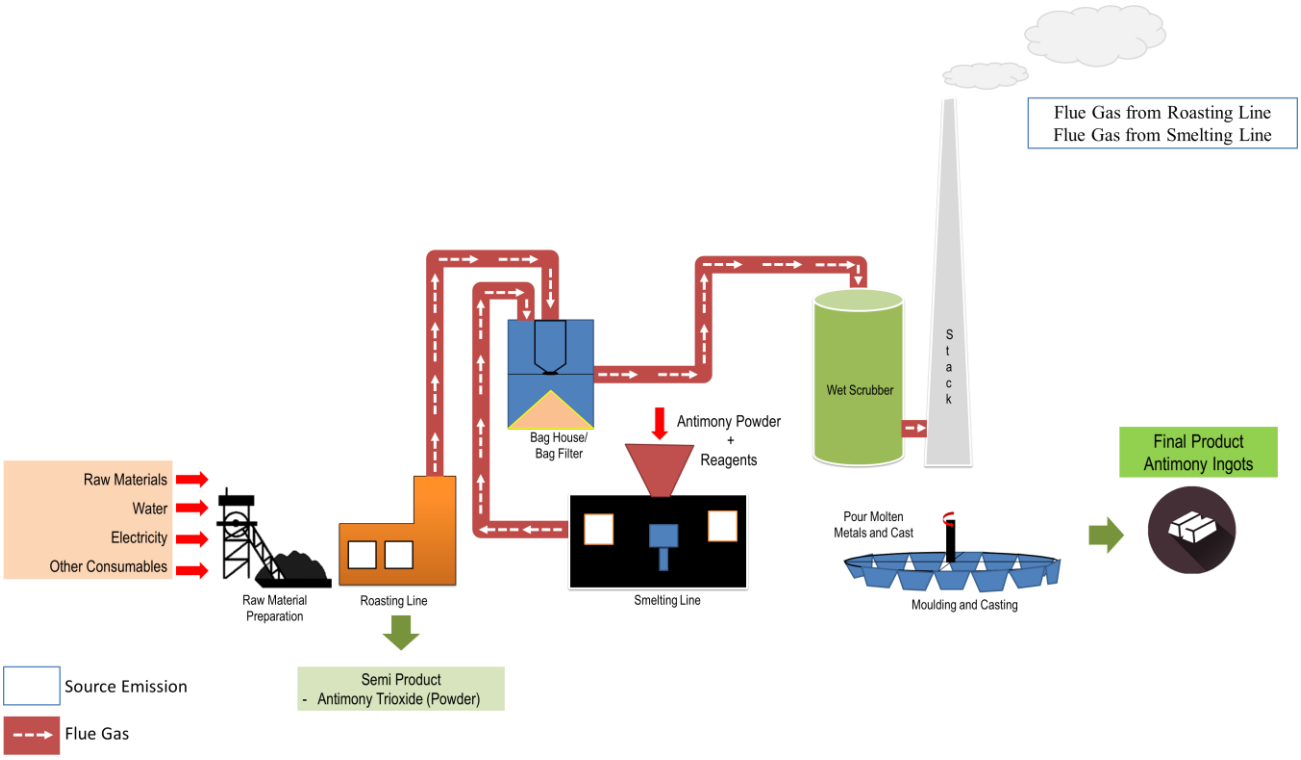


Figure 5-1 Activities in Production Process Related to Emissions

Source: EnvO Study Team

(2) Air Pollution Assessment

Air pollution status of the MSS Factory is assessed by using the following steps: (1) Identification of the major pollutants emitted from the operation process; (2) Estimation of annual emission amount of key pollutants; (3) Examination of sufficient stack height for emission and; (4) Evaluation of current installed facilities for emission control. Then, the possible mitigation measures are proposed to minimize the impact of air pollution.

(A) Identification of Pollutants from Operation Process

According to the IFC EHS guidelines, antimony roasting and smelting activities can generally emit particulate matter (PM), sulphur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO) and carbon dioxide (CO_2).

Table 5-15 Predicted Significant Pollutants from the Operation Process

Pollutants	Description
Particulate Matter (PM)	Roasting of antimony ores will generate a large volume of hot gas, largely containing antimony oxides in the form of particulate matter, mists or fumes. A small amount of metals that may be present in the particulate matter include coper and iron oxides, arsenic, cadmium, lead, mercury and zinc. PM may also be generated during the smelting process.
Sulphur Dioxide (SO_2)	Typically, the sulfur dioxide emission is the most significant contaminant from the roasting and smelting process. The combustion of fossil fuel (coal and coke) and roasting antimony ore oxidizes and generates sulfur dioxides.
Nitrogen Oxides (NO_x)	The combustion of fuel (coke and coal) also generates the small amount of NOx (fuel NOx – formed from nitrogen components that are present in the fuel) as the roasting and smelting temperature is around 1000 degree Celsius. However, there is no reason of formation of thermal NOx as nitrogen from atmosphere is oxidized only at the temperature above 1300 degree Celsius.
Carbon Monoxide (CO) and Carbon Dioxide (CO_2)	Carbon monoxide (CO) may be produced by the incomplete combustion of roasting and smelting furnaces, when the furnace is about to start fire. Carbon dioxide (CO_2) is generated from the direct combustion of fossil fuels (coal and coke) in the roasting and smelting furnace.

Source: EnvO Study Team

(B) Estimation of Annual Emission Amount of SO_2

As per the above observation, sulfur dioxides (SO_2) is the key pollutant of emission which needs to be further examined. Depending on the sulfur content contains in coal, coke and antimony ores, the emission rate of sulfur dioxide is calculated by using with engineering calculation, referenced from the Emission Estimation Technique Manual by the National Pollutant Inventory (NPI), Australia[11].

$$E_{SO2} = Q_f * C /100 * (MW_p /EW_f)$$

where: E = annual emissions of pollutant SO_2, ton/yr
Q_f = fuel use, ton/yr
MW_p = molecular weight of SO_2 emitted, g/mole
EW_f = elemental weight of SO_2 in fuel, g/mole
C = concentration of pollutant SO_2 in fuel, weight percent

As a result, approximately 31.13 ton/year of SO_2 is estimated to be emitted from the annual operation of MSS factory. The detail calculation is attached in ANNEX-4.

[11] National Pollutant Inventory (NPI) Emission Estimation Technique (EET) Manual for Combustion Engines - Version 1.2 – 14 June 2002 (unitar.org)

(C) Efficient Stack Height Calculation Based on Sulfur Dioxide Emission

As the sulfur dioxide is the most significant pollutant generated from the roasting and smelting furnaces, the estimation of minimum stack height for MSS factory is calculated based on the emission value of Sulfur dioxide. The detail calculation is described in Annex- 3.

It has been examined that the installed stack height (120 ft) is sufficient to control the emission of MSS factory as per guidance of Emission Regulations by Central Pollution Control Board, India in 1998. According to the calculation results, it is observed that the minimum 66.3 ft is necessary and thus having 120 ft height is sufficient enough to reject the plume of smoke and gases through the stack.

(D) Installed Facilities for Emission Control

Two bag houses and one bag filter are installed at MSS factory with the aim of collecting antimony oxide powder and also performing the function of air pollution control device that removes particulate matters from the flue gas released from the refinery processes. Moreover, wet scrubber system is additionally installed to treat the flue gas which passed through the bag house and bag filter. This system can also be called the "Flue Gas Desulphurization (FGD) System" as it is capable to remove the sulfur dioxide from the flue gas before it is released into the atmosphere and hence reduces the impact on the environment.

(i) Bag House and Bag Filter

The combustion of coal, coke and antimony ores during the roasting process generates a large amount of particulate matter in which the metal oxides; metal of value (antimony) and other less desirable metals such as lead, arsenic and etc. are present. As catching of antimony oxides in the form of powder (PM) is one of the operation processes, it is implemented by using with bag houses and bag filter. Out of the 3 roasting lines, one is connected to one bag filter which is recently upgraded and the others are connected to one bag house, a two storied built structure. PM may also be generated from the smelting line and therefore, the outlets of two smelting line are connected to one two-storied bag house. After the flue gas passed through the bag house and bag filter, it is then entered into the wet scrubber for further treatment.

(a) One Bag House connected to the two roasting furnaces

(b) One Bag House connected to two smelting furnaces

(c) One Bag Filter connected to one roasting furnace

Figure 5-2 Two Bag Houses and One Bag Filter Installed at MSS Factory

Source: EnvO Study Team

During the site visit, it is observed that two bag houses and a newly built bag filter installed at MSS factory are operating well. As the particulate matters (antimony oxide powders) are valuable and important for the production, the responsible staffs are continuously monitoring the air flow pressure to find whether the leakage is happened or not. If any leakage is found out (i.e. filter damage or filter blockage), maintenance of filter bags inside the bag filter or bag house is performed immediately. According to the IFC, EHS General Guidelines, the bag filters which use fabric filters have the reducing capacity of > 99% in the control of particulate matter (PM) and therefore, it can be said that the control facilities installed at MSS factory seem to be adequate to control the PM emission.

(ii) Wet Scrubber (Flue Gas Desulfurization (FGD) System)

Wet scrubber is installed as a post treatment facility to remove the gaseous pollutants from the flue gas, mainly targeted to the Sulphur dioxide (SO_2). Moreover, it also has the ability to remove the other pollutants such as nitrogen oxides (NO_x), particulate matters (PM) and others into some extent before the flue gas is emitted from the stack. Photos showing the components of wet scrubber system and the schematic diagram are shown in the Figure 5-3 and Figure 5-4 respectively.

(a) Reagent Mixing Tank

(b) Scrubbing Towers

(c) Clarifier Tanks

Figure 5-3 Photos of Each Component of Wet Scrubber System

Source: EnvO Study Team

As illustrated in the above figures, the scrubbing liquid is prepared first in the reagent mixing tank by mixing the soda ash (sodium carbonate) with required amount of water. Then the scrubbing liquid is pumped into each clarifier while make-up water is added to reach the desired amount of water volume and the pH level. Later, the wet scrubber is ready to start the operation.

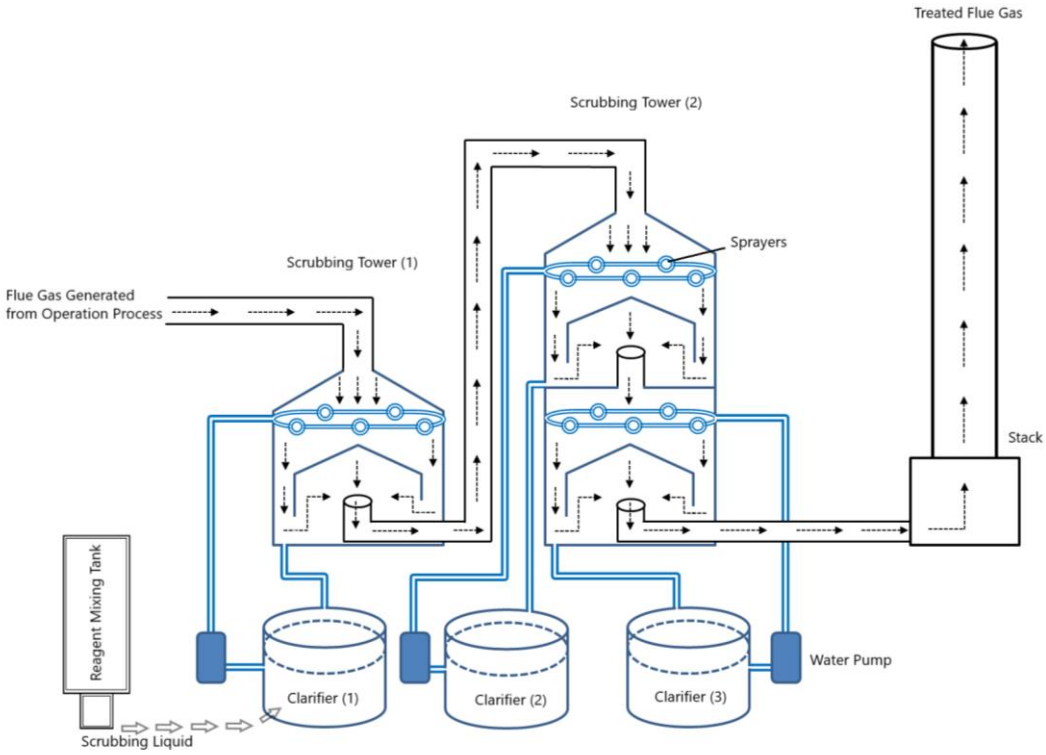


Figure 5-4 Schematic Diagram of Wet Scrubber Installed at MSS Factory

Source: Project Proponent

The type of wet scrubber installed in MSS factory is a spray tower type which is one of the most popular wet scrubber configurations used to bring flue gas into contact with the sorbent designed to absorb and reach with the SO_2. In the wet scrubber system, two scrubbing towers; scrubbing tower (1) with one level of sprayer and scrubbing tower (2) with two levels of sprayer are installed as described in the above diagram. The scrubbing liquid from the clarifier tank is pumped up and sprayed with the help of nozzles at the top of each tower. A bleed

stream from the bottom of the scrubbing tower is recirculated back in the clarifier and it forms the continuous flow of scrubbing liquid between the clarifier and the towers.

As the sorbent used in MSS factory is Soda Ash (Sodium Carbonate), the SO_2 in the flue gas react with it, forming the gypsum at the base of the column and a few amounts on the bottom of the clarifier. The FGD wet scrubber not only reduce the amount of SO_2 in the flue gas but also the PM and other gaseous pollutants into the significant extent. Generally, FGD wet scrubber has the removal efficiency of over 90% if it is well operated. During the site visit, it was observed that although the wet scrubber is operating, the management of its operation is not yet systematically developed. As the wet scrubber is operating manually, it is important that the operators are fully aware of changes in the system and monitor the performance of the wet scrubber in a timely manner. Otherwise, it may not be efficiently operated to remove the SO_2 and other pollutants which contain in the flue gas. Therefore, the study team has developed a Standard Operating Procedures (SOP) for wet scrubber operation, attached in the Annex – 5. It is assumed that the operation of wet scrubber will be more affective if the recommended measures from the SOP are fully implemented.

(3) Evaluation of Significance of Impact without Mitigation Measures

Based on the activities performed under the project, the preliminary evaluation is done considering no mitigation measures. The evaluated result showed that the significant of the air pollution impact is Major as described in the following table.

Table 5-16 Evaluation of Significance of Air Pollution Impact without Mitigation Measures

Activities	Status	Type	Extent	Duration	Intensity	Reversibility	Magnitude	Importance	Significance
Operation of Roasting and Smelting Furnace	Negative	3	2	2	2	1	10 (Medium)	High	Major

(4) Proposed Mitigation Measures

The following mitigation measures are proposed to be implemented by the project proponent.

- Careful operation and regular maintenance of furnaces, condensing pipes, blowers, bag filters and wet scrubber with record.
- Seeking advanced operation techniques which makes less pollution compared with the installed facilities.
- Giving priority to use fuel (coke or coal) with lower sulfur content.
- Conducts measures and inspections as per the recommendations given in SOP of wet scrubber operation (Annex – 5).
    - Calculating the amount of Soda Ash required in wet scrubber operation.
    - Maintaining the pH value of scrubbing liquid between 7 and 8.
    - Timely monitoring the pH value of scrubbing liquid in each clarifier.
    - Monthly monitoring the opacity of smoke emitted from the stack.
- Proper handling of raw materials (i.e., coal, coke, antimony ore and grinded matters) not to emit dust from loading, unloading, and mixing activities
- Avoid storing or piling raw materials (especially grinded coal and antimony in open airy area with large amount)
- Regular maintenance of backup generators and vehicles used in the operation.

(5) Evaluation of Significance of Impact with Mitigation Measures

Based on the installed pollution control facilities, if the recommendations given above in this section and Annex - 5 can be performed and implemented in MSS, the impact level of air pollution can be reduced from Major to Moderate as described in the following table.

Table 5-17 Evaluation of Significance of Impact with Mitigation Measures

Activities	Significance without Mitigation	Confidence Level	Significance after Mitigation
Operation of Roasting and Smelting Furnace	Major	High	Moderate

5.2.2 Solid Waste

(1) Project Activities

Activities in the MSS factory which generate industrial and domestic wastes are shown in Figure 5-5. Different types of industrial waste are observed. Being the metal refining project, operation of roasting and smelting lines mainly generates different composition level of slag, in which some are recycled again in roasting and smelting if antimony is still presented in the slag. Use of chemical reagents for precipitation of metals in smelting process and for the laboratory are the activities which generates a small amount of wastes such as the used chemical containers and bags. Operation of wet scrubber produces the deposited slag. Cleaning of settling tanks generates the sediment sludge. Also, the damaged filter bags are also considered as one type of the waste generated from the operation. Those industrial waste are evaluated as hazardous waste due to the possibility of presenting toxic metals. The domestic activities at the offices and worker accommodations generates various types of non-hazardous wastes such as kitchen wastes, office wastes and other wastes such as emptied packs, used masks, etc.

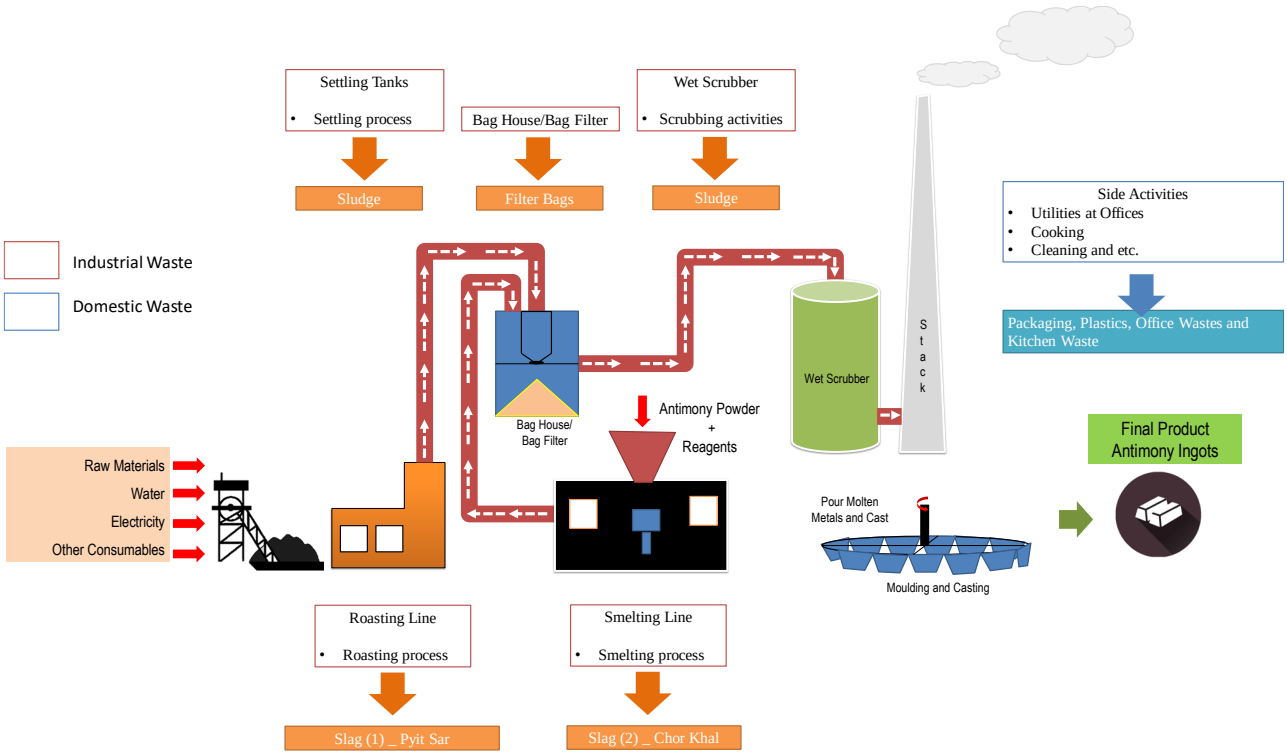


Figure 5-5 Activities in the Factory which generate Industrial and Domestic Waste

Source: EnvO Study Team

(2) Solid Waste Assessment

The academic researches indicated that the non-ferrous metallurgical processing industry have typically the hazardous solid waste issues. The types and characteristics of pollutants included in the waste slag and the hazard of dominant pollutants are examined to comprehend impact of hazardous waste slag produced from the roasting and smelting processes. The other type of industrial waste generation is very limited in quantity and the impact are less significant. The current practice of solid waste management (industrial and domestic) is also evaluated. Then, the possible mitigation measures for are proposed to reduce the impacts resulted from the generated solid waste.

(A) Examination of Industrial Waste from Roasting and Smelting Processes

(i) Origin of Waste and its Properties

The origin of each type of waste are described as follow:

Slag (1) (Pyit Sar) – is made from roasting of antimony ores together with coal and coke:

Slag (2) (Chor Khal) – is made time by time from the smelting process where any Arsenic and other metals accompanying the antimony oxide is removed by the addition of soda ash, and the slag is also known as arsenic-alkali slag:

According to the literature[12] entitled as "Antimony smelting process generating solid wastes and dust: Characterization and Leaching Behaviors", possible chemical composition of each waste (Slag (1), and Slag (2)) are observed in Table 5-18. It is founded that Arsenic (As) is the major pollutant in the waste and antimony (Sb) itself is containing in the waste. However, as per operation status in MSS, Slag (2)-Chor Khal is recycling in the smelting process until to reach less than 1% (<10,000 mg/kg) of antimony. Hence, the rest dominant metal and heavy metal in the slags are assumed as Zinc (Zn) and Arsenic (As), respectively.

Table 5-18 Hazardous Wastes and Its Properties Observed from Literature

Hazardous Waste	Origin Activities	Properties – (heavy metals presented in) mg/kg										
		As	Sb	Cd	Co	Cr	Cu	Hg	Ni	Pb	Sn	Zn
Slag (1) – Pyit Sar	Oxidation in Roasting line	5700	11100	0.07	32.6	213	139	2.63	24.7	51.7	2.74	665
Slag (2) – Chor Khal	Arsenic Removal in Smelting Line	86000	316000	1.04	0.23	12.0	7.85	7.51	0.72	12.4	0.09	48.2

Note: As the origins of wastes sampled in the research paper are supposed to be the same as in MSS, properties of WQS is taken as Slag (1), and AAR as Slag (2)

Source: Antimony Smelting Processing Generating Solid Wastes and Dust: Characterization and Leaching Behaviors, Xuejun GuoKunpeng, WangMengchang, HeZiwei, LiuHailin, YangSisi Li

(ii) Characteristics of Potential Dominant Pollutants

The characteristics of the potential dominant pollutants are examined based on its existence in water and soil. The potential dominant pollutants (As, Sb, Hg, and Zn) are selected depending upon level of toxic and maximum amount of pollutant in each type of waste. In Table 5-19 the potential impacts on aquatic plants and animals, human, soil properties are tabulated when the pollutants reach into another media such as surface water, ground water, and soil. It means that the leaching of heavy metals from the waste slag into soil, ground water and surface water causes the certain impacts and hazards on aquatic plants and animals, human, and soil properties.

[12] Antimony smelting process generating solid wastes and dust: Characterization and Leaching Behaviors, Xuejun GuoKunpeng, WangMengchang, HeZiwei, LiuHailin, YangSisi Li, Environmental Science, 26 2014 (1549-1556)

Table 5-19 Dominant Pollutants in Solid Waste and its Potential Hazards

Potential Pollutants in Solid Waste	Media where pollutant exists	Potential Impact on Aquatic Plants and Animals	Potential Impact on Human	Potential Impact on Soil Properties
Arsenic	Surface Water	-	When human has direct exposure with the pollutant for long time and/or the pollutant is entered human's body: • Alteration of genetics • Gastrointestinal effects • Anemia • Peripheral neuropathy • Skin lesions • Hyperpigmentation • Liver or kidney damage	-
	Ground Water	• Alteration of genetics affects the whole downstream of food chain.		-
	Soil	• Interferes with metabolic processes. • Inhibits plant growth and development. • Inhibition of seed germination. • Decrease in plant height. • Reduction in root growth and some necrosis.	-	• Sulfide (e.g., arsenopyrite, pyrite, loellingite, realgar) and arsenate minerals (e.g., scorodite, beudantite, yukonite) are the most common soil-bound mineral forms.
Antimony	Surface Water	-	When human has direct exposure with the pollutant for long time and/or the pollutant is entered into human's body: • Strong irritating effect on the gastrointestinal mucosa. • Sustained vomiting. • Abdominal cramps. • Diarrhea and cardiac toxicity. • Expected to be carcinogen. • Metabolic disorders • Damage organs especially the nervous system.	-
	Ground Water	-		-
	Soil	• Soil pollution by Sb may be rarely so severe. • Taken up by crop plants, it may enter the food chain and present a health risk for	-	-

Potential Pollutants in Solid Waste	Media where pollutant exists	Potential Impact on Aquatic Plants and Animals	Potential Impact on Human	Potential Impact on Soil Properties
		animals and humans, even if the plants themselves remain unaffected.		
Mercury	Surface Water	• Accumulate fish and food chains. • Fish are organisms that absorb great amounts of methyl mercury from surface water every day.	When human has direct exposure with the pollutant for long time and/or the pollutant is entered into human's body: • Associated with nervous system damage in adults. • Neurological development in infants and children. • Mercury poison resulting in death, mental retardation, dysarthria, blindness, neurological deficits, loss of hearing, developmental defects, and abnormal muscle tone.	-
	Ground Water	-		-
	Soil	• surface water or soil microorganisms can convert it to methyl mercury • The availability of soil mercury to plants is low, and there is a tendency for mercury to accumulate in roots, indicating that the roots serve as a barrier to mercury uptake.	-	-
Zinc	Surface Water	-	When human has direct exposure with the pollutant for long time and/or the pollutant is entered into human's body: • Stomach cramps, nausea, and vomiting (large doses) • Cause anemia damage the pancreas (High levels - long term) • Decrease level of high-density	-
	Ground Water	• Taken up by animals eating soil or drinking water containing zinc. • Zinc is also a trace mineral nutrient and as such, small amounts of zinc are needed in all animals.		-

Potential Pollutants in Solid Waste	Media where pollutant exists	Potential Impact on Aquatic Plants and Animals	Potential Impact on Human	Potential Impact on Soil Properties
			lipoprotein (HDL) cholesterol.	
	Soil	• Only a limited number of plants has a chance of survival. • Degradation in production of farmland.	-	• Interrupt the activity in soils. • Negatively influences the activity of microorganisms and earthworms.

Source: Different sources including USEPA, WHO websites and different research papers

(B) Evaluation of Current Waste Management Practice in MSS

The detail waste handling status is already shown in Chapter 3 with respective photos. Even though the waste slag contains some heavy metals as observed in the Table 5-18, it is already acknowledged that the metal-producing industries obtain one of the highest recycling rates as compared to other industrial sectors by recycling/reusing the slag in non-ferrous metal industries as well as in other industries (e.g. cement manufacturing, abrasives manufacturing, construction industries, etc.)

The current hazardous waste management in MSS Factory is summarized in Table 5-20. Most of the hazardous wastes at MSS are temporarily stored in the warehouse in other plot in Mawlamyine Industrial Zone and bare land in the project site and finally disposed to the mine at Nat San Village, Kyaikmayaw Township which is operating by Myanmar Shing Shing Metal Company Limited. However, Slag 1- Pyit Sar are currently being laid at the bare land area inside the project site with the purpose of preparation for the further extension of the project.

Table 5-20 Summarized Hazardous Waste Management

Hazardous Waste	Origin	Temporary Storage	Final Disposal Method	Recycle or Reusing Method
Slag (1) – Pyit Sar	Oxidation in Roasting line	Warehouse	• Dumping at Nat San Mine (property of MSS) • Selling to Third Party	• Cement Industry (as Raw Material) • Reused back in Roasting if Sb is >1%.
Slag (2) – Chor Khal	Arsenic Removal in Smelting Line		• Dumping at Nat San Mine (property of MSS)	• 2nd skimmed layer is reused back in Smelting if Sb is present.
Sludge	Wet Scrubber operation		• Selling to Third Party	• Brick Making Industry (As Gypsum)
Sludge	Settling Process		• No Disposal	• Burning in the roasting furnace for the recovery of antimony
Used Filter Bags	Use in Bag Filter/Bag House		• No Disposal	• Burning in the roasting furnace for the recovery of antimony powder attached in the filter bag.

Source: EnvO Study Team

The current non-hazardous waste management in MSS Factory is summarized in Table 5-21. Most of the non-hazardous wastes are collected in bins and it is finally either burned or buried.

Table 5-21 Summarized Non-Hazardous Waste Management

Non-Hazardous Waste	Origin	Temporary Storage	Final Disposal Method	Recycle or Reusing Method
Emptied Packs of Electrolyte Power/ Masks, etc.	Providing workers as daily supplement / as PPE	• Open dump near the factory	• Burning • Buried	• Nil
Plastics and Office wastes	Office works			
Kitchen Wastes	Cooking/Canteen			

Source: EnvO Study Team

Hazardous waste management is very essential for this industry since the waste slag containing heavy metals. The current practice of MSS showed that basically the disposal at antinomy mine area could be acceptable when its disposal with proper guidance from waste dumping by State ECD. However, the waste slag filling at the bare land area inside the project site is quite challenging for environmental issues unless installation of proper liner layer prior to filling. Also, it is found out that solid wastes resulted from MSS is varied and needs better management for each type in terms of collection, storing, and disposal. The recordings for waste management is still lacked. Hence, MSS requires to have a specific solid waste management plan.

(3) Evaluation of Significance of Impact without Mitigation Measures

Based on the activities performed under the project, the preliminary evaluation is done considering no mitigation measures.

Table 5-22 Evaluation of Significance of Impact without Mitigation Measures

Activities		Status	Type	Extent	Duration	Intensity	Reversibility	Magnitude	Importance	Significance
Generation of industrial wastes (hazardous) from operation process	Roasting of Antimony	Negative	3	2	3	2	1	11 (Large)	Medium	Major
	Smelting of Antimony	Negative	3	2	3	2	1	11 (Large)	Medium	Major
	Wet Scrubbing Process	Negative	3	2	1	2	1	9 (Medium)	Medium	Moderate
	Settling Process	Negative	2	1	1	2	1	7 (Small)	Medium	Minor
Generation of domestic wastes	Domestic activities	Negative	2	1	1	2	1	7 (Small)	Medium	Minor

(4) Proposed Mitigation Measures

The following mitigation measures to be implemented by the project proponent are proposed by carefully considering all the factors such as economic, approachable, applicable and capacity of the project proponent regarding to each activity.

- Resell the slag (1) – Pyit Sar to the local buyers (cement and construction industry for further use) as much as possible with the purpose of recycling.
- Not to directly dispose hazardous waste slag at any land without any liner layer.
- Dispose hazardous waste slag appropriately at mine located in Nat San Village, Kyaikmayaw Township, under the regulations / guidance of respective departments such as mining department and environmental conservation department.
- Segregate non-hazardous waste and reuse or resell the items as much as possible.
- To pave the concrete floor at the temporary slag collection area outside the factory.
- Reserve the adequate waste storage area.
- Avoid open burning and contact local municipal for the domestic waste disposal.
- Arrange to dispose at the existing municipal disposal site by project proponent if the municipal collection is not available.

As a specific mitigation measure, EnvO Study Team prepares a detail solid waste management plan (Annex-9) which includes hazardous solid waste management, giving project proponent a guidance of waste collecting, handling, suitable temporary storage with adequate space, precautions and mitigation measures of waste slag filling activities inside the project area, recording of waste amount, designated final disposal for each waste type and etc.

(5) Evaluation of Significance of Impact with Mitigation Measures

If the recommendations given above in this section and Annex-9 can be performed and implemented in MSS, the impact level of solid waste generation can be reduced as described in the following table.

Table 5-23 Evaluation of Significance of Impact with Mitigation Measures

Activities	Significance without Mitigation	Confidence Level	Significance after Mitigation
Roasting of Antimony	Major	Medium	Moderate
Smelting of Antimony	Major	Medium	Moderate
Wet Scrubbing Process	Moderate	Medium	Minor
Settling Process	Minor	High	Negligible
Domestic Activities	Minor	High	Negligible

5.2.3 Water Pollution

(1) Project Activities

Water is required for the activities such as the cooling of gas in roasting lines and smelting lines, casting, and wet scrubber. However, the cooling water is circulated within the project. Also, water used for wet scrubber is circulated. Hence, wastewater from the cleaning of facilities working area and bag filters, housekeeping and the laboratory, and overflow of cooling tanks, are evaluated to be discharged to the environment. The runoff can also be generated from the stockpile and handling of raw materials and by-products. Moreover, wastewater from domestics' activities such as sanitary purposed activities, cooking, cleaning, bathing and etc. is discharged into the public drain.

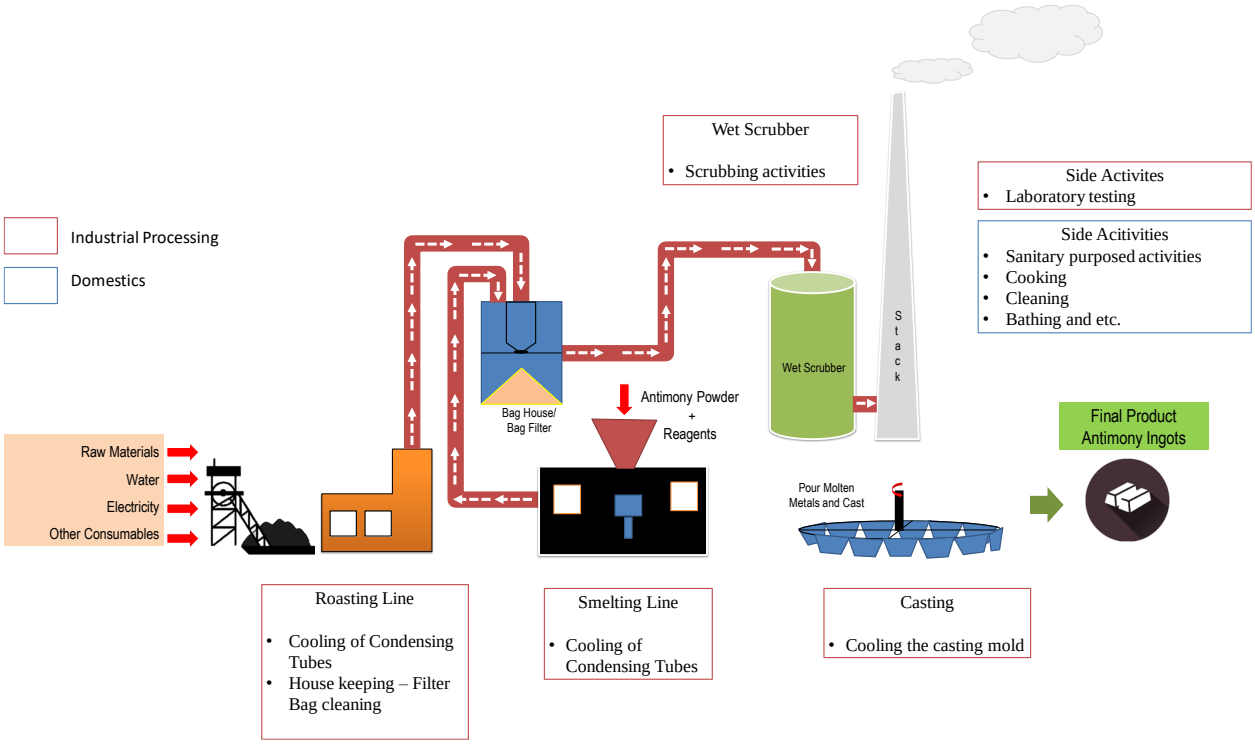


Figure 5-6 Activities throughout the process that result water pollution

Source: EnvO Study Team

(2) Water Pollution Assessment

Water pollution which likely caused by the discharge of wastewater from the project site is assessed. First of all, the quality of wastewater which discharge from the MSS Factory is evaluated based on the results of water quality survey. The current practice of wastewater management is reviewed and the weakness of the practice is figured out. The mitigation measures for improving the wastewater management system are proposed.

(A) Evaluation of Current Wastewater Quality

Since the industrial wastewater quality is an issue from environmental aspects, the EnvO team conducted the wastewater quality measurement at the places where represent the quality of wastewater discharged into the environment. The locations of sampling points are shown in the below figure. The in-situ water quality (pH, temperature, TDS and EC) were measured at the site and the other 16 parameters as per the requirements of NEQG Guidelines for smelting and refining of base metals and BAT Associated Emission Limit were measured at the Laboratory. Here, the additional parameters required by BAT Associated Emission Limit which covers the production, recovery or processing of non-ferrous metals, their compounds or other alloys including antimony, were measured as well because NEQG doesn't indicate the specific parameters required for antimony processing industry. The detailed on-site measurement results, original laboratory results, description about sampling methods, procedures and device are attached in the Annex 4.

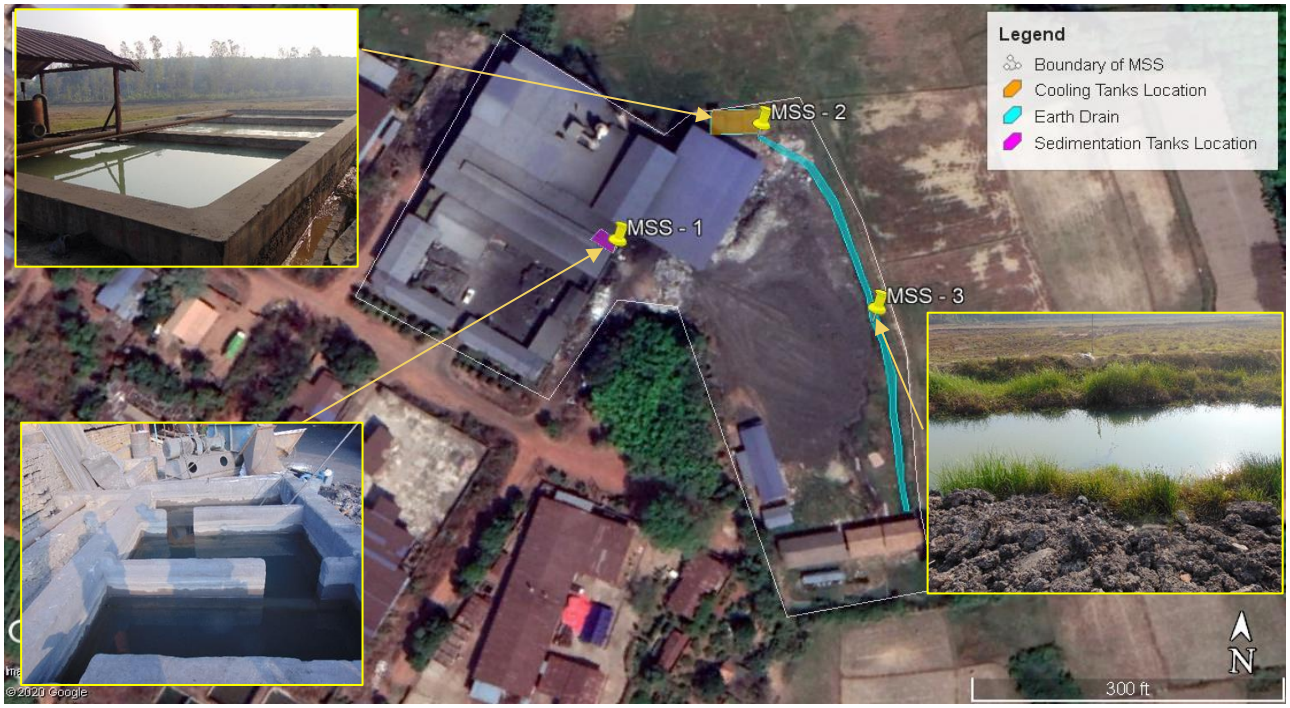


Figure 5-7 Locations of Effluent Sampling Points

Table 5-24 Results of On-Site Wastewater Measurements Comparing with NEQG Guideline Values

Monitoring Points	Description	Parameters			
		pH Meter		TDS Meter	
		pH	Temperature (°C)	TDS (ppm)	EC (μs/cm)
MSS-1	Wastewater from cleaning	8.76	28.4	501	1002
MSS-2	Overflown Cooling Wastewater	8.33	**39.4**	378	756
MSS-3	Downstream of Earth Drain	7.11	31.4	572	1144
NEQG Guideline Value		***6-9***	***< 3 degree Celsius***	***nil***	***nil***

According to the on-site measurement, all the wastewater pH value is within the guideline limit of NEQG. However, the temperature difference from the point MSS-2 to the point MSS-3 where is about 100m far from the MSS-2 is greater than 3 degrees Celsius. Hence, temperature of the discharged overflown water should be controlled to cool down before discharging into the earth drain.

The table below lists the measured values of wastewater quality at each point as compared to the guideline values of NEQG and BAT emission level.

Table 5-25 Results of Wastewater Analysis at Laboratory

No	Test Parameter	MSS-1	MSS-2	MSS-3	Unit	NEQG Guideline Value	BAT Emission Level
1	Aluminium	0.08	0.01	0.02	mg/l	0.2	
2	Arsenic	**0.25**	**0.25**	**0.5**	mg/l	0.05	
3	Cadmium	ND LOD = 0.01	ND LOD = 0.01	ND LOD = 0.01	mg/l	0.05	
4	Chemical Oxygen Demand	**160**	**140**	**310**	mg/l	50	
5	Copper	ND LOD = 0.02	ND LOD = 0.02	0.02	mg/l	0.1	

No	Test Parameter	MSS-1	MSS-2	MSS-3	Unit	NEQG Guideline Value	BAT Emission Level
6	Fluoride	0.4	0.36	0.7	mg/l	5	
7	Lead	ND LOD = 0.1	ND LOD = 0.1	ND LOD = 0.1	mg/l	0.1	
8	Mercury	< 0.1	< 0.1	< 0.1	mg/l	0.01	
9	Nickel	< 0.2	< 0.2	< 0.2	mg/l	0.1	
10	Oil and Grease	5	7	3	mg/l		10
11	Total Nitrogen	11.4	19.8	12.8	mg/l		5-25
12	Total Phosphorus	0.698	0.082	0.433	mg/l		2
13	Total Suspended Solids*	**78**	**87**	**76**	mg/l	20	
14	Zinc	0.05	0.04	0.02	mg/l	0.2	

Note: *TSS = Total Solid – Total Dissolved Solid

The specific findings upon the results of wastewater quality (on-site + lab result) is tabulated below.

Table 5-26 Specific Findings and Discussions upon Wastewater Quality

Item	Sampling point	Findings
Wastewater from cleaning after passed through settling tanks	MSS - 1	The wastewater quality from the settling tanks indicated the exceed of concentration of arsenic, chemical oxygen demand and total suspended solids out of 16 parameters measured. Arsenic is five times greater than the target value.
Overflown water from the cooling tanks	MSS - 2	Similarly, the wastewater quality from the cooling tanks indicated the exceed of concentration of arsenic, chemical oxygen demand and total suspended solids out of 16 parameters measured. Arsenic is five times greater than the target value. Also, temperature of the overflown water is very high at the discharge point as compared to other locations.
Water quality in the earth drain	MSS - 3	Similarly, the wastewater quality from the earth drain indicated the exceed of concentration of arsenic, chemical oxygen demand and total suspended solids out of 16 parameters measured. Arsenic is ten times greater than the target value likely due to the leaching of arsenics from the waste slag filling up the land inside the project site. The electrical conductivity is in the slight and moderate zone as per FAO guideline, which could cause the salinity problems to the nearby irrigation if there is no adequate drainage. Also, temperature of the overflown water is relatively high in the earth drain.

Source: EnvO Study Team

Overall, the wastewater from the MSS factory is observed that among 16 parameters, there are only four parameters (As, COD, TSS, and temperature) which were slightly exceed the NEQG guideline values. The Arsenic (As) is a major concerned parameter to be managed as the concentration of As in the water circulating inside the operation process and discharging into the environment is five times greater than NEQG values. And, the As content was increased while passing through the waste slag filling area probably due to the leaching from waste slag filling. The values of COD and TSS are not significantly high as compared to other industry (e.g. brewery- approximately COD > 10,000mg/L, TSS> 30,000mg/L). Temperature of overflow wastewater from the cooling tanks are slightly high and is required to be controlled.

(B) Current Practice of Wastewater Management

Current practice of wastewater management in the MSS is reviewed thoroughly based on types of wastewater (industrial and domestic). Water used for the operation of the factory is mainly pumped from the Attran River to the overhead tank located inside the factory.

(i) Industrial Wastewater

(a) Water is needed for the cooling purpose in the processing lines and casting, which does not have a direct contact with the reaction. The water used for cooling doesn't include contaminants but the temperature of such water need attention to be controlled. Cooling water is re-circulating within the process with the continuous filling of the amount that was evaporated from the heat exchange process. The water is passed through the separate pipeline (condensing tubes) for cooling gases from the roasting and smelting lines. The used water then flows into the cooling tanks (initial cooling tank and cooling tank) inside and behind the factory, respectively. Then the cooled water is again pumped up and circulated in the cooling water system. Only overflown water is discharged into nearby earth drain across the bare land.

(b) As the antimony ores and its by-products could contain the other metals beside antimony, cleaning water from the working area, and washing of bag filters is also expected to contain heavy metals. Wash water from cleaning of workplace surfaces and bag filters is priority passed into the simple settling process before discharge into the drain. The discharged amount of wastewater from the settling tanks into the drain is very limited. The tanks have two partition walls. The sludge from the tanks are taken out from the tanks occasionally for reusing back in the process again.

(c) Wastewater from wet scrubber (including wash water) is one of the biggest effluent generators, which is expected to contain heavy metals such as arsenic, cadmium, lead, mercury and other metals. Wastewater from wet scrubber is enclosed and circulated in its system, remaking up as scrubbing liquid to scrub again the flue gas. Sludge are occasionally taken out, packed and disposed.

(d) The wastewater expected from a small testing laboratory is very limited as it used 10-100ml of solutions for testing the quality of antimony ores. The only cleaning water from the laboratory including less amount of chemicals is anticipated to be discharged.

The schematic wastewater circulation and drainage of MSS is presented in the following diagram.

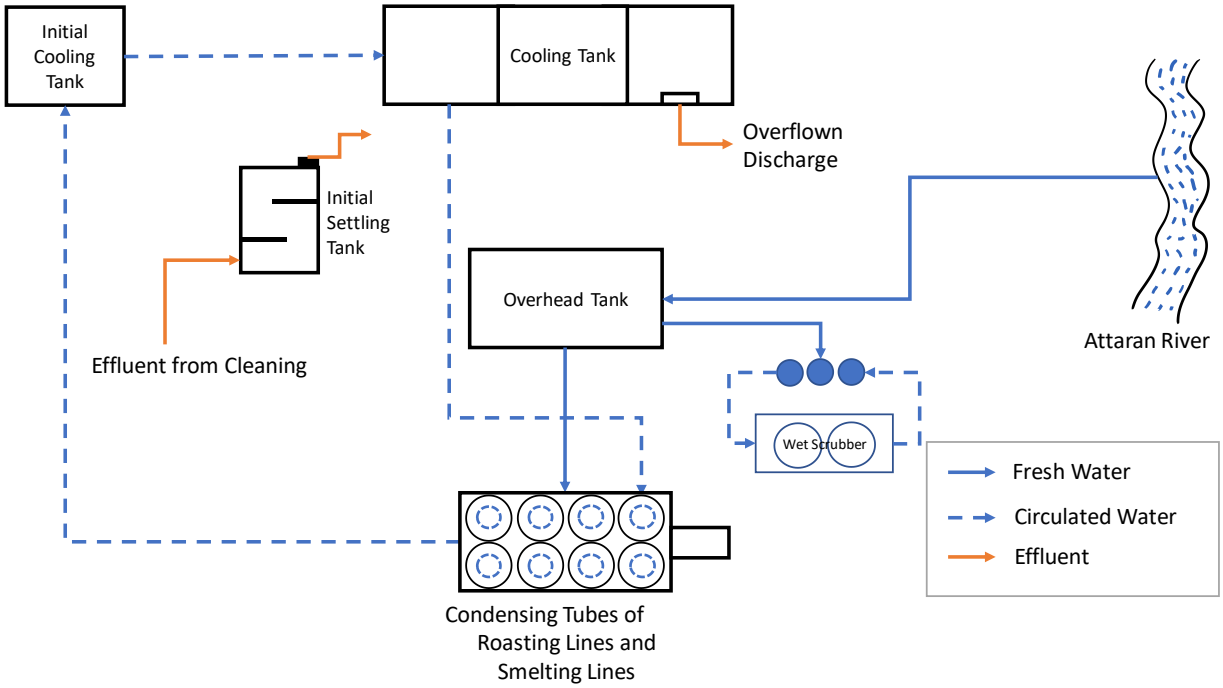


Figure 5-8 Schematic Layout of Wastewater Circulation and Drainage

Source: EnvO Study Team

(a) Settling Tanks

(b) Cooling Tanks

(c) Overflown at Cooling Tanks

(d) Overflown water

(e) Earth Drain

Figure 5-9 Related photos of Wastewater Management at MSS

Source: EnvO Study Team

(ii) Domestic Wastewater

The domestic wastewater discharges from the utilities in office areas and worker accommodations. Sanitary waste and wastewater from the office toilets and toilets at worker houses are stored in septic tanks with adequate capacity. The wastewater from bathing area, canteen and kitchen area directly flows into the nearby drains as shown in Chapter 3. The layout and flowing drainage system are described in detail in the Annex.

As a result of current wastewater management status, water quality measurements at the important location of wastewater in the factory, and observation from the field visit to the MSS, the mitigation measures which required to improve the wastewater management status are proposed in the next section.

(3) Evaluation of Significance of Impact without Mitigation Measures

Based on the activities performed under the project, the preliminary evaluation is done on each activity considering no mitigation measures applied. The evaluated result showed that the significant of the impact is Moderate for gas cooling system with condensing tubes due to water circulation practices and less existence of heavy metal contaminants except Arsenic, Minor for cleaning and bag filters washing due to limited amount of wastewater discharge, Moderate for operation of wet scrubber, and Negligible for working with small testing laboratory.

Table 5-27 Evaluation of Significance of Impact without Mitigation Measures

Activities	Status	Type	Extent	Duration	Intensity	Reversibility	Magnitude	Importance	Significance
Gas cooling system with condensing tubes	Negative	3	1	2	1	2	9 (Medium)	Medium	Moderate
Cleaning and bag filters washing	Negative	3	1	1	1	1	7 (Small)	Low	Minor

Activities	Status	Type	Extent	Duration	Intensity	Reversibility	Magnitude	Importance	Significance
Wet scrubber operation	Negative	3	1	2	1	2	9 (Medium)	Medium	Moderate
Small testing laboratory operation	Negative	1	1	1	1	1	5 (Small)	Low	Negligible

(4) Mitigation Measures

The following mitigation measures are proposed to be implemented by the MSS by carefully considering all the factors such as economic, approachable, applicable and capacity of the project owner.

- Restrict the discharge of wastewater from the wet scrubber operation such as spent scrubbing liquid to the environment.
- Ensure that no wastewater is discharged during the time of sludge collection, effluents from each tank shall be detained in others.
- Collect, treat and discharge properly the scrubbing water in case of pumping out or taking out the scrubbing water for the maintenance of tanks or any reason and ensure that the discharged wastewater quality meet NEQG guideline values.
- Set up an overflown water storage tank for overflown water from the cooling tanks before directly discharge into the earth drain aiming to reduce the wastewater temperature up to (<30˚C).
- Seek the ways to reduce the concentration of Arsenic, COD and TSS such as use of raw materials (antimony ores with less arsenic content), installation of treatment system mainly for treating those three parameters, etc.
- Discharge all type of wastewater (from cooling tanks, from wet scrubber (if any), from settling tanks, and laboratory) only after passing through the treatment system when the installation is done.
- Avoid the filling of waste slag from roasting and smelting lines on the bare land without any liner system in order to get rid of the increase of Arsenic content along the earth drain caused by leaching of Arsenic from waste slag.
- Monitor annually the quality of all types of wastewater discharged from MSS.
- For the measurement of mercury in wastewater, it should be aware that the detection limit at the laboratory shall be 0.01mg/L (NEQG value) and the designated laboratory which is capable to measure the mercury content up to two decimal value (i.e. 0.00) shall be chosen.
- Construct the design drain (brick or concrete) instead of the earth drain which passing through the paddy fields and bare land to the nearby creek.
- Ensure the avoidance of direct discharge of wastewater from the laboratory to the environment.
- Ensure the proper drainage lines provision for storm/rain water as well.

(5) Evaluation of Significance of Impact with Mitigation Measures

It was observed that the project proponent has installed the conventional settling tanks. Hence, if the recommendations given above in this section can be performed and implemented in MSS, the water pollution can be significantly reduced. As described in the below table, the significance of the impact is evaluated as for each activity after applying the mitigation measures.

Table 5-28 Mitigation Measures of Impact with Mitigation Measures

Activities	Significance without Mitigation	Confidence Level	Significance after Mitigation
Gas cooling system with condensing tubes	Moderate	Medium	Minor
Cleaning and bag filters washing	Minor	Medium	Minor
Wet scrubber operation	Moderate	Medium	Minor
Small testing laboratory operation	Negligible	Medium	Negligible

5.2.4 Soil Contamination

(1) Project Activities

Soil contamination in MSS is expected to be led by the following activities performed during the operation of process.

- Storage of fuel, raw material and utilization of fuel
- Temporary Waste Piling at project site

Moreover, waste (slag) filling within the compound of the MSS with the purpose of foundation of new building may arise the issue of soil pollution.

(2) Soil Contamination Assessment

The consumption of fuel at MSS is relatively low and it is stored with barrels. The chance of the soil contamination from the spillage is also low as the fuel storage area is paved with concrete which doesn't let any spillage permeable into the soil. Most of the raw materials are also piled at the paved area and grinding, mixing activities performed on the paved platform.

Figure 5-10 Fuel Storage Area at MSS

Temporary waste (pyit sar) pilling at project site is also observed before transporting to the warehouse. Since such waste are piling on the paved ground temporarily, the soil pollution impact is expected not to happen. However, recently in 2020, MSS started filling up the land inside the compound. As waste filling without any liner layer at the base, (operation waste) can contribute the soil pollution at MSS, the possible issues are assessed based on their characteristics of the waste (slag), current management (especially storage and

disposal) and characteristics of the dumping area (i.e. soil type and underground water table) with the best available information. Filling and dumping waste for the purpose of foundation for new building are mainly slag (1), pyit sar which resulted from the roasting line of the antimony processing, containing antimony and arsenic. The area is approximately 28,930 square feet (2,690 square meter) for the slag filling with the depth of around 3-5 feet, which makes up approximately (115,720) cubic feet in volume. In other word, such amount of slag (1) was used to fill up the land area for the foundation of new building. As per the research paper mentioned, the acid-soluble fraction of antimony and arsenic is below 10 %, which means the low risk of heavy metal release through a rainwater leaching. On the other hand, the arsenic has the potential to be soluble into the groundwater depending upon the situations such as higher pH, and existence of organic carbon in the groundwater. If the arsenic is not soluble, it will precipitate and remain in the solid phase of the groundwater system as part of the soil.[13] Then, soil polution caused by arsenic is expected to be occurred in case of any arsenic content in the waste slag.

The soil type in Mon state is Gleysol soil, occur within a wide range of unconsolidated materials, mainly fluvial, marine and lacustrine sediments of Pleistocene or Holocene age, having the property of basic to acidic mineralogy.Therefore, insoluble antimony and arsenic can remain attached with the soil and contaminate the soil. (mentioned in section 4.1.4)

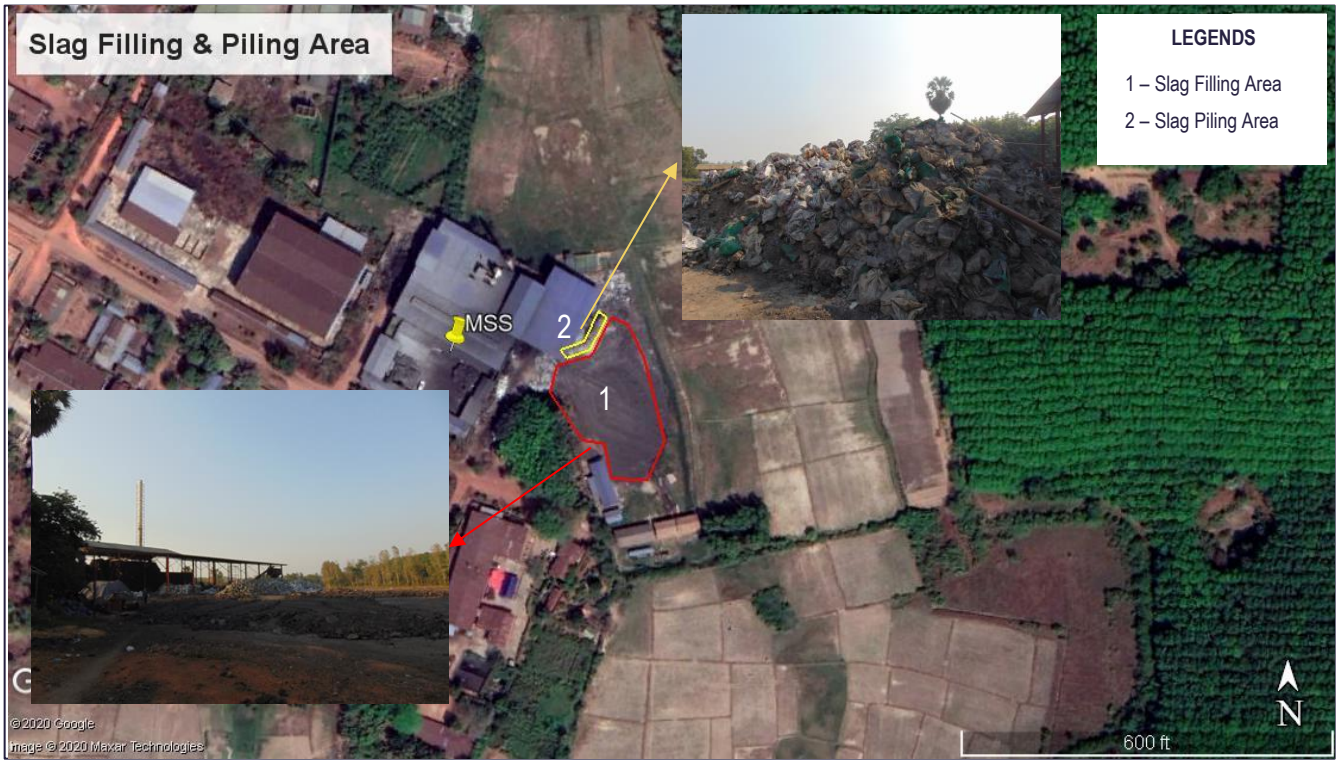


Figure 5-11 Slag Filling and Piling Area

Source: EnvO Study Team using Google Earth Pro

(3) Evaluation of Significance of Impact without Mitigation Measures

Based on the activities performed under the project, the preliminary evaluation is done considering no mitigation measures on each activity. The evaluated result showed that the significant of the impact is ***Moderate*** for all the waste filling and piling activities, which need mitigation measures to address the impact significance.

[13] https://umaine.edu/arsenic/how-does-arsenic-get-into-the-groundwater/

Table 5-29 Evaluation of Significance of Impact without Mitigation Measures

Activities	Status	Type	Extent	Duration	Intensity	Reversibility	Magnitude	Importance	Significance
Waste piling at project site	Negative	2	2	2	3	1	10 (Medium)	Medium	Moderate
Storage of fuel, raw material and utilization of fuel	Negative	2	1	2	1	1	8 (Medium)	Low	Minor
Waste (slag) filling in the compound	Negative	2	2	2	3	1	10 (Medium)	High	Major

(4) Mitigation Measures

The following mitigation measures are proposed to be implemented by Project proponent by carefully considering all the factors such as economic, approachable, applicable and capacity of the project proponent regarding to each activity.

- Avoid piling on the unpaved area and direct piling on the ground
- Proper storage, handling of fuel/chemicals and proper disposal of used chemical containers in accordance with guidelines without spillage, and leakage
- The storage area should be under roof
- Immediate cleaning shall be undertaken as per Emergency Response Plan if any leakage is observed
- Designate the machinery maintenance area if possible
- Before landfilling process, a designated area must be clay layer or concrete lining which doesn't allow the fluid permeable into the soil
- Contact with local CDC and dispose domestic wastes to their designated collection point or final disposal

(5) Evaluation of Significance of Impact with Mitigation Measures

If the recommendations given above in this section can be performed and implemented in MSS, the soil contamination can be reduced. The significance of the impact is evaluated as Minor and Moderate after applying the mitigation measures.

Table 5-30 Evaluation of Significance of Impact with Mitigation Measures

Activities	Significance without Mitigation	Confidence Level	Significance after Mitigation
Waste Piling at project site	Moderate	Medium	Minor
Storage of fuel, raw material and utilization of fuel	Minor	Medium	Minor
Waste (slag) filling in the compound	Major	Medium	Moderate

Source: EnvO Study Team

5.2.5 Noise

(1) Project Activities

Major activities which could make noise from the project are the blower operation. Activities of raw material preparation and handling such as grinding, crushing, and the vehicle mobilization of transporting raw materials and products are expected to generate noise from the project area.

(2) Noise Assessment Upon "Spot Check Results" at Factory Boundary

Noise impact that might affect to the surrounding environment is assessed under this section while the noise impacts within the project site is assessed under the occupational health and safety category of the risk assessment section of Chapter 6. Noise assessment is made based on the simple noise check "spot check" at the boundary of the factory which adequately supports to make the quick judgement on the noise levels that the receptors from the surrounding environment might receive. If the spot check measurement results are higher than the target values, it should be considered to conduct the longer duration of noise monitoring.

The detailed survey methodology of the noise level is described in Annex 7. Locations of spot check measurement are illustrated in the following figure.

Figure 5-12 Spot Check Measurement Points at Project Boundary

Source: EnvO Study Team based on Google Earth Pro

(3) Evaluation of Significance of Impact without Mitigation Measures

Noise measurement values are measured in dbA and presented at respective measured location on the map. All the noise level is well within the acceptable level stipulated by the MONREC, ECD in NEQG value – 70 dbA for the receptor in industrial and commercial area.

Table 5-31 Noise Level Spot Check Measurement Results at MSS Boundary

Monitoring Points	Nearby Description	Noise Level	Unit	Guideline Values (NEQG)
Boundary		**Receptors - Industrial, Commercial**		
NS-B-1	Smelting Line	55.8	dBA	70 dBA
NS-B-2	Office	51.5	dBA	
NS-B-3	Factory Gate	55.7	dBA	
NS-B-4	Back of laboratory	52.9	dBA	
NS-B-5	Small wood of rubber trees	63.6	dBA	
NS-B-8	Cooling tanks	48.9	dBA	
NS-B-9	Cooling tanks	66.5	dBA	
NS-B-11	Workers Canteen	58.6	dBA	
NS-B-12	Workers Houses	55.8	dBA	

Source: EnvO Study Team

Based on the spot check measurement results, the preliminary evaluation is done considering no mitigation measure. The evaluated result showed that the significant of the noise impact is negligible and hence no mitigation measures is necessary to be implemented.

Table 5-32 Evaluation of Significance of Impact without Mitigation Measures

Activities	Status	Type	Extent	Duration	Intensity	Reversibility	Magnitude	Importance	Significance
Mineral Processing, blower operation and mobilization of vehicles.	Negative	3	1	1	1	1	7 (Small)	Low	Negligible

5.2.6 Odor

(1) Project Activities

The metal (antimony) processing industry is not the type of industry which releases odor such as livestock operation, food and beverage processing, pesticides, sugar or distillery production. However, some odor may be released from the operation processes together with the flue gas due to the chemical reactions take place inside the furnaces. The activities which could generate odor are as follow.

(b) Roasting of antimony ores – due to the oxidation of antimony ores
(c) Smelting of antimony oxides – due to the removal of other metal impurities

It is predicted to generate the disagreeable metallic odor due to the oxidation of antimony ores during the roasting process. Besides, the other metals contain in the antimony oxides mixture could release some offensive odor based on the chemical reactions during the smelting process.

(2) Odor Assessment

(A) Sources of Odor from MSS Factory Operation

(i) Roasting of Antimony Ores

According to the research[14], faint odor of SO_2 gas is starting to release from roasting operation at the temperature around 196 degree Celsius and becomes sharp and strong around 336 degree Celsius with the visible formation of antimony oxides (Sb_2O_3). Later when the temperature rises, the odor of SO_2 disappeared again. As the temperature inside the roasting furnace is varying time by time, it is assumed that the SO_2 odor will be released occasionally during the operation of roasting furnace.

(ii) Smelting of Antimony Oxides

During the smelting operation, the fluxing agent, soda ash is added for purging the metal impurities. In this process, various reactions could take places in the furnace based on the other metals presented in the antimony oxides, most of them are then forming into the salt form into the slag. During this time, the fumes generated from the smelting furnace may contain some offensive odor due to the chemical reactions.

(B) Current Practice for Odor Control

Although odor is released as point source emission from roasting and smelting processes, it is sucked by the blowers through the enclosed pipelines and finally emitted from the stack after passing through the wet scrubber. During the site visit, there is no observation of offensive odor within or outside the factory. Based on the conversation with the technicians, the metallic smell is sometimes got by the workers when there is a leakage of filter bags inside the bag houses. At the time, the workers check and fixed the damaged filter bags. However, odor may be leaked to the surrounding area in a short period when the electricity goes off and the generators are not ready to be started.

The wet scrubber (please see the Section 3.7.2 and Section 5.2.1 (2) (D)) installed at MSS factory has the ability to remove odor significantly together with the SO_2 and particulate matters. Moreover, the stack height has been renovated from the previous 70 ft to 120 ft to be able to emit the treated gases away from the nearby resident areas. Due to the current measures, it is assumed that the odor impact would be insignificant upon the receptors.

(3) Evaluation of Significance of Impact without Mitigation Measures

Based on the activities performed under the project, the preliminary evaluation is done considering no mitigation measures on each activity. The evaluated result showed that the significant of the impact is ***Moderate*** for the related project activities.

Table 5-33 Evaluation of Significance of Impact without Mitigation Measures

Activities	Status	Type	Extent	Duration	Intensity	Reversibility	Magnitude	Importance	Significance
Roasting and Smelting Processes	Negative	3	2	1	1	1	8 (Medium)	Medium	Moderate

[14] https://www.911metallurgist.com/behavior-stibnite-oxidizing-roast/

(4) Proposed Mitigation Measures

The following mitigation measures are proposed to be implemented by the project proponent by carefully considering all the factors such as economic, approachable, applicable and capacity of the proponent.

- Regular check and maintenance of blowers, ducts, condensing tubes and pipelines connected with the bag house, wet scrubber and final stack, ensuring no leakage of flue gas along the connection.
- Ensure that emergency backup generators are to be online within a few minutes if the electricity goes off in order to run the blowers as fast as possible.
- Regular check and maintenance of web scrubber operation.
- Conducts measures and inspections as per the recommendations given in the SOP of wet scrubber operation (Annex – 5) to ensure the effective operation of wet scrubber.
- Immediate response for fixing the damaged filter bags inside the bag house as soon as the leakage is detected.
- Maintain the record of odor if any offensive smell is experienced inside or nearby the project site.
- Record and investigate the reasons for causing offensive odor if any complaint from the nearby residents or nearby factory is received, then take corrective actions.

(5) Evaluation of Significance of Impact with Mitigation Measures

If the recommendations given above in this section can be performed and implemented in MSS factory, the significance of odor impact can be reduced from ***"Moderate" into "Minor".***

Table 5-34 Evaluation of Significance of Impact with Mitigation Measures

Activities	Significance without Mitigation	Confidence Level	Significance after Mitigation
Roasting and Smelting Processes	Moderate	High	Minor

5.3 Social, Health and Safety Impacts in Operation Stage

Prior to the impact assessment, the possibility of the impacts which could be raised during the operation stage is anticipated based on the nature of project activities. The following table describes the preliminary assessment of the potential impacts related to the social and health and safety of the community. The detailed assessment for those anticipated impacts is set out in the later section.

Table 5-35 Potential Social, Health and Safety Impacts during the Operation Stage

Impact Category	Potential Impacts	Status of Impact	Reasons
Social, Health and Safety Impacts			
III. Socio-economic and Cultural Component	(1) Local Economy	Positive	The local economy is anticipated to be developed gradually due to the contribution of the project benefits such as increase in revenue of local government and job opportunities of local communities.
	(2) Heritage and Cultural Valued Properties	-	Impacts on heritage and cultural valued property are not anticipated since the project is located in existing Mawlamyine industrial zone.
	(3) Ethnicity and Intangible Cultural Value	-	Impacts on the ethnicity and intangible culture are not anticipated as the MSS factory arranged workers' accommodation in the factory area not to be mixed with the local peoples living in the nearby villages.
	(4) Local resources	Negative	Impacts on the local water resource is anticipated due to the use of water from Attaran River in the factory operation.
	(5) Landscape, Greening and Scenery	-	Impact on landscape, greening and scenery is not anticipated as the factory was already constructed since 2014 in the existing Mawlamyine Industrial Zone.
	(6) Workers welfare	Positive	This is anticipated to be positive since the labors are provided with welfare facilities (such as provision of lockers, rest shelter, free meal, free supplements, etc.) and accommodations to the workers and their family members.
IV. Health Component	(1) Community Health and Safety	Negative	Impacts on community health and safety are anticipated due to the activities related to the factory operation.

Note: Grey highlighted are the impacts which are not anticipated during the operation of the project.

5.3.1 Local Economy

(1) Project Activities

The business operation of the project itself supports the local economy in positive ways. To be specific, the following activities of the project will bring benefits to the local economy.

- Providing employments
- Purchasing of local resources
- Exporting the products to the international market
- Paying taxations

(2) Local Economy Assessment

The project has been positively contributing the local economy by providing the employment for over 60 persons directly and supporting their families with the accommodations to them. The activities such as resourcing out the local coal monthly and the diesel fuel monthly from the local, are contributing the local economy indirectly. Moreover, as the products are exported to the other foreign countries, the project earns the money from the foreign countries which affects not only the regional economy but also supports the country's economy.
It also has been indirectly supporting the local developments by paying the required taxations and revenues to the related departments and regional government. As the project proponent has the plan to extend its project in the future years, it can be definitely said that its contribution on the local economy will increase.

(3) Evaluation of Significance of Impact

Based on the activities performed under the project, the preliminary evaluation is done considering no enhancement measures on each activity. The evaluated result showed that the significant of the positive impact is ***Minor*** for all the activities that impact the local economy.

Table 5-36 Evaluation of Significance of Impact without Enhancing Measures

Activities	Status	Type	Extent	Duration	Intensity	Reversibility	Magnitude	Importance	Significance
Business Operation	Positive	3	2	3	1	1	10 (Medium)	Low	Minor

(4) Recommendations for Enhancing Measures for Positive Impacts

As the basic idea of the impact assessment is to enhance the positive impacts, the EnvO Study Team proposed the project proponent the following recommendations:

- To give the local residents priority in employing at the project
- To purchase all the raw materials from the local regions as much as possible
- To extend the business with the ideas in which the nearby residents can participate

5.3.2 Local Resource

(1) Project Activities

The following activities of the project contributes the impacts on the local resources.

- Extracting water from the Attaran River

(2) Local Resources Assessment

For the local resources' extraction, the project extracts and uses water required for the operation of the process from Attaran River. Typically, it extracts water daily for the use of cooling process and other utilities in the metal processing. However, it doesn't make significant amount to affect the alteration of water level in the Attaran River for the water transportation.

(3) Evaluation of Significance of Impact

Based on the activities performed under the project, the preliminary evaluation is done considering no enhancing measures on each activity. The evaluated result showed that the significant of the impact is ***Negligible*** for extraction of water from Attaran River.

Table 5-37 Evaluation of Significance of Impact without Enhancing Measures

Activities	Status	Type	Extent	Duration	Intensity	Reversibility	Magnitude	Importance	Significance
Extraction of water from Attaran River	Negative	2	2	1	1	1	7 (Small)	Low	Negligible

(4) Recommendations for Enhancing Measures for Positive Impacts

As the basic idea of the impact assessment is that to mitigate the negative impacts and monitor the status of impact regularly, the EnvO Study Team proposed the project proponent the following recommendations:

- To install metering system for water usage from the Attran River
- To record the amount of monthly water usage for the operation of the factory

5.3.3 Workers Welfare

(1) Project Activities and Current Provision

Workers at MSS are provided personal facilities like lockers, rooms for accommodation at project site. Moreover, for the convenience of the workers in the work place, cooling fans are supplied at the working line, electrolyte powder or some drinks for 24-hour access and surgical masks at MSS. MSS always consider the workers' desires by providing different dishes and juices which they want for each meal. Provision of health care, in case of any injuries or diseases.

(2) Evaluation of Significance of Impact

Based on the activities performed under the project, the preliminary evaluation is done considering no enhancing measures on each activity. This is denoted as negligible impact.

Table 5-38 Evaluation of Significance of Impact without Enhancing Measures

Activities	Status	Type	Extent	Duration	Intensity	Reversibility	Magnitude	Importance	Significance
Providing Necessary facilities to workers	Positive	1	1	2	1	1	6 (Small)	Low	Negligible

(3) Recommendations for Enhancing Measures for Positive Impacts

As the basic idea of the impact assessment is that to enhance the positive impacts, the EnvO Study Team proposed the project proponent the following recommendations:

- To organize occasional ceremonies, annual party or trips for all the workers (May be at the time of temporary shut down on rainy season)
- To ensure the provision of full right and allowance identified by the local laws related to labour affairs

5.3.4 Community Health and Safety

(1) Pollutions Attributing Community Health and Safety

As the smelting and refinery projects are the significant pollutants emitters industry, the impacts such as its emissions are anticipated likely to occur for the community health and safety. These pollutions such as pollutants

emissions, odor emissions and discharge of wastewater are apparently caused by the activities during roasting and smelting process.
Besides, other attributions from traffic is not assessed as the traffic used for the transportation of the raw materials are significantly low and the route aren't loaded with heavy traffic as in urban areas.

(2) Findings and Assessment

(A) Emission Pollutants

From the air pollution assessment, it is estimated to produce certain amount of sulfur dioxide yearly from the operation of the metal processing. These emissions from MSS could impact the community health to some extend as the pollutants are treated with wet scrubber prior to the emission via the stack.

Table 5-39 Health Hazards of Emissions from MSS

Emissions	Exposure	Health Hazards by Inhalation
Sulfur Dioxide	• Short Term	• wheezing or shortness of breath • pain when taking a deep breath, coughing, throat irritation, and breathing difficulties.
	• Long Term	• worsen asthma attacks, and worsen existing heart disease in sensitive groups
Nitrogen Dioxide	• Short Term	• respiratory diseases, particularly asthma, leading to respiratory symptoms (such as coughing, wheezing or difficulty breathing)
	• Long Term	• Damage to lung but also in other organs, such as the spleen, liver and blood • development of asthma and potentially increase susceptibility to respiratory infections

Source: Air Quality Guideline for Europe – WHO Regional Publications, European Series, No. 91 and USEPA

(B) Odor Emission

It is observed that the emission of Sulphur Dioxide or other related pollutants during oxidation of antimony ores via the roasting process and release of the other metals contain in the antimony oxides mixture based on the chemical reactions during the smelting process, may release offensive odor to the community. Depending upon the duration of emission of offensive odor, the community will feel unpleasant and the sensitive group may have health problem if the long-term emission is occurred.

(3) Evaluation of Significance of Impact without Mitigation Measures

Based on the activities performed under the project, the preliminary evaluation is done considering no mitigation measures on each activity. The evaluated result showed that the significant of the impact is ***Moderate*** for all the activities, which need mitigation measures to address the impact significance.

Table 5-40 Evaluation of Significance of Impact without Mitigation Measures

Activities	Status	Type	Extent	Duration	Intensity	Reversibility	Magnitude	Importance	Significance
Roasting and Smelting Process	Negative	3	2	1	2	1	9 (Medium)	Medium	Moderate

(4) Mitigation Measures

The following mitigation measures are proposed to be implemented by Project proponent by carefully considering all the factors such as economic, approachable, applicable and capacity of the project proponent regarding to each of the activities.

- Mitigation Measures addressed in Air pollution assessment to reduce the level of the emission such as the enhancement of the efficiency of wet scrubber using standard operational procedure described in this IEE study shall be fully implemented.
- Set up the simple and effective grievance procedures in case of any complaints from the community in terms of odor emission or other impacts.
- Monitor any significant public health issues raised in the nearby community, identify with the help of environmental expert and address any measures for the issue.

(5) Evaluation of Significance of Impact with Mitigation Measures

If the recommendations given above in this section can be performed and implemented in MSS, the impact of Community health and safety can be reduced. The significance of the impact is evaluated as Moderate for all activities after applying the mitigation measures.

Table 5-41 Evaluation of Significance of Impact with Mitigation Measures

Activities	Significance without Mitigation	Confidence Level	Significance after Mitigation
Roasting and Smelting Process	Moderate	Medium	Minor

5.4 Environmental Impacts in Decommission / Closure Phase

The factory is currently in operating and is projected to run for 30 years. For the time being, it is still developing gradually to enhance the operational performance as well as environmental compliance of the factory and therefore, it is difficult and impractical to determine the activities which are to be done in the closing stage. However, the project proponent is committed to conduct specific environmental management plan for decommission / closure phase 3 years before the end of proposed project and will submit it to the ECD accordingly. This commitment is added in Chapter (9), Section 9.2 of the IEE Report.

CHAPTER (6) RISK ASSESSMENT AND MITIGATION MEASURES

6.1 Risk Assessment

Workers should be protected from occupational risks they would be exposed to. Risk is the likelihood that a person may be harmed of suffers adverse health effects if exposed to a hazard. Hazards and risks present in the workplace may need to be assessed to determine what consequences could result, to allocate a risk level or rating, and to determine priorities for actions to be implemented to ensure the health and safety of workers. By referencing and implementing the methodologies and concepts mentioned in this chapter, risks assessments have performed by EnvO Study Team for the following two main issues regarding to the occupational health and safety of workers based on the nature of project activities and operation processes of MSS Factory.

- Risk Assessment of Industrial Hazards
    - Occupational Hazards
    - Emergency Hazards
- Risk Assessment of Natural Hazards

6.2 Risk Assessment Methodology

6.2.1 Basic Concept of Risk Management

Important concepts in risk management are the concepts of hazard and risk. A hazard is a source, situation, or act with a potential for harm in terms of human injury or ill health, or a combination of these. Therefore, a hazard can be anything present in the workplace that has the potential to cause an injury to workers, either a work accident or an occupational disease. Examples of physical hazardous situations can be working on a ladder, handling chemicals substances or walking on a wet floor. Risk is the combination of the likelihood of an occurrence of a hazardous event or exposure and the severity of injury or ill health that can be caused by the event or exposure.

Risk management is an iterative and cyclic process, as depicted on Figure 6-1. The following methodology PDCA (Plan-Do-Check-Act) risk management is a systematic process that includes the examination of all characteristics of the work system where the worker operates, namely, the workplace, the equipment/machines, materials, work methods/practices and work environment. The aim of Risk Management is to identify what could go wrong, i.e. finding what can cause injury or harm to workers, and to decide on proper safety control measures to prevent work accidents and occupational diseases and implement them (i.e. risk control). The main goal of risk management is to eliminate or at least to reduce the risks according to the ALARP (as low as reasonably practicable) principle. A key aspect in risk management is that it should be carried out with an active participation/involvement of the entire workforce. Carrying out risk management implies performing several steps (whose activities will be detailed in the next sub-sections).

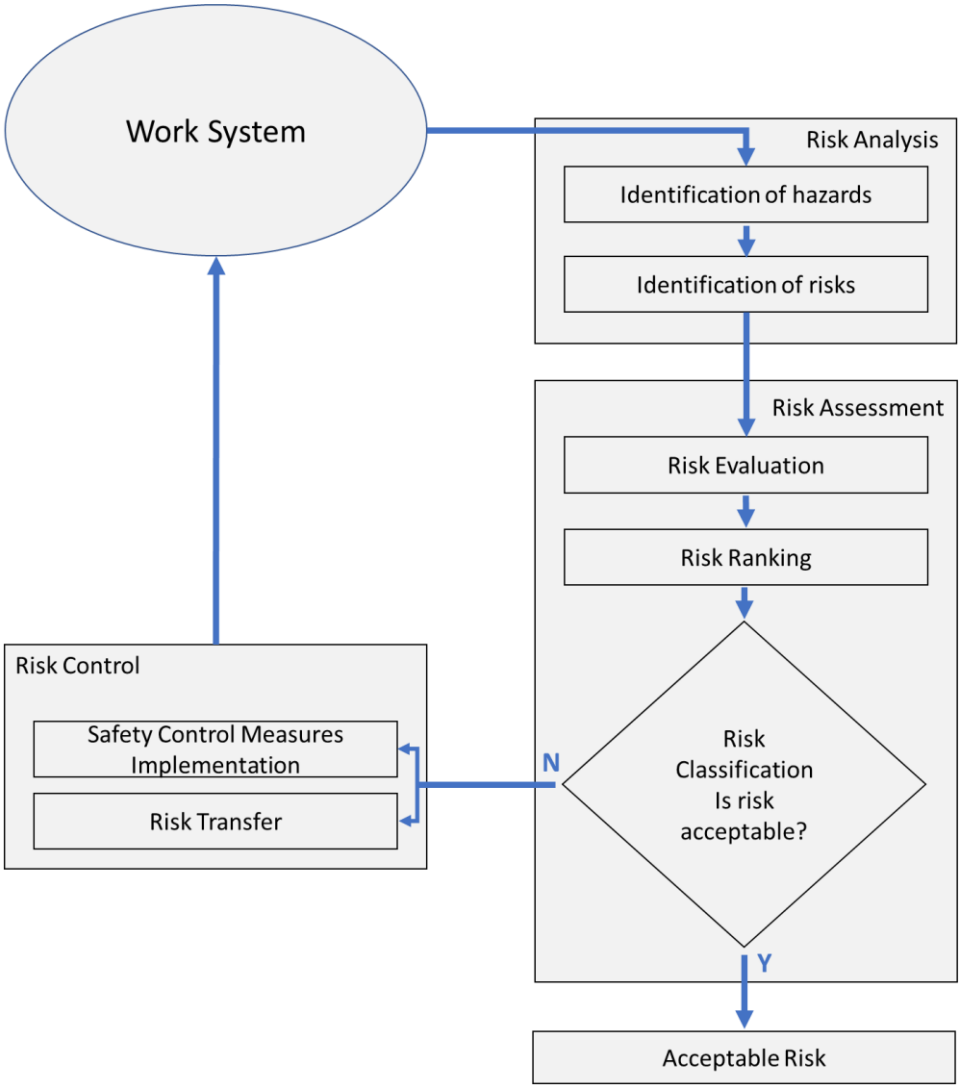


Figure 6-1 Structural Processes of Risk Management

Source: EnvO Study Team

6.2.2 Methodology for Risk Assessment

Risk assessment is the process of thinking about what might cause harm to the people especially for workers working at factory and deciding which steps need to be taken to avoid or mitigate. Risk assessment and risk analysis can be defined as a set of systematic methods to:

- Identify hazards
- Quantify risks
- Determine components, safety measures and/or human interventions important for factory safety

Methodology for risk assessment is basically referenced from **"General Environmental Impact Assessment Guideline (Version – 3) Draft Version"** disclosed in 2017, September. A risk assessment is usually composed of two metrics: severity and likelihood or frequency. Each can be given a numeric value from 1-5 with increasing severity and likelihood respectively and displayed in a risk matrix as shown in Table 6-1. An explanation of the descriptors used to classify likelihood and consequence of impacts is provided in Table 6-2 and Table 6-3.The risk level is indicated by a colour code, with the green denoting generally acceptable risks and red denoting generally unacceptable risks. The intermediate yellow and orange zone requires careful examination for a particular project to identify the level of acceptability, where risks are reduced to as low as reasonably practicable.

Table 6-1 Risk Assessment Matrix

	Improbable / Rare (1)	Remote / Unlikely (2)	Occasional (3)	Probable / Likely (4)	Almost Certain / Frequent (5)
Catastrophic (5)	5	10	15	20	25
Critical (4)	4	8	12	16	20
Moderate (3)	3	6	9	12	15
Minor (2)	2	4	6	8	10
Negligible (1)	1	2	3	4	5

Source: EnvO Study Team

Table 6-2 Likelihood and Consequence of Descriptors for Industrial Hazards

Level	Descriptor	Detail of Description
Likelihood		
5	Almost Certain/Frequent	Is expected to occur in most circumstances, or is of a continuous nature, or likelihood is unknown
4	Probable/Likely	Will probably occur during lifetime of the project
3	Occasional	Might occur during the life of the project
2	Remote/Unlikely	Could occur but considered unlikely or doubtful
1	Improbable/Rare	May occur in exceptional circumstances
Consequence		
5	Catastrophic	Life threatening injuries _ Fatalities / Death or Permanent Disability
4	Critical	Life impacting injuries _ Serious Injury, Hospital Treatment required Injury, Permanent-partial or Temporary Disability
3	Moderate	Major Injuries _ Recordable injury / illness
2	Minor	Minor Injuries _ First aid or minor medical treatment)
1	Negligible	No Injuries or Injuries requiring no treatment of first aid

Source: EnvO Study Team

Table 6-3 Likelihood and Consequence of Descriptors for Natural Hazards

Level	Descriptor	Detail of Description	
Likelihood			
5	Almost Certain/Frequent	The event is expected to occur annually.	
4	Probable/Likely	The event will probably occur about one time in three years.	
3	Occasional	The event might occur at some time of the project lifetime.	
2	Remote/Unlikely	The event could occur but it is improbable.	
1	Improbable/Rare	The event may occur only in exceptional circumstances.	
Consequence			
5	Catastrophic	Flood	Severe effect and threat on human life. Evacuation is immediately needed.
		Earthquake	The earthquake is felt very strongly, people are alarmed and lose balance. High probability of severe damage to buildings and even to very stable structures.
4	Critical	Flood	Services may be disconnected. Food, water supplies, first aid, life jackets, safety boots are major requirements to tackle the flood.
		Earthquake	The earthquake is felt strongly, people are alarmed and lose balance. Probability of severe damage to buildings and less stable structures may also collapse.
3	Moderate	Flood	Some roads are likely to be closed. It is necessary to watch the levels of warnings and prepare as per instructions.
		Earthquake	The earthquake is felt across a wide area, people are alarmed. Damage is likely to be caused by falling objects in buildings. Probability of damage to buildings such as cracks in plaster and cracks in walls.
2	Minor	Flood	Safe to live inside building.
		Earthquake	Felt in scattered locations outdoors and noticed by many people inside buildings. Generally, no probability of damage in buildings.

Level	Descriptor	Detail of Description	
1	Negligible	Flood	No effect at all.
		Earthquake	Noticed by few people. No probability of damage to buildings.

Source: EnvO Study Team

Table 6-4 Risk Categorization

Rating Value of Risk	Category of Risk	Evalution of tolerability	Necessary Action and Time scale
1-4	Low	Acceptable	These risks are considerd acceptable. No further action is necessary other than to ensure that the controls are maintained.
5-9	Medium	Risks that sbould be reduced so that they are tolerable or acceptable	Consideration should be given as to whether the risks can be lowered, where applicable, to an acceptable level. The risk reduction measures are not necessary to be implemented within a defined time period. Arrangements should be made to ensure that the controls are maintained, particularly if the risk levels are associated with harmful consequences.
10-19	High		Substantial efforts should be made to reduce the risk. Risk reduction measures should be implemented urgently with a defined time period and it might be necessary to consider suspending or restricting activity, or to apply interim risk control measures, until this has been completed. Consideable resources might have to be allocated to additional control measures. Arrangements should be made to ensure that the controls are maintained, particularly if the risk levels are associated with harmful consequences and very harmful consequences.
20-25	Very High	Unacceptable	These risks are unacceptable. Substantial improvements in risk controls are necessary, so that the risk is reduced to a tolerable or acceptable level.

Source: EnvO Study Team

6.3 Risk Identification

For risk assessment, possible risks are identified based on the nature of project activities and operational processes of MSS Factory. The industrial hazards (occupational hazards and emergency hazards) and natural hazards are the two concerned issues which were identified and accessed during the operation stage of MSS factory.

Table 6-5 Identification of Possible Risks with Related Project Activities

Categories	Possible Risks	Related Project Activities
Occupational Hazards (Industrial Hazards)	1. Workplace Air Quality	Workplace air quality risk is anticipated due to the following activities: 1. raw material preparation and handling 2. roasting and smelting activities
	2. Heat Exposure	Heat exposure risk is anticipated due to the following activities: 1. operation of furnaces 2. handling and disposal of slag
	3. Chemical Exposure	Chemical exposure risk is anticipated due to the following activities: 1. use of chemicals in factory operation 2. use of chemicals in the laboratory
	4. Noise and vibration	Noise and vibration risk is anticipated due to the following activities: 1. raw material preparation and handling such as crushing and grinding of coal 2. operation of blowers 3. operation of backup generators
	5. Physical Hazards	Risk on physical injury is anticipated due to the following activities: 1. slips, trips and falls resulted from poor housekeeping activities 2. eye hazards from furnace operation and grinding of coal 3. traffic accidents due to the vehicles

Categories	Possible Risks	Related Project Activities
	6. Communicable Diseases	The following types of communicable diseases are anticipated for the risk assessment. 1. Covid-19 2. Cholera, Diarrhea and Dysentery
Emergency Hazards (Industrial Hazards)	1. Fire	Fire risk is anticipated due to the following types of fire sources: 1. storage of coal and coke (raw materials) 2. storage of diesel fuel 3. timber buildings (Workers' Accommodation and Canteen)
	2. Explosion	Explosion risk is anticipated due to the following types of explosion which may occur from project activities: 1. Dust Explosion (Antimony Powder) 2. Furnace Explosion
Natural Hazards	1. Flood	Flood risk is anticipated since the project location lies in Kyaikmaraw township of Mon State which is a flood prone region in Myanmar.
	2. Earthquake	Earthquake risk is anticipated since the earthquake is one of the common types of disasters in Myanmar and is unpredictable.

Source: EnvO Study Team

6.4 Risk Assessment of Occupational Hazards

6.4.1 Workplace Air Quality

(1) Preliminary Risk Assessment of Workplace Air Quality

The quality of indoor air inside workplaces is important not only for workers' comfort but also for their health. Poor air quality due to the release of contaminants into the workplace can result in respiratory irritation, discomfort, or illness to workers. Concerned air pollutants that could harm on workers' health in a typical base metal smelting and refinery factory are predicted to be Sulfur Dioxide (SO_2), Nitrogen Oxides (NO_x), Particulate Matters (PM_{10}, $PM_{2.5}$), Carbon Monoxide (CO) and Carbon Dioxide (CO_2). Based on the nature of MSS factory operation, PM emission to the workplace would be significant and gaseous emission to the wokplace would be insignificant.

Those pollutants may be emitted from the processes of raw materials preparation (coal, coke, antimony ore), burning coal and coke, roasting of antimony ores, handling of antimony oxide and smelting activities. The following table shows the activities which may cause the emission of air pollutants into the workplace together with the effects of these air pollutants on health.

Table 6-6 Activities that may Contribute Emission of Air Pollutants and their Effect on Health

Activities		Potential Air Pollutants	Nature of Emission	Potential Effects on Health
Raw Materials Preparation and Handling	- Grinding of Coal	Coal Dust	Coal dust is expected to be emitted during the grinding of coal.	Short-term – inhalation of fine invisible coal dust particles in the lungs Long-term – chronic hazard of causing pulmonary illness (lung cancer)
Roasting and Smelting activities	- Burning Coal and Coke for roasting Antimony Ore	SO_2, NO_x, PM, CO, CO_2	The furnace doors are usually opened at the start of operation for about 15 - 30 minutes. During that time, some air pollutants may be	**SO_2** Short-term – can irritate nose, throat and lungs. - linked to cardiovascular disease. **NO_x**

Activities		Potential Air Pollutants	Nature of Emission	Potential Effects on Health
	- Smelting and Refining	SO_2, NO_x, PM, CO, CO_2	released together with black smoke. During the time of slag collection (Pyit Sar and Chor Khal) from the furnaces, some air pollutant may be released from the openings of furnaces.	Short-term – breathing problems, headaches, eye irritation, loss of appetite. Long-term- decrease lung functions, cardiovascular diseases **PM** Short-term – eye, nose and throat irritation. Long term- aggravation of coronary and respiratory disease symptoms, premature death in people with heart or lung disease. **CO** Short-term – can cause headache, dizziness, vomiting and nausea. Long-term- linked to increased risk of heart disease. **CO_2** Short-term – difficulty breathing, rapid heart rate, headaches, dizziness, sweating, tiredness, elevated blood pressure. Long-term – nausea, vomiting, collapse, convulsions, coma.
	- Smelting and Casting of Molten Metal	PM	Fumes are released during the melting, hot metal transfer and casting process.	
	- Collection and Cleaning of Antimony Oxide from Bag House	Antimony Oxide Dust	The antimony powder is collected at bag house before carrying out smelting works. The residued powder which stuck at the bag filters is cleaned and taken out once in every two weeks. The workers are likely to expose to antimony oxide dust during the time of collection and cleaning process.	Short term- chronic exposure in the air at level of 9 mg/m3 may exacerbate irritation of eyes, skins and lungs. Long-term – potentiate pneumoconiosis, altered electrocardiograms, stomach pain, diarrhea, vomiting and stomach ulcers

Source: EnvO Study Team

Without any mitigation measures, potential risk for indoor air quality hazard is assessed as described in the following table.

Table 6-7 Risk Assessment of Indoor Air Quality Hazard without Any Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Probably/ Likely	Catastrophic	Very High
Level	4	5	20
Reasons for Evaluation	The likelihood of indoor air quality hazard is expected to be likely. The pollutants may present in the workplace at the intermittent time during particular works and expose to workers doing these activities.	The consequence of indoor air quality hazard is decided to be catastrophic. There may be the risk of respiratory problems, heart and lung diseases on long-term exposure of air pollutants in uncontrolled work place.	Multiplication of Likelihood and Consequence.
The rating for the risk of indoor air quality hazard becomes **Very High (20)** based on its likelihood and consequence. Adequate mitigation measures are necessary to be implemented to reduce the likelihood of this hazard.			

(2) Current Management Activities for Indoor Air Quality

(A) Provision of N-95 Masks and Respirators

It has been noticed that MSS Factory has provided N95 masks, which are capable to block at least 95 percent of very small (0.3 micron) particles, to the supervisors and respirators to workers who has to go inside bag houses to collect antimony oxide powder.

It is a good control measure for indoor air quality hazard and it is recommended to provide N-95 Masks to all workers who have to do activities mentioned in the above Table 6-6. The workers must be well informed of possible indoor air quality hazard and be ensure to wear N-95 masks during carrying out the above activities.

Figure 6-2 Provision of N-95 Masks and Respirators at MSS Factory

(3) Workplace Air Quality Monitoring

Based on the workplace air quality monitoring results shown in the Annex – 10, it was found that the workplace air quality inside the factory is good during the normal and becomes moderate during the time of removing slags (Pyit Sar and Chor Khal) from both roasting and smelting furnaces. However, it would reach to the “Unhealthy” stage for a few minutes when the black smoke is emitted though the openings of furnaces at the time of starting fire.

(4) Recommendations

(A) Industrial Practices

(i) Avoid furnace opening at the beginning of fire

The furnace doors are opened at the start of firing for about 15 - 30 minutes. The opening of furnace doors at the beginning of furnace operation releases a massive amount of black smoke (including the air pollutants) and may cause direct exposure of air pollutants with workers. Therefore, it is recommended to avoid furnace opening at the start of the operation as much as possible. The exposure with the black smoke should be prevented by allowing the fumes to pass through the enclosed pipeline (ducts), wet scrubber and finally to emit from the stack. In addition, the workers should wear mask at the time of opening the furnace doors especially for feeding the fuels (coal), removing slags (Pyit Sar and Chor Khal) from the furnaces and whenever the black smoke is observed during the time of working.

(B) Management Practices

(i) Recommendations for Coal Grinding Area

The coal grinding area should also be limited for access. The workers assigned for grinding of coal must be provided with dust masks. The working area should be marked with yellow lines and the potential hazard signs shall be mounted and informed to workers.

Figure 6-3 Lines and Signage to be Adopted at Coal Grinding Area

(ii) Casting of Molten Metal

The recommended control measures for casting molten metals are

- Ensuring that the workers who are supposed to interact with the fumes shall wear masks at the time of casting.
- Ensuring that the workers are not standing in the leeward direction of the fumes.

(iii) Collection of Antimony Oxide

The antimony oxide is collected from two places: inside bag house and through openings of pipelines. The access to baghouse should be allowed to skillful workers wearing respirators. The number of workers inside the bag house should be limited and the time of collections should be reduced and limited (as much as practically possible). The floor of the bag house should be cleaned regularly and temporary storage of other things should be removed. The workers must not consume food or water without cleaning hands after working inside bag house.

For collection through openings, it should be covered with protective materials to prevent the dispersion of antimony oxide powder into the workplace. The workers must not stay close near the openings. The collection of powder should be done with necessary PPE such as respirators.

Figure 6-4 Recommended Protective Covers to Prevent Dispersion of Antimony Oxide Powder into Workplace

(iv) General Management Practices

Other general management practices recommended to apply at factory operations are -

- Mounting warning signs to wear mask at respective areas.
- Encouraging good personal hygiene, and prohibit smoking and eating at the worksite.
- Arranging awareness training programs among the workers in regards to hazards and the use of safety equipment, respirators, dust masks etc.
- Arranging medical checkup for the staffs especially dealing with furnace operation and antimony oxide powder collection.

(5) Evaluation

To prevent indoor air quality hazards, MSS Factory has provided N-95 masks and respirators to some of the workers. However, some industrial and management practices are needed to be implemented for effective control of indoor air quality hazard. If the recommendations given above in this section and measures in the Occupational Health and Safety Plan can be performed and implemented in MSS Factory, the hazard of indoor air quality can be reduced as shown in the following table.

Table 6-8 Risk Assessment of Indoor Air Quality Hazard with Mitigation Measures

	Likelihood	**Consequence**	**Significance**
Descriptor	Occasional	Moderate	Medium
Level	3	3	9
Reasons for Evaluation	The likelihood of indoor air quality hazard can be reduced to occasional by applying the simple and effective management activities. The route of exposure will be reduced to a minimum situation by practicing these management activities.	The consequence of indoor air quality hazard will be reduced to moderate by providing necessary protective equipment like masks and creating minimum exposure in working environment.	Multiplication of Likelihood and Consequence.
The rating for the risk of indoor air quality hazard becomes **Medium (9)** based on its likelihood and consequence. Adequate mitigation measures can reduce the likelihood and consequence of indoor air quality hazard.			

6.4.2 Heat Exposure

(1) Preliminary Risk Assessment of Heat Exposure

Heat exposure has a great impact on workers' health and productivity in many industrial workplaces. High temperatures and heat exposure can cause higher body temperatures, sweating, excessive thirst (dehydration), insomnia, fatigue, muscular discomfort, heat exhaustion and heat stroke. Burns may occur through contact of hot surfaces of furnace, molds, metal, slag and hot water.

(A) Sources of Heat Exposure

(i) Furnace Operation

Roasting and smelting furnaces in MSS Factory are operating at a temperature around 800 to 1100°Celsius. Radiant heat from furnaces is a fundamental factor leads to thermal stress. The molten metal produced from smelting furnace is then poured into the molds and casted. The pouring and circulating works are done manually. Heat stroke may primarily be caused due to infrared radiation from furnaces and molten metals.

(ii) Handling and Disposal of Slags

The fraction which left inside the roasting furnace (Slag - Pyit Sar) are temporarily placed at vacant space of the factory compound to cool down the temperature before carrying to the final disposal site. The slag (Pyit Sar) is put inside the trolley and moved to the designated location manually. The handling of slag (Chor Khal) from smelting furnace is also done manually after collecting in the trolley. Burns may occur from handling and disposal of slags.

Without any mitigation measures, potential risk for heat exposure is assessed as the following table.

Table 6-9 Risk Assessment of Heat Exposure Without Any Mitigation Measures

	Likelihood	**Consequence**	**Significance**
Descriptor	Almost Certain/ Frequent	Moderate	High
Level	5	3	15
Reasons for Evaluation	The likelihood of heat exposure hazard is expected to be almost certain as the work nature of antimony smelting and refinery is always related to hot works.	The consequence of heat exposure is decided to be moderate as the possible injuries from heat exposure are burns, fatigue, excessive sweating and dehydration.	Multiplication of Likelihood and Consequence.
The rating for the risk of heat exposure becomes **High (15)** based on its likelihood and consequence. Adequate mitigation measures are necessary to reduce the likelihood and consequence of heat exposure hazard.			

(2) Current Management Activities for Heat Exposure

To protect the workers from heat exposure, MSS Factory has provided the following things inside the factory.

(A) Cooled Booths

MSS Factory has provided cooled booths at the working environment of roasting and smelting line. The booth includes fans and chairs to receive ventilation and air conditioning and take a rest.

Figure 6-5 Cooled Booths Placed in Workplace at MSS Factory

(B) Supply of Electrolyte Powder Packs

MSS Factory provides the workers with unlimited electrolyte powder packs to recover dehydration. It is powdered water-soluble sports drink which balances and restores healthy electrolyte levels for hydration.

Figure 6-6 Supply of Electrolyte Powder Packs in MSS Factory

(3) Recommendations

The following mitigation measures are recommended to imply in MSS Factory to prevent and reduce heat exposure on workers.

(A) Recommendations for Furnace Operation

To reduce heat exposure on workers from furnace operation lines, the employer of MSS Factory shall create the following situations.

- Furnace workers should be provided more effective ventilation probably with water sprayers.
- The hands, arms and faces of workers should be protected by gloves, heat protective clothing and googles.
- Ensure that workers have adequate breaks from hot, internal environments at appropriate times throughout the day.
- Provide sufficient drinking water and beverages stations.

- Train the workers to recognize the signs of heat illness and exhaustion.
- Make sure that the workers are standing at a distance of 1.5 m -2 m away from the furnace.
- Restrain the unauthorized access by barriers and signages to the furnace and molten metal pouring areas.
- Make sure the workers wear heat resistant gloves when handling and molding molten metal.
- Replace the manual hot works with tools, equipment and machines whenever possible.

(B) Recommendations for Handling and Disposal of Slags (Pyit Sar and Chor Khal)

- Make sure that only the trained and experienced workers are assigned for handling and disposal of slags (Pyit Sar and Chor Khal)
- Make sure that the workers wear heat resistant gloves and appropriate clothing that cover arms, in handling and disposal of slags.
- Make sure that there is no chance of direct touching of slag with bare hand.
- The route to disposal site should be noticeably marked and there should be no obstruction.
- The temporary storage site should be prohibited from entering. (signage shall be mounted and barrier lines must be placed)

In addition to above recommendations, the general occupational health and safety measures mentioned in Occupational Health and Safety Plan (Annex 9B) must also be practiced to reduce effect of heat exposure on workers.

(4) Evaluation

If the recommendations given above in this section and measures in the Occupational Health and Safety Plan can be performed and implemented in MSS Factory, the hazard of heat exposure can be reduced significantly as shown in the following table.

Table 6-10 Risk Assessment of Heat Exposure Hazard with Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Occasional	Minor	Medium
Level	3	2	6
Reasons for Evaluation	The likelihood of heat exposure hazard can be reduced to occasional due to management activities for heat exposure hazard. Heat exposure hazard could occur at some time of the project lifetime.	The consequence of heat exposure can be reduced to minor as the management activities and supply of materials to reduce the extent of injuries caused by heat exposure.	Multiplication of Likelihood and Consequence.
The rating for the risk of heat exposure hazard becomes **Medium (6)** based on its likelihood and consequence. Adequate mitigation measures can reduce both likelihood and consequence of heat exposure hazard.			

6.4.3 Chemical Exposure

(1) Preliminary Risk Assessment of Chemical Exposure

In MSS factory, chemicals are used for two purposes; use in factory operations and use in the laboratory. Exposure to chemicals can occur from two possible ways; direct contact and inhalation. Direct contact with skin or eyes can occur from inappropriate storage, handling, and use and unprotected skin. Inhalation of harmful and toxic fumes can irritate the nose, air passages and lungs.

(A) Chemicals Used in Factory Operations

Two types of chemicals are used in factory operation. The main purpose of chemicals used for the factory operation is to remove impurities from antimony oxide during smelting and for wet scrubber operation. The types of chemicals used in factory operations and their effects on health are described in the following table.

Table 6-11 Types of Chemicals Used in Factory Operation and their Effects on Health

No	Name of Chemicals	Use	Use Amount (Ton per Month)	Effects on Health
1.	Soda Ash Light Na_2CO_3	Smelting and Wet Scrubber Operation	6.9	**Skin** – Mildly irritating. Repeated or prolonged contact can cause redness, itching, dryness and cracking. **Eye** – Slightly irritating. Irritation accompanied by redness and tearing. **Inhalation** – Causes irritation to mucous membranes and upper respiratory system.
2.	Mono Ammonium Phosphate $NH_4H_2PO_4$	Smelting	6	**Skin** – Slightly Irritation **Eye** – Irritation **Inhalation** – Upper Respiratory Tract Irritation

Source: EnvO Study Team

(B) Chemicals Used in Laboratory

Six chemicals are used in laboratory of MSS Factory. Chemicals are mainly used to test the composition percentage of Antimony Ingots and to test the remaining antimony percentage in slags for metal recovering purpose. The types of chemicals and their effects on health are extracted from corresponding Material Safety Data Sheets (MSDS) and described in the following table.

Table 6-12 Types of Chemicals Used in Laboratory and their Effects on Health

No	Name of Chemicals	Use Amount	Effects on Health
1.	Sodium Fluoride F Na	< 100 ml	**Skin** – Cause skin irritation. **Eye** – cause serious eye irritation **Inhalation –** can irritate nose, throat and lungs
2.	Potassium Sulphate K_2O_4S	< 100 ml	**Skin** – Low Hazard **Eye** – Irritation **Inhalation** – Respiratory Tract Irritation
3.	Cerium (IV) Sulfate CeO_8S_2	< 100 ml	**Skin** – Irritation **Eye** – Irritation **Inhalation** – Respiratory Tract Irritation
4.	Methyl Orange Indicator Solution $C_{14}H_{14}N_3NaO_3S$	< 100 ml	**Skin** – Irritation **Eye** – Irritation **Inhalation** – Respiratory Tract Irritation
5.	Hydrochloric Acid HCl	< 100 ml	**Skin** – Irritation **Eye** – Irritation **Inhalation** – Respiratory Tract Irritation
6.	Sulfuric Acid (Concentrated) H_2SO_4	< 100 ml	**Skin** – Causes burns, and brownish or yellow stains. Concentrated solutions may cause second or third degree burns with severe necrosis. Prolonged and repeated exposure to dilute solutions may cause irritation, redness, pain and drying and cracking of the skin. **Eye** – immediate pain, severe burns and corneal damage, which may result in permanent blindness.

No	Name of Chemicals	Use Amount	Effects on Health
			Inhalation – Causes respiratory irritation and at high concentrations may cause severe injury, burns, or death. Effects of exposure may be delayed.

Source: EnvO Study Team

Without any mitigation measures, potential risk for chemical exposure is assessed in the following table.

Table 6-13 Risk Assessment of Chemical Exposure Hazard without Any Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Occasional	Critical	High
Level	3	4	12
Reasons for Evaluation	The likelihood of chemical exposure hazard is expected to be occasional as the chemicals used for factory operations can be exposed to workers during the lifetime of the operation.	The consequence of chemical exposure is decided to be critical. The burns and injuries caused by some chemical exposure may need hospital treatment.	Multiplication of Likelihood and Consequence.
The rating for the risk of chemical exposure becomes **High (12)** based on its likelihood and consequence. Adequate mitigation measures are necessary to reduce the likelihood of chemical exposure hazard.			

(2) Current Management Activities for Chemical Exposure

During the site visit of EnvO Study Team, it has been noticed that all the chemicals used for factory operations and laboratory are stored at designated places.

Figure 6-7 Chemical Storage Locations at MSS Factory

(3) Recommendations

(A) Recommendations for Storage and Handling of Chemicals

Only allowed personnel shall enter the chemical storage area and the hazard signs should be placed at the entrances. Ignition sources should be kept away from the chemical storage locations. The containers must be tightly closed and kept in cool areas out of direct sunlight. While handling the chemicals, appropriate personal protection equipment must be worn. Inhalation, ingesting, getting in eyes, on skin or clothing should be avoided.

(i) Storage and Handling of Hydrogen Peroxide

Keep containers in cool areas out of direct sunlight and away from combustibles. Keep/store only in original container. Store room should be made of non-combustible materials with impermeable floors. Containers should be visually inspected on a regular basis to detect any abnormalities (swollen drums, increases in temperature, etc.).

Use only in well-ventilated areas. Keep/store away from clothing/combustible materials. Wear personal protective equipment. Never return unused hydrogen peroxide to original container. Empty drums should be triple rinsed with water before discarding.

(B) Recommendations for Accidental Release

The leak or spill area must be isolated. Only skillful person with suitable personal protective equipment should clean the area. Firstly, absorbents (loose powder as sand) which are able to contain and absorb the spill must be poured down and cleaned up with scoop or dust pan later. The contaminant surface must be cleaned thoroughly.

Figure 6-8 How an Emergency Spill of Chemical Should be Cleaned

Source: Creative Safety Supply

(C) Recommendations for Personal Protective Equipment

Eye/Face Protection – Safety glasses with side shields or googles and a face shield.
Skin Protection – Appropriate chemical resistant clothing (with long sleeves) and appropriate chemical resistant gloves.
Respiratory Protection – Air-supplied respirator (ASR) (concentrations in excess of 10 ppm)
General Hygiene Considerations – Contact with skin, eyes and clothing should be avoided. When using, do not eat, drink or smoke. Good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking should be carried out. Routinely wash work clothing and protective equipment to remove contaminants.

(D) General Recommendations

- To store chemicals separately in designated chemical store rooms
- To provide emergency shower or eye wash near chemical storage room and in laboratory

(4) Evaluation

If the recommendations given above in this section and measures in the Occupational Health and Safety Plan can be performed and implemented in MSS Factory, the hazard of chemical exposure can be reduced significantly as shown in the following table.

Table 6-14 Risk Assessment of Chemical Exposure Hazard with Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Improbable/Rare	Critical	Low
Level	1	4	4
Reasons for Evaluation	The likelihood of chemical exposure hazard can be reduced to improbable condition by practicing safety measures in handling, storage and etc.	The consequence of chemical exposure is decided to remain critical. The burns and injuries caused by some accidental chemical exposure may need hospital treatment.	Multiplication of Likelihood and Consequence.
The rating for the risk of chemical exposure becomes **Low (4)** based on its likelihood and consequence. Adequate mitigation measures can reduce the likelihood of chemical exposure hazard.			

6.4.4 Noise

(1) Preliminary Risk Assessment of Noise

The raw material preparation and handling such as crushing and grinding of coal, blower operation and generator operation in MSS Factory are considered as the project activities which contribute to noise within the factory area. Exposure to severe noise level in the noisy working environment can cause adverse health effects such as headache, stress, anxiety, high blood pressure and temporary or permanent hearing loss for the workers. Without any mitigation measures, potential risk for noise hazard is assessed as the following table.

Table 6-15 Risk Assessment of Noise Hazard without Any Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Probable/Likely	Critical	High
Level	4	4	16
Reasons for Evaluation	The likelihood of noise hazard is expected to be likely as noise will arise during operation of grinding machine and blower.	The consequence of noise hazard is decided to be critical as this can lead to permanent-partial or temporary hearing disability.	Multiplication of Likelihood and Consequence.
The rating for the risk of noise hazard becomes **High (16)** based on its likelihood and consequence. Adequate mitigation measures are necessary to reduce the likelihood of noise hazard.			

(2) On-site Noise Measurement Results

During the site visits to MSS Factory on March 2020, on-site measurements were carried out at significant noise sources. It was done by using “Teckocoplus SLIM-24” equipment to identify the noise levels emanated from different places of noise sources inside the MSS Factory compound. Detailed information about noise measurement can also be found in Annex – 7. Among the noise measurements, most of the significant noise level generally come from grinding area and near blower location. The locations of on-site noise measurement can be seen in the following figure.

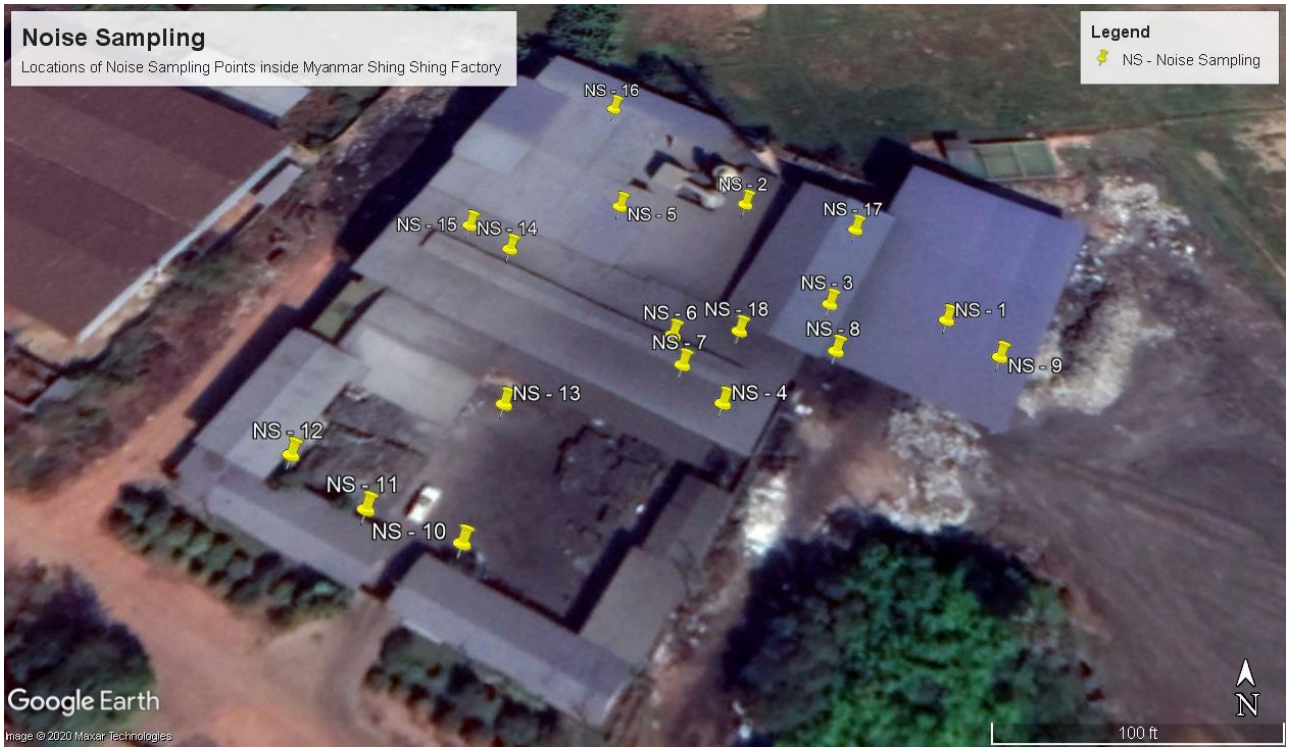


Figure 6-9 Locations of Noise Measurement Points inside MSS Factory

Source: EnvO Study Team

The following Table 6-16 shows the results of on-site noise measurement levels inside MSS Factory Compound. In Myanmar, there is no guideline for noise limits for occupational health and safety and therefore, one of the International Guideline, IFC EHS general guideline is referenced for the comparison.

Table 6-16 On-site Noise Measurement Results in MSS Factory (March 2020)

Point	Coordinate		Location	Noise Level (dB (A))	IFC Noise Limits (dB (A))	
	Latitude	Longitude			LA_{eq}, 8h	Maximum LA_{max}, Fast
NS-1	16°28'36.16"N	97°40'35.71"E	Coal Crushing and Grinding Area	**92.4**	85[15]	110[16]
NS-2	16°28'36.84"N	97°40'34.84"E	Wet Scrubber	80.4		
NS-3	16°28'36.24"N	97°40'35.19"E	Roasting Line (Near Generator)	77.6		
NS-4	16°28'35.70"N	97°40'34.68"E	Roasting Furnace (Near Blower)	**86.6**		
NS-5	16°28'36.81"N	97°40'34.23"E	Cooling Pipe Area	84.4		
NS-6	16°28'36.05"N	97°40'34.47"E	Roasting Furnace	**85.8**		
NS-7	16°28'35.89"N	97°40'34.51"E	Roasting Furnace (Near Blower)	**91.3 (1m)** **91.1 (2m)** 84.8 (3m)		
NS-8	16°28'35.98"N	97°40'35.19"E	By-Product Piling	82.1		
NS-9	16°28'35.96"N	97°40'35.91"E	Coal Crushing and Grinding Area	81.2		
NS-10	16°28'35.05"N	97°40'33.65"E	Office	63.5		
NS-11	16°28'35.19"N	97°40'33.26"E	Office	63.3		
NS-12	16°28'35.43"N	97°40'32.92"E	Office	62.4		

[15] Limit of Noise Equivalent Level (LAeq) for a duration of 8 hr specified by IFC for Heavy Industries
[16] Limit of Average Maximum Sound Level (LAmax) specified by IFC for Heavy Industries

Point	Coordinate		Location	Noise Level (dB (A))	IFC Noise Limits (dB (A))	
	Latitude	Longitude			LA_{eq}, 8h	Maximum $LA_{max,}$ Fast
NS-13	16°28'35.68"N	97°40'33.76"E	Raw Material Piling	81.4		
NS-14	16°28'36.53"N	97°40'33.72"E	Smelting Furnace	77.2		
NS-15	16°28'36.67"N	97°40'33.52"E	Smelting Furnace	76.7		
NS-16	16°28'37.49"N	97°40'34.19"E	Bag House	74.1		
NS-17	16°28'36.69"N	97°40'35.36"E	Roasting Line	80.2		
NS-18	16°28'36.08"N	97°40'34.77"E	Roasting Line	80.5		

Source: EnvO Study Team

Although it is not directly comparable between IFC (8 hr) noise limit and spot check noise measurement results, it is checked against with the IFC noise limits in order to know how much the noise level is beyond the target values. It was found out that NS-1, NS-4, NS-6 and NS-7 exceed the noise level limits of IFC which is specified for a duration of 8 hours in the workplace but less than the maximum limit. Exceeded noise levels are found to be emanating from the blowers installed at the furnaces and from the coal grinding activities.

(3) Recommendations

According to IFC guideline -

- No employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection. In addition, no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140 dB(C).
- The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reach 140 dB(C), or the average maximum sound level reaches 110 dB(A). Hearing protective devices provided should be capable of reducing sound levels at the ear to at least 85 dB(A).
- Although hearing protection is preferred for any period of noise exposure in excess of 85 dB(A), an equivalent level of protection can be obtained, but less easily managed, by limiting the duration of noise exposure. For every 3 dB(A) increase in sound levels, the 'allowed' exposure period or duration should be reduced by 50 percent.

Therefore, it is recommended to establish the following mitigation measures to minimize potential occupational noise hazards to the workers of MSS Factory.

- Check the fans and filters of blower to make sure they are clean
- Warning signs should be mounted at each noise source.
- Regular cleaning and maintenance of machineries (blower, grinding machine, generator) to avoid unnecessary noise production.
- 3 m lines from the NS-1, NS-4, NS-6 and NS-7 should be drawn to remind and warn the workers not to work or stay close near the exposure noise sources for a long time.
- The cooled booths where the workers rest must be located at least 3m distance from the above noise sources.

(4) Evaluation

If the recommendations given above can be provided in MSS Factory, the significance of risk can be reduced according to the following Table 6-17.

Table 6-17 Risk Assessment of Noise with Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Probable/Likely	Negligible	Low
Level	4	1	4
Reasons for Evaluation	The likelihood of noise and vibration hazard is expected to remain likely as noise will continue to arise during some operations like grinding machine.	The consequence of noise and vibration hazard will become negligible if the control measures like preventing workers near potential noise sources and regular cleaning and maintenance of machineries.	Multiplication of Likelihood and Consequence.
The rating for the risk of noise hazard becomes **Low (4)** based on its likelihood and consequence. Adequate control measures can reduce the likelihood of noise hazard in the working environment.			

6.4.5 Physical Hazard

(1) Preliminary Risk Assessment of Physical Hazard

The types of physical hazard that can be happened in MSS Factory are expected as -

- slips, trips and falls from poor housekeeping activities,
- eye hazards from furnace operation and grinding of coal, and
- industrial vehicle driving

Slips, trips and falls may happen due to inadequate cleaning, trailing cables, wet floors and uneven floor. The flying small materials from furnace and grinding machines can enter into the eyes of the workers. In addition, there may be accidents from vehicles (forklifts) used inside the factory compound.

The potential risk of physical hazard is evaluated in the following Table 6-18.

Table 6-18 Risk Assessment of Physical Hazard without Any Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Occasional	Critical	High
Level	3	4	12
Reasons for Evaluation	The likelihood of physical hazard is expected to be occasional as one or more of the above physical hazards can be happened during the operation time of the factory.	The consequence of physical hazard is decided to be critical as this can lead to hospital treatment required injuries.	Multiplication of Likelihood and Consequence.
The rating for the risk of physical hazard becomes **High (12)** based on its likelihood and consequence. Adequate mitigation measures are necessary to reduce the likelihood physical hazard.			

(2) Current Conditions of MSS Factory

During site visit to MSS Factory, it was observed that the housekeeping practice of the factory is poor and lack of cleaning system and management. The storage areas are not properly designated and the stuffs are stored at vacant spaces. Trailing cables can be found on the working floor. Hot slags are collected and cooled temporarily in the outside area where there is no warning sign or barriers that someone may get burnt. Conditions of MSS Factory during the site visit are shown in the following figures.

Figure 6-10 Photos Showing Housekeeping Management of MSS Factory during Site Visit

(3) Recommendations

(A) Recommendations for the Prevention of Slips, Trips and Falls

Good practices for housekeeping inside the factory and factory compound should be established in a timely manner. Staffs should be specifically assigned to carry out housekeeping activities including day to day housekeeping activities, planned and non-routine activities. The factory manager should carry out a round check before starting work and assign housekeeping duties to responsible workers. The storage locations of raw materials, products and by-products must be fixed and barriers must be placed for designated slag disposal area. The wires should not be left on the working floor and wet floor should be cleaned immediately. The holes should be mended in order to prevent accidental falling into it.

(B) Recommendations for Eye Hazards

The two sources that can happen eye hazards are the furnaces and grinding area. Therefore, eye shields or googles shall be worn while carrying out these works. If possible, standing at a distance of 1.5m – 2m should be practiced working near the furnaces. For grinding machine area, the crushed coal from the grinding machine falls from a height so it is just needed to be careful not going near before grinding is finished.

(C) Recommendations for Industrial Vehicle Driving

For industrial vehicles (forklifts), there must be a defined driving course and only trained drivers shall drive a forklift. While driving inside the factory, it is needed to drive with minimum speed and honking or warning sound shall be given at the time of forklift driving inside the factory compound.

(4) Evaluation

If the recommendations given above can be provided in MSS Factory, the significance of physical hazard can be reduced as described in the following.

Table 6-19 Risk Assessment of Physical Hazard with Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Remote/Unlikely	Minor	Low
Level	2	2	4
Reasons for Evaluation	The likelihood of physical hazard can be reduced remote/unlikely condition by providing safety measures to prevent physical hazard.	The consequence of physical hazard can be reduced to minor by practicing safety measures in daily works.	Multiplication of Likelihood and Consequence.
The rating for the risk of physical hazard becomes **Low (4)** based on its likelihood and consequence. Adequate control measures can reduce the likelihood and consequence of physical hazard in the working environment.			

6.4.6 Communicable Diseases

(1) Preliminary Risk Assessment of Communicable Diseases

Individuals working in close to one another share a likelihood of contracting communicable diseases from one another. Communicable diseases can spread by contact with a contaminated surface or object and travel through the air and other ways. For MSS Factory, two types of communicable diseases; Covid-19 and Cholera, Diarrhea and Dysentery are considered for risk assessment.

Covid-19 is a global pandemic disease which is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). As of October 2021, more than 240 million cases have been reported across 222 countries and territories, resulting in more than 4.9 million deaths. The virus spreads from person to person among those in close contact (within about 6 feet or 2 meters). In addition, it spreads by respiratory droplets released when someone with the virus coughs, sneezes or talks. It can also spread if a person touches his or her mouth, nose or eyes.

Cholera, Diarrhea and Dysentery are water-borne diseases spread by contamination of food and water, usually in impoverished areas with poor sanitation. They are the most common diseases happened in Kyaikmaraw township in 2019 according to Township Profile (Kyaikmaraw) 2019 by Kyaikmaraw GAD.

Potential risk for communicable diseases is assessed as follows in the following Table 6-20.

Table 6-20 Risk Assessment of Communicable Diseases without Any Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Occasional	Catastrophic	High
Level	3	5	15
Reasons for Evaluation	The likelihood of communicable diseases is expected to be occasional. The anticipated communicable diseases might occur during the life of the project.	The consequence of communicable diseases is decided to be catastrophic. One of the anticipated communicable diseases can lead to fatalities.	Multiplication of Likelihood and Consequence.
The rating for the risk of communicable diseases becomes **High (15)** based on its likelihood and consequence. Adequate mitigation measures are necessary to reduce the likelihood communicable diseases.			

(2) Current Conditions at MSS Factory

It was observed that MSS Factory has provided worker accommodations and meals to all workers. Therefore, all the workers live in hostel and eat meals at canteen inside the factory compound. This kind of provision can prevent transmission of Covid-19 from outside but it may make it worse if one of the workers results positive as all the workers are using shared rooms, meals and other utilities.

During the site visit to MSS Factory, it was noticed that the toilets provided for workers need regular cleaning as the water-borne diseases can spread from poor sanitation.

Figure 6-11 Conditions of Toilets at MSS Factory

(3) Recommendations

(A) Recommendations for Prevention of Covid-19

The Ministry of Health and Sports has released criteria for prevention and control of Covid-19 at factories, workshops and workplaces in April 2020. All workers must follow that criteria and the factory manager should lead to implement the workplace conditions in accordance with these criteria attached in Annex --- Occupational Health and Safety Plan.

The criteria that must be provided at factory are -

- The worker with symptoms of Covid-19 must not come to workplace and must receive medical treatments at near health department.
- The workers must stay at apart of 6 feet from each other at the times of entering and leaving workplace.
- Non-Touch Thermometer or Thermal Scanner must be used to detect temperature of workers before entering workplace.
- The attendance sheet must only be filled by assigned supervisor.
- All workers must be provided with masks and gloves.
- The numbers of the workers present at the workplace must be recorded daily.
- Hand washing stations must be provided at entrance, exit, inside workplace, canteen, rest area and toilets.
- Items necessary for hand washing (soap, water, hand standardizer, tissue) must be placed at hand washing stations.
- The posters of “How to wash your hands systematically” must be placed.
- Adequate ventilation must be provided.
- Arranging canteen, rest area able to rest or eat at a distance of 6 feet from each worker.
- Disinfecting the utilities, equipment on a daily basis.
- Inform to Health Department about the information of worker(s) with symptoms.

In additions to above instructions from Ministry of Health and Sports,

The employer shall create and follow the conditions mentioned below.

- The working assigns must be planned in a manner of same groups working and resting alternately.

- The workers must be assigned at different job locations as possible far away as from other.
- The tables at canteen must be marked to sit or not to sit in order to avoid face-to-face eating conditions and provide transparent barriers if possible.
- The personal hygiene of workers must be enhanced and provide knowledge on causes, symptoms and preventive ways to workers.

The workers must

- Always wear surgical masks while working and wash hand often thoroughly with soap and water at least 20 seconds, rubbing hands together vigorously and scrubbing all surfaces.
- If doubt about having fever or symptoms of Covid-19, inform to worker representative and factory manager.
- All workers must inform about going outside at holiday including their designation and intention of going outside. All workers must stay inside the factory compound if possible.

(B) Recommendations for Prevention of Cholera, Diarrhea and Dysentery

- Regular cleaning of toilets using chlorine-based disinfectant and proper use of toilets by workers.
- Arrange to adopt frequent and careful hand washing after using the toilet, before and after preparing food or eating.
- Personal hygiene and food safety precautions by chef, like thoroughly cooking all meats, washing kitchen work surfaces and utensils after contact with raw meat and avoiding preparing food for others while having symptoms of fever or feeling unwell.
- Providing properly treated water which is stored in a clean container.
- Maintenance of water supply, sanitation systems, pumps and wells.

(4) Evaluation

If the recommendations given above in this section can be performed and implemented in MSS Factory, the risk for communicable diseases can be reduced significantly as shown in the following table.

Table 6-21 Risk Assessment of Communicable Diseases with Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Improbable/Rare	Catastrophic	Medium
Level	1	5	5
Reasons for Evaluation	The likelihood of communicable diseases can be reduced to improbable/rare condition if the above preventive ways and control measures can be implemented.	The consequence of communicable diseases will remain catastrophic as the anticipated communicable disease (Covid-19) can lead to fatalities.	Multiplication of Likelihood and Consequence.
The rating for the risk of communicable diseases becomes **Medium (5)** based on its likelihood and consequence. Adequate mitigation measures can reduce the likelihood communicable diseases.			

6.5 Risk Assessment of Emergency Hazards

6.5.1 Fire Hazard

(1) Preliminary Risk Assessment of Fire Hazard

To start a fire, there are three standard requirements. They are heat, oxygen and fuel. All are required to start and maintain a fire and therefore removal of one of these components can also extinguish a fire.

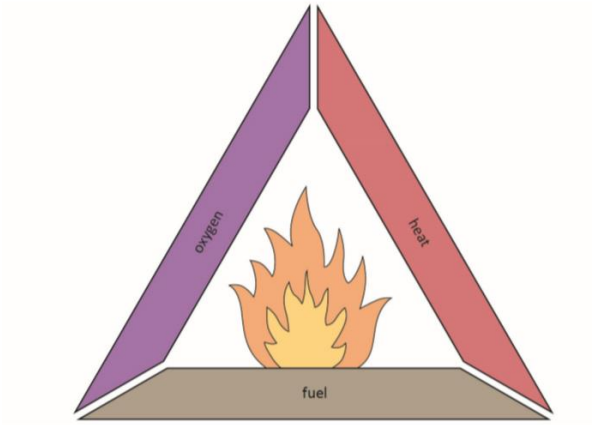


Figure 6-12 Fire Triangle

Source: Assessing and Managing Spontaneous Combustion of Coal

The risk of a fire breaking out in a particular place and spreading rapidly will depend largely upon the materials being used and stored, the general standards of housekeeping, the construction and layout of the factory and the training of employees. The risk to people after a fire has started will largely depend on the adequacy and maintenance of means of escape and of the alarm system and the training of the workforce in fire routine and evacuation procedures.

(A) Sources of Fire Hazard

(i) Coal and Coke

Coal and coke are solid-fuel types used in the shaft furnace and smelting furnace for roasting and smelting purposes. Coal is unique in that it can act as the fuel but on reaction with oxygen, can also provide the heat to initiate a fire without any other external influences. Coal can provide its own ignition reaction.

For coals that are stored as stock piles, there is a hazard named Spontaneous Combustion. In spontaneous combustion, coal is the fuel, and the interaction of oxygen on the surface of the coal leads to oxidation reactions which may result in heat and eventually results in fire.

The movement of oxygen and air over the surface of the pile causes oxidation which heats up the coal. This heat is transferred both inwards and outwards but the heat that travels inwards can build-up within the pile and lead to the formation of a high temperature hotspot. The hotspot continues to spread until it reaches a point on the surface. Once it reaches the surface, it will interact with oxygen in the air and can lead to glowing embers and actual ignition of the coal pile.

(ii) Diesel

Diesel is a liquid fuel used in shaft furnace and smelting furnace. It is also used in back-up generators during an electricity black-out. Diesel in MSS Factory is stored in drums. Diesel has a property of flammability. In its vapor form, diesel is very dangerous and can catch fire easily in the presence of an accelerant such as fan air or oxygen.

(iii) Timber buildings (Hostel and Canteen)

MSS Factory has provided their employees with workers' accommodation. The types of buildings constructed for accommodation and canteen are timber buildings. Fire is a primary hazard in timber buildings as they are composed with combustible contents of structural members.

Potential risk for fire hazard is assessed as follows in the following Table 6-22.

Table 6-22 Risk Assessment of Fire Hazard without Any Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Probable/Likely	Critical	High
Level	4	4	16
Reasons for Evaluation	The likelihood of fire hazard is expected to be likely as there are places which are expose to fire hazard based on the properties of the materials stored. The hazard is likely to occur during the lifetime of the project.	The consequence of fire hazard is decided to be critical. There may be the exposure to inhalation of dust, gases and flames during a fire outbreak and leads to serious injury and permanent-partial or temporary disability.	Multiplication of Likelihood and Consequence.
The rating for the risk of fire hazard becomes **High (16)** based on its likelihood and consequence. Adequate mitigation measures are necessary to reduce the likelihood Fire hazard.			

(2) Current Management Activities for Fire Hazard

According to the Occupational Safety Management Plan prepared by MSS Factory, it is alerted that the employees to report the responsible persons immediately when a fire outbreak.

Currently, six 50 kg fire extinguishers and twenty 2 kg fire extinguishers are mounted at various locations of the factory. The Township Level Fire Services Department has investigated and instructed the factory to renew the fire extinguishers twice a year. The respective photos can be seen in the following figures.

(a) Fire Extinguishers Installed at Office

(b) Fire Extinguishers installed in and outside of Canteen
Figure 6-13 Locations of Fire Extinguishers in MSS Factory

(3) Recommendations

(A) Recommendations for Storage of Coal and Coke

The designated locations for coal stockpiles should be determined by the MSS Factory instead of piling at vacant spaces in the compound of the factory. The following considerations should be noted in selecting the location for coal stockpiles:

- The location should be free of moisture and water.
- The location should have limited expose to wind.
- Flammable or combustible liquids (diesel) and hazardous wastes should not be stored near coal stockpile.
- Dry Powder Fire Extinguishers should be available near coal stockpiles.

According to Guideline for stockpile management by Environmental Protection Authority, South Australia, there should be sufficient spacing between stockpiles to allow access in case of emergency and to help prevent the spread of fire. This spacing at least be equal to the height of the stockpile or adequate for vehicle access. The typical width of a fire truck is 7ft to 8ft so this spacing should be allowed between adjacent coal stock pile.

Although there is not specific guideline for coal stockpile size and height, the height of the stockpile should be limited between 5ft (1.5m) to 6ft (1.8 m) as this height is convenient for firefighting procedures if there is an emergency case of fire. According to the book of Recent Trends in Physics of Material Science and Technology, the ideal slope of the coal's stockpile is 38°. Therefore, the slope should be maintained around this angle (± 2°). By maintaining the height and slope of the coal stockpile, the diameter (base length) of the coal stockpile will be around 13 ft (4m) to 16.5 ft (5m).

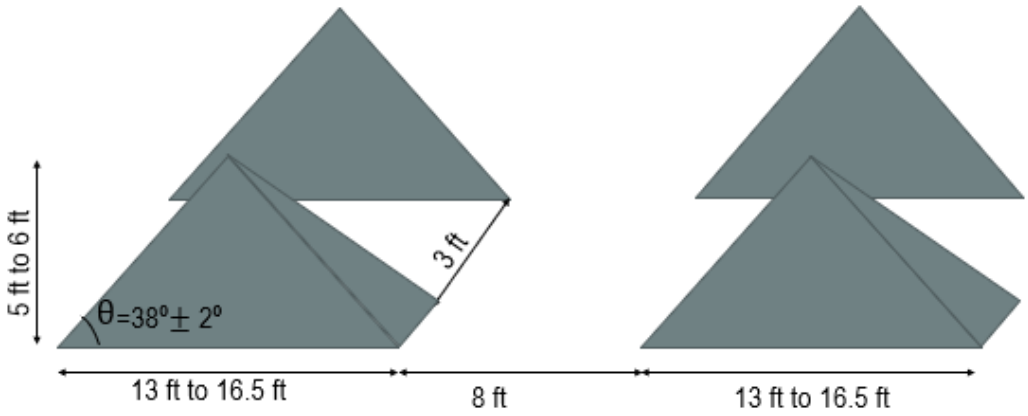


Figure 6-14 Sketch for Recommended Coal Stockpile Layout

Source: EnvO Study Team

For preventing spontaneous combustion of coal, careful monitoring should be carried out for coal stockpiles. Date of Stacking should be recorded and coal should not be stored for a long time. "First in First Out" System should be practiced for using stored coal. If possible, stockpile temperature reading should be done in a biweekly basis. The temperature should be measured at the center and inclines. If the temperature of the stockpiles exceeds 60 ºC, the stockpile may lead to spontaneous combustion. If the temperature of the stockpile exceeds 60 ºC, use the coal immediately or move to another location and allow to cool down.

(B) Recommendations for Diesel Storage

For diesel storage, it is recommended to follow the common guidelines provided by the National Fire Protection Association, United States to avoid fire hazard from diesel storage.

- The drum should not be filled over 95 percent capacity to allow for expansion.
- The Storage area shall be free of weeds and other combustible material.
- Open flames and smoking shall not be permitted in the area.
- The drums should be marked with the name of the fuel content and a sign with "FLAMMABLE – KEEP FIRE AND FLAME AWAY". The words should be big enough to notice from a distance and be in a bright red color.
- "NO SMOKING" signs should also be placed.
- Class B type fire extinguishers (Foam, Dry Powder) should be mounted in easy to access locations.
- A roof structure is recommended to reduce evaporation and condensation effects and to reduce the amount of solar radiation the drum receives.

(C) Recommendations for Timber Buildings (Accommodation and Canteen)

It was observed that MSS Factory has mounted fire extinguishers in hostel and canteen. It is a good practice to prevent and control a fire. It is recommended to store water, sand and other fire-retardant tools. It is required to check whether the electric switches are off, mosquito repellents are not lighted before leaving the own room and go to work.

The employees at kitchen (cook and general workers) should also be alert of fire hazard while preparation of food. They should also have access to fire extinguishing procedures and locations of fire extinguishers. If a fire outbreak is noticed in hostel or canteen, it must be informed and the response procedure described in Emergency Response Plan (Annex 9-C) must be followed.

(D) General Recommendations

(i) Recommendations for Fire Extinguishers

It was observed that the type of Fire Extinguisher used in MSS Factory is Dry Powder Type. Dry Powder Type Fire Extinguisher is the satisfactory option for metal processing and metal working industries. Dry Powder Type Fire Extinguishers should be placed inside and outside the buildings in the compound of the factory (main working area, office, warehouse, hostel, canteen) and storage areas of coal, coke and diesel.

To ensure that fire extinguishers are always ready to effectively fight a fire, they must be inspected and maintained on a regular basis. They should be inspected at least once a month to ensure they are in good shape. Fire extinguishers should be mounted on wall hangers so they can easily be seen. Access to fire extinguishers should not be blocked. The pressure gauge must indicate that it is fully charged. The locking pin and tamper seal should also be in place and intact.

If a fire extinguisher is used, despite the duration, it must be serviced and recharged. Fire extinguishers must be periodically serviced by an extinguisher servicing company. After servicing, a tag that contains an expiration date must be attached to the fire extinguisher. During monthly inspections, it must be sure that the service expiration date on the tag has not passed. If it has passed the expiration date, the fire extinguisher must be removed and re-serviced.

(ii) Recommendations for Fire Alarm System (Horns)

To report a fire emergency, it is recommended to use horns in MSS Factory. Horns should be placed at locations that are distinctive and recognized by all employees. In case of a fire, the employee who notices it first must use the horn which is at the nearest location and inform to others.

(iii) Recommendations for Setting Assembly Points

When a fire outbreaks, it is important that everyone inside the factory gets out safely and gather at an assembly point. By gathering at a designated location, one can easily know whom is left inside the fire and carry out evacuation procedure. Previously, that was not designated and implemented in MSS Factory and therefore EnvO Study Team proposed and recommended to set up two assembly points as described in the following Figure 6-15.

When the fire occurs near or inside the factory, everyone inside the factory except responsible staffs for firefighting must leave the workplace and gather at designated assembly point 1. When the fire occurs near hostel and canteen, everyone inside the accommodation and canteen except responsible staffs for firefighting must leave the place and gather at designated assembly point 2.

Figure 6-15 Satellite Photo Showing Assembly Points for Fire Emergency in MSS Factory

Source: EnvO Study Team

Note: Assembly Point 1: If the fire outbreaks inside or near factory, office and laboratory, employees working inside the factory must gather at the entrance of the factory.

Assembly Point 2: If the fire outbreaks near hostel and canteen, everyone who is staying inside or near that location must gather at the open space near the workers' accommodation.

(4) Evaluation

It was observed that fire extinguishers are mounted for fire safety in MSS Factory. Moreover, emergency response plan has been prepared and shown in Annex 9C of this IEE report. If the recommendations given above in this section and practices described in the emergency response plan can be performed adequately in MSS Factory, the risk for fire can be reduced significantly as shown in the following table.

Table 6-23 Risk Assessment of Fire Hazard with Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Remotely/Unlikely	Critical	Medium
Level	2	4	8
Reasons for Evaluation	The likelihood of fire hazard can be reduced to unlikely condition due to management activities and preparedness for fire hazard. Fire hazard could occur but considered unlikely or doubtful.	The consequence of fire hazard will remain to be critical. If the fire outbreaks, there may be the exposure to inhalation of dust, gases and flames during a fire outbreak and leads to serious injury and permanent-partial or temporary disability.	Multiplication of Likelihood and Consequence.
The rating for the risk of fire hazard becomes **Medium (8)** based on its likelihood and consequence. Adequate mitigation measures can reduce the probability of occurrence of fire hazard.			

6.5.2 Explosion Hazard

(1) Preliminary Risk Assessment of Explosion Hazard

(A) Dust Explosion (Antimony Powder)

According to International Labor Organization and World Health Organization, dust explosion is possible if the Antimony is in powder or granular form, mixed with air. Therefore, the severity of explosion hazard of Antimony Powder is determined as below.

The Bureau of Mines, United States Department of the Interior has studied Explosibility of Metal Powders in 1964. Based on this study, an empirical explosibility index for Antimony Powder is calculated in the following manner:

An empirical explosibility index is used in rating the hazard of a dust. The index of explosibility is related to ignition sensitivity and explosion severity. Ignition sensitivity is assumed to be a function of ignition temperature, minimum ignition energy, and minimum explosive concentration. Explosion severity is assumed to be a function of maximum explosion pressure and rate of pressure rise. The ignition sensitivity, explosion severity, and explosibility index are defined as unity for a dust having ignition and explosion characteristics similar to that of Pittsburgh seam coal and are calculated as follows:

Ignition Sensitivity = $\frac{(Ign.temp \times min.ign.energy \times min.conc)\ Pgh.coal\ dust}{(Ign.temp \times min.ign.energy \times min.conc) Sample\ dust}$

Explosion Severity= $\frac{(Max.explosion\ press. \times \max\ rate\ of\ pressure.rise)\ sample\ dust}{(Max.explosion\ press. \times max.rate\ of\ pressure.rise) Pgh.coal\ dust}$

Index of Explosibility = Ignition Sensitivity × Explosion Severity

Table 6-24 Relative Explosion Hazard Index of Metal Powders

Relative Explosion Hazard Index	Index of Explosibility
None	0
Weak	< 0.1
Moderate	0.1 – 1.0
Strong	1.0 – 10.0
Severe	> 10

Source: Explosibility of Metal Powders, Bureau of Mines 1964

Table 6-25 Data for Calculation of Index of Explosibility of Antimony Powder

Antimony Powder	Pittsburgh Seam Coal
Ignition Temperature = 420 °C (Cloud) Minimum ignition energy for dust cloud = 1,920 millijoues Minimum Explosive Concentration = 0.420 oz/cu ft Maximum Pressure = 8 psig Maximum Rate of Pressure Rise = 100 psi/sec	Ignition Temperature = 610 °C (Cloud) Minimum ignition energy for dust cloud = 60 millijoues Minimum Explosive Concentration = 0.055 oz/cu ft Maximum Pressure = 83 psig Maximum Rate of Pressure Rise = 2,300 psi/sec

Source: Explosibility of Metal Powders, Bureau of Mines 1964
Note: The properties of antimony powder and coal in that study and that of MSS factory are assumed to be the same.

Ignition Sensitivity = $\frac{(Ign.temp \times min.ign.energy \times min.conc)\ Pgh.coal\ dust}{(Ign.temp \times min.ign.energy \times min.conc) Sample\ dust}$

$= \frac{610\ ℃ \times 60\ millijoues \times 0.055\ oz/cuft}{420℃ \times 1920\ millijoues \times 0.420\ oz/cuft} = 0.006$

Explosion Severity= $\frac{(Max.explosion\ press. \times \max\ rate\ of\ pressure.rise)\ sample\ dust}{(Max.explosion\ press. \times max.rate\ of\ pressure.rise) Pgh.coal\ dust}$

$= \frac{8\ psig \times 100\ psi/sec}{83\ psig \times 2300\ psi/sec} = 0.0042$

Index of Explosibility = Ignition Sensitivity × Explosion Severity
= 0.006 × 0.0042 = 2.52×10^{-5} (< 0.1)

Therefore, based on the calculation, the relative explosion hazard index of Antimony Powder can be concluded as "**WEAK**".

According to the Bureau of Mines, United States Department of the Interior, materials that are not ignited by electric spark or in the furnace are considered to present no explosion hazard. A notation of <<0.1 designates materials that ignite in the furnace but not by the spark or flame source.

Based on the above calculation and fact, the explosion hazard of Antimony Dust is considered not likely to be happened throughout the lifetime of the project. Therefore, it is not considered in the preliminary risk assessment of explosion hazard.

(B) Furnace Explosion

The working nature of Antimony Smelting and Refinery Factory includes the operation of roasting furnace (shaft furnace) and smelting furnace at high temperature around 800 to 1000°C. The basic cause of furnace explosions is ignition of an accumulated combustible mixture within the confined space of the furnace. The magnitude and intensity of the explosion will depend upon both the relative quantity of combustibles which has accumulated and the proportion of air which is mixed therewith at the moment of ignition.

The situations that are in connection with the explosion conditions are that:

- There is an interruption of the fuel or air supply and result in momentary loss of flames, followed by restoration and delayed ignition of an accumulation.
- Repeated unsuccessful attempts to light off.
- Moisture or Water leaked into furnace.

Without any mitigation measures, potential risk for explosion hazard is assessed as the following table.

Table 6-26 Risk Assessment of Explosion Hazard without Any Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Remote/Unlikely	Catastrophic	High
Level	2	5	10
Reasons for Evaluation	The likelihood of explosion hazard is expected to be unlikely. Explosion hazard could occur from furnace operation but it is considered unlikely or doubtful.	The consequence of this hazard is decided to be catastrophic. Explosions occur in a short time with a catastrophic impact. There may be risk of death or loss or permanent disability of some body parts.	Multiplication of Likelihood and Consequence.
The rating for the risk of explosion hazard becomes **High (10)** based on its likelihood and consequence. Adequate mitigation measures can reduce the probability of occurrence of explosion hazard.			

(2) Recommendations

(A) General Preventive Measures for Furnace Explosion

(i) Coal Used for Furnace

The coal used in furnaces should be free of foreign substances. The foreign substances include scrap iron, wood chips, rags, rocks, etc. The mix of foreign substances can interrupt coal feed, or become a source of ignition within the furnace. This may cause a total or partial flameout and possible reignition accompanied by dangerous furnace explosion. Wet coal and wide variations in the size of raw coal should also not be used in furnace operation.

(ii) Combustible Materials Near Furnace

Raw materials stock (coal, coke) and combustible materials (diesel, paper, wooden, cloth) shall be located at a secured distance from the furnace so that the combustible materials will not be ignited, with a minimum separation distance of 2.5 ft (0.8 m).

(iii) Water and Fuel Oil Leaks Near Furnace

Water leaks around the furnace, from pipe connecting to the coolin tanks or outside rain can cause unwanted moisture to build up around the furnace. The fuel oil leaks near the furnace can lead to a fire and explosion hazard. If leaks are noticed around the furnace, immediate cleaning should be carried out.

(iv) Furnace Maintenance

Furnaces should be checked and maintained annually. With regular maintenance and preventive care, they can be kept functioning properly and efficiently, which minimize downtime for major repairs and improves productivity. Regular maintenance also improves the performance and lifetime of the furnace.

(v) Training

Personnel who operate, maintain, or supervise the furnace shall be thoroughly instructed and trained in their respective job functions under the direction of a qualified person(s). They should receive regularly scheduled refresher training and should demonstrate understanding of the furnace, its operation and practice of safe operating procedures in their respective job functions. The training program shall cover startup, shutdown and safe operating procedures and emergency procedures in detail.

(B) Efficient Operation of Furnace

When the furnace is in operation, it is needed to check whether the furnace is operating in its optimum state or not. If the furnace is operating efficiently, it can prevent situations which would lead to furnace explosion. For the efficient performance of furnace operation, it is recommended to achieve the following conditions for the efficient furnace operation.

(i) Complete Combustion of Fuel with Minimum Excess Air

There is the minimum amount of air which will allow the complete combustion of the fuel and the excess air is the air ratio value that is given by dividing the actual air supplied amount by the required theoretical combustion air amount. Higher excess air will reduce flame temperature, furnace temperature and heating rate. On the other hand, if the excess air is less, then unburnt components in flue gases will increase and would be carried away in the flue gases through stack.

(ii) Correct Heat Distribution

At a given time, as much of the ore should be heated uniformly to a desired temperature with minimum fuel firing rate.

(iii) Operating at Desired Temperature

It is important to operate the furnace at optimum operating temperature. Operating at too high temperatures than optimum causes heat loss, excessive oxidation, as well as over-stressing of the refractories.

(iv) Reducing Heat Loss from Furnace Opening

Heat loss through openings consists of the heat loss by direct radiation through openings and the heat loss caused by combustion gas that leaks through openings. If the furnace pressure is slightly higher than outside air pressure (as in case of reheating furnace) during its operation, the combustion gas inside may blow off through openings and heat is lost with that. The intrusion of outside air also makes uneven temperature distribution.

(C) When the Furnace is in Resting State,

When the operation activities are done, let the furnace cool down and then dug out the dust accumulated inside the furnace. If more fine dust depositions than usual are noticed inside the furnace, regular cleaning of bag filter

should be carried out. The floor area around the furnace should also be cleaned to remove dust, combustible particles and other fuel leaks near the furnace. The housekeeping practice and maintenance should be kept on a weekly basis or batch basis of production, whichever is convenient.

(3) Evaluation

Occurrence of explosion hazard from furnace can be reduced by regular furnace maintenance activities and other housekeeping activities mentioned in above recommendations. If the recommendations given above in this section can be performed and implemented in MSS Factory, the risk for explosion hazard can be reduced significantly as shown in the following table.

Table 6-27 Risk Assessment of Explosion Hazard with Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Improbable/Rare	Catastrophic	Medium
Level	1	5	5
Reasons for Evaluation	The likelihood of this hazard can be reduced to the condition of improbable/rare by the regular maintenance of furnace and general housekeeping activities.	The consequence of this hazard will be remained catastrophic as the explosion in a short period can expose to the risk of death or serious injury or loss or permanent disability of some body parts.	Multiplication of Likelihood and Consequence.
The rating for this risk becomes **Medium (5)** based on its likelihood and consequence. Adequate mitigation measures can reduce the probability of occurrence of explosion hazard.			

6.6 Risk Assessment of Natural Hazards

6.6.1 Flood

(1) Preliminary Risk Assessment of Flood

The type of Flood faced by Mon State every rainy season is wide spread flood which occur along Thanlwin and other rivers. The flooding in Mon state is common during raining season (May to September) due to the high river water flow caused by the continuous rainfall.

Flood Hazard Map for Mawlamyine (4th version) prepared by Department of Meteorology and Hydrology by using RRI model in May 2016 is shown in the following Figure 6-16. Based on this figure, the river bank where the Attaran bridge is situated may be exposed to flood level up to 5m but the location of MSS Factory may not be exposed to high flood level.

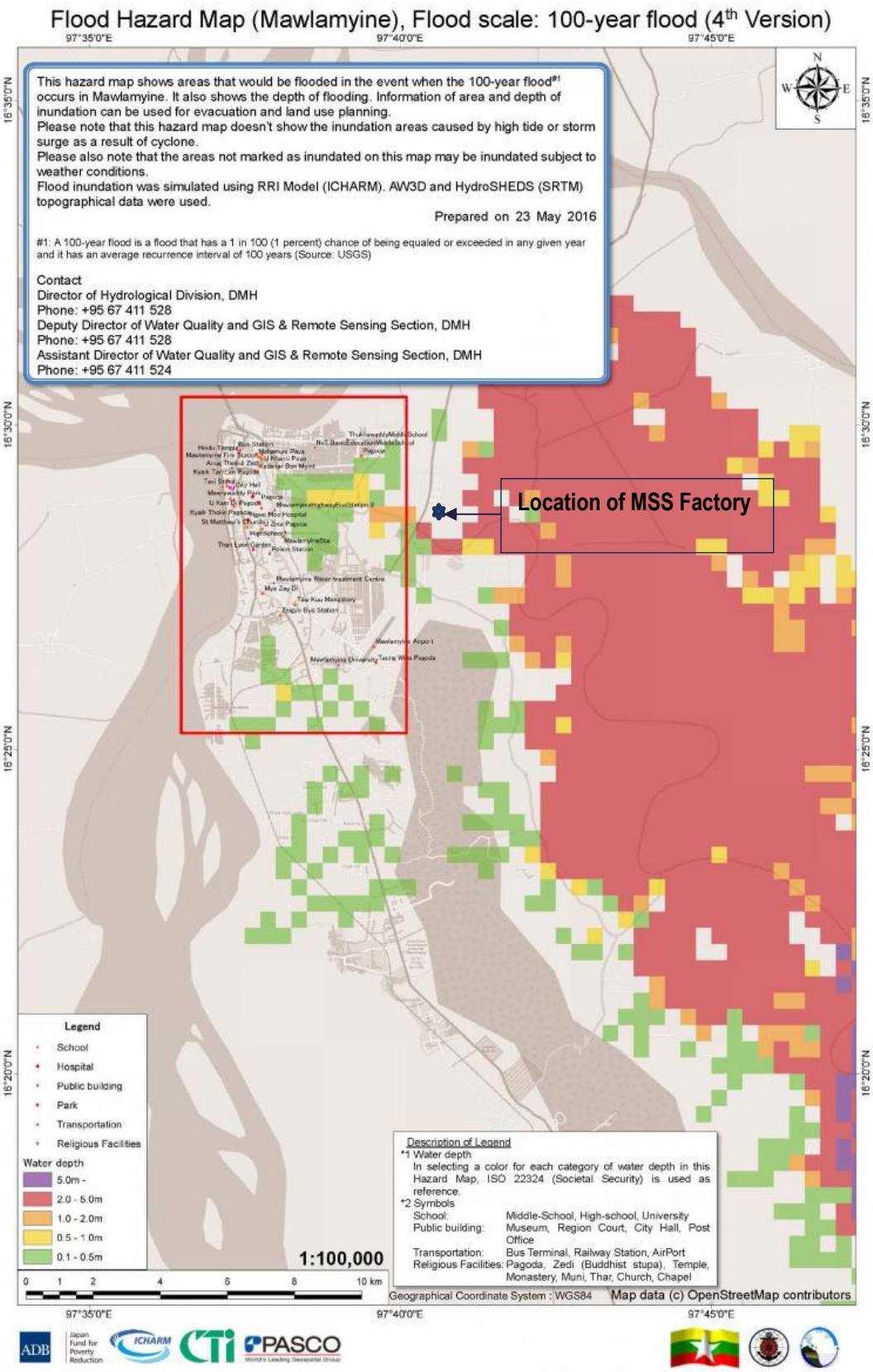


Figure 6-16 Flood Hazard Map of Mawlamyine Township

Source: Department of Meteorology and Hydrology

In 2019, Mon State has faced the worst flood in 20 years and both Mawlamyine and Kyaikmaraw townships also faced severe flood and there were many food inundated areas within the townships. The following figure

shows the probable flood inundated areas for Mawlamyine and Kyaikmaraw townships as of 9th and 13th August 2019. It can be seen that almost all areas of Kyaikmaraw township were predicted to be flooded but the location of MSS Factory did not fall into probable flooded area.

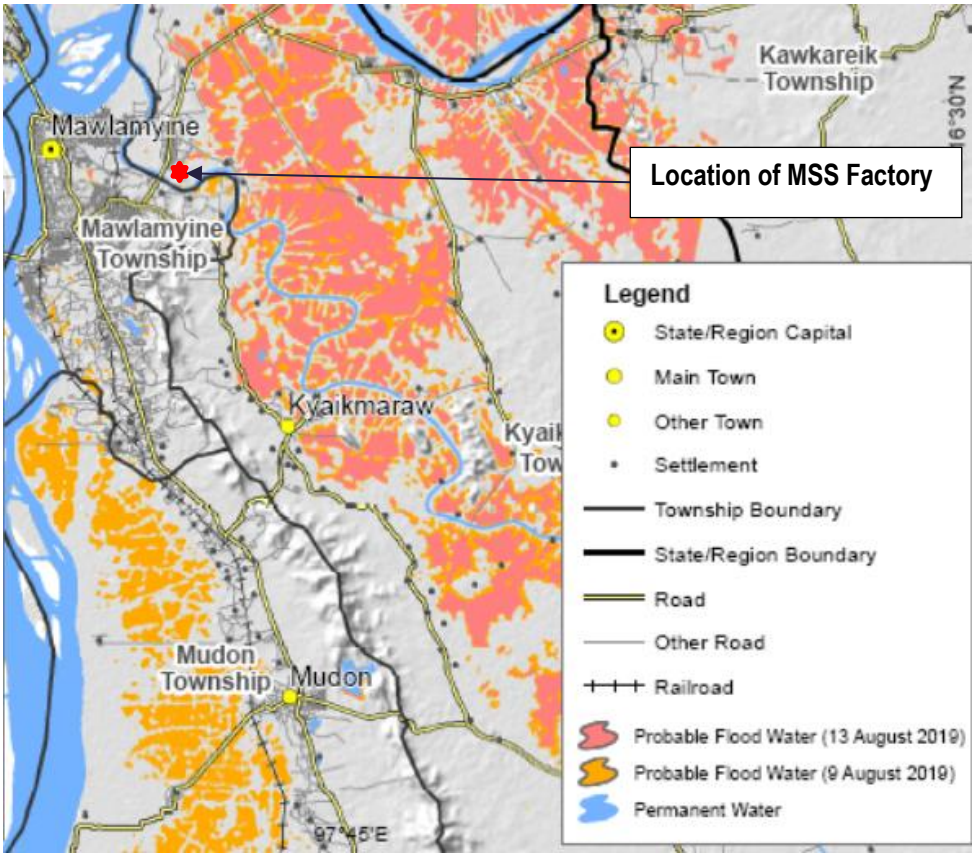


Figure 6-17 Probable Flood Inundated Areas in Mawlamyine and Kyaikmaraw Townships as of 13th August 2019

Source: Myanmar Information Management Unit (MIMU)

Near the location of MSS Factory, the Attaran River, a river of Myanmar and Thailand, is passing through and merges into the larger Gyaing and Thanlwin River near Mawlamyine. The distance between the entrance of MSS Factory and the nearest river bank of the Attaran River is around 450 m.

Figure 6-18 Surrounding River Near MSS Factory

Source: EnvO Study Team

In overall, Mon state is a flood prone area and both Mawlamyine and Kyaikmaraw townships has faced flooding in almost every rainy season. For MSS Factory, it is located at an elevated place and there is no history of severe flood record happened in Mawlamyine Industrial Zone. Paddy Fields and other factories lie between MSS Factory and Attaran River. The risk of flood can be assessed as described in the following Table 6-28.

Table 6-28 Risk Assessment of Flood without Any Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Probable/ Likely	Critical	High
Level	4	4	16
Reasons for Evaluation	The likelihood of flood hazard is expected to be probable/likely as it will probably happen once in three years as flood occurs in Mon State almost all the rainy season.	The consequence of flood hazard is decided to be critical. If a flood occurs in Mawlamyine Industrial Zone, it may lead to disconnection of services like closure of access roads and difficulties in collecting food/water supplies.	Multiplication of Likelihood and Consequence.
The rating for this risk becomes **High (16)** based on its likelihood and consequence. Adequate mitigation measures are necessary to reduce the consequence of this risk.			

(2) Mitigation Measures

For the emergency situation of flood, the EnvO Study Team has prepared the emergency response plan for flood and mentioned in Annex – 9C of this IEE report. By following the procedures mentioned in the emergency response plan, the impacts of flood exposed to the factory will be reduced into some extent.

(3) Evaluation

When there is an emergency of flood, MSS Factory will follow emergency response plan and undertake procedures according to this plan in order to evacuate the employees safely. Due to the emergency preparedness, the risk of flood can be reduced as shown in the following Table 6-29.

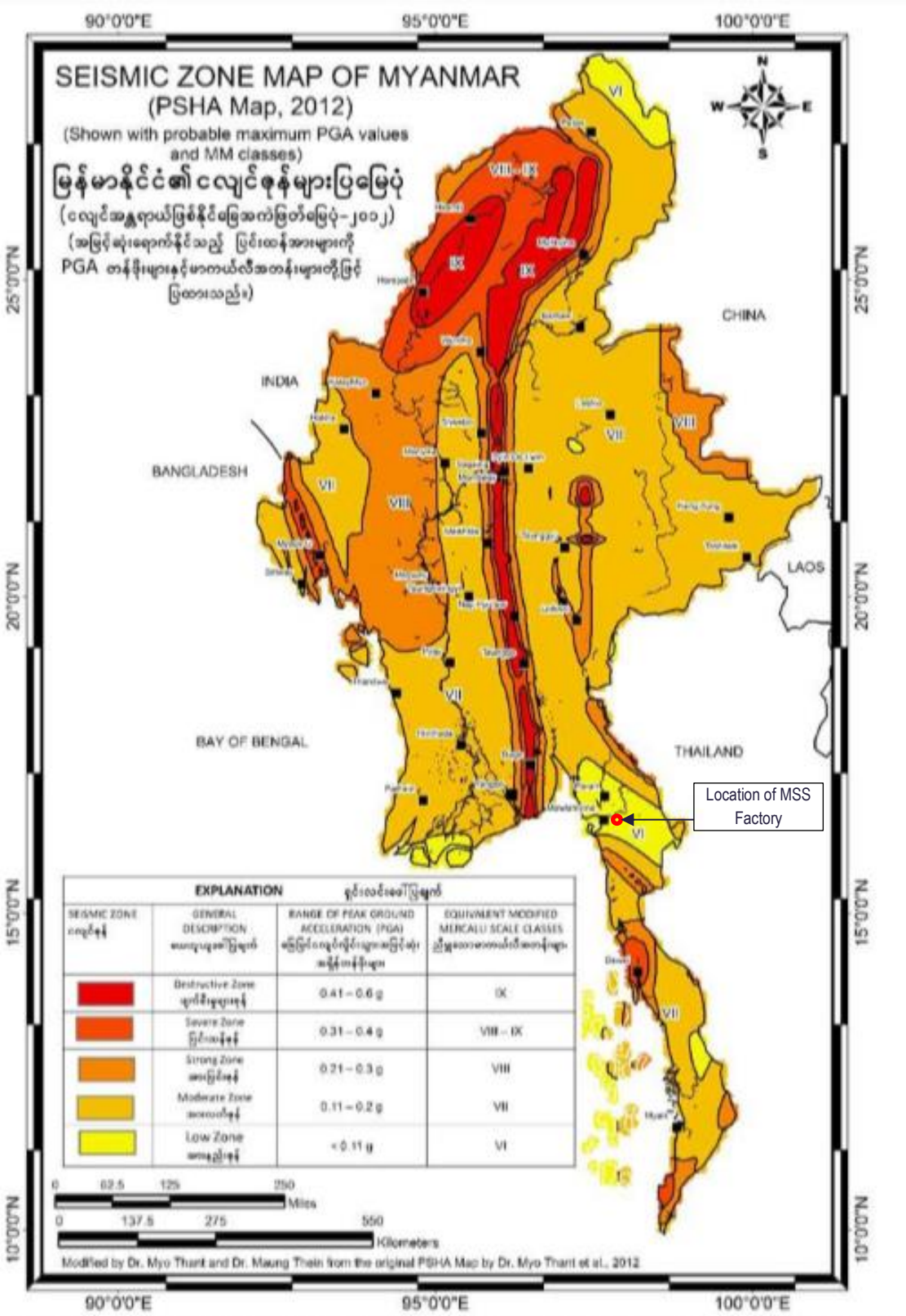
Table 6-29 Risk Assessment of Flood with Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Probable/Likely	Minor	Medium
Level	4	2	8
Reasons for Evaluation	The likelihood of this hazard is expected to be remained as likely as it will probably happen once in three years as flood occurs in Mon State almost all the rainy season.	The consequence of this hazard will be reduced into minor by planning ahead according to procedures mentioned in Emergency Response Plan.	Multiplication of Likelihood and Consequence.
The rating for this risk becomes **Medium (8)** based on its likelihood and consequence. Adequate preparations mentioned in emergency response plan can reduce the consequence of flood risk.			

6.6.2 Earthquake

(1) Preliminary Risk Assessment of Earthquake

The seismic zone map of Myanmar (2012) is showed in the following figure. It is a probable intensity zoning map. It divides five seismic zones with respective range of peak ground accelerations and equivalent modified Mercalli scale classes.



Probabilistic Seismic Hazard Assessment Map (PSHA Map) of Myanmar showing expected peak ground acceleration (PGA) values with 100% probability in 500 years. (Note: 0.21 - 0.3 g zone in the northern part of Shan State is taken from the Seismic Zone Map of Myanmar by Dr. Maung Thein et al., 2005)

Figure 6-19 Seismic Zone Map of Myanmar (2012)

Source: Myanmar Earthquake Committee, Yangon Region Earthquake Preparedness and Response Plan 2019

From the seismic zone map of Myanmar, Mon state and the location of MSS Factory fall in Low Zone with peak ground acceleration value < 0.11 g and equivalent modified Mercalli scale class (VI). The probable damage in this zone is slight damage which is minor damage in ordinary brick buildings.

Peak ground acceleration (PGA) is equal to the maximum ground acceleration that occurred during earthquake shaking at a location and its value is related to the soil conditions and bedrock of the location. The magnitude of earthquake is presented by Ritcher Scale and intensity is described as Modified Mercalli Intensity. The following table shows the possible damage due to earthquake in earthquake zones with the respective Modified Mercalli Intensity.

Table 6-30 Probable Damage of Earthquake in Seismic Zones

Seismic Zones	Modified Mercalli Scale Class	Probable Damage	Examples of Damage
Destructive Zone	IX	Major Damage	Considerable damage in specially designed structures Major damage in good RC buildings
Severe Zone	VIII – IX	Considerable Damage	Considerable damage in good RC buildings Major damage in ordinary brick buildings
Strong Zone	VIII	Moderate Damage	Moderate damage in good RC buildings Considerable damage in ordinary brick buildings
Moderate Zone	VII	Minor Damage	Minor damage in good RC buildings Moderate damage in ordinary brick buildings
Low Zone	VI	Slight Damage	Minor damage in ordinary brick buildings

Source: Seismic Zone Map of Myanmar, Dr. Maung Thein and U Tint Lwin Swe, 2006

The risk of earthquake can be assessed as described in the following Table 6-31.

Table 6-31 Risk Assessment of Earthquake without Any Mitigation Measures

	Likelihood	Consequence	Significance
Descriptor	Unlikely	Minor	Low
Level	2	2	4
Reasons for Evaluation	The likelihood of this hazard is expected to be unlikely as there is no history of earthquake in Mawlamyine Industrial Zone and no history of recent and historical earthquake in Mon State.	The consequence of this hazard is anticipated to be minor. The earthquake may be noticed by many people in buildings but there is no probability of damage in buildings.	Multiplication of Likelihood and Consequence.
The rating for this risk becomes **Low (4)** based on its likelihood and consequence. As the significance of this earthquake risk is considered acceptable, no further action is necessary.			

CHAPTER (7) PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

7.1 Requirement of Public Consultation and Information Disclosure

7.1.1 Background of Requirement of Public Consultation and Information Disclosure

According to Section 34 of the EIA Procedures (2015), in regard to an IEE type project, the project proponent shall disclose relevant information about the proposed project to the public and civil society immediately upon commencement of the IEE and arrange the required complement of consultation meetings as advised by the Ministry, with local communities, potential project affected persons, local authorities, community based organizations and civil society. For existing project, the communication between local community and the project owner is essential while operating the factory.

7.1.2 Objective of Public Consultation Meeting (PCM) and Public Disclosure (PD)

Public Consultation Meeting (PCM) is a proper and meaningful way of collecting stakeholders' voice on the project. By conducting PCM, the project proponent can explain the information about processing of the factory, their efforts in environmental management and CSR activities and other misunderstanding things. The stakeholders can also ask questions, suggest and share their opinions and ideas to minimize impacts and maximize environmental and social benefits. The main objective of PCM and PD is to involve stakeholders' concerns and feedbacks in all of the project design, development and implementation stages.
The following information should be disclosed to the Public at PCM and PD;

- Outline of project, maps and current plans of the project
- Information about the project and the project proposal
- Outline of possible social and environmental impacts from processing and operations
- General impact mitigation measures in a simplified form
- Opportunities to maximize environmental and social benefits of the project

7.2 Summary of Consultations Undertaken

This existing project is located in Mawlamyine Industrial Zone unlike a new proposed project for IEE study. Two major consultation meetings were undertaken by the project proponent after getting handover the Factory from Kaung Kin Kyal Chout Pwint Co., Ltd in 2016. As per the comments described in letter no-EIA-1/4ka (971/2018) on 10th August 2018, the project proponent has conducted another consultation in June 2019. The meeting was arranged and presented by the project proponent. Due to the lack of records by the project proponent, the details of meetings and meeting minutes are not available.

Table 7-1 Summary of Consultation Meetings Undertaken in 2019

No	Date	Purpose of Consultation	Remarks
1	01.06.2019	- To clarify the concerns of community upon the use of coal in the Factory - To inform the upgrade of environmental controls in order to reduce the environmental impacts due to the antimony production processes.	Union Minister, Ministry of Natural Resources and Environmental Conservation has also attended.

Source: Project Proponent

(a) Receiving Instructions from ECD Head Quarter at the Industrial Management Committee Office

(b) Site Visit and Inspection undertaken by ECD (Mon) State at the factory

(c) Explaining about Factory Operation Status to ECD (Head Quarter) at MSS Office

Figure 7-1 Photo Records of Consulting with Community and Officers from ECD

7.3 Tentative Methodology and Approach

While preparing this IEE report, the project proponent plans to arrange PCM and PD at appropriate time and stage in order to collect opinions and feedback of the public and to disseminate information, as necessary, with the support of EnvO Study Team.

7.3.1 Public Consultation

As systematic approach for holding PCM, public consultation will be carried out according to the following process.

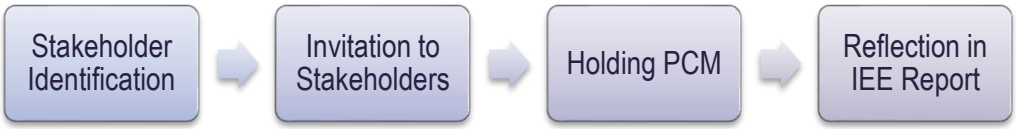


Figure 7-2 Methodology and Approach for Public Consultation Meeting

Source: EnvO Study Team

(1) Stakeholder Identification

According to the draft guideline on public participation in Myanmar's EIA Processes (2017), stakeholder means persons, groups, or communities external to the core operations of a project who may be affected by the project proposal, or have interest in it, at any stage in the project cycle (whether planning and construction, operation, or closure and decommissioning).

Stakeholders to be invited for PCM are classified and categorized in the following manner.

(i) Being government authorities in which the factory is interrelating in licensing, registration, gaining permits, insurances and recommendations for related purpose.
(ii) Being under same authorities (Under Mawlamyine Industrial Zone Management Committee and administration departments) and based on project's geographic sphere of influence (surrounding factories – to hear concerns from different factories and different business types)
(iii) Based on project's geographic sphere of influence (Residents surrounding of Mawlamyine Industrial Zone – to hear their voices)
(iv) CSO (acting as representative of local or interested people – to hear their concerns and ideas to improve the project)
(v) MSS Factory Workers (to express their needs and ideas for process design improvement and better working environment)
(vi) Media (to disseminate news to reach other people and better understanding of the project), as necessary

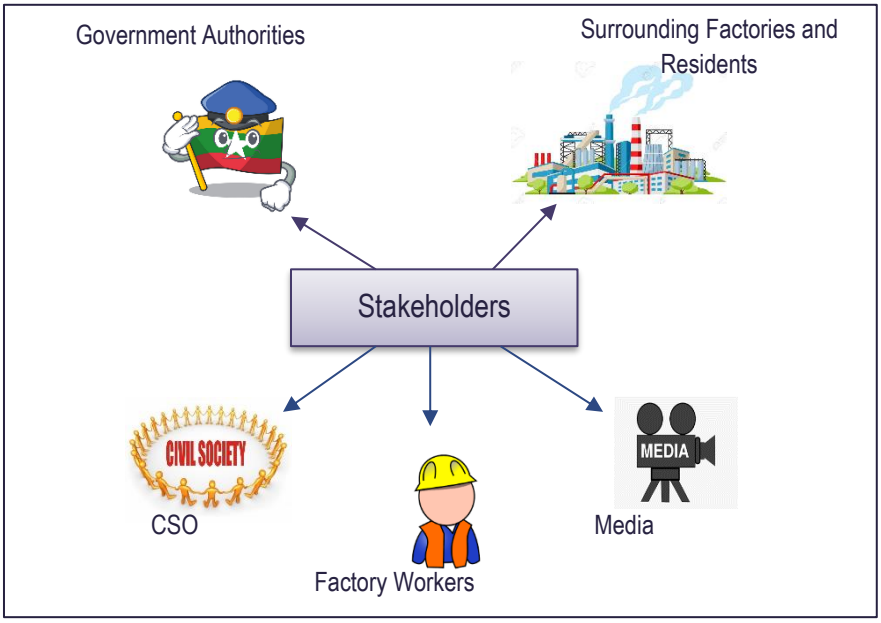


Figure 7-3 Types of Stakeholders Identified for PCM

(2) Invitation to Stakeholders

Invitations will be delivered to different identified stakeholders via email and/or invitation letters. The invitation will include description of the meeting, location, date and time. The follow up activities such as calls will be done whether the invitations are surely delivered to all intended stakeholders or not.

(3) Holding PCM

The PCM will be carried out based on the factors: "Inclusive, Participatory and Reciprocal". The tentative plan for PCM is described in Table 7-2.

(4) Reflection in IEE Report

After PCM, the categorization of issues evolved during PCM will be carried out and reflected in the IEE Report.

7.3.2 Public Disclosure

Public disclosure will be carried out according to the following process.

Figure 7-4 Methodology and Approach for Public Disclosure

(1) Disclosure Consideration

The Public disclosure will be done based on the following factors;

(i) Easy Accessibility & Availability - Locations of disclosure should be accessible by most of the stakeholders.

(ii) Sufficient Duration - A duration in which the stakeholders can read and fully understand, comment and submit comment

(iii) Adequate Information - Information should not more or less, adequate and necessary information should be provided

(iv) Ability of Easy Understanding - Plain language, choice of words, visual and minimum technical terms should be used

(2) Public Disclosure

After considering all the above factors, the executive summary of IEE Report (Myanmar Version) will be disclosed to public. The disclosure will be done in a timeframe covering "Before and After of the PCM". The tentative plan for public disclosure is described in Table 7-3.

(3) Reflection in IEE Report

The comments submitted by public will be recorded, found solution and reflected in IEE Report.

7.4 Tentative Plan for PCM and PD

The project proponent plans to arrange the public consultation meeting (PCM) and public disclosure (PD) in coordinate with Mawlamyine Industrial Zone Management Committee, as necessary. The tentative plan for PCM and PD is shown in the following Table 7-2 and Table 7-3.

Table 7-2 Tentative Plan for Public Consultation Meeting

Public Consultation Meeting	
Date	A day of Week Day (Morning Section or Afternoon Section)
Venue (Easy Access is priority, a venue where stakeholders feel more comfortable; mostly likely at a location within the community)	• Mawlamyine Industrial Zone Management Committee Office or Town Hall (Mawlamyine or Kyaikmaraw) or Ward Damaryone
Invitation Method	• Using Invitation Letter, • Announcement at Mawlamyine Industrial Zone Management Committee Office, and Notice in front of Factory
List of Invitees	• Government Departments that interrelating with factory 1) Mon State Regional Government Office 2) Ministry of Natural Resources and Environmental Conservation (Mon State) 3) Environmental Conservation Department (Mon State) 4) Directorate of Industrial Supervision and Inspection (Mon State & Mawlamyine District) 5) City Development Committee (Mawlamyine & Kyaikmaraw) 6) Social Security Board (Mon State, Mawlamyine & Kyaikmaraw) 7) Factories and General Labour Laws Inspection Department (Mon State) 8) Fire Services Department (Mawlamyine & Kyaikmaraw) 9) Public Health Department (Mawlamyine & Kyaikmaraw) 10) Township Parliamentary Representative • Administration Office 1) General Administration Department (Mawlamyine & Kyaikmaraw) 2) Ward GAD Office (Nyaung Pin Seik Village) 3) Mawlamyine Industrial Zone Management Committee 4) Village Tract Administrator (Nyaung Pin Seik Village) • Nearby Factories 1) Myanmar San Zaw Antimony Refinery Factory 2) Rubber Crumb Manufacturing Factory (EPAS) 3) Steel Frame Manufacturing Factory (Jagman Steel) 4) Ever Fame Antimony Refinery Factory 5) Other Interested Factories • Residents within/nearby Mawlamyine Industrial Zone • MSS Factory Workers • Civil Society Organizations, NGO, INGO, Communities Based Organizations • Other Interested Parties 1) Media 2) Any Individual, party who has interested or against the factory or has concern on factory

Public Consultation Meeting	
	**The additional invitees will be considered, if necessary
Agenda	• Registration • Project Information (Project Proponent) • Findings in IEE Study and Environmental Management Plan (EnvO Study Team) • Q & A Section • Time for comment writing
Language Use	• Burmese (Local Translator (the Mon Language) will be considered if necessary)
Materials to be distributed	• Summary of IEE Report (Myanmar Version) • Comment form • Refreshments

Source: EnvO Study Team

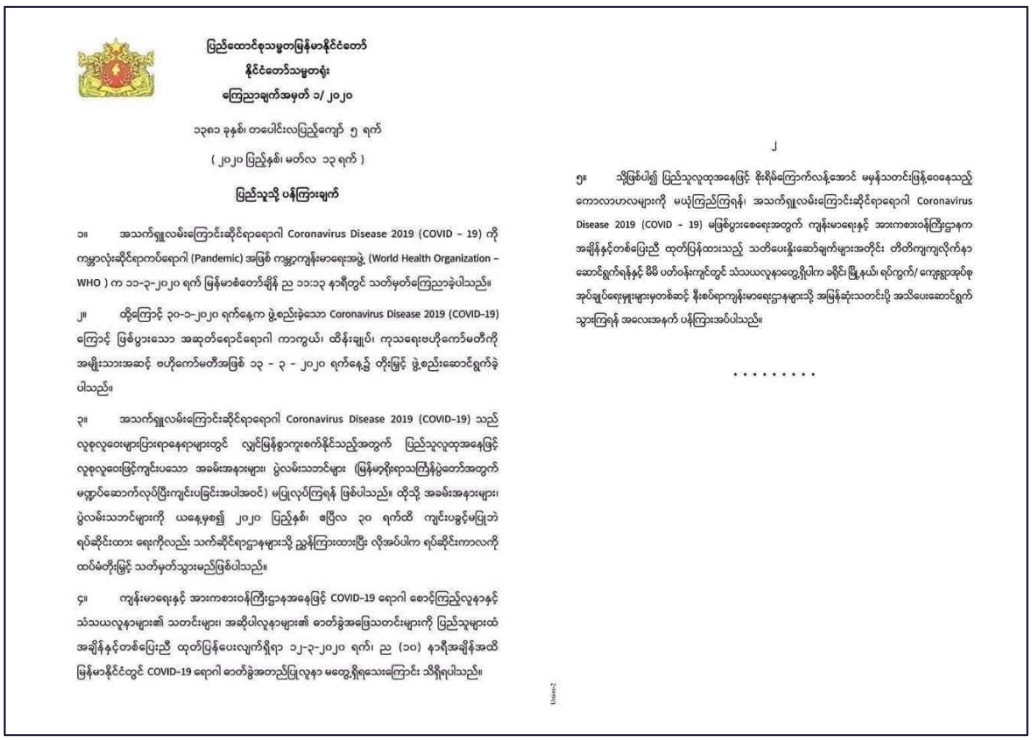
Table 7-3 Tentative Plan for Public Disclosure

Public Disclosure	
Disclosure Period	14 days (PCM will be held on a day in the middle of disclosure period)
Disclosure Locations	• Mawlamyine Industrial Zone Management Committee Office and GAD Offices • Myanmar Shing Shing Factory
Disclosed Materials	• Executive Summary of IEE Report (Myanmar Version) • Comment form
Comment Form Submission	• At all disclosure locations

Source: EnvO Study Team

7.5 Current Condition and Constraint for PCM

Unfortunately, during the IEE study, the COVID-19 outbreak is being occurred. World Health Organization – WHO has announced Coronavirus Disease 2019 (Covid-19) as Pandemic Disease on 11 March 2020 (11:13 PM of Local Time). Therefore, the President Office, The Republic of the Union of Myanmar, has released notification 1/2020 on 13 March 2020. The notification states that the ceremonies, activities and festivals which are celebrated and participated by a large number of people should be suspended.



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နိုင်ငံတော်သမ္မတရုံး
ကြေညာချက်အမှတ် ၁/ ၂၀၂၀

၁၃၈၁ ခုနှစ်၊ တပေါင်းလပြည့်ကျော် ၅ ရက်
(၂၀၂၀ ပြည့်နှစ်၊ မတ်လ ၁၃ ရက်)

ပြည်သူ့ဘဏ္ဍာ

၁။ အသက်ရှူလမ်းကြောင်းဆိုင်ရာရောဂါ Coronavirus Disease 2019 (COVID – 19) ကို ကမ္ဘာလုံးဆိုင်ရာကပ်ရောဂါ (Pandemic) အဖြစ် ကမ္ဘာ့ကျန်းမာရေးအဖွဲ့ (World Health Organization – WHO) က ၁၁-၃-၂၀၂၀ ရက် မြန်မာစံတော်ချိန် ည ၁၁:၁၃ နာရီတွင် သတ်မှတ်ကြေညာခဲ့ပါသည်။

၂။ ထိုကြောင့် ၃၀-၁-၂၀၂၀ ရက်နေ့က ဖွဲ့စည်းခဲ့သော Coronavirus Disease 2019 (COVID-19) ကြောင့် ဖြစ်ပွားသော အဆုတ်ရောင်ရောဂါ ကာကွယ်၊ ထိန်းချုပ်၊ ကုသရေးဗဟိုကော်မတီကို အမျိုးသားအဆင့် ဗဟိုကော်မတီအဖြစ် ၁၃ - ၃ - ၂၀၂၀ ရက်နေ့၌ တိုးမြှင့် ဖွဲ့စည်းဆောင်ရွက်ခဲ့ပါသည်။

၃။ အသက်ရှူလမ်းကြောင်းဆိုင်ရာရောဂါ Coronavirus Disease 2019 (COVID-19) သည် လူစုလူဝေးများပြားရာနေရာများတွင် လျှင်မြန်စွာကူးကော်နိုင်သည့်အတွက် ပြည်သူလူထုအနေဖြင့် လူစုလူဝေးဖြင့်ကျင်းပသော အခမ်းအနားများ၊ ပွဲလမ်းသဘင်များ (မြန်မာ့ဗိုလ်ရာသက္ကြီန်ပွဲတော်အတွက် မဏ္ဍာပ်ဆောက်လုပ်ပြီးကျင်းပခြင်းပါအပါအဝင်) မပြုလုပ်ကြရန် ဖြစ်ပါသည်။ ထိုသို့ အခမ်းအနားများ၊ ပွဲလမ်းသဘင်များကို ယနေ့မှစ၍ ၂၀၂၀ ပြည့်နှစ်၊ ဧပြီလ ၃၀ ရက်ထိ ကျင်းပခွင့်မပြုဘဲ ရပ်ဆိုင်းထား ရေးဂိုလည်း သက်ဆိုင်ရာဌာနများသို့ ညွှန်ကြားထားပြီး လိုအပ်ပါက ရပ်ဆိုင်းကာလကို ထပ်မံတိုးမြှင့် သတ်မှတ်သွားမည်ဖြစ်ပါသည်။

၄။ ကျန်းမာရေးနှင့် အားကစားဝန်ကြီးဌာနအနေဖြင့် COVID-19 ရောဂါ စောင့်ကြည့်လုနှာနှင့် သံသယလူနာများ၏ သတင်းများ၊ အဆိုပါလူနာများ၏ ဓာတ်ခွဲအဖြေသတင်းများကို ပြည်သူများထံ အချိန်နှင့်တစပြေးညီ ထုတ်ပြန်ပေးလျက်ရှိရာ ၁၂-၃-၂၀၂၀ ရက်၊ ည (၁၀) နာရီအချိန်အထိ မြန်မာနိုင်ငံတွင် COVID-19 ရောဂါ ဓာတ်ခွဲအတည်ပြုလူနာ မတွေ့ရှိရသေးကြောင်း သိရှိရပါသည်။

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၅။ သို့ဖြစ်ပါ၍ ပြည်သူလူထုအနေဖြင့် ဝိုးဝိုမ်းကြောက်လန့်အောင် မမှန်သတင်းဖြန့်ဝေနေသည့် ကောလာဟလများကို မယုံကြည်ကြရန်၊ အသက်ရှူလမ်းကြောင်းဆိုင်ရာရောဂါ Coronavirus Disease 2019 (COVID – 19) ဖြစ်ပွားစေရေးအတွက် ကျန်းမာရေးနှင့် အားကစားဝန်ကြီးဌာနက အချိန်နှင့်တစပြေးညီ ထုတ်ပြန်ထားသည့် သတင်းပေးနှိုးဆော်ချက်များအတိုင်း တိတိကျကျလိုက်နာ ဆောင်ရွက်ရန်နှင့် မိမိ ပတ်ဝန်းကျင်တွင် သံသယလူနာတွေ့ရှိပါက ခရိုင်၊ မြို့နယ်၊ ရပ်ကွက်/ ကျေးရွာအုပ်စု အုပ်ချုပ်ရေးမှူးများမှတစ်ဆင့် နီးစပ်ရာကျန်းမာရေးဌာနများသို့ အမြန်ဆုံးသတင်းပို့ အသိပေးဆောင်ရွက်သွားကြရန် အလေးအနက် ပန်ကြားအပ်ပါသည်။

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Figure 7-5 Notification 1/2020 from President Office, Republic of the Union of Myanmar

Source: President Office, Republic of the Union of Myanmar

The nature of Public Consultation Meeting is inviting the stakeholders including government institutions at a place. It requires participation of a large number of people related or interested to the project. Therefore, as per the current conditions, the EnvO Study Team has decided to obey the notification 1/2020 and not to conduct PCM until the pandemic disease is controlled and stable. Then, in July 2020, MOREC announced the guidelines to follow up for public consultations by the ongoing and coming projects within Covid-19 Pandemic period.

Unfortunately, due to many other constraints (Political and Covid – 19) during the year 2021, PCM could not be arranged by the time of submission of IEE report to ECD. However, there were consultations with the community by the project proponent previously conducted before the study of IEE. Even those cannot be regarded as meaningful public consultation meetings, it shows the approach and willingness of project proponent intended for consulting with the community at the beginning of the project.

Because of the difficulties for conducting public gathering at the time of IEE study, public consultation meeting for this IEE stage is intended to be conducted as per the condition when the ECD's Comment upon submitted IEE report is received or at the time when the government abolish the public gathering restrictions officially.

CHAPTER (8) ENVIRONMENTAL MANAGEMENT PLAN

8.1 Institutional Arrangement for EMP

As for the environmental and safety related management in operation stage, MSS is under the supervision of five major authorities; ECD (Mon State) of MONREC, DISI of MOEE, Social Security Board of MOLP, City Development Committee and Fire Service Department. It has been operating the factory under the guidance and support of these authorities, not to admit any major environmental and safety related issues, expecting for the local economy development. Institutional framework with external authorities at the operation phase regarding with the typical activities carried out is shown in Figure 8-1.

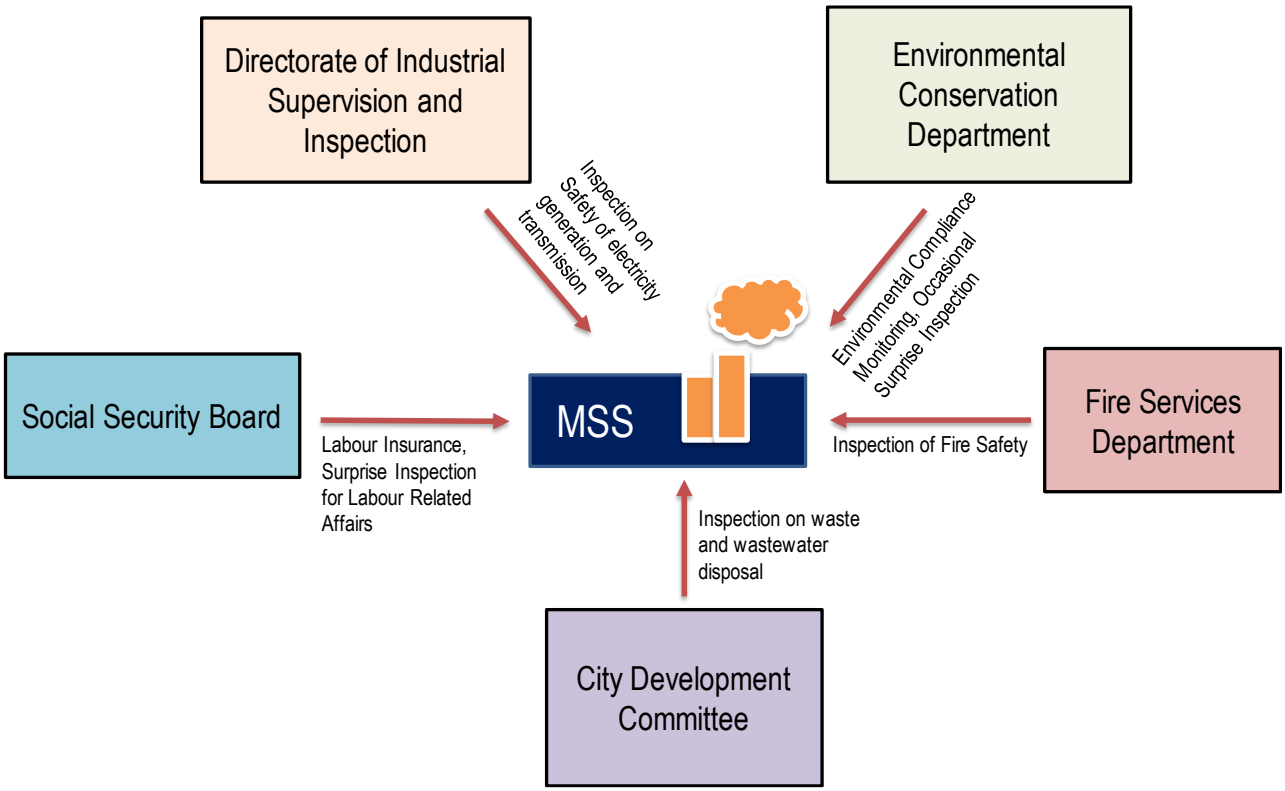


Figure 8-1 Institutional Framework for the Environmental Management of the MSS at Operation Phase
Source: EnvO Study Team

8.1.1 EMP Implementation Team and Its Responsibilities

(1) Main EHS Team

The project proponent plans to form a main EHS team with their full-time permanent staffs, giving responsibility for each of them regarding with environmental protection management. As a main EHS Team, it takes in charge of the company's environmental protection, coordination with other organizations and fulfills environmental management and supervision of day-to-day factory operation. The team is targeted to be established under the direct supervision of Director of Myanmar Shing Shing Metal Company Limited. The environmental related tasks are also undertaken with the coordination and help of the other departments: Procurement, Operation and Maintenance.

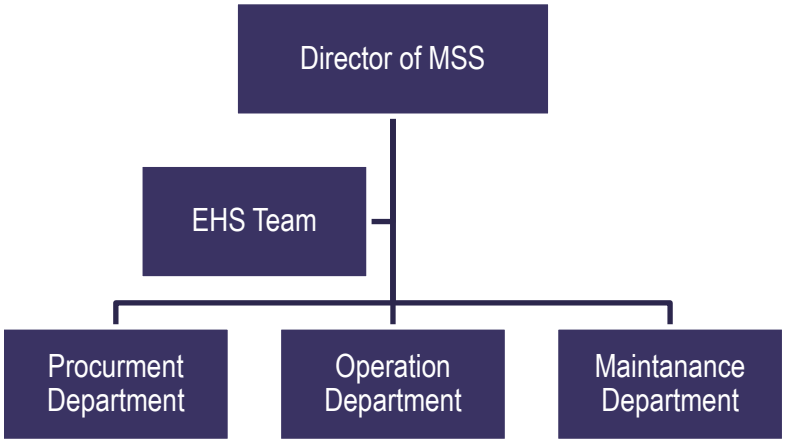


Figure 8-2 Institutional Framework of the MSS for EMP Implementation

Source: EnvO Study Team

The structure of EHS Team is proposed and presented in Figure 8-3. For the time being, the team shall be led by Factory/Operation Manager which is also the MSS factory manager and later the factory may need to hire a separated skilled officer (EHS Supervisor) who will take both the supervision and carrying out the EMP and other additional environmental and safety related activities specified in the respective sub-plans. The ***Environment, Health and Safety (EHS) Team*** will assign the EHS staffs at each shift of work duty for monitoring and reporting the environmental related problems happened at the respective assigned hours. In case of important environmental incidents/environmental related issues, the consultation with the external environmental expert will be conducted.

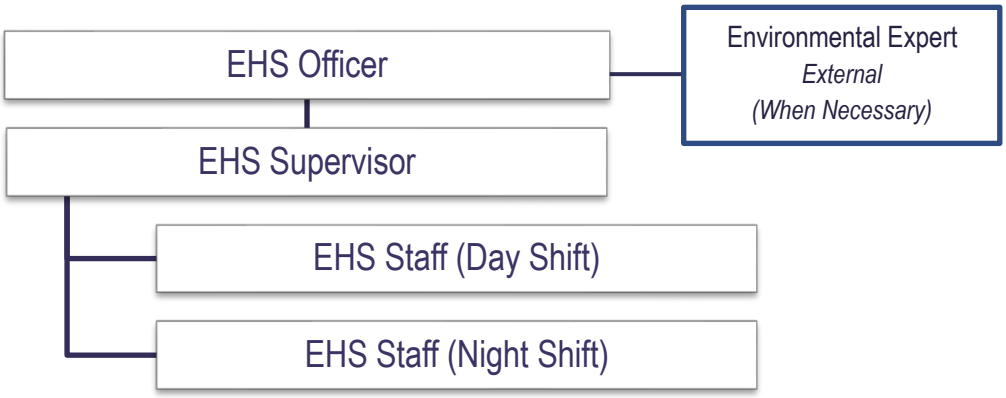


Figure 8-3 Proposed Organizational Structure of EHS Team

Source: EnvO Study Team

In regard of worker safety, EHS officer plays a role to prevent and eliminate injury and sickness to the employees. The team assist the company to comply with safety laws in systematic and organized approach. Specifically, the team must conduct the following responsibilities regularly as mentioned in the EMP and EMoP.
(1) To monitor environmental status (water, wastewater, air, noise, solid waste, etc.) and social status (worker's health and safety, social affairs, etc.) in the factory and take actions as necessary,
(2) To monitor the preparedness for emergency risks (fire, flood, earthquake, incidents, etc.) and take actions for emergency response plan in case of emergency
(3) To maintain documentation for the above-mentioned monitored status
(4) To inspect and monitor environment, machineries and processes to ensure safety as per government rules and regulations and industry standards.
(5) To conduct periodic inspection of hazards and recommend changes in products, machineries or processes to protect workers
(6) To raise awareness continuously about safety amongst employees of the company

(7) To know the government's rules and regulations that helps worker's health as well as safety
The specific role of each team member is presented in Table 8-1.

Table 8-1 Role and Responsibilities of Each Team Member

No.	Title	Role and Responsibility
1	EHS Officer	Lead the team to fulfill EMP/EMoP requirements
2	EHS Supervisor	Record keeping, monitoring and measurements according to EMP/EMoP
3	EHS Staff (Day Shift)	Support for monitoring each item in EMoP and reporting to EHS supervisor (day)
4	EHS Staff (Night Shift)	Support for monitoring each item in EMoP and reporting to EHS supervisor (night)

Source: EnvO Study Team

(2) EHS Team as Emergency Safety Team

The EHS team member will also behave as Emergency Safety Team member to undergo the respective rescuing and emergency responsibility for the natural/emergency hazards at the project site due to the limited human resources in the MSS.

Table 8-2 Assigning EHS Team Member as Emergency Safety Team Member

Title as EHS Team Member	Title as Emergency Safety Team
EHS Officer	Emergency Commander
EHS Supervisor	Emergency Assembly Officer (Factory)
EHS Staff (Day Shift)	Emergency Response and Evacuation Team leader (Factory) – Day
EHS Staff (Night Shift)	Emergency Response and Evacuation Team leader (Factory) – Night

Source: EnvO Study Team

8.1.2 Reporting System

(1) External Reporting (Government Authorities)

As discussed, the project proponent will be under supervision of mainly five government authorities, ECD, CDC, Fire brigade, SSB, and DISI (Mon state). The monitoring report will be prepared bi-annually based on the EMP and will be submitted to ECD (Mon State) bi-annually. Also, the Project proponent communicate and report to Fire Services Department in case of any fire incident. Moreover, the Project proponent will report and be under supervision of CDC for license renewing process and other processes. The Project proponent will apply labour insurance to SSB. In case of any electrical incident, it is required to report to DISI.

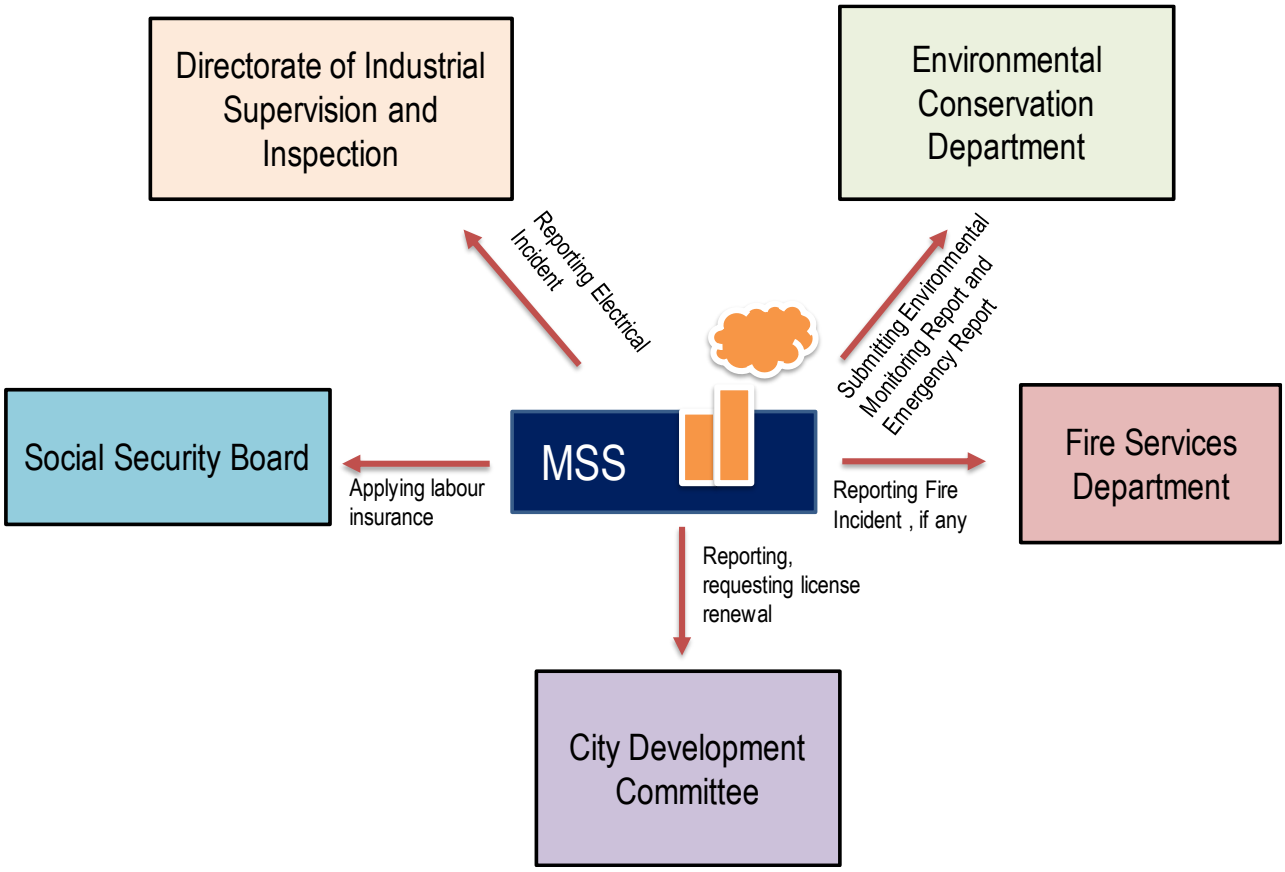


Figure 8-4 Reporting to Authorities

Source: EnvO Study Team

(2) Internal Reporting (MSS Institution)

If there is any problems or incompliance activities is explored, any team member shall firstly report to the EHS Officer. If the issue or problem can be solved easily, only record will be kept in the monthly reporting file. If any violation of environmental regulations or serious issues which are difficult to solve on site, EHS Officer shall directly report to the director of MSS (whom is the team leader of EHS Team). In case of any accidents/emergency, the respective EHS staffs will be the respective team leader for responding the emergency under the supervision of EHS Officer.

As regular basic reporting mechanism, the EHS supervisor will monthly collect, prepare and keep the records of documentation as described in environmental monitoring plan of this EMP on the recorded/monitored environmental (water, wastewater, air, noise, solid waste, etc.) data, and recorded/monitored social (worker's health and safety, social affairs, etc.) data. Those records will be analyzed by EHS Officer with the help of environmental expert if necessary. It will be helpful to prepare the environmental monitoring report (twice a year) to be submitted to the ECD (Mon State).

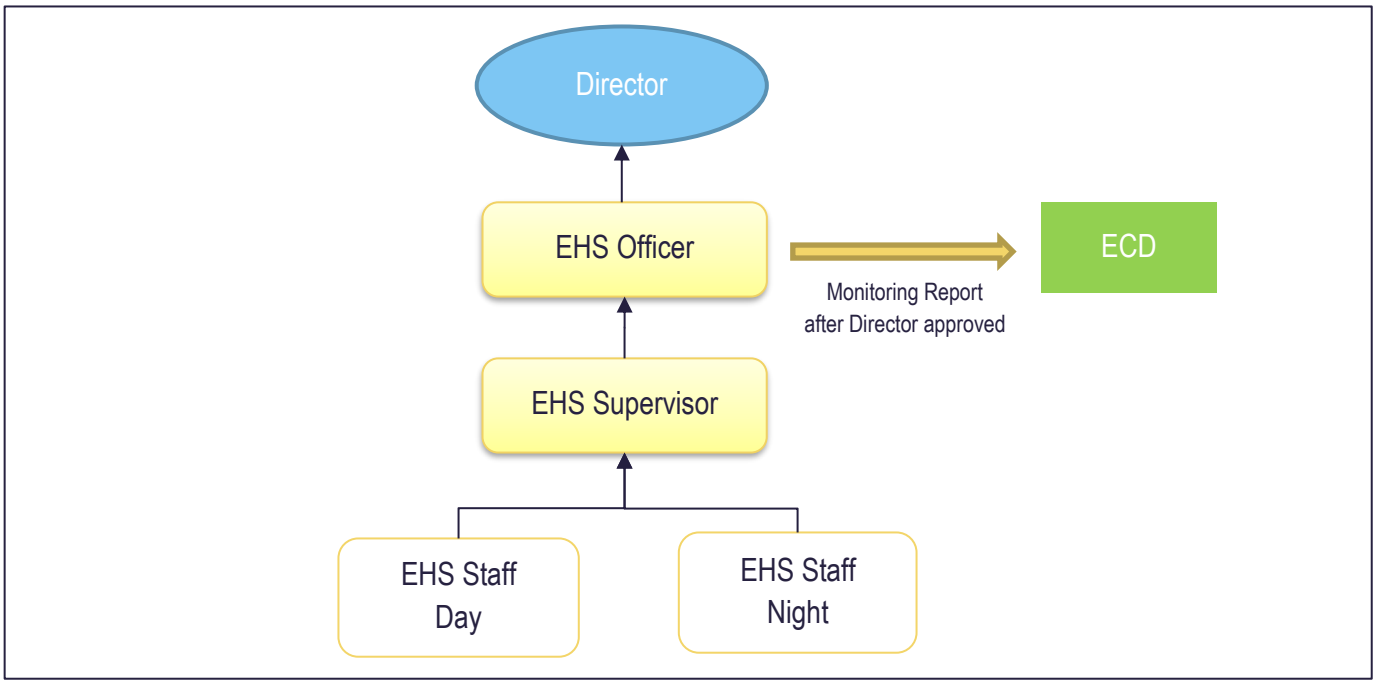


Figure 8-5 Internal Reporting Mechanism

Source: EnvO Study Team

8.2 Mitigation and Enhancing Measures of Impact Considered in IEE

In order to management and mitigate the impacts considered in this IEE study, a range of measures have been developed to reduce the overall residual impacts to acceptable levels and as low as reasonably practicable. The mitigation/enhancing measures for the considered impacts are summarized below.

Table 8-3 Summary of Mitigation Measures for the Environmental, Social, and Health Impacts in Operation Phase

Categories	Impact Category	Project Activities	Mitigation/Enhancing Measures	Responsible Organization
Environmental Impacts				
Physical Component	Air Pollution	Operation of Roasting and Smelting Furnace	• Careful operation and regular maintenance of ducts (pipes), blowers and wet scrubber with record • Seek advanced operation techniques which makes less pollution compared with the installed facilities. • Always give priority to use coke or coal with low Sulfur content • Inspect the performance of wet scrubber installed on a regular basis • Conduct measures/inspections as per the recommendations given in the SOP of wet scrubber operation • Proper handling of raw materials (i.e., coal, coke, antimony ore and grinded matters) not to emit dust from loading, unloading, and mixing activities • Avoid storing or piling raw materials (especially grinded coal and antimony in open airy area with large amount) • Regular maintenance of backup generators and vehicles used in the operation.	Project Proponent

Categories	Impact Category	Project Activities	Mitigation/Enhancing Measures	Responsible Organization
	Solid Waste (Hazardous and Non-Hazardous)	Generation of industrial wastes (hazardous) from operation process Generation of domestic wastes	• Resell the slag (Pyit Sar) to the local buyers (cement and construction industry for further use) as much as possible with the purpose of recycling. • Not to directly dispose hazardous waste slag at any land without any liner layer. • Dispose hazardous waste slag appropriately at Nat San mine located in Kyaikmayaw Township under the regulations / guidance of respective departments such as mining department and environmental conservation department. • Segregate non-hazardous waste and reuse or resell the items as much as possible. • Pave the concrete floor at the temporary slag collection area outside the factory. • Reserve the adequate waste storage area. • Avoid open burning and contact local municipal for the domestic waste disposal. • Arrange to dispose at the existing municipal disposal site by project proponent if the municipal collection is not available. • Implement in accordance with the recommendations given in Solid Waste Management Plan	Project Proponent
	Water Pollution (Effluent)	Gas cooling system with condensing tubes Cleaning and bag filters washing Wet scrubber operation Small testing laboratory operation	• Restrict the discharge of wastewater from the wet scrubber operation such as spent scrubbing liquid to the environment. • Ensure that no wastewater is discharged during the time of sludge collection, effluents from each tank shall be detained in others. • Collect, treat and discharge properly the scrubbing water in case of pumping out or taking out the scrubbing water for the maintenance of tanks or any reason and ensure that the discharged wastewater quality meet NEQG guideline values. • Set up an overflown water storage tank for overflown water from the cooling tanks before directly discharge into the earth drain aiming to reduce the wastewater temperature up to (<30˚C). • Seek the ways to reduce the concentration of Arsenic, COD and TSS such as use of raw materials (antimony ores with less arsenic content), installation of treatment system mainly for treating those three parameters, etc. • Discharge all type of wastewater (from cooling tanks, from wet scrubber (if any), from settling tanks, and laboratory) only after passing through the treatment system when the installation is done. • Avoid the filling of waste slag from roasting and smelting lines on the bare land without any liner system in order to get rid of the increase of Arsenic content along the earth drain caused by leaching of Arsenic from waste slag. • Monitor annually the quality of all types of wastewater discharged from MSS. • For the measurement of mercury in wastewater, it should be aware that the detection limit at the laboratory shall be 0.01mg/L (NEQG value) and the designated laboratory which is capable to measure the mercury content up to two decimal value (i.e. 0.00) shall be chosen.	Project Proponent

Categories	Impact Category	Project Activities	Mitigation/Enhancing Measures	Responsible Organization
			• Construct the design drain (brick or concrete) instead of the earth drain which passing through the paddy fields and bare land to the nearby creek. • Ensure the avoidance of direct discharge of wastewater from the laboratory to the environment. • Ensure the proper drainage lines provision for storm/rain water as well.	
	Soil Contamination	Waste piling at project site Storage of fuel, raw material and utilization of fuel Waste (slag) filling in the compound	• Avoid piling on the unpaved area and direct piling on the ground • Proper storage, handling of fuel/chemicals and proper disposal of used chemical containers in accordance with guidelines without spillage, and leakage • The storage area should be under roof • Immediate cleaning shall be undertaken as per emergency response plan if any leakage is observed • Designate the machinery maintenance area if possible • Before landfilling process, a designated area must be concrete lining which doesn't allow the fluid permeable into the soil • Contact with local CDC and dispose domestic wastes to their designated collection point or final disposal	Project Proponent
	Odor	Roasting and Smelting Processes	• Regular check and maintenance of blowers, ducts, condensing tubes and pipelines connected with the bag house, wet scrubber and final stack, ensuring no leakage of flue gas along the connection. • Ensure that emergency backup generators are to be online within a few minutes if the electricity goes off in order to run the blowers as fast as possible. • Regular check and maintenance of web scrubber operation. • Conducts measures and inspections as per the recommendations given in the SOP of wet scrubber operation to ensure the effective operation of wet scrubber. • Immediate response for fixing the damaged filter bags inside the bag house as soon as the leakage is detected. • Maintain the record of odor if any offensive smell is experienced inside or nearby the project site. • Record and investigate the reasons for causing offensive odor if any complaint from the nearby residents or nearby factory is received, take corrective actions as soon as possible.	Project Proponent
Socio-economic and Cultural Component	Local Economy	Business Operation	• To give the local residents priority in employing at the project • To purchase all the raw materials from the local regions as much as possible • To extend the business with the ideas in which the nearby residents can participate	Project Proponent
	Local Resource	Extraction of Water from Attaran River	• To install metering system for water usage from the Attran River • To record the amount of monthly water usage for the operation of the factory	Project Proponent
	Workers Welfare	Providing Necessary facilities to workers	• To organize occasional ceremonies, annual party or trips for all the workers (May be at the time of temporary shut down on rainy season) • To provide full right and allowance identified by the local laws related to labour affairs	Project Proponent

Categories	Impact Category	Project Activities	Mitigation/Enhancing Measures	Responsible Organization
Community Health and Safety	Emission Pollutants Odor Emission	Roasting and Smelting Processes	• Mitigation Measures addressed in Air pollution assessment to reduce the level of the emission such as the enhancement of the efficiency of wet scrubber using standard operational procedure described in this IEE study shall be fully implemented. • Set up the simple and effective grievance procedures in case of any complaints from the community in terms of odor emission or other impacts. • Monitor any significant public health issues raised in the nearby community, identify with the help of environmental expert and address any measures for the issue.	Project Proponent

Source: EnvO Study Team

8.3 Mitigation Measures of Risk Considered in IEE

The mitigation measures for the considered risks in this IEE study are summarized as follow:

Table 8-4 Summary of Mitigation Measures for Physical, Chemical and Natural Disaster Risks in Operation Phase

Type of Hazards	Risk Category	Mitigation Measures	Responsible Organization
Occupational Hazards	Indoor Air Quality	• Avoid furnace opening at the start of operation as much as practically possible. • Ensure that workers are wearing masks while working for furnace operation such as coal feeding, removing smokes or whenever the black smoke is appeared in the work place. • Limiting access to the coal grinding area. • Workers assigned for grinding of coal must be provided with dust mask • Ensure that the workers who are supposed to interact with the fumes shall wear masks at the time of casting. • Ensure that the workers are not standing in the leeward direction of the fumes. • Provision of essential PPE such as respirators to the workers assigned for collecting antimony oxide powder or going inside the bag house. • Limit the time of antimony oxide powder collection and going into the bag house as much as practically possible. • Mounting warning signs to wear respective masks at respective areas • Provide Awareness trainings on use of PPE. • Encouraging good personal hygiene and prohibiting smoking and eating at the worksite • Arranging awareness training programs among the workers in regards to hazards and the use of safety equipment, respirators, dust masks etc. • Provision of cover materials for antimony oxide collection through openings • Regular housekeeping in bag house and avoiding temporary storage of other things	Project Proponent

Type of Hazards	Risk Category	Mitigation Measures	Responsible Organization
		• Arranging medical checkup for the staffs especially dealing with furnace operation and antimony oxide powder collection.	
	Heat Exposure	Furnace Operation • Furnace workers should be provided more effective ventilation probably with water sprayers. • The hands, arms and faces of workers should be protected by gloves, heat protective clothing and googles. • Ensure that workers have adequate breaks from hot, internal environments at appropriate times throughout the day. • Provide sufficient drinking water and beverages stations. • Train the workers to recognize the signs of heat illness and exhaustion. • Make sure that the workers are standing at a distance of 1.5 m -2 m away from the furnace. • Restrain the unauthorized access by barriers and signages to the furnace and molten metal pouring areas. • Make sure the workers wear heat resistant gloves when handling and molding molten metal. • Replace the manual hot works with tools, equipment and machines whenever possible. Handling and Disposal of Slags • Make sure that only the trained and experienced workers are assigned for handling and disposal of slags (Pyit Sar and Chor Khal) • Make sure that the workers wear heat resistant gloves and appropriate clothing that cover arms, in handling and disposal of slags • Make sure that there is no chance of direct touching of slag with bare hand • The route to disposal site should be noticeably marked and there should be no obstruction. • The temporary storage site should be prohibited from entering. (signage shall be mounted and barrier lines must be placed)	Project Proponent
	Chemical Exposure	• Ensure that only allowed personnel can enter the chemical storage areas • Mounting hazard signs at the entrance of chemical storage areas • Provision of PPE (as recommended in MSDS of each chemical) on handling of chemicals • Provision of emergency shower and eye wash near the chemical storage area and laboratory • Ensure to keep ignition sources away from chemical storage areas • Store chemicals separately in designated chemical store rooms • Keeping chemicals in cool areas out of direct sunlight • Triple rinsing of empty containers with water before discarding. • Visual inspection of containers on a regular basis • Providing trainings on chemical handling and first aid procedure	Project Proponent
	Noise	• Providing 3 m distant lines from potential noise sources and reminding the workers to stay back from these lines • Mounting warning signs at potential noise sources • Checking and cleaning fans and filters of blowers on a	Project Proponent

Type of Hazards	Risk Category	Mitigation Measures	Responsible Organization
		regular basis • Regular cleaning and maintenance of machineries (blower, grinding machine, generator) • Placing cooled booths (fans) at least 3 m away from the noise sources	
	Physical Hazards	Slips, Trips and Falls • Housekeeping in a timely manner; day to day housekeeping activities, planned and non-routine activities • Round check before starting work by factory manager • Fixation of storage areas of raw materials, products and by-products • Cleaning of wet floor immediately • Removing trailing wires from the work floor • Mending holes to prevent accidental falling • Providing General Safety Trainings Eye Hazards • Providing eye shields or googles for working near furnace and grinding area • Ensuring workers standing at a distance of 1.5 m – 2m from the potential hazard sources Industrial Vehicle Driving • Ensure that only trained drivers are allowed to drive industrial vehicles • Driving with minimum speed inside the factory • Using horn or warning sound during forklift operation	Project Proponent
	Communicable Diseases	Covid-19 • The worker with symptoms of Covid-19 must not come to workplace and must receive medical treatments at near health department. • The workers must stay at apart of 6 feet from each other at the times of entering and leaving workplace. • Non-Touch Thermometer or Thermal Scanner must be used to detect temperature of workers before entering workplace. • The attendance sheet must only be filled by assigned supervisor. • All workers must be provided with masks and gloves. • The numbers of the workers present at the workplace must be recorded daily. • Hand washing stations must be provided at entrance, exit, inside workplace, canteen, rest area and toilets. • Items necessary for hand washing (soap, water, hand standardizer, tissue) must be placed at hand washing stations. • The posters of “How to wash your hands systematically” must be placed. • Adequate ventilation must be provided. • Arranging canteen, rest area able to rest or eat at a distance of 6 feet from each worker. • Disinfecting the utilities, equipment on a daily basis. • Inform to Health Department about the information of worker(s) with symptoms. • The working assigns must be planned in a manner of same groups working and resting alternately. • The workers must be assigned at different job locations as possible far away as from other. • The tables at canteen must be marked to sit or not to sit in order to avoid face-to-face eating conditions and	Project Proponent

Type of Hazards	Risk Category	Mitigation Measures	Responsible Organization
		provide transparent barriers if possible. • The personal hygiene of workers must be enhanced and provide knowledge on causes, symptoms and preventive ways to workers. Cholera, Diarrhea and Dysentery • Regular cleaning of toilets using chlorine-based disinfectant and proper use of toilets by workers. • Arrange to adopt frequent and careful hand washing after using the toilet, before and after preparing food or eating. • Personal hygiene and food safety precautions by chef, like thoroughly cooking all meats, washing kitchen work surfaces and utensils after contact with raw meat and avoiding preparing food for others while having symptoms of fever or feeling unwell. • Providing properly treated water which is stored in a clean container. • Maintenance of water supply, sanitation systems, pumps and wells.	
Emergency Hazards	Fire	• Managing the coal stock pile layout to prevent spontaneous combustion of coal in case of fire • Practicing "First-in, First-out" System of coal storage • Providing fire-fighting materials (water, fire extinguishers) near the coal stock pile • Fixing diesel storage area, mounting hazard signs and provision of fire extinguisher (Form or Dry Powder Type) • Alerting fire hazard in Workers' Accommodation (switching off electricity, lighting off mosquito repellents before leaving) • Alerting fire hazard while preparing food • Providing sufficient quantities of fire extinguishers and regular inspection • Establishing fire alarm system (horns) • Setting fire assembly points • Conducting regular fire drills • Implementing according to the emergency response plan in case of fire • Providing firefighting-related trainings	Project Proponent
	Explosion	• Checking quality of coal before using (free of foreign substances and dry) • Locating raw material stocks and combustible materials at a minimum distance of 0.8 m (2.5 ft) from furnace • Immediate cleaning of water and fuel leaks near furnace • Regular furnace maintenance • Setting safety practices for the efficient operation of furnaces • Provision of safety operation trainings on a regular basis • Conduct regular maintenance of furnaces	Project Proponent
Natural Hazards	Flood	• Implementing according to emergency response plan in case of flood	Project Proponent

Source: EnvO Study Team

8.4 Environmental and Social Management Sub-Plans

Based on the outcomes of IEE study, detailed management sub-plans are required to guide the project proponent for the effective implementation of mitigation and management measures. Therefore, EnvO study team has prepared the environmental and social management sub-plans as described in the following table. The project proponent shall implement those plans throughout the operation of the proposed project.

Table 8-5 Description of Environmental and Social Management Sub-Plans

Detailed Sub-Plans	Key Objective and Contents	Part of IEE Report
Standard Operating Procedures (SOP) of Wet Scrubber	This plan was prepared with the intention to help the operators in MSS factory to evaluate the wet scrubber performance at the earliest possible stage and able to conduct the measures in time as needed. This document mainly focuses on the procedures which are suitable for the conventional wet scrubber like the one which is installed at MSS factory and targets the checkpoints which can easily be detectable by the operators with visual check or simple instruments (pH meter/pH paper). The contents of SOP are as follow. 1. Operational Basic Requirements (I) Estimated Amount of Soda Ash Feed (II) Scrubbing Liquid pH 2. Monitoring Indicators (I) Monitoring the pH Value of Scrubbing Liquid (with Record Form) (II) Opacity of Smoke from the Stack (with Record Form) 3. Record Keeping (Daily and Monthly Records)	Annex 5
Solid Waste Management Plan	This plan aims to set a systematic management of solid waste generated from the MSS factory particularly for the waste which is hazardous for the environment and human beings. It will also ensure and guide proper collecting, handling, storing and disposal of waste at the MSS factory by proposing the additional measures to be conducted by the MSS. In addition, this plan identifies the monitoring activities and prepare the required record form for monitoring the management of solid waste. It includes – 1. Objective and Scope 2. Responsible Team 3. Management of Industrial and Domestic Waste (I) Industrial Waste i. Waste Slug from Roasting and Smelting Line ii. Sludge from Wet Scrubber and Settling Tanks iii. Empty Chemical Containers iv. Used Machineries Part (II) Domestic Waste (III) Necessary Documents for Monitoring (IV) Waste Inventory – Record Form (V) Slag Balance Sheet (VI) Waste Disposal Record Form	Annex 9 A
Occupational Health and Safety Plan	This plan provides procedures to reduce the risks upon health and safety of workers and enhance better occupational health and safety in MSS Factory, covering the anticipated occupational hazards assessed in Chapter 6 including the following types of occupational hazards: (i) Indoor Air Quality (ii) Heat Exposure (iii) Chemical Exposure (iv) Noise (v) Physical Hazards and (vi) Communicable Diseases. The contents include - 1. Occupational Safety Policy of MSS Factory	Annex 9 B

Detailed Sub-Plans	Key Objective and Contents	Part of IEE Report
	2. Currently Practicing Safety Measures by MSS Factory 3. Structure of Occupational Health and Safety Management Team 4. Occupational Health and Safety Management Works 5. Occupational Health and Safety Monitoring Plan 6. Implementation Programs (I) Enforcement Programs (II) General Safety Training (III) First Aid Training (IV) Response on Occupational Hazards (V) Record Forms i. Accident Record Form ii. Illness Record Form (VI) Health Enhancement Program to prevent Covid – 19	
Emergency Response Plan	This plan specifies detailed procedures to reduce human injury and damage to property during sudden or unexpected situations. Also, it provides how to act in an emergency and who to contact. Emergency response plan provides operational management for emergency response team members with a general guideline of the expected initial response to an emergency, and an overview of their responsibilities during an emergency. It is composed of – 1. Formation of Emergency Safety Team 2. Responsibility of Emergency Safety Team Members 3. Response Procedures for Each Emergency Situation (I) Response to Fire Hazard (II) Response to Furnace Explosion (III) Response to Flood 4. Implementation Trainings (I) Fire Fighting Trainings (II) First Aid Trainings (III) Fire Drill 5. Emergency Contact	Annex 9 C
Grievance Redress Mechanism	This mechanism has established for the project proponent to be able to handle, solve and record any possible complaints in more systematic ways. The GRM include procedures to receive complaints not only from the community but also from the factory workers. The components of GRM includes – 1. Current Practices of Managing Complaints 2. Grievance Redress Mechanism (GRM) (I) Procedures for Public Grievance Redress Mechanism (II) Procedures for Workers' Grievance Redress Mechanism 3. Announcement of GRM 4. Necessary Record Forms for GRM (I) Public Grievance Submission Form (II) Public Grievance Log Book (III) Workers' Grievance Submission Form (IV) Workers' Grievance Log Book	Annex 9 D

Source: EnvO Study Team

8.5 Residual Impacts and Risks

8.5.1 Residual Impacts

After the mitigation/ enhancement measures described in above sections are applied, the significant of residual impacts (impacts after mitigation measures) is described in the following table. It can be seen that most of the impacts become minor or negligible while major impacts were reduced into moderate levels with the help of those measures.

Table 8-6 Summary of Residual Impacts in Operation Phase

Categories	Impact	Activities	Status	Significance without mitigation measures	Significance with mitigation measures	Degree of Certainty (Probability)	Note
Environmental Impacts							
Physical Component	Air Pollution	Operation of Roasting and Smelting Furnace	Negative	Major	Moderate	Probable	
	Solid Waste (Hazardous and Non-Hazardous)	Roasting of Antimony	Negative	Major	Moderate	Probable	
		Smelting of Antimony	Negative	Major	Moderate		
		Wet Scrubbing Process	Negative	Moderate	Minor		
		Settling Process	Negative	Minor	Negligible		
		Domestic Activities	Negative	Minor	Negligible		
	Water Pollution – Surface Water (Effluent)	Gas Cooling System with Condensing Tubes	Negative	Moderate	Minor	Probable	
		Cleaning and Bag filters washing	Negative	Minor	Minor		
		Wet Scrubber Operation		Moderate	Minor		
		Small Testing Laboratory Operation	Negative	Negligible	Negligible		
	Soil Contamination	Waste piling at project site	Negative	Moderate	Minor	Probable	
		Storage of fuel, raw material and utilization of fuel	Negative	Minor	Minor		
		Waste (slag) filling in the compound	Negative	Major	Moderate		
	Noise	Mineral Processing,	Negative	Negligible			

Categories	Impact	Activities	Status	Significance without mitigation measures	Significance with mitigation measures	Degree of Certainty (Probability)	Note
		blower operation and mobilization of vehicles					
	Odor	Roasting and Smelting Processes	Negative	Moderate	Minor	Possible	
Social and Health Impacts							
Socio-economic and Cultural Component	Local Economy	Business Operation	Positive	Minor			
	Local Resources	Extraction of water from Attaran River	Negative	Negligible			
	Workers Welfare	Providing Necessary facilities to workers	Positive	Negligible			
Health Component	Community Health and Safety	Roasting and Smelting Process	Negative	Moderate	Minor	Probable	

Source: EMP study team

8.5.2 Residual Risks

In Chapter 6, the possible risks due to different hazards at workplace are assessed in details based on its likelihood and consequences. After consideration of current management activities and recommendations from the study team, the residual significance of risks remain low and medium as summarized in the following Table 8-7.

Table 8-7 Summary of Residual Risks in Operation Phase

Type of Hazards	Source of Risk	Significance of Risk Without Any Mitigation Measures	Significance of Risk with Mitigation Measures (Residual Impacts)
Occupational Hazards (Industrial Hazards)	Indoor Air Quality	Very High	Medium
	Heat Exposure	High	Medium
	Chemical Exposure	High	Low
	Noise	High	Low
	Physical Hazards	High	Low
	Communicable Diseases	High	Medium
Emergency Hazards	Fire	High	Medium
	Explosion	High	Medium
Natural Hazards	Flood	High	Medium
	Earthquake	Low	Low

Source: EnvO Study Team

8.6 Environmental Monitoring Plan

The project proponent will implement the environmental monitoring plan with respective frequency as shown in the table below. That includes the parameters to be measured, methods to be utilized, sampling locations, frequency of measurements and the responsibilities for implementation. The project proponent will submit the monitoring report to Environmental Conservation Department (ECD) in every 6 months (bi-annually).

Table 8-8 Environmental Monitoring Plan in Operation Phase

Category	Object of monitoring	Monitoring item	Type of Record Document	Location	Frequency	Responsible organization
Air Quality	Emission Status	SO_2, NO_x (As Identified in Section 2.3.2)	1. Test Results 2. Record Photos showing of air quality measurement 3. Graphs or Charts showing the fluctuation of results during monitoring	Final Stack	Annually	3rd Party Consultant
	Workplace Air Quality	PM 2.5, PM 10 (Mandatory) CO, SO_2 (Optional if in case of poor ventilation working area)		Working areas	Annually	3rd Party Consultant
	Opacity of Smoke	Visual check of Black Smoke	1. Inspection Record Form (Annex – 5)	Final Stack	Monthly	Project Proponent
Solid Waste	Chemical Composition of Waste Slag	Laboratory Analysis of Arsenic in Slag (Pyit Sar)	1. Original Test Results 2. Laboratory Testing Methods 3. Record Photos showing slag sampling	Temporary Waste Pilling Area	Annually (Until the time when that slag is stopped using for land filling)	Project Proponent
	Control and Management of Solid Waste	Record all types of generated waste amount	1. Daily and Monthly Record Form (Annex – 9A) 2. Record photos showing storage condition, disposal condition, etc.	Waste Storage Area	Daily	Project Proponent
		Record waste disposal status and recycle status		Waste Storage Area	Monthly	Project Proponent
		Record Waste Storage Condition		Final Disposal Site	Monthly	Project Proponent
Wastewater Quality	Effluent Quality	Laboratory Analysis of – Aluminum Arsenic Cadmium Chemical Oxygen Demand Copper Fluoride Lead Mercury Nickel pH Oil and Grease	1. Original Test Results 2. Laboratory Testing Methods 3. Record Photos showing wastewater sampling 4. Results of measurement comparing with guideline values.	Point 1: Final Discharge Point Point 2: Earth Drain which received Effluent	Annually	3rd Party Consultant (or) Project Proponent

Category	Object of monitoring	Monitoring item	Type of Record Document	Location	Frequency	Responsible organization
		Total Suspended Solids Zinc Total Nitrogen Total Phosphorus (16 Parameters as Identified in Section 2.3.3)				
Water Consumption	Amount of water consumption	Record the amount of water consumption	1. Monthly Water Consumption Record Form	Extraction point at Attaran River	Monthly	Project Proponent
Soil Contamination	Checking status of any spillage	Inspect any leakage/spillage of oil and chemical	1. Inspection Record Form 2. Record location 3. Record photos if found	Solid waste storage area, fuel storage area, any chemical storage area	Monthly	Project Proponent
Odor	Checking the odor status of surrounding area	Patrol Check	1. Inspection Record Form	Boundary of Project Site / Nearby Community Areas	Monthly & Whenever the complaint is received.	Project Proponent
Occupational Health and Safety	Checking Status of occupational health and safety measures	Record any work activities inside bag house	1. Work Permit Form 2. Record photos	Bag House	As necessary	Project Proponent
		Record housekeeping activities in workplace		Working Area	Daily	Project Proponent
		Record maintenance of machineries, water supply, sanitation systems, pumps and wells	1. Record locations, reason for maintenance 2. Record photos	Relevant Area	Occasionally	Project Proponent
		Record health and accident conditions	1. Accident Record Form (Annex – 9 B) 2. Illness Record Form (Annex – 9 B)	At Project site	Occasionally	Project Proponent
		Record the improvement of working conditions	1. Record photos of before and after making any workplace improvement	At Project site	Occasionally	Project Proponent
		Record Staff trainings	1. Record photos 2. Record the number of Attendees	At Project site	Occasionally	Project Proponent
		Record complaints raised by the workers	1. Workers' Grievance Submission Form and Grievance Log Book (Annex – 9 D)	At Project site	As necessary	Project Proponent
		Record medical inspection	1. Record the occurrence of communicable	At Project site	As necessary	Project Proponent

Category	Object of monitoring	Monitoring item	Type of Record Document	Location	Frequency	Responsible organization
			disease among workers 2. Record medical checkup results			
Community Health and Safety	Checking status of community health and safety measures	Records the complaints and comments from community	1. Community Grievance Submission Form and Grievance Log Book (Annex – 9 D)	Relevant Area	As necessary	Project Proponent
Other Social Considerations	Checking Social Contributions and Engagement with Communities	Record the CSR activities	1. Record photos 2. Record the number of participants 3. Record meeting minutes	Relevant Area	As necessary	Project Proponent
		Record the community engagement activities		Relevant Area	As necessary	Project Proponent
Emergency Risks	Checking preparedness of emergency risks	Records any emergency case and its responses	1. Record photos 2. Record situation and responses taken	At Project site	Occasionally	Project Proponent
		Record fire drill performance	1. Record photos 2. Record participants 3. Record details of the drills	At Project site	Yearly	Project Proponent
		Record and check extinguishers status	1. Visual check of any physical damage on the extinguishers 2. Record date of replacement 3. Check and record the pressure gauge	At Project site	Twice per year	Project Proponent

Source: EnvO Study Team

8.7 Tentative content of Environmental Monitoring Report

In preparing the monitoring report with the help of third-party consultant or by the company itself, the report shall at least contain the following content in accordance with the EIA Procedures (2015) with the necessary records and photos as described in the EMoP for each of the monitoring item.

- documentation of compliance or incompliance with all conditions;
- progress made to date on implementation of the EMP against the submitted implementation schedule;
- difficulties encountered in implementing the EMP and recommendations for remedying those difficulties and steps proposed to prevent or avoid similar future difficulties;
- number and type of non-compliance with the EMP and proposed remedial measures and timelines for completion of remediation;
- accidents or incidents relating to the occupational and community health and safety, and the environment; and
- monitoring data of environmental parameters and conditions as committed in the EMP or otherwise required.

8.8 Implementation Plan of EMP and Its Budget

The project proponent will allocate separated budget for environmental and social management plan implementation, training, environmental monitoring and reporting and capacity building activities as set out in this IEE report. The budget is estimated to be US$ 25,000 per year approximately. It should be noted that the costs for built-in mitigation measures such as installation of bag fitler, wet scrubber, cost of reagent for wet scrubber operation, etc., effluent settling tanks, etc. are already included in the operation cost. In addition, separated budget will be allocated for CSR activities which will be contributed to the community development.

As discussed in Section 5.4, the factory is currently in operating and is projected to run for 30 years. Thus, the potential impacts and risks at the decommissioning phased are unpredictable. However, the project proponent is committed to submit the detail environmental management plan for decommissioning phase including but not limited to the decommissioning schedule, impact assessment, proposed mitigation measures, monitoring activities, estimated budget, etc. to ECD, three years prior to the decommission of this project.

Table 8-9 Work Plan, Implementation Schedules and Estimated Cost of EMP

No.	Activities	Schedule	Estimated Cost (USD)
Implementation of Mitigation Measures			
1	Implementation of Sub-plans such as SOP of Wet Scrubber, Solid Waste Management Plan, Occupational Health and Safety Plan, Emergency Response Plan, Grievance Redress Mechanism, etc.	Yearly	> 5000 USD
Implementation of Monitoring Activities			
1	Measurement of emission from Stack and Workplace air quality, etc.	Yearly	> 5000 USD
2	Measurement of effluent quality and slag quality (collecting wastewater / slag sample and testing at the laboratory)	Yearly	> 1000 USD
3	Monitoring Report Preparation	Twice per Year	> 10000 USD
Implementation of Capacity Building Programs			
1	Conducting Drills and Practices	Yearly	> 1000 USD
2	Conducting Trainings for Workers such as General Safety Trainings, Fire-fighting trainings, First Aid Training, etc.	Yearly	> 3000 USD

Moreover, the project proponent will fulfill the targeted work plan in accordance with the implementation schedule. If there are any changes, the project proponent will consult with the ESIA Consultant to attain proper control and effective management.

8.9 CSR Schedule and Budget Allocation

As per the outcomes of IEE study, the project proponent, MSS is willing to allocate at least 15,000,000 MMK per year for achieving cooperate social responsibilities, categorizing; environmental responsibility, human rights responsibility, philanthropic responsibility and economic responsibility.

- Environmental responsibility aims to reduce pollution, GHG emissions and sustainable use of natural resources.
- Human right responsibility involves providing fair labor practices (e.g., equal pay for equal work regardless of race, nationality or gender), fair trade practices and disavowing child labor.
- Philanthropic responsibility includes things such as funding educational programs, supporting health initiatives, donating and supporting community development.
- Economic responsibility involves improving the company's business operation while participating in sustainable practices – for example, using a new production process to minimize emission and wastes. Records of CSR activities will also be reported in a biannual monitoring report which will be submitted to the ECD, MONREC.

Some donation records which was recently made as part of philanthropic responsibility are shown in the following figures.

(a) Donation for the Development of Basic Education High School in Mon State (Dec, 2017)

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်
မွန်ပြည်နယ်အစိုးရအဖွဲ့.

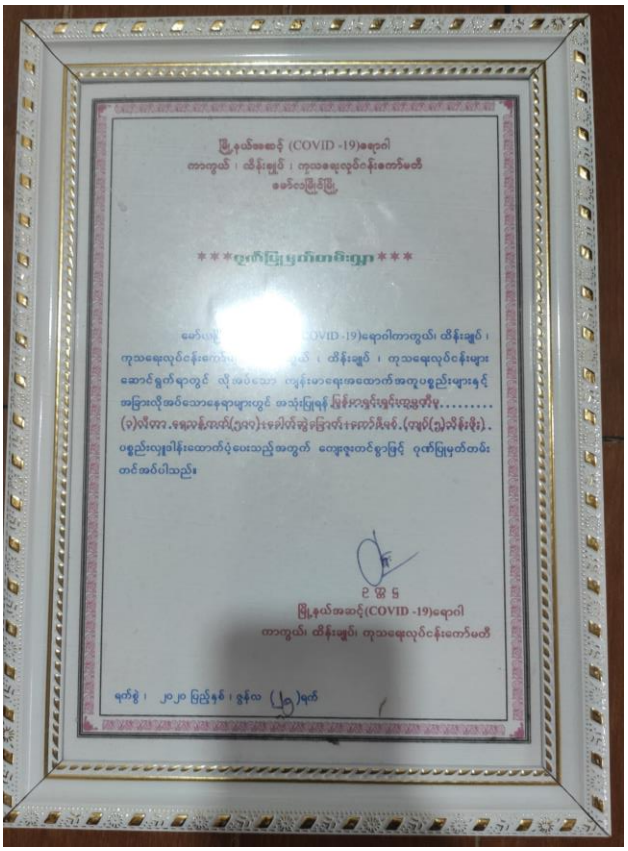
ဂုဏ်ပြုမှတ်တမ်းလွှာ

မွန်ပြည်နယ်အတွင်း Coronavirus Disease 2019 (COVID-19) ထိန်းချုပ်ရေးနှင့် အရေးပေါ်တုံ့ပြန်ရေးလုပ်ငန်းများ ဆောင်ရွက်ရာ၌ အထုံးပြု ရန်အတွက် ဒေါ်ကျပ် (၇,၂၀၀,၀၀၀/-) တန်ဖိုးရှိသော PPE ဝတ်စုံ(၂၀၀) Surgical Mask (၅၀၀၀) စတို့.ကို မွန်ပြည်နယ်အစိုးရအဖွဲ့.ထံ လှူဒါန်း ပေးပါသော Mr.Liu Pei Xin အား "ဤဂုဏ်ပြုမှတ်တမ်းလွှာ" ဖြင့် ဂုဏ်ပြု မှတ်တမ်းတင်အပ်ပါသည်၊

ခေါက်တာခေးခ်
ပြည်နယ်ဝန်ကြီးချုပ်

ရက်စွဲ- ၂၀၂၀ ပြည်နှစ်၊ စက်တင်ဘာ (၉) ရက်

(b) Donation for the Prevention of Covid – 19 Pandemic (April, 2020)



ကိုယ်ခန္ဓာ (COVID -19)ရောဂါ
ကာကွယ် ၊ ထိန်းချုပ် ၊ တုံ့သရေးလုပ်ငန်းကော်မတီ
မော်လမြိုင်မြို့

ဂုဏ်ပြုမှတ်တမ်းလွှာ

(COVID -19)ရောဂါကာကွယ်၊ ထိန်းချုပ် ၊ ... ထိန်းချုပ် ၊ တုံ့သရေးလုပ်ငန်းများ ဆောင်ရွက်ရာတွင် လိုအပ်သော ကျွန်းမာရေးဆောက်အတူပစ္စည်းများနှင့် အခြားလိုအပ်သောနေရာများတွင် အသုံးပြုရန် ... ပစ္စည်းလျှပ်စီးကြေးကို ... (၁)လီတာ.ဇရာနီအရည်(၂၄၃)၊ဧရိယာ်ဆွဲခြောက်၊ဧကာ်ဂီမင်.(၃ချပ်(၂)လိပ်စီး). ပစ္စည်းလျှပ်ဒါန်းထောက်ပံ့ပေးသည့်အတွက် တေးဇူးတင်စွာဖြင့် ဂုဏ်ပြုမှတ်တမ်း တင်အပ်ပါသည်။

ဒေါ်ဆန်း
မြို့နယ်အဆင့်(COVID -19)ရောဂါ
ကာကွယ်၊ ထိန်းချုပ်၊ တုံ့သရေးလုပ်ငန်းကော်မတီ

ရက်စွဲ ၊ ၂၀၂၀ ပြည်နှစ် ၊ ဇွန်လ (၂၅)ရက်

(c) Donation for the Prevention of Covid – 19 Pandemic (June, 2020)

(d) Donation for the Prevention of Covid – 19 Pandemic (Sept, 2020)

(e) Donation for Oxygen Generator Plant (Oct, 2021)

Figure 8-6 Photo Records of CSR Activities Implemented by MSS

CHAPTER (9) KEY FINDINGS AND CONCLUSIONS

9.1 Key Findings and Recommendations on the Environmental, Social, Health and Safety

During the time of IEE preparation, a number of site visits and investigations were carried out to identify the status of environmental and social related issues. It includes meeting with project proponent, project supervisors, workers, and relevant stakeholders including Environmental Conservation Department (ECD) in Mon State. Then, specific impact and risk assessments are conducted and the mitigation measures are proposed. The following key findings and recommendations are elaborated for MSS.

9.1.1 Key Findings and Recommendations on Environmental Management

The key environmental related observations found out by the EnvO Study Team are as follows;

i. Air Quality Management

(a) As the powder of Antimony oxides are precious in manufacturing of final product, Antimony Ingot, two bag houses with a number of filter bags and a separated bag filter are equipped through the roasting and smelting lines. It is observed that two bag houses and a newly built bag filter installed at MSS factory are operating well. According to the IFC, EHS General Guidelines, the bag filters which use fabric filters have the reducing capacity of > 99% in the control of particulate matter (PM) and therefore, it can be said that the control facilities installed at MSS factory seem to be adequate to control the PM emission.

(b) Wet scrubber is installed as a primary treatment of flue gas emitted from operation processes as per the instructions given by Mon State ECD. The FGD wet scrubber not only reduce the amount of SO_2 in the flue gas but also the PM and other gaseous pollutants into significant extent. Generally, FGD wet scrubber has the removal efficiency of over 90% if it is well operated. As the wet scrubber is operating manually, it is important that the operators are fully aware of changes in the system and monitor the performance of the wet scrubber in a timely manner. Otherwise, it may not be efficiently operated to remove the SO_2 and other pollutants contained in the flue gas. Therefore, the EnvO study team has developed a Standard Operating Procedures (SOP) for wet scrubber operation, attached in the Annex – 5.

(c) It has been examined that the installed stack height (120 ft) is sufficient to control the emission of MSS factory as per guidance of Emission Regulations by Central Pollution Control Board, India (1998) since minimum required height of the stack is 66.3 ft.

ii. Solid Waste Management

(a) Processing produces a variety of solid wastes, and the non-reusable wastes. Those waste are disposed by landfilling at the bare land inside the factory, some of waste are kept in bags and temporarily stored at the warehouse, and awaiting to be disposed finally at their mining site. Sludge resulted from wet scrubber are dragged out and packed in bags before recycling.

(b) Most of the hazardous wastes at MSS are temporarily stored in the warehouse in other plot inside Mawlamyine Industrial Zone and finally disposed to the Nat San mine at Kyaikmayaw Township which is owned and operating by Myanmar Shing Shing Metal Company Limited. However, Slag 1- Pyit Sar are currently being laid at the bare land area inside the project site with the purpose of land preparation for the further extension of the project.

(c) The waste slag filling at the bare land area inside the project site is quite challenging for environmental issues unless installation of proper liner layer prior to filling. Also, it is found out that solid wastes resulted from MSS is varied and needs better management for each type in terms of collection, storing, and disposal. The recordings for waste management is still lacked. Hence, as a specific mitigation measure, EnvO Study Team has prepared a detail solid waste management plan (Annex-9) which includes hazardous solid waste management, giving project proponent a guidance of waste collecting, handling, suitable temporary storage with adequate space, precautions and mitigation measures of waste slag filling activities inside the project area, recording of waste amount, designated final disposal for each waste type and etc.

iii Water Quality Management

(a) Water is needed for the cooling purpose in the processing lines and casting, which does not have a direct contact with any of raw materials, by-product or solid wastes. The water used for cooling doesn't include contaminants but the temperature of such water needs attention to be controlled. Cooling water is re-circulating within the process with the continuous filling of the amount that was evaporated from the heat exchange process. The water is passed through the separate pipeline (condensing tubes) for cooling gases from the roasting and smelting lines. The used water then flows into the cooling tanks (initial cooling tank and cooling tank) inside and behind the factory, respectively. Then the cooled water is again pumped up and circulated in the cooling water system. Only overflown water is discharged into nearby earth drain across the bare land.

(b) Since the industrial wastewater is an important issue from environmental aspects, the EnvO study team has conducted the wastewater quality measurement at the places where represent the quality of wastewater discharged into the environment. Based on the on-site measurements and laboratory measurements, the wastewater from the MSS factory is observed that among 16 parameters, there are four parameters (As, COD, TSS, and temperature) which were slightly exceeded than the NEQG guideline values. The Arsenic (As) is a major concerned parameter to be managed as the concentration of As in the water circulating inside the operation process and discharging into the environment is five times greater than NEQG values. And, the As content was increased while passing through the waste slag filling area probably due to the leaching from waste slag filling. The values of COD and TSS are not significantly high as compared to other industry (e.g. brewery- approximately COD > 10,000mg/L, TSS> 30,000mg/L). Temperature of overflow wastewater from the cooling tanks are slightly high and is required to be controlled.

(c) The key mitigation measures proposed for water quality management are described as follows:

- Restrict the discharge of wastewater from the wet scrubber operation such as spent scrubbing liquid to the environment.
- Ensure that no wastewater is discharged during the time of sludge collection, effluents from each tank shall be detained in others.
- Collect, treat and discharge properly the scrubbing water in case of pumping out or taking out the scrubbing water for the maintenance of tanks or any reason and ensure that the discharged wastewater quality meet NEQG guideline values.
- Set up an overflown water storage tank for overflown water from the cooling tanks before directly discharge into the earth drain aiming to reduce the wastewater temperature up to (<30˚C).

- Seek the ways to reduce the concentration of Arsenic, COD and TSS such as use of raw materials (antimony ores with less arsenic content), installation of treatment system mainly for treating those three parameters, etc.

Moreover, mitigation measures proposed for solid waste management will not only reduce the environmental impact of solid waste but also the impacts from wastewater into significant extent.

iv Other Environmental Impacts (Soil contamination, Noise, Odor)

(a) Basically, the risks for soil contamination is less for operation of MSS. Temporary waste (pyit sar) pilling at project site is also observed before transporting to the warehouse. Since such waste are piling on the paved ground temporarily, the soil pollution impact is expected not to happen. However, recently in 2020, MSS started filling up the land inside the compound. As waste filling without any liner layer at the base, it (operation waste) may contribute the potential for soil pollution at MSS. On the other hand, the arsenic has the potential to be soluble into the groundwater depending upon the situations such as higher pH, and existence of organic carbon in the groundwater. If the arsenic is not soluble, it will precipitate and remain in the solid phase of the groundwater system as part of the soil. Then, soil pollution caused by arsenic is expected to be occurred in case of any arsenic content in the waste slag. Hence, the recommendation for landfilling process is proposed to provide the impermeable layer (clay or concrete lining) at the designated area for landfilling.

(b) The noise impact to the environment is evaluated as negligible based on noise level spot check measurement results which were measured at the boundaries of the MSS in total of 12 spots.

(c) It is predicted to generate the disagreeable metallic odor due to the oxidation of antimony ores during the roasting process. Besides, the other metals contain in the antimony oxides mixture could release some offensive odor based on the chemical reactions during the smelting process. Although odor is released as point source emission from roasting and smelting processes, it is sucked by the blowers through the enclosed pipelines and finally emitted from the stack after passing through the wet scrubber. However, leakage of filter bags and condensing tubes and insufficient operation of wet scrubber will enhance the spreading of offensive odor to the nearby area. Hence, the continuous monitoring and maintenance of blowers, ducts, condensing tubes and pipelines connected with the bag houses, wet scrubber and the stack are essential to be performed.

Upon all findings related to environmental management in MSS, it is obvious that the proper environmental management plan including detailed sub-plans are required to be developed for implementing effective environmental management system. Hence, the detailed sub-plans for environmental management are prepared in this IEE report as necessary and appropriately with the facilities installed in the MSS and available and compactable practices.

9.1.2 Key Findings and Recommendations on Social Management

Previously, Mon ECD received a number of complaints regarding with odor issue from the surroundings. Due to the complaints, MSS was investigated, inspected and monitored by Mon ECD since 2018, with the continuous instructions by ECD and MSS took the actions on instructions throughout the years 2018 and 2019. Moreover, it is observed that Myanmar Shing Shing factory welcomes anyone who has complaints, suggestions related with the factory. The specific procedures for addressing the grievance is still needed to be effective and systematic. Although MSS has been donating approximately certain amount (150 lakhs) per annually for the

regional developments, the factory management could not record systematically. The following are the social related observations:

i. Basically, the project has been positively contributing the local economy by providing the employment, earning foreign income by exporting product, and the revenue to the regional government.
ii. MSS provides the required facilities such as worker accommodation, supplying the meals, providing necessary PPE and supplements, health care, to the workers. It is suggested to organize occasional ceremonies, annual party or trips for all the workers (May be at the time of temporary shut down on rainy season) and ensure the provision of full right and allowance identified by the local laws related to labour affairs.
iii. It is observed that the emission of sulphur dioxide or other related pollutants during oxidation of antimony ores via the roasting process and release of the other metals contain in the antimony oxides mixture based on the chemical reactions during the smelting process, may release offensive odor to the atmosphere. Depending upon the duration of emission of offensive odor, the community will feel unpleasant and the sensitive group may have health problem if the long-term emission is occurred. Hence, it is proposed to implement the mitigation measures for air quality control, to set up the simple and effective grievance procedures to response the community's complaints effectively and sufficiently, and to monitor any significant public poisoning or health issues raised in the nearby community, identify with the help of environmental expert and address any measures for those issue.

Overall, it is observed that factory has maintained a good relation with its employees and their families. In order to promote transparency and the good coordination between the community, the workers and the factory, the required Grievance Redress Mechanism addressing complaints from both community and the workers is prepared in the IEE report.

9.1.3 Key Findings and Recommendations on Health and Safety Management

Regarding health and safety management, the potential risks caused by three type of hazards such as occupational hazards, emergency hazards and natural hazards are assessed. A number of occupational hazards including workplace air quality, heat exposure, chemical exposure, noise and vibration, physical hazards, communicable diseases are identified and evaluated since the workers' health and safety are crucial. In this study, the workplace air quality was measured at two important locations (near roasting line and near smelting line). In general, the workplace air quality inside the factory seems to be good during the normal and becomes moderate during the time of removing slags (Pyit Sar and Chor Khal) from both roasting and smelting furnaces. However, it would reach to the "Unhealthy" stage for a few minutes when the black smoke is emitted though the openings of furnaces at the time of starting fire. Therefore, it is strongly recommended to emit the black smoke only from the stack after passing though the wet scrubber.

It has been noticed that MSS Factory has provided N95 masks, which are capable to block at least 95 percent of very small (0.3 micron) particles, to the supervisors and respirators to workers who has to go inside bag houses to collect antimony oxide powder. To protect the workers from heat exposure, MSS Factory has provided cooled booths at the working environment of roasting and smelting line. The booth includes fans and chairs to receive ventilation and air conditioning and take a rest. MSS Factory also provides the workers with unlimited electrolyte powder packs to recover dehydration. It has been noticed that all the chemicals used for factory operations and laboratory are stored separately at designated places.

On-site noise measurements were conducted at 11 points within the working areas to evaluate noise impacts to the workers. The exceeded noise levels in accordance with IFC noise level limits for working places are observed to be emanating from the blowers installed at the furnaces and from the coal grinding activities. Therefore, mitigation and control measures for controlling occupational noise are recommended. The factory takes responsibility of all the medical fees if there is any illness or any injury occur, and also it registered at Social Security Board for all the employees. In order to have more affective control of occupational health and safety issues, the EnvO study team has prepared a comprehensive Occupational Health and Safety Plan which is described in the Annex 9B of this IEE report.

Emergency hazards including fire and explosion hazards and natural hazards for consideration of earthquake and flood risks are also assessed. In addition to the mitigation measures, the emergency response plan (Annex-9 C) is prepared for the preparedness of emergency situations.

9.2 Project Commitments

The project proponent, recognizes its responsibility towards the environmental, social, health concerns and is committed to fulfill the following the key environmental and social commitments in order to manage and mitigate potential impacts throughout the project life.

Table 9-1 Project Key Commitments

Field	No.	Commitments	Reference Chapter in IEE
General	1.1	The information provided in this IEE report is correct.	All
Policy, Framework, Laws, Regulations, Standards and Guideline Values	2.1	MSS will fully comply the provision of the requirements as per each related sections of the related laws as described in Section 2.2.3, including - Environmental Conservation Law, ECL (2012) Environmental Conservation Rules, ECR (2014) EIA Procedures (2015) and National Environmental Quality (Emission) Guideline (2015)	Chapter 2 Section 2.2.3
	2.2	MSS will comply and adopt the environmental standards and guidelines values which are described in Section 2.3	Chapter 2 Section 2.3
Project Description	3.1	The information about the project provided in Chapter 3 is true and correct.	Chapter 3
Impact Assessment	4.1	MSS is fully aware of the impact assessed in the Chapter (5) and agree to implement the mitigation measures proposed for each impact.	Chapter 5
Risk Assessment	5.1	MSS is fully aware of the risks associated with occupational hazard, natural hazard and emergency situations assessed in the Chapter (6) and agree to implement the mitigation measures.	Chapter 6
Public Consultation and Public Disclosure	6.1	MSS will conduct the public consultation meeting as per the tentative plan in Section 7.4 when the restriction (notification1/2020) for social gathering is officially released by the government.	Chapter 7 Section 7.4
Air Quality	7.1	MSS will ensure the performance of air emission control devices such as bag houses, bag filter and wet scrubber and will carry out the regular maintenance.	Chapter 8
	7.2	MSS will ensure the performance of the wet scrubber and in order to do so, MSS will follow the measures recommended in the SOP of wet scrubber operation.	Chapter 8 Annex 5
	7.3	MSS will avoid opening the furnace door especially at the beginning of the furnace operation as much as technically possible in order to avoid dispersion of black smoke around the workplace.	Chapter 8

Field	No.	Commitments	Reference Chapter in IEE
	7.4	MSS will monitor the emission air quality, workplace air quality and opacity of smoke as recommended in the EMoP.	Chapter 8 Section 8.6
Solid Waste	8.1	MSS will ensure the disposal of hazardous waste at Nat San Mine, Kyaikmayaw Township as per the regulations and guidance of concerned departments such as Mining Department and the Environmental Conservation Department.	Chapter 8
	8.2	MSS will conduct the management and mitigation measures as per the Solid Waste Management Plan.	Annex 9 A
	8.3	MSS will not directly dispose the hazardous waste slag at any land without any liner layer.	Chapter 8
	8.4	MSS will regularly monitor the status of solid waste management as recommended in EMoP and the Solid Waste Management Plan.	Chapter 8 Annex 9 A
Water Quality	9.1	MSS will not discharge any effluent generated from the wet scrubber operation to the environment.	Chapter 8
	9.2	MSS will always seek the ways to reduce the amount of pollutants which are higher than the NEQG guideline values.	Chapter 8
	9.3	MSS will not use any ground water for the operation of the factory.	Chapter 8
	9.4	MSS will regularly monitor the effluent quality as per the EMoP.	Chapter 8
Odor	10.1	MSS will ensure the performance of bag filters and the wet scrubber, not to emit bad odor to the surrounding area.	Chapter 8
	10.2	MSS will conduct odor patrol check regularly and whenever the complaint about the bad odor is received.	Chapter 8
Occupational Health and Safety	11.1	MSS will provide necessary PPE (masks, respirators, heat resistant gloves, chemical resistant gloves, etc.) to all workers according to their responsible working conditions.	Chapter 8
	11.2	MSS will mount warning signs to wear masks, to remind noise exposure and chemical hazards at respective locations.	Chapter 8
	11.3	MSS will provide workers with sufficient ventilation, drinking water, electrolytes to prevent dehydration and adequate breaks from hot working environments.	Chapter 8
	11.4	MSS will regularly carry out housekeeping activities and maintenance of furnace, equipment and machineries.	Chapter 8
	11.5	MSS will conduct recommended measures from Occupational Health and Safety Plan.	Chapter 8 Annex – 9B
Emergency Preparedness	12.1	MSS will provide sufficient quantities of fire extinguishers and carry out regular inspection.	Chapter 8
	12.2	MSS will establish fire alarm system (horns), set assembly points, organize emergency safety team and conduct fire drills as per Emergency Response Plan.	Chapter 8 Annex – 9 C
Environmental Management Plan and Sub -Plans	13.1	MSS will comply and implement mitigation measures described in Environmental Management Plan and other sub-plans (SOP of wet scrubber, Solid Waste Management Plan, Emergency Response Plan, Occupational Health and Safety Plan, Grievance Redress Mechanism).	Chapter 8 Annex – 5 Annex – 9 A Annex – 9 B Annex – 9 C Annex – 9 D
EMP Budget	14.1	MSS will allocate the separated budget for the implementation of EMP and associated sub-plans.	Chapter 8 Section 8.8
Environmental Monitoring Plan	15.1	MSS will carry out monitoring actions as proposed in the Environmental Monitoring Plan (EMoP).	Chapter 8 Section 8.6

Field	No.	Commitments	Reference Chapter in IEE
Reporting Timeline	16.1	MSS will submit the Environmental Monitoring Report to ECD (Mon State) in every six months (bi-annually).	Chapter 8 Section 8.6
Complaints Mechanism	17.1	MSS will establish the Grievance Redress Mechanism (GRM) and follow the recommended procedures to solve the complaints from community and the workers.	Annex – 9 D
Decommission	18.1	The detail environmental management plan for decommissioning phase including but not limited to the decommissioning schedule, impact assessment, proposed mitigation measures, monitoring activities, estimated budget, etc. will be submitted to ECD three years prior to the decommission of the project.	Chapter 8 Section 8.8

9.3 Conclusions

Possible impacts by the project (MSS) were evaluated based on the operation status of antimony ingot manufacturing (antimony smelting and refinery) such as manufacturing process, installed facilities, working environment, occupational health and safety measures, surrounding environment and etc. Basically, MSS has installed the required environmental control facilities but the specific operational procedures, systematic recording system, monitoring activities are being lack.

This IEE report was prepared with fully considerations of mitigation measures on the possible/potential impacts. In addition, the regular monitoring plans including investigations and recording from various aspects of environmental, social, health conditions are proposed to be implemented. Based on this IEE report, MSS ensure to fully implement the mitigation measures and monitoring plan described in Chapter (8). Then, during the operation phase, Myanmar Shing Shing Metal Company Limited will prepare a regular monitoring report in accordance with content of monitoring report described in chapter 8 including monitoring activities and submit it to Environmental Conservation Department in Mon State. If necessary, either the ECD (Mon) will be requested for inspections by the Project Proponent or the ECD (Mon), itself will inspect the factory at any time as required.

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ANNEX 1 - PROFESSIONAL RESUMES OF ENVO STUDY TEAM

Dr. Ei Ei Mon

Environmental and Social Specialist

PhD. (Environmental Science and Infrastructure Engineering), Saitama University, 2013
M.E., (Civil and Environmental Engineering), Saitama University, Japan, 2009
B.E., (Civil Engineering), Yangon Technological University, Myanmar, 2004

*Registered No. 00229, Transitional Consultant at Environmental Conservation Department

Dr. Ei Ei Mon is a senior environmental and social specialist with a demonstrable history of working in civil engineering, environmental related works in infrastructure industries and industrial zone management regarding to the environmental management issues in Thilawa SEZ. She has experience in collaboration mainly with Ministry of Natural Resources and Environmental Conservation (MONREC) for Capacity Development, Technical Support and Trainings and with Different Governing Authorities/Ministries in Myanmar. She is skilled in environmental compliance, environmental assessment, technical review of environmental reports as well as in team management, leading and co-operation.

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Language: English, Myanmar, Japanese

Professional Trainings

- The Open Learning Campus Certificate, Course for Security Responsiveness, World Bank, 2019
- The Open Learning Campus Certificate, Course for Introduction to the World Bank Environmental and Social Framework, 2019
- IAIA Certificate of Participation, IAIA Special Symposium, "Using Impact Assessment to Achieve the SDGs in Asia", Malaysia, 2018
- Environmental and Social Framework of World Bank, 2018
- Training Workshop on Management Processes and Procedures in Nippon Koei Co., Ltd (2017)
- Seminar for Developing Guidelines for Public Participation in Environmental Impact (2016)
- Workshop on Environmentally Sound Management of Hazardous Waste (2016)
- Kick-off Meeting of Hazardous Waste Management Project (2016)
- Seminar for Consultant Registration Scheme (Draft Version) and Administrative Instruction of EIA Procedures (draft version) by ECD, MOECAF (2015)
- Symposium on Environment in Sustainable Development of Myanmar (2015)
- 3rd Seminar on Maritime Disaster Risk Management (2014)
- NK-GIAS Training (2014,2015)
- Seminar on FIDIC Conditions of Contract, Conducted by Nippon Koei Co., Ltd (2014)
- PhD course of Merging, Measurement and Modelling in Soil Physics at Aarhus University, Denmark (2011)
- Engineering Training Course (2006)

Contribution

- **American Geophysical Union (AFU) Fall Meeting**: Poster Presentations in 2008 and 2011, San Francisco, CA, USA
- **JSCE International Conference**: Oral Presentation in 2008, Tokyo, Japan
- **Japanese Geoscience Union (JPGU) Annual International Conferences**; Oral Presentations in 2009, 2011, 2012, 2013, Tokyo, Japan
- **Annual International Conference on** Geological and Earth Sciences: Oral Presentation in 2012, Singapore
- **Annual International Conference on** South East Asian Geotechnical Engineering: Oral Presentation in 2013, Singapore
- **Teaching Assistant** in Environmental Soil Science Class and Soil Physics Class (2011,2012)
- **Trainer** for Advanced Environmental Engineering and Management Course at Myanmar Engineering Society (2017)
- **Trainer** for Advanced Environmental Engineering and Management Course at Myanmar Engineering Society (2018)
- **IAIA Special Symposium**: Using Impact Assessment to achieve SDGs in Asia: Oral Presentation: The Current Status of Impact Assessment Development in Myanmar, Kuching, Malaysia (2018)

Professional Experience Record

(More than 7 Years' Experience in Environmental and Social Related Field)

Project:	Preparation of EIA Project Proposal of Aeon Mall Development Project, *June 2020*	**Expertise Tag**
Client	Private Company	• Infrastructure Development Sector • EIA Project Proposal • Potential Impact Identification
Position:	Team Leader/ Environmental Specialist	
Activities Performed:	Preparation and overall technical management of the EIA project proposal. The EIA project proposal includes project description, likely affected area, feasibillity studies, resources utilization, potential impact identification, public consultation and proposal for screening.	

Project:	National Community Driven Development Project, *May 2020 – June 2020*	**Expertise Tag**
Client	World Bank	• ESMF preparation • Community Development Sector • ES instruments
Position:	National Environmental Consultant	
Activities Performed:	As a national consultant, the addendum of ESMF for emergency response component of NCDDP is prepared discussion with counterpart departments and worked together with WB Safeguard team.	

Project:	Preparation of EIA plan for YOSB project , *March 2020*	**Expertise Tag**
Client	Private Company	• Legal analyiss • Impact Identificaiton • Plans for Preparation of EIA
Position:	Environmental Consultant	
Activities Performed:	Preparation of EIA plan to submit to MIC during application process. The EIA plan includes the project description, legal background, plan for preparation of EIA and brief impact identification, budget estimation for prepartion of EIA plan.	

Project:	Preparation of IEE report for Antimony Processing Project, *March 2020 – July 2020*	**Expertise Tag**
Client	Private Company	• Metal Refinery Industry Sector • Technical Supervision • Review on Assessments ad Sub-plans
Position:	Team Leader/ Environmental and Social Specialist	
Activities Performed:	As a team leader, responsible for overall technical management, quality control, review on environment and social Impact assessments, review on environment, social, health & safety management plans, technical supervision, consulting with project proponent and discussion with ECD for EMP implementation, public consultation, etc.	

Project:	Forest Restoration, Development and Investment Project, *Feb 2020 – June 2020*	**Expertise Tag**
Client	World Bank	• ESMF preparation • Forest Sector • ES instruments
Position:	National Environmental Consultant	
Activities Performed:	As a national consultant, the ESMF is prepared from the aspects of environmental concerns for project implementation stages. The essential environmental instruments such as solid waste management plan, protected area management plan, cultural heritage management plan, guide for environmental management plan are prepared for the respective governmental department.	

Project:	Preparation of Review Report on Investment Opportunities for Power Sectors in Myanmar , *Oct 2019 – Dec 2019*	**Expertise Tag**
Client	Private Company	• Legal Analysis • Power Sector • Renewable Energy
Position:	Team Leader	
Activities Performed:	Responsible for making desktop study about the investment opportunities for power sectors in Myanmar specifically for renewable energy sources, data mining, identifying necessities to be implemented in accordance with national laws and regulations and finding issues and challenges for the investor.	

Project:	Myanmar National Food and Agriculture Systems Project, *Oct 2019 – March 2020*	**Expertise Tag**
Client	World Bank	• ESMF Preparation • Food and Agriculture • EMP
Position:	National Environmental Consultant	
Activities Performed:	As a national consultant, the ESMF is preparing from the aspects of environmental concerns for project implementation stages. The example EMP for specific projects are preapred. The cooperation with counterpart	

	government departments and international consultants from world bank is also performed to reach clear goals of the project.	

		Expertise Tag
Project:	Myanmar Peaceful and Prosperous Communities Project, *June 2019 – June 2020*	
Client	World Bank	• ESMF Prepartion • EMP Preparation • Stakeholder Engagement • States and Regions Development • Conflict Areas
Position:	National Environmental Consultant	
Activities Performed:	As a national consultant, the ESMF is preparing from the aspects of environmental concerns for project implementation stages. The examples EMP for different types of projects are prepared. The cooperation with counterpart government departments and international consultants from world bank is also performed to reach clear goals of the project. The participation in Stakeholder meetings for the disclosure of draft ESMF in States is also included.	

		Expertise Tag
Project:	Developing of Environmental and Social Good Practices for Rubber Processing Industry in Myanmar, *Nov 2018 – Mar 2019*	
Client	CARE International (Myanmar) (International Non-Governmental Organization)	• Rubber Sector • Team Management • Environmental and social good practices
Position:	Environmental Management Expert (Team Leader)	
Activities Performed:	Responsible for overall supervision on the project in regard to time management, budget management, team management, quality of work, coordination with different stakeholders including rubber planters, factories owners, governmental organization, relevant association, preparation of environmental and social good practices, etc.	

		Expertise Tag
Project:	Environmental Safeguard Institutional Strengthening: Environmental Impact Assessment Review Consultant (4815-001), *Nov 2018 – Dec 2018*	
Client:	Asian Development Bank (ADB)	• EIA Review • Collaboration with ECD • Environmental Safeguard
Position:	Individusl EIA Review Consultant	
Activities Performed:	Responsible for communication, consultation and working together with ECD officers and staffs and fulfill the other tasks requested by ECD, providing comments and requests for additional information needed to complete the EIA and IEE report review, preparing draft letters and other administrative documents as needed to support the EIA Review Process, reporting the status of work progress and completion status of each assignment to ADB, contribute the experience of EIA review to respective ECD officers.	

		Expertise Tag
Project:	Technical Support for reviewing the EIA reports of Cement Production Projects (Cement Plant, Limestone Quarry) *Nov 2018 – Mar 2019*	
Client	MONERC/ECD	• Cement Production Projects • EIA Review Quality Control
Position	Team Leader/ EIA Review Consultant	
Activities Performed:	Management on the assignment of experts in timely manner, supervision and Review Quality Control on the results of review on EIA reports, communication and consultation with the officers from Environmental Conservation Department under MONERC, attending the Review Team Meeting at ECD, facilitate the review process flow in various ways and joining site investigation.	

		Expertise Tag
Project:	Project for Environmental Management Plan (EMP) Report on Operation of Recycle Paper Mill, *Jun 2018 – Apr 2019*	
Client	Private Company	• Pulp and Paper Industry • Supervision of EMP • Environmental Monitoring Plan
Position	Team Leader/ Environmental Management Expert	
Activities Performed:	Responsible for supervision on the preparation of EMP for the recycle paper mill in order to meet with the requirements of national EIA procedures and guidelines and consultation to improve the environmental controls such as effluent water quality, emitted air quality and occupational health and safety measures after the preparation of EMP. Conducted the public consultation meeting for disclosure of EMP of the factory.	

		Expertise Tag
Project:	Technical Support for reviewing the EIA Reports of Cement Production Projects (Cement Plant, Jetty, Coal Fired Power Plant, Limestone Quarry), *Jan 2018 – Present*	
Client	MONERC/ ECD	• Cement Plant • Coal Fired Power Plant • Jetty • Limestone Quarry • Review Process Flow
Position	Team Leader/ EiA Review Consultant	
Activities Performed:	Management on the assignment of experts in timely manner, supervision and Review Quality Control on the results of review on EIA reports, communication and consultation with the officers from Environmental Conservation Department under MONERC, attending the Review Team Meeting at ECD, facilitate the review process flow in various ways and joining site investigation.	

project:	IGES-EIA Review Project, *Oct 2017 – Jan 2018*	**Expertise Tag**
Client	Institute for Global Environmental Strategies (IGES)	• EIA System in Myanmar • EIA Review Study Report • Good Practices in EIA
Position	Environmental and Social Consultant	
Activities Performed:	Co-operation with the team of IGES and Ministry of Japan for the interview to the different EIA related parties in Myanmar, updating the status of EIA system in Myanmar, preparation of the study report in regards of Good Practice and well-known EIA reports in Myanmar.	

Project:	The Study for Improvement of Power Supply in Thilawa, *Aug 2017 – Feb 2018*	**Expertise Tag**
Client	Japan International Cooperation Agency (JICA)	• Power Generation System • Environmental and Social Consideration • Final Preparatory Study Report
Position	Environmental and Social Expert (Pro-A: International)	
Activities Performed:	Evaluation of environmental and social consideration on the proposed options for repowering project; proposal on the best available option from the aspect of environmental and social; arranging and presentation in a stakeholder meeting for the preparatory study; preparation of the chapter of environmental and social consideration in the final preparatory study report.	

Project:	Project for Capacity Development in Basic Water Environmental Management in Myanmar, *June 2017 – May 2018*	**Expertise Tag**
Client	Japan International Cooperation Agency (JICA)	• Water Quality Survey Report Training • Technical Workshops • Manuals
Position	Environmental Expert	
Activities Performed:	Providing the Water Quality Survey Report Writing Training to the officers from ECD (Yangon, Mandalay, Naypyitaw), YCDC, and MCDC; Arranging the technical workshop; preparing the main parts of manual.	

Project:	Environmental Safeguard Institutional Strengthening, *May 2017 – April 2018*	**Expertise Tag**
Client	Asian Development Bank (ADB)	• On Job Training for EIA reports review • Collaboration with ECD
Position	Team Leader/ EIA Review Consultant	
Activities Performed:	Management on the assignment of experts in timely manner, supervision and Review Quality Control on the results of review on EIA reports, communication, consultation and working together with ECD officers and staffs and fulfill the other tasks requested by ECD, providing comments and requests for additional information needed to complete the EIA and IEE report review, preparing draft letters and other administrative documents as needed to support the EIA Review Process, reporting the status of work progress and completion status of each assignment to ADB, facilitate the review process flow in various ways.	

Project:	EMP Preparation for Food and Beverage Industry (Tea/Cereal/Coffee Mix Products), *Mar 2017 – June 2017*	**Expertise Tag**
Client	Private Company	• Tea/Cereal/ Coffee mix industry • EMP Preparation
Position	Team Leader/ Environmental Expert	
Activities Performed:	Responsible for supervision on the preparation of EMP for Tea/Cereal/Coffee mix powder production factory in order to meet with the requirements of national EIA procedures and guidelines and consultation to improve the environmental controls such as effluent water quality, emitted air quality and occupational health and safety measures after the preparation of EMP.	

Project:	Thilawa Special Economic Zone Management Committe's Capacity Development, *Oct 2014 – Present*	**Expertise Tag**
Client	Japan International Cooperation Agency (JICA)	• Capacity Development • Approval and License Procedure (Environment) • Environmental Conservation and Prevention Plans
Position	National Consultant, Environment	
Activities Performed:	Responsible for research and review of related rules, regulations and notifications (environment, investment), assisting international environmental specialists in establishing workflows of approval and license procedure (Environment), preparation of primary initial environmental examination (draft version) of proposed industries in Thilawa SEZ, technical support to OSSC members who are representatives from Environmental Conservation Department (ECD) of MONREC for appraisal of Environmental Conservation and Prevention Plans (ECPPs) submitted by investors in Thilawa SEZ, reviewing ECPP applications/ IEE and EIA reports, conducting inspection of construction sites and factories in Thilawa SEZ to manage environmental protection activities, and developing environmental related procedures (i.e., inspection procedure, report submission procedure, checklist formats for appraisal process, etc.)	

Project:	Project for Environmental Impact Assessment (EIA) Study on Construction and Operation of Cement Manafacturing Factory, *Jan 2017 – June 2017*	**Expertise Tag**
Client	Myanmar/ Vietnam Private Company	• EIA of cement manufacturing factory • Pollution Control • Risk Assessment
Position	Pollution Control Expert	
Activities Performed:	Responsible for site survey to similar factory in Vietnam, supervision on the preparation of environmental impact assessments on potential pollution issues (e.g., water pollution, soil contamination, noise and vibration, etc.), risk assessment, environmental management plan including mitigation measures and monitoring plan, as well as coordination and organization of public consultation activities.	

Project:	Project for Environmental and Social Consideration Study for Kyaikkasan Development Project: Yangon Park City, *Aug 2015 – Oct 2015*	**Expertise Tag**
Client	Private Company	• ESIA Study • Environmental and Social Consideration Report
Position	Deputy/Acting Team Leader	
Activities Performed:	Responsible for overall management of ESIA study, including environmental impact assessments on potential pollution issues (e.g., water pollution, soil contamination, noise and vibration, etc.), risk assessment, environmental management plan including mitigation measures and monitoring plan, as well a coordination and organization of public consultation activities.	

Project:	Project for Initial Environmental Examination (IEE) Report on Construction and Operation of a Noodle Making Factory, *Jan 2015 – June 2015*	**Expertise Tag**
Client	Private Company	• Noodle Making Factory • IEE Prepartion • Pollution Control
Position	Pollution Control Expert	
Activities Performed:	Responsible for the preparation of environmental impact assessments on potential pollution issues (e.g., water pollution, soil contamination, noise and vibration, etc.), risk assessment, environmental management plan including mitigation measures and monitoring plan, as well a coordination and organization of public consultation activities.	

Project:	Environmental Impact Assessment (EIA) for Construction of Solid Waste Management Facilities, *Aug 2014 – Oct 2014*	**Expertise Tag**
Client	Private Company	• Solid Waste Management • Baseline environmental survey • Stakeholder Holdings
Position	Project Assistant	
Activities Performed:	EIA preparation, noise and vibration measurement activities, arrangement of Stakeholder Meetings (SHM), and translating summary of EIA report and SHM documents. Carried out baseline environmental survey including environmental monitoring (air, water, noise and vibration), organized Stakeholders Meetings during screening and EIA drafting stages, assisted for the preparation of environmental impact assessment report including environmental management and monitoring plan and translating project reports/ documents from English to Myanmar.	

Project:	Environmental Consideration of Electric Power Sector, *Apr 2014 – Oct 2014*	**Expertise Tag**
Client	Japan International Cooperation Agency (JICA)	• Electric Power Sector • Data Collection • Meeting Arrangement
Position	Technical Facilitator (Environment)/ Project Assistant	
Activities Performed:	Responsible for collecting of the existing environmental information, arrangement of meetings with officials, conducting workshops for officers of power plants and stakeholders meeting, facilitating in meetings with officials from ministries and workshops, preparation of meeting and workshop records, communicating with field surveys, translating of all documents (i.e., reports, collected information/data, materials for workshops and stakeholder meeting) prepared by environmental experts from English into Myanmar and managing the logistic matters of the expert team.	

I certify that this Resume correctly describes my qualifications and experiences and understand that any willful misstatement described herein may lead to my disqualification or dismissal, if engaged.

Mr. Hein Zaw Htet

Environmental and Social Expert

M.E. (Environmental Science and Civil Engineering), Saitama University, Japan, 2015
B.E. (Civil Engineering), Yangon Technological University, Myanmar, 2004

Mr. Hein Zaw Htet is an environmental consultant who has diverse knowledge in Environmental Science and Civil Engineering Field, as he had studied the concrete technology in Saitama University. Since 2015, he established H.E.S Construction & Consultant Co., Ltd to provide construction and environmental management services. He has experience of EMP Preparation for concrete manufacturing industry and so on.

Date of Birth: 24-10-1980
Citizenship: Myanmar

Personal Contact:
hzawt24@gmail.com
+951522490, +959262432525

Language: English, Japanese, Myanmar

Professional Trainings

- Workshop on Environmentally Sound Management of Hazardous Waste (2016)
- Seminar for Developing Guidelines for Public Participation in Environmental Impact (2016)
- Workshop on Introduction Japanese Renewable Energy Technologies for Sustainable Development (2015)
- Seminar on Challenges and Solutions Improving Water Supply (2015)
- Transport Technology Seminar between Myanmar and Japan Technological Cooperation on Transport (2015)
- Attending Construction Management Course in Saitama University (2013)
- Participated in Engineering Training Course (2/2006) conducted by Olympic Construction and Engineering Company Limited in Yangon, Myanmar (2006)

Contribution

- Participated in JSCE International Conferences (2013, 2014, 2015)

Working Profile

April 2015 – Present
- Working as Freelance Consultant in Civil and Environmental Projects
- Established H.E.S Construction & Consultant Co., Ltd.

October 2011 – November 2012
- Own Business in Construction Management Consultation

June 2004 – January 2010
- Site Engineer, Shwe Taung Development Co., Ltd (Myanmar)
- Project Engineer, M.O Group Construction Co., Ltd (Myanmar)

Professional Experience Record

With almost 4 years' Experience in Environmental Related Fields

		Expertise Tag
Project:	Preparation of IEE report for Antimony Processing Project, *March 2020 – July 2020*	
Client	Private Company	• Metal Refinery Industry Sector
Position:	Environmental and Social Expert	
Activities Performed:	Overall Project Management, Site Inspection and Investigation, Environmental Monitoring, Facilitation of Public Consultation, etc.	• Project Management • Site Investigation

Project:	Preparation of Environmental Management Plan (EMP) Report for the Operation of Recycle Paper Mill, *Jun 2018 – Apr 2019*	**Expertise Tag**
Client	Private Company	• EMP Preparation • Environment and Social • Pulp and Paper Industry
Position:	Environmental and Social Expert	
Activities Performed:	Responsible for the overall managment of the project, measuring environmental quality such as air, water and noise, study of laws, rules & policies needs and requirements of monitoring, etc.	

Project:	Country Profile: Enabaling Activities to Facilitate Early Action on the Stockholm Convention on POPs in Myanmar, *June 2018 – August 2019*	**Expertise Tag**
Client	MONREC – Environmental Conservation Department (ECD)	• Country Profile • Environment and Social
Position:	National Expert for POPs Information and Awareness	
Activities Performed:	Responsible for the study of baseline information of Myanmar such as: Geography, Demography, Political Profile, Economic Profile, Environmental Overview, Current Environmental Quality in the Country and Health Overview and prepare the study report of the country profile as a part of the main report	

Project:	EMP Prepartion for Concrete Manufacturing Project, *Sep 2017 – Jan 2018*	**Expertise Tag**
Client	Private Company	• EMP Preparation • Environment and Social • Concrete Industry
Position:	Environmental and Social Consultant	
Activities Performed:	Responsible for overall management of EMP Report Preparation, Environmental Impact Consideration, Social and Health Impacts Consideration, Mitigation Measures and Monitoring Program.	

Project:	POPs Information and Awareness Inventory: Enabaling Activities to Facilitate Early Action on the Stockholm Convention on POPs in Myanmar *Oct 2016 – Nov 2017*	**Expertise Tag**
Client	MONREC – Environmental Conservation Department (ECD)	• Legal Analysis • Persistant Organic Pollutants • Public Awareness
Position:	National Expert for POPs Information and Awareness	
Activities Performed:	Responsible for the study of current level of information, awareness and education among Target Groups, Existing Systems to Communicate Such Information to the Various Groups and prepare the inventory report for the Environmental Conservation Department	

I certify that this Resume correctly describes my qualifications and experiences and understand that any willful misstatement described herein may lead to my disqualification or dismissal, if engaged.

Mr. Htet Wai Yan Aung

Deputy Team Leader / Environmental and Social Consultant

B.E (Port & Harbour Engineering), Myanmar Maritime University, Myanmar, 2015
Diploma in Geographic Information System, Yangon University, Myanmar, 2017

Experienced environmental and social consultant with Port and Harbor engineering and geospatial background, involved in environmental and social related projects funded by ADB, JICA and private sectors regarding social survey, relocation, civic engagement and environmental monitoring works since 2015 after changing career from civil engineer life. Possess comprehensive knowledge about EIA regulations, EIA review, social and environmental assessments, risk assessments, GIS and remote sensing, and business management.

Date of Birth: 14-3-1992
Citizenship: Myanmar

Personal Contact:
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+959 799357066

Language: English, Myanmar

Professional Trainings

- Microsoft Excel Specialist Course, 2016 (Myanmar)
- Basic Concepts and Application of Statistics Using SPSS Software and EpiData, 2017 (Myanmar)
- Advance Environmental Engineering and Management Course, (MES), 2018 (Myanmar)
- Principles of Environmental Impact Assessment Review, 2019 (Vietnam)
- Single Subject ICM Diploma in Business Management and Administration, 2019 (Myanmar)
- Certificate of Completion of Regional Engineer E-learning Program by Nippon Koei, 2019

Contribution

- GIS Diploma Course: Poster and Oral Presentation at Yangon University, Myanmar (2018) (Achieved 2nd Best Presentation Award and Best Presenter Award)
- Nippon Koei (NK) Group Technical Forum: Poster and Oral Presentation at NK Head Quarter, Tokyo, Japan (2018)
- Giving training at EIA Review Experience Workshop to officers from Environmental Conservation Department (ECD), (2018)

Professional Experience Record

(More than 5 Years' Experience in Environmental and Social Related Field)

		Expertise Tag
Project:	Preparation of EIA Project Proposal of Aeon Mall Development Project, *June 2020*	• Infrastructure Development Sector • EIA Project Proposal • Potential Impact Identifcation
Client	Private Company	
Position:	Deputy Team Leader / Senior Environmental and Social Consultant	
Activities Performed:	Responsible for preparation of EIA project proposal and identifying likely affected area and potential impacts. The EIA project proposal includes project description, likely affected area, feasibillity studies, resources utilization, potential impact identification, public consultation and proposal for screening.	

		Expertise Tag
Project:	Preparation of EIA plan for YOSB Project , *March 2020*	• Legal analyis • Impact Identificaiton • Plans for preparation of EIA
Client	Private Company	
Position:	Environmental Consultant	
Activities Performed:	Preparation of EIA plan to submit to MIC during application process. The EIA plan includes the project description, legal background, plan for preparation of EIA and brief impact identification, budget estimation for prepartion of EIA plan.	

		Expertise Tag
Project:	Preparation of IEE report for Antimony Processing Project , *March 2020- July 2020*	• Metal Refinery Industry Sector • Law Assessment • Impact and Risk Assessment
Client	Private Company	
Position:	Deputy Team Leader/ Senior Environmental Consultant	
Activities Performed:	As a deputy team leader, responsible for law assessment, Environmental Impact Evaluation and Assessment, Risk Evaluation and Assessment, Environmental Monitoring, Environmental Management Plans, Public Consultation, etc.	

		Expertise Tag
Project:	Technical Support for reviewing the EIA reports of Cement Production Projects (Cement Plant, Limestone Quarry), *Nov 2018 – Present (Intermittent Assignment)*	• EIA Review • Cement Industry • Limestone Industry • Legal Analysis • Environmental Compliance
Client	MONREC / Environmental Conservation Department (ECD)	
Position:	EIA Review Consultant (Environmental, Social and Health and Safety Review)	
Activities Performed:	Responsible for reviewing two EIA reports especially from environmental, social and health and safety aspects, communication and consultation with officers from ECD, attending Review Team Meeting at ECD, joining site investigation, issuing specific conditions to be considered in the approval of project and preparing technical review report.	

		Expertise Tag
Project:	Technical Support for reviewing EIA reports of Cement Production Project and its facilities (Cement Plant, Power Plant, Jetty and Limestone Extraction), *Jan 2018 – Present (Intermittent Assignment)*	• EIA Review • Cement Industry • Coal Fired Power Plant • Limestone Extraction • Jetty Operation
Client	MONREC / Environmental Conservation Department (ECD)	
Position:	EIA/IEE Review Consultant (Environmental, Social and Health and Safety Review)	
Activities Performed:	Responsible for reviewing works of IEE and EIA reports for four projects: Cement Production, Limestone Extraction, Power Plant and Jetty projects especially from environmental, social and health and safety aspects, communication and consultation with officers from ECD, attending Review Team Meeting at ECD, joining site investigation, issuing specific conditions to be considered in the approval of project and preparing technical review report.	

		Expertise Tag
Project:	Preparation of Review Report on Investment Opportunities for Power Sectors in Myanmar , *Oct 2019 – Dec 2019*	• Legal Analysis • Power Sector • Renewable Energy
Client	Private Company	
Position:	Environmental Consultant	
Activities Performed:	Responsible for making desktop study about the investment opportunities for power sectors in Myanmar specifically for renewable energy sources, data mining, identifying necessities to be implemented in accordance with national laws and regulations and finding issues and challenges for the investor.	

		Expertise Tag
Project:	Preparation of Environmental Management Plan (EMP) for Existing Beer Production Factory , *June 2018 – Jan 2019*	• Brewery Production • Environmental and Social Assessment • Environmental Monitoring • Overall Project Management • Stakeholder Engagement
Client:	Private Company	
Position:	Team Leader / Environmental and Social Expert	
Activities Performed:	Responsible for the overall management and supervision on the preparation of EMP report and related works such as measuring air quality, sampling of wastewater discharged, measuring noise level, site investigation of environmental management activities implemented by the factory. Giving consultation to client regarding to environmental and social related issues, leading public consultation meeting, establishing grievance mechanism and dealing with relevant different stakeholders are the additional duties of team leader.	

		Expertise Tag
Project:	Developing Environmental and Social Good Practices for Rubber Processing Industry in Myanmar, *Nov 2018 – Mar 2019*	• Rubber Manufacturing • Rubber Plantation • Civic Engagement
Client	CARE International (Myanmar) (International Non-Governmental Organization)	
Position	Environmental and Social Expert	
Activities Performed:	Responsible for the coordination with different stakeholders including rubber planters, factories owners, governmental organization, relevant association, conducting stakeholder meetings in each State and Region; performing key informant interviews to the relevant governmental organizations, researching environmental and social related rules and regulations as well as guidance and good practices from rubber growing countries to be reflected in Good Practice Report.	

		Expertise Tag
Project:	Preparation of Environmental Management Plan (EMP) Report for the Operation of Recycle Paper Mill, *Jun 2018 – Apr 2019*	• Pulp and Paper Manufacturing • Indoor Air and Water Quality Monitoring • Risk Assessment
Client	Private Company	
Position	Risk Management Expert	
Activities Performed:	Responsible for the preparation of EMP for recycle paper mill in order to meet with the requirements of national EIA procedures and guidelines and consultation to improve the environmental controls for air emissions, effluent water quality, occupational risks, health and safety measures and emergency risks in workplace based on the findings from	

	environmental monitoring works. Involved as a presenter in public consultation meeting and shared about risk potentials at workplace, assessments and proposed control measures.	• Environmental & Health and Safety Management

Project:	Preparation of Scoping Report for Galvanizing and Painting of Metal Steel Plates Factory, *Aug 2018 – Dec 2018*	**Expertise Tag**
Client	Private Company	• EIA Assessment Methodology • Environmental Management Strategy
Position	Pollution Control Expert	
Activities Performed:	Responsible for developing impact assessment methodology, impact identifications for environmental, social and health and safety related issues, proposing mitigation measures and monitoring plans.	

Project:	ADB TA-8786 MYA: Environmental Safeguard Institutional Strengthening, *May 2017 – April 2018*	**Expertise Tag**
Client	Asia Development Bank (ADB)	• Comprehensive EIA Review in Various Development Projects • Capacity Building
Position	EMP/IEE/EIA Review Consultant	
Activities Performed:	Responsible for reviewing work of EIA/ IEE/ EMP reports of development projects (More than 20 Projects) in various different sectors in Myanmar assigned by ECD, developing tools to be used for reviewing, providing comments by considering from environmental, social, health and safety aspects, preparation of review reports and sharing technical expertise such as using international guidelines, references and GIS knowledges to the government officers.	

Project:	Preparation of Environmental Management Plan (EMP) of Myanmar GR Factory, *March 2017 – May 2017*	**Expertise Tag**
Client	Private Company	• Civic Engagement • Environmental & Health and Safety Management
Position	Occupational Health and Safety Expert/ Project Coordinator	
Activities Performed:	Responsible for the preparation of EMP report including sampling wastewater generated from the factory, measuring noise level, preparing record forms for the health and safety, waste management and co-operate social responsibility events, making assessment and assisting team leader for required tasks.	

Project:	Kyaik Ka San Serviced Apartment Traffic Impact Survey, *March 2017 – April 2017*	**Expertise Tag**
Client	Private Developer	• Traffic Surveying • Data Analysis • Traffic Impact Assessment • Project Coordiation
Position	Project Coordinator / Supervisor	
Activities Performed:	Responsible for planning survey points, surveying methods and required survey format preparations to conduct the traffic survey and managing surveyors. Also involved as a surveyor, compiling surveyed data, making analysis and assisting in preparation of traffic impact assessment report.	

Project:	Water Quality Monitoring for Development of Industrial Area in Thilawa SEZ Zone (A), *February 2017 – March 2017*	**Expertise Tag**
Client	Private Company	• Water Quality Monitoring
Position	Environmental Monitoring Assistant	
Activities Performed:	Responsible for the monitoring of wastewater discharged from the Sewage Treatment Plant (STP) inside the Thilawa Special Economic Zone (TSEZ) Zone A.	

Project:	The Project for Updating the Strategic Urban Development Plan of the Greater Yangon in the Republic of the Union of Myanmar (SUDP), *August 2016 – January 2017*	**Expertise Tag**
Client	Japan International Cooperation Agency (JICA)	• Urban Environmental Management • Project Cycle Management • Civic Engagement • Project Coordiation
Position	Financial and Institutional Development Assistant	
Activities Performed:	Responsible for providing assistance to Institutional Development Expert from JICA including interviews with heads of sections, divisions and departments under YCDC to understand the capacity requirements of staffs. Involved in interviews with responsible persons from respective Key Ministries to get the updated information regarding to urban planning matter. Conducting "Project Cycle Management Workshop" designed for senior officials and heads of divisions under Urban Planning Division. Working with Financial Expert for the interviews with focal persons from financial sectors to get solutions for improving financial base of YCDC. Arrangement of meetings and interviews, translation of documents, laws, rules and regulations are additional tasks.	

		Expertise Tag
Project:	Infrastructure Development Project in Thilawa Area (Phase II) [Thilawa Access Road Project], *December 2015 – July 2016*	
Client	Nippon Koei Co., Ltd (JICA Funded)	• Environmental and Social Survey • Relocation • Stakeholder Engagement • Project Coordination
Position	Environmental and Social Assistant	
Activities Performed:	Responsible for environmental and social census survey of affected households including vendors (approximated 350 PAPs), surveying potentially affected religious structures, public related facilities (signboards, telephone booth, landscape, parks) and detailed survey of road side trees (nearly 2800 trees) along the existing access road between the Thanlyin Bridge and the northeast corner of Thilawa SEZ with a total length of about 8.7 km. Arranging stakeholder consultation meeting and cut-off dates, conducting face to face interview with affected households, implementing public consultation Meetings, analyzing social and tree survey results, preparation of required documents and updating RAP were performed as main tasks under this project.	

I certify that this Resume correctly describes my qualifications and experiences and understand that any willful misstatement described herein may lead to my disqualification or dismissal, if engaged.

Environmental Management Consulting Services Co., Ltd.

Ms. Win Thiri Lwin

Environmental Expert

B.E (Civil Engineering), Yangon Technological University, Myanmar, 2019

Win Thiri Lwin is enthusiastic and hard-working young professional who has the background of civil engineering. She has been contributing herself in both academic and professional career life, including assisting the environmental and social specialists in development projects, preparing Environmental Management Plan and preparing Review Reports for the Solar Power Investment sectors. She also has presented her research work in MEAA International Conference 2020. She has been working in the environmental field where she found her passionate career since the final year of her Bachelor degree. The last but not the least, she received her OKP scholarships award to IHE Delft in short course 2021.

Date of Birth: 15-6-1996
Citizenship: Myanmar

Personal Contact:
winthiri.envo@gmail.com
+95044011

Language: English, Myanmar

Membership in Professional Association:

- Affiliate member of "Myanmar Environmental Assessment Association", 2020

Professional Trainings

- "Introduction to the Environmental and Social Framework", World Bank, 2020 (Myanmar)

Contribution

- B.E Civil Engineering Course: Poster and Oral Presentation at Yangon Technological University, Myanmar (2019)
- International Conference on Science and Engineering: Poster Presentation at Yangon Technological University, Myanmar (2019)
- Environmental and Sustainable Development International Conference: Poster Presentation at Sule Square, Yangon, Myanmar (2020)
- Experience Sharing 2020: Speaker at Yangon Technological University, Civil Department, Myanmar, (2020)

Professional Experience Record

(Almost 2 Years' Experiences in Environmental and Social Related Field)

Supportive Role

Responsible for supporting to national environmental and social specialist who is working with international funding institutes. Particularly, responsible for continuously supporting to the preliminary reviewing monitoring reports for industries, preliminary reviewing of IEE reports for industries, desktop studies, legal analysis, translation, preparation of base data for presentations, administrative supports, field data collection, and drafting documents related to environmental studies in various sectors (infrastructure, agriculture, forest, rubber, etc.).

Professional Role

Project:	Preparation of IEE report for Antimony Processing Project *Mar 2020 – July 2020*	**Expertise Tag**
Client	Private Company	• Metal Refinery Industry Sector • Impact Assessemnt • Envrionmental Management
Position:	Environmental Expert	
Activities Performed:	Responsible for Project Related Studies, Engagement with Client and Relevant Ministries, Environmental Monitoring, Preliminary Impact Assessment, Preliminary Environmental Management Plans, Public Consultation, etc .	

Project:	Preparation of EIA Project Proposal of Aeon Mall Development Project *June 2020 – June 2020*	**Expertise Tag**
Client	Private Company	• Intrastructure Development Sector • Public Consultation
Position:	Environmental Expert	
Activities Performed:	Responsible for baelinestudy of project (by deskstop study and site visit), conducting baseline preliminary report preparation of the following chapters (public consultation, project description and etc.) and assisting to the senior experts for the necessary tasks	

		• Envrionmental Management

Project:	Preparation of Review Report on Investment Opportunities for Power Sectors in Myanmar , *Oct 2019 – Dec 2019*	**Expertise Tag**
Client	Private Company	• Legal Analysis • Power Sector • Investment
Position:	Environmental Expert	
Activities Performed:	Responsible for making desktop study about the investment opportunities for power sectors in Myanmar specifically for renewable energy sources, overall management of preparing draft report, researching baseline data, analysing data, managing, supervising and assigning juniors in searching and interpreting the baseline data in the report.	

Project:	Preparation of Environmental Management Plan (EMP) Report for the Operation of Recycle Paper Mill, *Jun 2018 – Nov 2018*	**Expertise Tag**
Client	Private Company	• Sampling • Pulp and Paper Manufacturing • Legal Analysis
Position	Junior Environmental Expert	
Activities Performed:	Responsible for the sampling of wastewater discharge from the factory, measuring noise level, preparing record forms for the health and safety, waste management and co-operate social responsibility sectors, making analysis, writing project description and assisting team leader for required tasks.	

Project:	Public Consultation Meeting & Public Disclosure of Environmental Management Plan for Paper Mill, *Feburary 2019 – April 2019*	**Expertise Tag**
Client	Private Company	• Pulp and Paper Manufacturing • Civic Engagement • Coordination
Position	Social Engagement Expert	
Activities Performed:	Responsible for the general engagement, revising "project overview" chapter in accordance with the comment from ECD, writing "PCM & PD" chapter in report, general documentations for the preparation of PCM & PD and assisting team leader and other team member for required tasks.	

I certify that this Resume correctly describes my qualifications and experiences and understand that any willful misstatement described herein may lead to my disqualification or dismissal, if engaged.

Ms. Ei Thinzar Myo

Junior Environmental Expert

B.E (Civil Engineering), Yangon Technological University, Myanmar, 2020

Ei Thinzar Myo is a fresh graduate from Yangon Technological University who is enthusiastic about environmental related issues. During her Under-Graduate Studies, she joined environmental related programs like UNICEF Social Innovation Weekend about Climate Change and Myanmar-Netherlands Water Challenge 2018. Her specialization for graduation thesis is about Wastewater Treatment. She joined EnvO on June 2019 as the youngest team member. She is also an Awardee of Honda Young Engineer and Scientist Program 2019. Currently, she is studying Post-Graduate Diploma in Environmental Studies at University of Yangon.

Date of Birth: 16-3-1997
Citizenship: Myanmar

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+959799920727

Language: English, Japanese, Myanmar

Professional Trainings

- Occupational Safety and Health (OSH) Training Program, 2015 (Myanmar)
- UNICEF Social Innovation Weekend for Communications about Climate Change, 2015 (Myanmar)
- Myanmar-Netherlands Water Challenge 2018 (Myanmar)
- The Workshop Program on ASEAN/JAPAN Chemical Industry's Labor Safety and Operational Safety Improvement Initiative in Myanmar 2020 (Myanmar)
- Open Learning Campus, Introduction to the World Bank Environmental and Social Framework, 2020 (Myanmar)

Contribution

- Internship Experience Sharing to Junior Civil Engineering Students, Department of Civil Engineering, Yangon Technological University, Myanmar (2019)
- The Translation Project: "Are Microplastics a Challenge for Wastewater Treatment?"-IWA Article to Burmese Language, The Water Agency, Myanmar (2020)

Professional Experience Record

(Almost A Year' Experience in Environmental and Social Related Field)

Supportive Role

Responsible for continuously supporting to national environmental and social specialist who is working with international funding institutes. Particularly, responsible for desktop study, translation, baseline data collection, legal analysis and drafting the required documents related to environmental studies in forest sector.

Professional Role

Project:	Preparation of EIA Project Proposal of Aeon Mall Development Project *Mar 2020 – July 2020*	**Expertise Tag**
Client	Private Company	• Infrastructure Development Sector • EIA Project Proposal
Position:	Junior Environmental Expert	
Activities Performed:	Responsible for baseline study of the project, and assisting senior experts to implement necessary tasks, etc.	

Project:	Preparation of Initial Environmental Examination Report for Antimony Processing Project *Mar 2020 – July 2020*	**Expertise Tag**
Client	Private Company	• IEE Preparation • Antimony Smelting & Refinery • Preliminary Risk Assessment
Position:	Junior Environmental Expert	
Activities Performed:	Responsible for Environmental Baseline Studies, Coordination with Client and Relevant Ministries, Preliminary Risk and Emergency Assessment, Public Consultation and Public Disclosure, Assisting Experts to implement Necessary Works, etc.	

Project:	Preparation of Review Report on Investment Opportunities for Power Sectors in Myanmar, *Oct 2019 – Dec 2019*	**Expertise Tag**
Client	Private Company	• Power Sector • Renewable Energy • Investment
Position:	Junior Environmental Expert	
Activities Performed:	Responsible for making desktop study about investment opportunities for investment opportunities for power sectors especially renewable energy sector, possible renewable energy types in Myanmar, related laws in Myanmar, investment types and prodedures and challenges for the investor.	

I certify that this Resume correctly describes my qualifications and experiences and understand that any willful misstatement described herein may lead to my disqualification or dismissal, if engaged.

ANNEX 2 – COMMENT RESPONSE SHEET

စဉ်	ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ဦးစီးဌာန၏ စိစစ်တွေ့ရှိချက်များ	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဦးစီးဌာန၏ အကြံပြုချက်များ	IEE လေ့လာရေး အဖွဲ့မှ ရှင်းလင်း တင်ပြချက်များ	ရှင်းလင်း တင်ပြချက် များပါဝင်သော အစီရင်ခံစာ၏ အခန်း၊ အပိုဒ် နှင့် စာမျက်နှာများ
	ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း (၂၀၁၅) ၊ နောက်ဆက်တွဲ (က)၊ ဇယား (၁၃ဖ) အရ IEE ဆောင်ရွက်ရမည့် လုပ်ငန်းဖြစ်သဖြင့် အပိုဒ် (၃၅)၊ (၃ဖ) နှင့် အညီ ပြင်ဆင်တင်ပြရန်။		ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း (၂၀၁၅) ၊ အပိုဒ် (၃၅) ပါ စီမံကိန်းအဆိုပြုသူ၏ ကတိဝန်ခံချက်အား IEE အစီရင်ခံစာ၏ အရှေ့ဘက်စာမျက်နှာတွင် ထည့်သွင်းဖော်ပြထားပါသည်။ အစီရင်ခံစာအား ပြန်လည်ပြင်ဆင်ရာတွင် လုပ်ထုံးလုပ်နည်း အပိုဒ် (၃ဖ) ပါ ထည့်သွင်းဖော်ပြရမည့် အချက်များနှင့်အညီ ပြင်ဆင်ကာ ပြန်လည်တင်ပြထားပါသည်။	
၁။	အစီရင်ခံစာ အကျဉ်းချုပ်			
	အကျဉ်းချုပ်အစီရင်ခံစာအား ဖော်ပြထားခြင်းမရှိသည်ကို စိစစ်တွေ့ရှိရပါသည်။	အကျဉ်းချုပ်အစီရင်ခံစာအား (မြန်မာ/အင်္ဂလိပ်) နှစ်ဘာသာ ဖြင့် အခန်း (Chapter) အလိုက် အဓိကအချက်များကို ဖော်ပြရန်၊	အစီရင်ခံစာ အကျဉ်းချုပ်ကို လူအများ အလွယ်တကူ နားလည်သိရှိစေရန် နည်းပညာဆိုင်ရာ အသုံးအနှုန်းများကို တတ်နိုင်သမျှ ရှောင်ကြဉ်၍ (မြန်မာ/အင်္ဂလိပ်) နှစ်ဘာသာ ဖြင့် အစီရင်ခံစာ၏ အရေးကြီးသော အခန်းအလိုက် အဓိကအချက်အလက်များကို အနှစ်ချုပ် ထည့်သွင်း ဖော်ပြထားပါသည်။	အစီရင်ခံစာ အကျဉ်းချုပ်အား အစီရင်ခံစာ စာမျက်နှာ (i) တွင် ထည့်သွင်း ဖော်ပြထားပါသည်။
၂။	ကတိကဝတ်			
	တင်ပြလာသောအစီရင်ခံစာတွင် ကတိကဝတ်များနှင့် ပတ်သက်၍ ပြည့်စုံလုံလောက်မှု မရှိပါကြောင်း စိစစ်တွေ့ရှိရပါသည်။	စီမံကိန်းအဆိုပြုသူသည် အောက်ပါ အချက် အလက်များ မှန်ကန်ကြောင်း အတည်ပြု ထောက်ခံချက် အား ဖော်ပြရန် - (က) ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း၏ တိကျမှုနှင့် ပြည့်စုံမှု ရှိကြောင်း၊ (ခ) ပတ်ဝန်းကျင် ထိခိုက်မှု ဆန်းစစ်ခြင်းကို ဤလုပ်ထုံးလုပ်နည်းအပါအဝင် သက်ဆိုင်ရာ ဥပဒေများ၊ ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း ပြုလုပ်ရန် လုပ်ငန်းတာဝန်များနှင့် အညီ တိကျစွာ လိုက်နာပြုစုကြောင်း၊ (ဂ) စီမံကိန်းက ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ချက် အစီရင်ခံစာပါ ကတိကဝတ်၊ ပတ်ဝန်းကျင် ထိခိုက်မှု လျော့ချရေး လုပ်ငန်းများ နှင့် အစီအစဉ်များကို အစဉ်အမြဲ လိုက်နာ ဆောင်ရွက်မည် ဖြစ်ကြောင်း။	စီမံကိန်းအဆိုပြုသူသည် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း ဆိုင်ရာ လုပ်ထုံးလုပ်နည်း အပိုဒ် (၃၅) အရ - (က) ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်ခြင်းသည် တိကျခိုင်မာ ကြောင်းနှင့် ပြည့်စုံကြောင်း၊ (ခ) ဤလုပ်ထုံးလုပ်နည်းအပါအဝင် သက်ဆိုင်ရာ ဥပဒေများ ကို တိကျစွာလိုက်နာ၍ ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်ခြင်းကို ဆောင်ရွက်ထားကြောင်း၊ (ဂ) စီမံကိန်းသည် ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်ခြင်း အစီရင်ခံစာပါ ကတိကဝတ်၊ ပတ်ဝန်းကျင်ထိခိုက်မှု လျော့ချရေးလုပ်ငန်းများနှင့် အစီအစဉ်များကို အပြည့်အဝ အစဉ်အမြဲလိုက်နာဆောင်ရွက်မည် ဖြစ်ကြောင်း။ အစရှိသည့် အချက်အလက်များမှန်ကန်ကြောင်း အတည်ပြုဝန်ခံချက်အား ထည့်သွင်းဖော်ပြထားပါသည်။	Endorsement Letter အား အစီရင်ခံစာ၏ အရှေ့ဘက် စာမျက်နှာ တွင် ထည့်သွင်း ဖော်ပြထားပါသည်။
၃။	မူဝါဒ၊ ဥပဒေ နှင့် အဖွဲ့အစည်းဆိုင်ရာ မူဘောင်			
	အစီရင်ခံစာတွင် မူဝါဒ၊ ဥပဒေနှင့် အဖွဲ့အစည်းဆိုင်ရာမူဘောင်နှင့် ပတ်သက်၍ ဖော်ပြထားခြင်း မရှိကြောင်း စိစစ်တွေ့ရှိရပါသည်။	အစီရင်ခံစာတွင် လုပ်ငန်းနှင့် သက်ဆိုင်သည့် ဥပဒေများကို ထည့်သွင်း ဖော်ပြရန်နှင့် အဆိုပါ ဥပဒေများကို ရေးသားဖော်ပြရာတွင် ဥပဒေများ၏ ပုဒ်မ၊အပိုဒ်အား ကူးယူခြင်းမဟုတ်ဘဲ အဆိုပါ ဥပဒေ၏ ပုဒ်မ၊	ဥပဒေများကို ဖော်ပြရာတွင် စီမံကိန်းနှင့် သက်ဆိုင်မှုရှိပြီး စီမံကိန်း အဆိုပြုသူမှ ဥပဒေ တစ်ခုချင်းစီအလိုက် လိုက်နာဆောင်ရွက်ရမည့် ပုဒ်မများနှင့် သက်ဆိုင်ရာဥပဒေပုဒ်မများ၏ ဖော်ပြချက်များကို အသေးစိတ် ဖော်ပြထားပါသည်။ စီမံကိန်းအဆိုပြုသူမှ သိရှိနားလည်ပြီး လိုက်နာ	အစီရင်ခံစာ၊ အခန်း (၂)၊ အပိုဒ် ခွဲ (၂.၂.၃)၊ စာမျက်နှာ (၂-၄) တွင် ထည့်သွင်း ဖော်ပြထား ပါသည်။

စဉ်	ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ဦးစီးဌာန၏ စိစစ်တွေ့ရှိချက်များ	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဦးစီးဌာန၏ အကြံပြုချက်များ	IEE လေ့လာရေး အဖွဲ့မှ ရှင်းလင်း တင်ပြချက်များ	ရှင်းလင်း တင်ပြချက် များပါဝင်သော အစီရင်ခံစာ၏ အခန်း၊ အပိုဒ် နှင့် စာမျက်နှာများ
		အပိုဒ်ပါအချက်များကို စီမံကိန်း အဆိုပြုသူမှ လိုက်နာ ဆောင်ရွက်မည့် ကတိ ကဝတ်ကို ထည့်သွင်းဖော်ပြရန်၊	ဆောင်ရွက်မည် ဖြစ်ကြောင်း ကတိကဝတ်ကိုလည်း ထည့်သွင်းဖော်ပြထားပါသည်။	
		အစီရင်ခံစာ၏ အခန်းတစ်ခုချင်းစီမှ အစီရင်ခံစာ တွင် ပါဝင်သော လိုက်နာဆောင်ရွက်မည့် အကြောင်းအရာ တစ်ခုချင်းစီကို ဖော်ပြပြီး သဘောတူ၍ လိုက်နာ ဆောင်ရွက်မည် ဖြစ်ကြောင်း ကတိဝန်ခံချက်ကို ဖော်ပြ ပေးရန်၊	စီမံကိန်းအဆိုပြုသူမှ အစီရင်ခံစာ၏ အခန်းတစ်ခုချင်းစီ အလိုက် လိုက်နာ ဆောင်ရွက်သွားမည့် စီမံကိန်းဆိုင်ရာ ကတိကဝတ်များအား ထည့်သွင်း ဖော်ပြထားပါသည်။	အစီရင်ခံစာ အခန်း (၉) ၊ အပိုဒ်ခွဲ (၉.၂) စာမျက်နှာ (၉-၅) တွင် ထည့်သွင်း ဖော်ပြ ထားပါသည်။
		စီမံကိန်းလုပ်ငန်းနှင့် သက်ဆိုင်သည့် နိုင်ငံတကာ ကွန်ဗင်းရှင်း များ၊ လမ်းညွှန်ချက်များ လိုက်နာ ဆောင်ရွက်မည် ဖြစ်ကြောင်း ဖော်ပြရန်၊	မြန်မာနိုင်ငံမှ သဘောတူလက်မှတ်ရေးထိုးထားသည့် နိုင်ငံ တကာ ကွန်ဗင်းရှင်းများနှင့် သဘောတူညီချက်များအား ဖော်ပြထားပြီး စီမံကိန်း အဆိုပြုသူမှ သက်ဆိုင်ရာ လမ်းညွှန်ချက် များအတိုင်း လိုက်နာ ဆောင်ရွက် သွားမည် ဖြစ်ကြောင်း ထည့်သွင်းရေးသား ဖော်ပြထားပါသည်။	အစီရင်ခံစာ၊ အခန်း (၂)၊ အပိုဒ် ခွဲ (၂.၂.၂)၊ စာမျက်နှာ (၂-၃) တွင် ထည့်သွင်း ဖော်ပြထား ပါသည်။
		စက်မှုဝန်ကြီးဌာနမှ ထုတ်ပြန်ထားသည့် ဓာတုပစ္စည်း နှင့် ဆက်စပ်ပစ္စည်းများ အန္တရာယ်မှ တားဆီးကာကွယ်ရေး ဥပဒေနှင့် နည်းဥပဒေများ ထည့်သွင်းဖော်ပြရန်၊	စက်မှုဝန်ကြီးဌာနမှ ထုတ်ပြန်ထားသည့် ဓာတုပစ္စည်းနှင့် ဆက်စပ်ပစ္စည်း များ အန္တရာယ်မှ တားဆီးကာကွယ်ရေး ဥပဒေနှင့် နည်းဥပဒေများကို ထည့်သွင်းဖော်ပြထားပါသည်။	အစီရင်ခံစာ အခန်း (၂)၊ အပိုဒ်ခွဲ (၂.၂.၃)၊ ဇယား (၂-၃) စာမျက်နှာ (၂-၁၀) တွင် ဖော်ပြထားပါသည်။
		စက်မှုဝန်ကြီးဌာနနှင့် သတ္တုတွင်းဦးစီးဌာနများမှ ထုတ်ပြန် ထားသည့် ဥပဒေများကိုလည်း ထည့်သွင်း ဖော်ပြပေးရန်၊	ယခင်စက်မှုဝန်ကြီးဌာန၊ ယခု စီမံကိန်း၊ ဘဏ္ဍာရေးနှင့် စက်မှု ဝန်ကြီးဌာန မှထုတ်ပြန်ထားသော ဥပဒေများ ဖြစ်သည့် စက်မှုဇုန်ဥပဒေ၊ ပုဂ္ဂလိကစက်မှုလုပ်ငန်းဥပဒေ၊ အစရှိသည့် ဥပဒေများအား လည်းကောင်း၊ သတ္တုတွင်းဦးစီးဌာနမှ ထုတ်ပြန်ထားသည့် မြန်မာ့သတ္တုတွင်းဥပဒေများ၊ နည်းဥပဒေများကို ထည့်သွင်းဖော်ပြထားပါသည်။	အစီရင်ခံစာ အခန်း (၂)၊ အပိုဒ်ခွဲ (၂.၂.၃)၊ ဇယား (၂-၃) တွင် ပြည့်စုံစွာ ထည့်သွင်း ဖော်ပြထားပါသည်။

စဉ်	ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ဦးစီးဌာန၏ စိစစ်တွေ့ရှိချက်များ	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဦးစီးဌာန၏ အကြံပြုချက်များ	IEE လေ့လာရေး အဖွဲ့မှ ရှင်းလင်း တင်ပြချက်များ	ရှင်းလင်း တင်ပြချက် များပါဝင်သော အစီရင်ခံစာ၏ အခန်း၊ အပိုဒ် နှင့် စာမျက်နှာများ
၄။	စီမံကိန်းအကြောင်းအရာ ဖော်ပြချက်			
	အစီရင်ခံစာတွင် စီမံကိန်းအကြောင်းအရာ ဖော်ပြချက်များနှင့် ပတ်သက်၍ ယေဘုယျသာ ဖော်ပြထားသည်ကို စိစစ်တွေ့ရှိရပါသည်။	အစီရင်ခံစာတွင် စီမံကိန်း အကြောင်းအရာ ဖော်ပြချက်များနှင့် ပတ်သက်၍ အောက်ဖော်ပြပါ အချက်များကို ဖြည့်စွက်ဖော်ပြပေးရန်-		
		• စီမံကိန်းတည်နေရာ၊ ဆက်စပ်နေရာများ၊ အနီးစပ်ဆုံး မြစ်ချောင်းများအပါအဝင် ဆက်စပ် နေရာအားလုံးကို ဖော်ပြထားသော UTM Map/Layout Mapများဖြင့် ရှင်းလင်းစွာ ဖော်ပြပါရန်။	စီမံကိန်းတည်နေရာ နှင့် ဆက်စပ်နေရာများဖြစ်သော မော်လမြိုင် စက်မှုဇုန်ပတ်ဝန်းကျင် နှင့် အနီးအနားရှိ မြစ်ချောင်းများ (အတ္တရံမြစ်) အပါအဝင် ဆက်စပ်နေရာ အားလုံး၏ ဝန်းကျင်အနေအထားကို UTM Map / Satellite Map / Landuse Map များဖြင့် ရှင်းလင်းစွာ ဖော်ပြထားပါသည်။	အစီရင်ခံစာ အခန်း (၃)၊ အပိုဒ်ခွဲ (၃.၂)၊ စာမျက်နှာ (၃-၃) မှ (၃-၆) အထိ ထည့်သွင်းဖော်ပြထားပါသည်။
		• စတင်တည်ဆောက်ခဲ့သည့် အချိန်ကာလနှင့် လည်ပတ်မှု / ထုတ်လုပ်မှု စတင်ခဲ့သည့် အချိန်ကာလ။	စက်ရုံ စတင်တည်ဆောက်ခဲ့သည့် အချိန်ကာလမှာ (၂၀၁၃) ခုနှစ် ဖြစ်ပြီး ယခုစီမံကိန်းအဆိုပြုသူဖြစ်သော Myanmar Shing Shing Metal Co., Ltd မှ ၂၀၁၆ ခုနှစ်တွင် လက်လွှဲ ရယူ၍ ပြုပြင်မွမ်းမံမှုများဆောင်ရွက်ခဲ့ပြီး ၂၀၁၈ ခုနှစ် တွင် ထုတ်လုပ်မှုလုပ်ငန်းများ စတင်ဆောင်ရွက် ခဲ့ပါသည်။	အစီရင်ခံစာ အခန်း (၃)၊ အပိုဒ်ခွဲ (၃.၁.၁)၊ စာမျက်နှာ (၃-၁) တွင် ထည့်သွင်းဖော်ပြထားပါသည်။
		• စက်ရုံစီမံကိန်းရှိ အဆောက်အဦများ၏ Layout Map။		
		• အသုံးပြုမည့် စက်ပစ္စည်းနှင့် ယန္တရားအင်အား စာရင်း။		
		• လုပ်ငန်းစဉ်အလိုက်/အဆိုင်းအလိုက် လုပ်သား အရေအတွက်နှင့် အလုပ်ချိန်သတ်မှတ်ချက်။		
		• တစ်နှစ် စက်လည်ပတ်ရက်။		
		• ထုတ်လုပ်သည့် ထုတ်ကုန်အမျိုးအစား (Product) နှင့် အခြားထုတ်ကုန်အမျိုးအစား (By-product) ၏ ထွက်ရှိမှု ပမာဏ (နေ့အလိုက်/လအလိုက်/နှစ်အလိုက် ထွက်ရှိမှု ပမာဏ)	စက်ရုံစီမံကိန်းရှိ အဆောက်အဦများ၊ စက်ပစ္စည်းများအား ကွင်းဆင်း တိုင်းတာမှုများ ဆောင်ရွက်ခဲ့ပြီး စကေးကိုက် ရေးဆွဲထားသော Layout Map များကို ထည့်သွင်းဖော်ပြထားပါသည်။ ပိုမိုရှင်းလင်းပြတ်သားသည့် ပုံများကို A-3 ဆိုဒ်ဖြင့် အစီရင်ခံစာ နောက်ဆက်တွဲ (၁၁) တွင် ထည့်သွင်းဖော်ပြ ထားပါသည်။	အစီရင်ခံစာ အခန်း (၃)၊ အပိုဒ်ခွဲ (၃.၂.၄)၊ စာမျက်နှာ (၃-၆) နှင့် နောက်ဆက်တွဲ (၁၁) တွင် ထည့်သွင်း ဖော်ပြထားပါသည်။
		• တစ်နှစ်အတွက် ရေလိုအပ်ချက်နှင့် ရယူ သုံးစွဲမည့်ရေ အရင်းအမြစ်		
		• တစ်နှစ်အတွက် စွမ်းအင်လိုအပ်ချက်နှင့် ရယူ သုံးစွဲမှု အခြေအနေ၊ အဓိက သုံးစွဲမည့် စွမ်းအင် အရင်းအမြစ်အပြင် အခြားနည်းလမ်းများ ရှိပါက ဖော်ပြပေးရန်။	ထုတ်လုပ်ရေးလုပ်ငန်းများတွင် အသုံးပြုမည့် စက်ပစ္စည်းနှင့် ယန္တရား အင်အားများ စာရင်းအား သက်ဆိုင်ရာ အချက်အလက်များ နှင့်တကွ ထည့်သွင်းဖော်ပြထားပါသည်။	အစီရင်ခံစာ အခန်း (၃)၊ အပိုဒ်ခွဲ (၃.၁.၂) တွင် ထည့်သွင်းဖော်ပြထား ပါသည်။
		• လုပ်ငန်း၏ စွန့်ပစ်ပစ္စည်း (အစိုင်အခဲ၊ အရည်၊ အခိုးအငွေ့) စီမံခန့်ခွဲမှု အကျဉ်းချုပ် စွန့်ပစ် ပစ္စည်းများ ထွက်ရှိမှုနှင့် စွန့်ထုတ်မည့် လုပ်ငန်းစဉ်တို့ကို ရှင်းလင်းစွာ ဖော်ပြသည့် ကားချပ်များနှင့် အညွှန်းများ ဖော်ပြရန်။	စက်ရုံတွင် ခန့်အပ်ထားသော အလုပ်သမားအရေအတွက်၊ အလုပ်ချိန် သတ်မှတ်ချက်နှင့် တစ်နှစ်တာ စက်လည်ပတ်သည့်ရက်များကို ထည့်သွင်း ဖော်ပြထားပါသည်။	အစီရင်ခံစာ အခန်း (၃)၊ အပိုဒ်ခွဲ (၃.၃)၊ စာမျက်နှာ (၃-၇) နှင့် အခန်း (၂)၊ ပုံ (၂-၁) တို့တွင် ထည့်သွင်းဖော်ပြထား ပါသည်။
		• အဓိက စွန့်ထုတ်အခိုးအငွေ့များ၊ အမျိုးအစား နှင့် စီမံခန့်ခွဲမှုစနစ်။		

စဉ်	ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ဦးစီးဌာန၏ စိစစ်တွေ့ရှိချက်များ	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဦးစီးဌာန၏ အကြံပြုချက်များ	IEE လေ့လာရေး အဖွဲ့မှ ရှင်းလင်း တင်ပြချက်များ	ရှင်းလင်း တင်ပြချက် များပါဝင်သော အစီရင်ခံစာ၏ အခန်း၊ အပိုဒ် နှင့် စာမျက်နှာများ
		• စွန့်ပစ်အစိုင်အခဲ (Solid Waste) ထွက်ရှိမှု ပမာဏ၊ အမျိုးအစားအလိုက် ပါဝင်မှုနှင့် စီမံခန့်ခွဲမှုစနစ်၊ • စွန့်ထုတ်အရည် (Effluent) စွန့်ပစ်ရေ (Wastewater) ထွက်ရှိမှုပမာဏနှင့် စီမံခန့်ခွဲမှု စနစ် • စီးဆင်းရေ (Storm Water) နှင့် ရေမြောင်း စနစ် (Drainage System) အခြေအနေ၊	ထုတ်လုပ်သည့် ထုတ်ကုန်အမျိုးအစား (Product) မှာ ခနောက်စိမ်းသန့်စင်ဘလောက်တုံး ဖြစ်ပြီးတစ်လလျှင် ပျှမ်းမျှ တန် ၂၀ ခန့် ထွက်ရှိပါသည်။ စက်ရုံတွင် တပ်ဆင်ထားသော စက်ပစ္စည်းများ၏ အများဆုံး ထုတ်လုပ်နိုင်စွမ်းမှာ တစ်လလျှင် တန် (၅၀) နှင့် တစ်နှစ်လျှင် တန် (၅၀၀) ခန့် ရှိပါသည်။ ၎င်းမှာ အချိန်နှင့်တပြေးညီ ကုန်ကြမ်းပစ္စည်းရရှိမှုအပေါ် မူတည်ပါသည်။	အစီရင်ခံစာ အခန်း (၃)၊ အပိုဒ်ခွဲ (၃.၁.၂)၊ စာမျက်နှာ (၃-၁) တွင် ထည့်သွင်းဖော်ပြထား ပါသည်။
			လုပ်ငန်းလည်ပတ်ရန်အတွက် ရေလိုအပ်ချက်မှာ တစ်လလျှင် ဂါလန် ၆၀၀၀ ခန့်ရှိပြီး အတ္ထရံမြစ်မှ ရယူသုံးစွဲလျက်ရှိပါသည်။	အစီရင်ခံစာ၊ အခန်း (၃)၊ အပိုဒ်ခွဲ (၃.၆.၁)၊ စာမျက်နှာ (၃-၁၇) တွင် ထည့်သွင်း ဖော်ပြ ထားပါသည်။
			စီမံကိန်းတွင် လိုအပ်သော စွမ်းအင် (လျှပ်စစ်စွမ်းအင်) အတွက် 250 kV နှင့် 500 kV ထရမ်စဖော်မာ နှစ်လုံးတပ်ဆင်ထားရှိ၍ သုံးစွဲလျက်ရှိပြီး လျှပ်စစ်ဓာတ်အားပြတ်တောက်ချိန်တွင် အရံသင့်အသုံးပြုနိုင်ရန်အတွက် 300 kV မီးစက်နှစ်လုံးကို ထားရှိပါသည်။	အစီရင်ခံစာ၊ အခန်း (၃)၊ အပိုဒ်ခွဲ (၃.၆.၂)၊ စာမျက်နှာ (၃-၁၉) တွင် ထည့်သွင်း ဖော်ပြ ထားပါသည်။
			လုပ်ငန်း၏ စွန့်ပစ်ပစ္စည်း (အစိုင်အခဲ၊ အရည်၊ အခိုးအငွေ့) စီမံခန့်ခွဲမှု အကျဉ်းချုပ် စွန့်ပစ်ပစ္စည်းများ ထွက်ရှိမှုနှင့် စွန့်ထုတ်မည့် လုပ်ငန်းစဉ်တို့ကို ရှုပ်ပုံကားချပ်များဖြင့် ရှင်းလင်းစွာ ဖော်ပြထား ပါသည်။	အစီရင်ခံစာ၊ အခန်း (၃)၊ အပိုဒ်ခွဲ (၃.၇.၁) မှ (၃.၇.၃) အထိ စာမျက်နှာ (၃-၂၂) မှ (၃-၂၈) အထိ ထည့်သွင်း ဖော်ပြထားပါသည်။
			အဓိက စွန့်ထုတ်အခိုးအငွေ့များ၊ အမျိုးအစားနှင့် စီမံခန့်ခွဲမှု စနစ်များကို အသေးစိတ်ရှင်းလင်းဖော်ပြထားပါသည်။	အစီရင်ခံစာ၊ အခန်း (၃)၊ အပိုဒ်ခွဲ (၃.၇.၂) စာမျက်နှာ (၃-၂၂) တွင် ထည့်သွင်း ဖော်ပြထားပါသည်။
			စွန့်ပစ်အစိုင်အခဲ (Solid Waste) ထွက်ရှိမှုပမာဏ၊ အမျိုးအစားအလိုက် ပါဝင်မှုနှင့်စီမံခန့်ခွဲမှုစနစ်များအား အသေးစိတ်ရှင်းလင်းဖော်ပြ ထားပါသည်။	အစီရင်ခံစာ၊ အခန်း (၃)၊ အပိုဒ်ခွဲ (၃.၇.၃) စာမျက်နှာ (၃-၂၃) တွင် ထည့်သွင်း ဖော်ပြထားပါသည်။
			စွန့်ထုတ်အရည် (Effluent) စွန့်ပစ်ရေ (Wastewater) ထွက်ရှိမှုပမာဏနှင့် စီမံခန့်ခွဲမှုစနစ် များအား အသေးစိတ်ရှင်းလင်းဖော်ပြ ထားပါသည်။	အစီရင်ခံစာ၊ အခန်း (၃)၊ အပိုဒ်ခွဲ (၃.၇.၄) စာမျက်နှာ (၃-၂၇) တွင် ထည့်သွင်း ဖော်ပြထားပါသည်။

စဉ်	ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ဦးစီးဌာန၏ စိစစ်တွေ့ရှိချက်များ	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဦးစီးဌာန၏ အကြံပြုချက်များ	IEE လေ့လာရေး အဖွဲ့မှ ရှင်းလင်း တင်ပြချက်များ	ရှင်းလင်း တင်ပြချက် များပါဝင်သော အစီရင်ခံစာ၏ အခန်း၊ အပိုဒ် နှင့် စာမျက်နှာများ
			စီးဆင်းရေ (Storm Water) နှင့် ရေမြောင်းစနစ် (Drainage System) အခြေအနေတို့ကို အသေးစိတ် ထည့်သွင်းဖော်ပြထားပါသည်။	အစီရင်ခံစာ၊ အခန်း (၃)၊ အပိုဒ်ခွဲ (၃.၇.၄) စာမျက်နှာ (၃-၂၉) တွင် ထည့်သွင်း ဖော်ပြထားပါသည်။
၅။	လက်ရှိပတ်ဝန်းကျင်အခြေအနေ			
	လေအရည်အသွေးနှင့် ပတ်သက်၍ နေရာ(၃)ခု တိုင်းတာထားသော်လည်း ကိုသြဒိနိတ်အမှတ်များဖြင့် ဖော်ပြထားခြင်း မရှိသည်ကို စိစစ်တွေ့ရှိရပါသည်။ PM10 တိုင်းတာမှု ရလာဒ် သတ်မှတ်တန်ဖိုးထက် ကျော်လွန်နေကြောင်း စိစစ်တွေ့ရှိရပါသည်။ ရေအရည်အသွေး တိုင်းတာမှု ရလာဒ်အား နေရာ(၈)ခုတွင် တိုင်းတာ၍ ဖော်ပြထားပါသည်ကို စိစစ်တွေ့ရှိရပါသည်။	အစီရင်ခံစာတွင် လေအရည်အသွေး တိုင်းတာရာတွင် ကိုသြဒိနိတ်အမှတ်များနှင့် တိုင်းတာမည့် နေရာသတ်မှတ်ရသည့် အကြောင်းအရင်းများကို ဖော်ပြပေးရန်၊ အဆိုပြုစီမံကိန်းသည် လက်ရှိလည်ပတ်နေသည့် စီမံကိန်း ဖြစ်သဖြင့် PM10 တိုင်းတာမှုရလာဒ် သတ်မှတ်စံချိန် စံနှုန်း ထက် ကျော်လွန်ရသည့် အကြောင်းအရင်းကို ဆန်းစစ်ဖော်ပြရန်၊ ရေအရည်အသွေး တိုင်းတာရာတွင် National Guideline Standard ဟု နှိုင်းယှဉ်ဖော်ပြထားရာ မည်သည့် Standard ကို ရည်ညွှန်းဖော်ပြထားသည်ကို ဖော်ပြပေးရန်၊	လေအရည်အသွေးတိုင်းတာခဲ့သည့် ကိုသြဒိနိတ်အမှတ်များနှင့် အမှတ်တစ်မှတ်ချင်းစီအလိုက် တိုင်းတာမည့်နေရာ သတ်မှတ်ရသည့် အကြောင်း အရင်း များကိုလည်း ထည့်သွင် ဖော်ပြထားပါသည်။ ယခင်ဆောင်ရွက်ထားရှိသော EIA အစီရင်ခံစာတွင် CO, SO_2 နှင့် NO_2 တို့ကို တိုင်းထားထားကြောင်း တွေ့ရှိရပြီး PM 10 အား တိုင်းတာထားမှု မရှိကြောင်း တွေ့ရှိရပါသည်။ သို့ဖြစ်ပါ၍ ဤသဘောထားမှတ်ချက်အတွက် ရှင်းလင်းရန် မရှိပါ။ ယခင် EIA အစီရင်ခံစာပြင်ဆင်ချိန်သည် ၂၀၁၄ ခုနှစ်ဖြစ်သည့်အတွက် အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး ထုတ်လွှတ်မှု လမ်းညွှတ်ချက် (NEQG) ထွက်ရှိမှု မရှိသေးပါ။ ယခု ပြန်လည်တင်ပြလာသော IEE အစီရင်ခံစာတွင် ယခင်တိုင်းတာထားရှိသည့် ရေအရည်အသွေး ရလဒ်များကို NEQG တန်ဖိုးများနှင့် နှိုင်းယှဉ်ဖော်ပြထားပါသည်။	အစီရင်ခံစာ နောက်ဆက်တွဲ (၃) ၊ စာမျက်နှာ ii တွင် ထည့်သွင်း ဖော်ပြ ထားပါသည်။ အစီရင်ခံစာ နောက်ဆက်တွဲ (၃) ၊ စာမျက်နှာ iii မှ စာမျက်နှာ vi အထိ တွင် ထည့်သွင်း ဖော်ပြ ထားပါသည်။
၆။	ပတ်ဝန်းကျင်အပေါ် သက်ရောက်မှုများနှင့် လျော့နည်းစေရန် ဆောင်ရွက်မည့် လုပ်ငန်းများ			
	အစီရင်ခံစာတွင် ပတ်ဝန်းကျင် အပေါ် သက်ရောက်မှုများနှင့် လျော့နည်းစေမည့် နည်းလမ်းများနှင့် ပတ်သက်၍ ယေဘုယျသာ ဖော်ပြထားသည်ကို စိစစ်တွေ့ရှိရပါသည်။	Bag Filterများ ချို့ယွင်းမှုကြောင့် ဖြစ်ပေါ်လာနိုင်သည့် ထိခိုက်မှုများနှင့် လျော့ချမည့် နည်းလမ်းများကို ဆန်းစစ်ဖော်ပြရန်၊	Bag Filter များသည် ထုတ်လုပ်ရေးလုပ်ငန်းမှ ထွက်ရှိလာသော ထုတ်ကုန် (By-product) ဖြစ်သော Antimony Trioxide Powder အား ဖမ်းယူရန် အဓိကထား၍ တပ်ဆင်ထားခြင်း ဖြစ်သောကြောင့် Bag Filter များ ချို့ယွင်း မှုဖြစ်လျှင် လုပ်ငန်းလည်ပတ်၍ မရနိုင်ပါ။ Bag Filter များ၊ Bag House များ အတွင်းတွင် တပ်ဆင်ထားသည့် Filter များ ပေါက်ပြဲမှုရှိပါက တန်ဖိုးရှိသော အမှုန်များ ပြင်ပသို့ မတော်တဆ လွှင့်စင်ခြင်း မရှိစေရန် လဲလှည်ခြင်း	အစီရင်ခံစာ အခန်း (၅)၊ အပိုဒ်ခွဲ ၅.၂.၁၊ စာမျက်နှာ ၅-၉ နှင့် ၅-၁၀ တို့တွင် ထည့်သွင်း ဖော်ပြ ထားပါသည်။

စဉ်	ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ဦးစီးဌာန၏ စိစစ်တွေ့ရှိချက်များ	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဦးစီးဌာန၏ အကြံပြုချက်များ	IEE လေ့လာရေး အဖွဲ့မှ ရှင်းလင်း တင်ပြချက်များ	ရှင်းလင်း တင်ပြချက် များပါဝင်သော အစီရင်ခံစာ၏ အခန်း၊ အပိုဒ် နှင့် စာမျက်နှာများ
	Bag Filterများ ချို့ယွင်းမှုကြောင့် ဖြစ်ပေါ်လာနိုင်သည့် ထိခိုက်မှုများနှင့် လျော့ချမည့် နည်းလမ်းများကို ဖော်ပြထားခြင်း မရှိကြောင်း စိစစ်တွေ့ရှိရပါသည်။		လုပ်ငန်းအား ချက်ချင်း ဆောင်ရွက်လျက်ရှိပြီး မီးပေါင်းဖိုများ လည်ပတ်ခြင်း မပြုမီ Fitler များ ပေါက်ပြမှု ရှိ၊ မရှိအား စစ်ဆေးခြင်း လုပ်ငန်းများ ဆောင်ရွက်လျက်ရှိပါသည်။	
		ကျောက်မီးသွေးအစားထိုး အသုံးပြုမည့် Coke မီးသွေးကို မီးရှို့ရာမှ ထွက်ရှိနိုင်မှု အခိုးအငွေ့၊ ထိခိုက်နိုင်မှုများ လျော့ပါးစေမည့် နည်းလမ်းများကို ဆန်းစစ်ဖော်ပြရန်၊	လေအရည်အသွေး သက်ရောက်မှု ဆန်းစစ်ရာတွင် ကျောက်မီးသွေး၊ နှင့် Coke တို့အား မီးဖိုထဲတွင် လောင်ကျွမ်းစေရာမှ ထွက်ရှိလာသော အခိုးအငွေ့ ၏ သက်ရောက်မှုများ ထိခိုက်နိုင်မှုများကို တွက်ချက်မှုများနှင့် စနစ်တကျ ဆန်းစစ်ထားရှိပြီး ၎င်းတို့ကို လျော့ပါးစေနိုင်သည့်နည်းလမ်းများအား ထည့်သွင်းဖော်ပြထားပါသည်။	အစီရင်ခံစာ အခန်း (၅)၊ အပိုဒ်ခွဲ ၅.၂.၁၊ စာမျက်နှာ ၅-၇ မှ ၅-၁၃ အထိ တွင် ထည့်သွင်း ဖော်ပြ ထားပါသည်။
		အရေးပေါ်အခြေအနေ လျှပ်စစ်မီးပြတ်တောက်မှုကြောင့် ဖြစ်ပေါ်လာနိုင်သည့် ထိခိုက်နိုင်မှုများနှင့် လျော့ပါးမည့် နည်းလမ်းများကို ဖော်ပြပေးရန်၊	အရေးပေါ်အခြေအနေကြောင့် လျှပ်စစ်မီးပြတ်တောက်ပါက အရံမီးစက်နှစ်လုံးကို စက်ရုံတွင်း ထားရှိပြီး မီးစက်မောင်းနှင်ရန် အတွက် အလုပ်သမား တစ်ဦးအား အမြဲတစေ အဆင်သင့်ထားကာ လည်ပတ်စေမည်ဖြစ်သည်။ အကယ်၍ လျှပ်စစ်မီးပြတ်တောက်သွားပါက Blowers များ ခေတ္တရပ်နားသွားမည် ဖြစ်သည့်အတွက် မီးဖိုအတွင်းမှ မီးခိုးများနှင့်အတူ အနံ့များ ထွက်ရှိလာနိုင်ပါသည်။ သို့ဖြစ်ပါ၍ မီးပြတ်သည်နှင့် တစ်ပြိုက်နက် မီးစက်များ မိနစ်အနည်းငယ်အတွင်း လည်ပတ်စေနိုင်ရေး ပြင်ဆင်ထားရှိရန် အကြံပြုချက်များအား ပေးထားပြီး ဖြစ်ပါသည်။	အစီရင်ခံစာ အခန်း (၅)၊ အပိုဒ်ခွဲ ၅.၂.၆၊ စာမျက်နှာ ၅-၃၃ တွင် ထည့်သွင်း ဖော်ပြထားပါသည်။
		ခနောက်စိမ်းထွိုင်အောက်ဆိုဒ် အမှုန်များအား ကိုင်တွယ် ဆောင်ရွက်မည့် လုပ်သားများအပေါ် ကျန်းမာရေး ထိခိုက်နိုင်မှုနှင့် ထိခိုက်မှု မရှိစေရေး ဆောင်ရွက်မည့် နည်းလမ်းများကို ဆန်းစစ်ဖော်ပြရန်၊	ခနောက်စိမ်းထွိုင်အောက်ဆိုဒ် အမှုန်များအား ကိုင်တွယ် ဆောင်ရွက်မည့် လုပ်သားများအပေါ် ကျန်းမာရေး ထိခိုက်မှုလျော့ပါးစေရန် ဆောင်ရွက်ရမည့် နည်းလမ်းများအပြင် အခြားလုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်း ရေးဆိုင်ရာ သက်ရောက်မှုများအား ဆန်းစစ်ဖော်ပြထားပါသည်။ ထို့အပြင် လုပ်ငန်းခွင်ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေး စီမံချက် အခွဲကိုလည်း အသေးစိတ် ထည့်သွင်းရေးဆွဲ ဖော်ပြထားပါသည်။	အစီရင်ခံစာအခန်း (၆)၊ အပိုဒ်ခွဲ ၆.၄၊ စာမျက်နှာ (၆-၅) မှ(၆-၂၃) အထိ နှင့် နောက်ဆက်တွဲ ၉ (ခ) တို့တွင် ထည့်သွင်းဖော်ပြထားပါသည်။

စဉ်	ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ဦးစီးဌာန၏ စိစစ်တွေ့ရှိချက်များ	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဦးစီးဌာန၏ အကြံပြုချက်များ	IEE လေ့လာရေး အဖွဲ့မှ ရှင်းလင်း တင်ပြချက်များ	ရှင်းလင်း တင်ပြချက် များပါဝင်သော အစီရင်ခံစာ၏ အခန်း၊ အပိုဒ် နှင့် စာမျက်နှာများ
		ကုန်ကြမ်းပစ္စည်းများ သယ်ယူခြင်း၊ ကြိတ်ခွဲခြင်းတို့ကြောင့် ထွက်ရှိနိုင်မည့် အမှုန်အမွှား၊ ထိခိုက်နိုင်မှုနှင့် လျော့ပါးမည့် နည်းလမ်းများကို ဖော်ပြပေးရန်၊	ကုန်ကြမ်းပစ္စည်းများ သယ်ယူခြင်း၊ ကြိတ်ခွဲခြင်းတို့ကြောင့် ထွက်ရှိနိုင်မည့် အမှုန်အမွှား၊ ထိခိုက်နိုင်မှုကို ဆန်းစစ်ထား၍ ထိခိုက်မှုလျော့ပါးစေရန် ဆောင်ရွက်ရမည့် နည်းလမ်းများကို ဖော်ပြထားပါသည်။	အစီရင်ခံစာအခန်း (၆)၊ အပိုဒ်ခွဲ ၆.၄.၁၊ စာမျက်နှာ (၆-၅) မှ(၆-၉) အထိတွင် ထည့်သွင်းဖော်ပြထားပါသည်။
		ခနောက်စိမ်း မီးဖုတ်မှုကြောင့် ထွက်ရှိမည့် အနံ့ ထိခိုက်နိုင်မှု လျော့ပါးစေမည့် နည်းလမ်းများကို ဆန်းစစ်ဖော်ပြရန်၊	ခနောက်စိမ်း မီးဖုတ်မှုကြောင့် ထွက်ရှိမည့် အနံ့နှင့် စပ်လျဉ်း၍ သက်ရောက်မှု ဆန်းစစ်ချက်များနှင့် လျော့ပါးစေမည့် နည်းလမ်းများကို ဆန်းစစ် ဖော်ပြထားပါသည်။	အစီရင်ခံစာ အခန်း (၅)၊ အပိုဒ်ခွဲ ၅.၂.၆၊ စာမျက်နှာ ၅-၃၁ မှ ၅-၃၃ အထိ တွင် ထည့်သွင်း ဖော်ပြ ထားပါသည်။
		ကုန်ကြမ်းပစ္စည်းများ စုပုံသိုလှောင်ရာမှ ထွက်ရှိလာမည့် ရေဆိုး၊ ထိခိုက်နိုင်မှု လျော့ပါးစေမည့် နည်းလမ်းများကို ဆန်းစစ်ဖော်ပြရန်၊	စီမံကိန်းမှ စွန့်ပစ်ရေ ထွက်ရှိမှု အခြေအနေများနှင့် ၎င်းတို့ကြောင့် ဖြစ်ပေါ်နိုင်သော သက်ရောက်မှု ဆန်းစစ်ချက်များနှင့် လျော့ပါးစေရေးနည်းလမ်းများကို အသေးစိတ် ဆန်းစစ်ဖော်ပြထားပါသည်။	အစီရင်ခံစာ အခန်း (၅)၊ အပိုဒ်ခွဲ ၅.၂.၂၊ စာမျက်နှာ ၅-၁၉ မှ ၅-၂၇ အထိ တွင် ထည့်သွင်း ဖော်ပြ ထားပါသည်။
		Community Health အပေါ် ထိခိုက်နိုင်မှုနှင့် လျော့ပါးစေမည့် နည်းလမ်းများကို ဆန်းစစ်ဖော်ပြရန်၊	Community Health အပေါ် ထိခိုက်နိုင်မှုနှင့် လျော့ပါးစေမည့် နည်းလမ်းများကို ဆန်းစစ်ဖော်ပြထားပါသည်။	အစီရင်ခံစာ အခန်း (၅)၊ အပိုဒ်ခွဲ ၅.၃.၄၊ စာမျက်နှာ ၅-၃၆ မှ ၅-၃၈ အထိ တွင် ထည့်သွင်း ဖော်ပြ ထားပါသည်။
၇။	ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်နှင့် စောင့်ကြပ်ကြည့်ရှုမည့် အစီအစဉ်			
	အစီရင်ခံစာတွင် ဆောင်ရွက်မည့် လုပ်ငန်းအဆင့်အလိုက် ထိခိုက်နိုင်မှုများအပေါ် လျော့ချမည့် နည်းလမ်းများကို အကောင်အထည်ဖော် ဆောင်ရွက်မည့် လုပ်ငန်းစဉ် အသေးစိတ်၊ အဖွဲ့အစည်း၊ ရန်ပုံငွေလျာထားချက် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်အား ဖော်ပြထားခြင်း မရှိကြောင်း ဖော်ပြထားသည်ကို စိစစ်တွေ့ရှိရပါသည်။	အစီရင်ခံစာတွင် ဆောင်ရွက်မည့် လုပ်ငန်းအဆင့်အလိုက် ထိခိုက်နိုင်မှုများအပေါ် လျော့ချမည့် နည်းလမ်းများကို အကောင်အထည်ဖော် ဆောင်ရွက်မည့် လုပ်ငန်းစဉ်အသေးစိတ်၊ အဖွဲ့အစည်း၊ ရံပုံငွေလျာထားချက် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်အား ဖော်ပြရန်၊ ကုန်ကြမ်းရယူခြင်း၊ သယ်ယူပို့ဆောင်ခြင်း၊ မီးဖုတ်ခြင်း၊ သန့်စင်ခြင်းတို့နှင့် ပတ်သက်၍ ပတ်ဝန်းကျင်ထိခိုက်မှုနှင့် လျော့ချမည့် နည်းလမ်းများ၊ စောင့်ကြပ်ကြည့်ရှုမည့်	ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်တွင် လုပ်ငန်းစဉ်အဆင့်ဆင့်အလိုက် ဖြစ်ပေါ်နိုင်သော သက်ရောက်မှုများအပေါ် လျော့ကျရေး နည်းလမ်းများ၊ ၎င်းတို့ကို အကောင့်အထည်ဖော်မည့် လုပ်ငန်းစဉ်များ၊ အကောင်အထည်ဖော်မည့် အဖွဲ့အစည်းများ၊ စောင့်ကြပ်ကြည့်ရှုမှုဆိုင်ရာ လုပ်ငန်းစဉ်များ နှင့် ရန်ပုံငွေလျာထားချက်များကို အသေးစိတ် ထည့်သွင်းဖော်ပြထားပါသည်။ ထို့အပြင် ဆန်းစစ်သုံးသပ်မှု အရ အခြားလိုအပ်သော ပတ်ဝန်းကျင်နှင့် လူမှုဆိုင်ရာ စီမံချက်အခွဲများဖြစ်သည့် (၁) Wet Scrubber လုပ်ငန်းလည်ပတ်မှုဆိုင်ရာ လုပ်ထုံးလုပ်နည်းများ (၂) အစိုင်အခဲ စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှု အစီအစဉ်	အစီရင်ခံစာ အခန်း (၈)၊ စာမျက်နှာ ၈-၁ မှ ၈-၂၂ အထိ နှင့် နောက်ဆက်တွဲ ၅၊ ၉က၊ ၉ခ၊ ၉ဂ၊ ၉ဃ တို့တွင် ထည့်သွင်း ဖော်ပြ ထားပါသည်။

စဉ်	ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ဦးစီးဌာန၏ စိစစ်တွေ့ရှိချက်များ	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဦးစီးဌာန၏ အကြံပြုချက်များ	IEE လေ့လာရေး အဖွဲ့မှ ရှင်းလင်း တင်ပြချက်များ	ရှင်းလင်း တင်ပြချက် များပါဝင်သော အစီရင်ခံစာ၏ အခန်း၊ အပိုဒ် နှင့် စာမျက်နှာများ
		အဖွဲ့အစည်း၊ ရန်ပုံငွေလျာထားချက်၊ ဆောင်ရွက်မည့် အစီအစဉ် အသေးစိတ်တို့ကို ဖော်ပြပေးရန်၊	(၃) လုပ်ငန်းခွင်ဆိုင်ရာ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေး အစီအစဉ် (၄) အရေးပေါ် တုံ့ပြန်မှု အစီအစဉ် နှင့် (၅) တိုင်ကြားမှုဖြေရှင်းရေး ယန္တရား (GRM) တို့ကို လည်း ထပ်မံရေးဆွဲ၍ ထည့်သွင်းဖော်ပြထားပါသည်။	
၈။	ကျန်းမာရေးနှင့် သဘာဝဘေးအန္တရာယ် ကာကွယ်ရေး အစီအစဉ်			
	အဆိုပြုစီမံကိန်းတွင် အတ္ထရံမြစ်အနီးတွင် ရှိသဖြင့် ရေကြီးခြင်း ဖြစ်ပေါ်နိုင်ကြောင်း ကိုသာ ဖော်ပြထားသည်ကို စိစစ်တွေ့ရှိရပါသည်။	အခြား သဘာဝဘေးအန္တရာယ် (Natural Hazard) နှင့် စက်ရုံ၏ လုပ်ငန်းစဉ်များကြောင့် ဖြစ်ပေါ်လာနိုင်သည့် (Industrial Hazard) ဖြစ်နိုင်ခြေများကိုပါ ဆန်းစစ်၍ (Risk Assessment) ဘေးအန္တရာယ် စီမံခန့်ခွဲမှု အစီအစဉ်အား ဖြည့်စွက်ဖော်ပြရန်၊	Risk Assessment တွင် စက်ရုံ၏ လုပ်ငန်းစဉ်များကြောင့် ဖြစ်ပေါ်နိုင်သည့် (Industrial Hazard) ၈ မျိုးနှင့် Natural Hazard ၂ မျိုးတို့၏ ဖြစ်နိုင်ချေများကို ဆန်းစစ်၍ သက်ရောက်မှု လျော့ပါးစေရေး နည်းလမ်းများကို ထည့်သွင်းဖော်ပြထားပါသည်။ ထို့အပြင် ၎င်းတို့ ဖြစ်ပေါ်လာပါက အရေးပေါ်တုံ့ပြန်မှုအစီအစဉ်များကိုလည်း အသေးစိတ် ရေးဆွဲထားပြီး ဖြစ်ပါသည်။	အစီရင်ခံစာအခန်း (၆)၊ အပိုဒ်ခွဲ ၆.၄ မှ ၆.၆ အထိ စာမျက်နှာ (၆-၅) မှ(၆-၃၉) အထိနှင့် နောက်ဆက်တွဲ - ၉ ၈ တို့တွင် ထည့်သွင်းဖော်ပြထားပါသည်။
၉။	အများပြည်သူနှင့် တိုင်ပင်ဆွေးနွေးခြင်း			
	အစီရင်ခံစာတွင် အများပြည်သူနှင့် တိုင်ပင်ဆွေးနွေးခြင်းနှင့် ပတ်သက်၍ ခနောက်စိမ်းသန့်စင်စက်ရုံသည် စက်မှုဇုန်လူနေရပ်ကွက်နှင့် နီးကပ်လွန်းကြောင်းဖော်ပြထားသည်ကို စိစစ်တွေ့ရှိရပါသည်။ အများပြည်သူနှင့် တိုင်ပင်ဆွေးနွေးခြင်းကို ၂၀၁၅ခုနှစ်တွင် ဆောင်ရွက်ခဲ့ကြောင်း ဖော်ပြထားသည်ကို စိစစ်တွေ့ရှိရပါသည်။	စီမံကိန်း အနီးဝန်းကျင်ရှိ ဒေသခံများအပေါ် လူမှုရေး၊ ကျန်းမာရေး ထိခိုက်နိုင်မှုကို ဆန်းစစ်၍ ထိခိုက်မှု မရှိစေရေးတို့ ဆောင်ရွက်မည့် အစီအစဉ် တို့ကို ဖော်ပြရန်၊ လက်ရှိအခြေအနေတွင် စက်ရုံဝန်းကျင်ရှိ အများ ပြည်သူ၏ ဆန္ဒသဘောထားရယူရန်နှင့် အကြံပြုချက်တို့ ရယူရန် အများပြည်သူနှင့် တိုင်ပင် ဆွေးနွေးခြင်းကို ထပ်မံဆောင်ရွက်ရန်၊	စီမံကိန်းအနီးဝန်းကျင်ရှိ ဒေသခံများအပေါ် လူမှုရေး၊ ကျန်းမာရေး သက်ရောက်မှု များအား ဆန်းစစ်ဖော်ပြထားပြီး ဖြစ်ပါသည်။ အများပြည်သူနှင့် တိုင်ပင်ဆွေးနွေးခြင်းကို ယခုစီမံကိန်းအဆိုပြုသူမှ ၂၀၁၇ ခုနှစ်တွင် တစ်ကြိမ်နှင့် ၂၀၁၉ ခုနှစ်တွင် တစ်ကြိမ် ဆောင်ရွက်ခဲ့ပါသည်။ ယခု IEE အစီရင်ခံစာ ပြင်ဆင်ချိန်တွင် Covid-19 ကပ်ရောဂါ ဖြစ်ပွားချိန်နှင့် တိုက်ဆိုင်နေပြီး လူစုလူဝေးဖြင့် လုပ်ဆောင်ရမည့် ကိစ္စရပ်များကို တားမြစ်ထားရှိသော အချိန်ကာလဖြစ်နေပါသဖြင့် အစီရင်ခံစာနှင့် ပတ်သက်၍ အများပြည်သူနှင့် တိုင်ပင်ဆွေးနွေးပွဲအား ဆောင်ရွက်နိုင်ခြင်း မရှိပါ။ သို့သော် အဆိုပါ တားမြစ်ချက်များအား ဖြေလျော့မည့် အချိန်တွင် အများပြည်သူနှင့် တိုင်ပင်ဆွေးနွေးခြင်းအား ဆောင်ရွက်သွားမည် ဖြစ်ပြီး လိုအပ်သော အသေးစိတ် အစီအစဉ် များကို အခန်း (၇) Public Consultation and Information Disclosure တွင် အသေးစိတ် ထည့်သွင်း ဖော်ပြထားပါသည်။	အစီရင်ခံစာအခန်း (၅)၊ အပိုဒ်ခွဲ ၅.၃၊ စာမျက်နှာ (၅-၃၆) မှ (၅-၃၈) အထိ တွင် ထည့်သွင်းဖော်ပြထားပါသည်။ အစီရင်ခံစာအခန်း (၇)၊ စာမျက်နှာ (၇-၁) မှ (၇-၇) အထိ တွင် ထည့်သွင်း ဖော်ပြထားပါသည်။

စဉ်	ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ဦးစီးဌာန၏ စိစစ်တွေ့ရှိချက်များ	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဦးစီးဌာန၏ အကြံပြုချက်များ	IEE လေ့လာရေး အဖွဲ့မှ ရှင်းလင်း တင်ပြချက်များ	ရှင်းလင်း တင်ပြချက် များပါဝင်သော အစီရင်ခံစာ၏ အခန်း၊ အပိုဒ် နှင့် စာမျက်နှာများ
၁၀။	စီမံကိန်းကြောင့် ထိခိုက်ခံစားရသည့် ဒေသခံပြည်သူများအတွက် ဆောင်ရွက်ပေးမည့် ဖွံ့ဖြိုးရေးအစီအစဉ်			
	စီမံကိန်းကြောင့် ထိခိုက်ခံစားရသည့် ဒေသခံပြည်သူများအတွက် ဆောင်ရွက်ပေးမည့် ဒေသဖွံ့ဖြိုးရေးလုပ်ငန်းများအား ဖော်ပြထားခြင်း မရှိသည်ကို စိစစ်တွေ့ရှိရပါသည်။	စီမံကိန်းကြောင့် ထိခိုက်ခံစားရသည့် ဒေသခံပြည်သူများအတွက် ဆောင်ရွက်ပေးမည့် ဒေသဖွံ့ဖြိုးရေးလုပ်ငန်းများအား ဖော်ပြရန်၊	စီမံကိန်းမှ လူမှုတာဝန်သိအစီအစဉ်များနှင့် စပ်လျဉ်း၍ လုပ်ဆောင်သွားမည့် အစီအစဉ်များကို ထည့်သွင်းဖော်ပြထားပါသည်။ CSR အား Environmental Responsibility, Human Right Responsibility, Philanthropic Responsibility, Economic Responsibility အစရှိသဖြင့် အမျိုးအစား လေးမျိုးခွဲခြား၍ အကောင်အထည်ဖော် ဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။	အစီရင်ခံစာအခန်း (၈)၊ အပိုဒ်ခွဲ (၈.၉)၊ စာမျက်နှာ (၈-၂၀) မှ (၈-၂၂) အထိ တွင် ထည့်သွင်းဖော်ပြထားပါသည်။
၁၁။	အထွေထွေ			
	အစီရင်ခံစာ ရေးသားရာတွင် ဆောင်ရွက်သင့်ကြောင်း အကြံပြုတင်ပြထားခြင်းမျိုး ရေးသားထားသဖြင့် ဆောင်ရွက်မည့် ထိခိုက်မှု လျော့ပါးစေရေးလုပ်ငန်းများကို ဆောင်ရွက်မည်ဖြစ်ကြောင်း၊ ကတိပြုဖော်ပြ ရေးသားသည့် အရေးအသားဖြင့် ပြင်ဆင်ရေးသား ဖော်ပြပေးရန်၊ EIA Procedure အပိုဒ် ၁၀၈အရ စီမံကိန်းအဆိုပြုသူသည် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်၏ ဇယားပါအတိုင်း စောင့်ကြပ်ကြည့်ရှုမှု အစီရင်ခံစာကို ဝန်ကြီးဌာနသို့ (၆) လတစ်ကြိမ် တင်ပြမည်ဖြစ်ကြောင်း ထည့်သွင်းဖော်ပြရန်၊ ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း အပိုဒ် (၇၇) အရ အစီရင်ခံစာ Soft Copyကို ပူးတွဲတင်ပြရန်၊ ပြန်လည်ရေးဆွဲမည့် IEEအစီရင်ခံစာတွင် ယခုပေးပို့သော အကြံပြုချက် တစ်ခုချင်းစီအလိုက် ဖြေရှင်းချက် များကို အစီရင်ခံစာ၏ မည်သည့် အပိုင်းတွင် ရေးသားထားသည်ကို ဖော်ပြသည့် Comment Response Tableကို ဖော်ပြပေးရန်၊ အစီရင်ခံစာအခန်းအလိုက် အဆိုပြုသူမှ ပတ်ဝန်းကျင်ထိခိုက်မှုမရှိစေရေး ဆောင်ရွက်မည့် အစီအစဉ် အကျဉ်းချုပ်ကို ကတိကဝတ်ဇယားအဖြစ် စုစည်းတင်ပြရန်၊ IEE အစီရင်ခံစာကို ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း အပိုဒ် (၃၆) ပါ အစီအစဉ်အတိုင်း ရေးသားတင်ပြရန်၊	IEE အစီရင်ခံစာသည် တတိယအဖွဲ့အစည်းမှ ပြင်ဆင်ရေးသားသော အစီရင်ခံစာဖြစ်သဖြင့် ဆောင်ရွက်သင့်သည့် ကိစ္စရပ်များကို အကြံပြုတင်ပြထားသည့် ပုံစံဖြင့် ပြုစုရေးသားထားခြင်း ဖြစ်ပါသည်။ သို့ရာတွင် ဤ အစီရင်ခံစာတွင် ပါဝင်သည့် သက်ရောက်မှု တစ်ခုချင်းစီအတွက် လျော့ပါးစေရေးနည်းလမ်းများကို စီမံကိန်းအဆိုပြုသူမှ လိုက်နာ ဆောင်ရွက်မည်ဖြစ်ကြောင်း ကတိတဝတ်အား အစီရင်ခံစာ အခန်း (၉)၊ အပိုဒ်ခွဲ (၉.၂)၊ စာမျက်နှာ (၉-၅) မှ (၉-၇) အထိတွင် ထည့်သွင်း ဖော်ပြထားပါသည်။ EIA Procedure အပိုဒ် (၁၀၈) အရ စီမံကိန်းအဆိုပြုသူသည် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်၏ ဇယားပါအတိုင်း စောင့်ကြပ်ကြည့်ရှုမှု အစီရင်ခံစာကို ဝန်ကြီးဌာနသို့ (၆) လတစ်ကြိမ် တင်ပြမည်ဖြစ်ကြောင်းကို အခန်း (၈)၊ အပိုဒ်ခွဲ (၈.၆)၊ စာမျက်နှာ (၈-၁၆) တွင် ထည့်သွင်းဖော်ပြထားပါသည်။ ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း အပိုဒ် (၇၇) အရ အစီရင်ခံစာ Soft Copy ကို ပူးတွဲ တင်ပြသွားပါမည်။ IEE အစီရင်ခံစာတွင် ယခုပေးပို့သော အကြံပြုချက် တစ်ခုချင်းစီအလိုက် ဖြေရှင်းချက်များကို အစီရင်ခံစာ၏ မည်သည့် အပိုင်းတွင် ရေးသားထားသည်ကို ဖော်ပြသည့် Comment Response Table ဖြင့် ယခု ဇယားအတိုင်း ပူးတွဲဖော်ပြထားပါသည်။ အစီရင်ခံစာအခန်းအလိုက် အဆိုပြုသူမှ ပတ်ဝန်းကျင်ထိခိုက်မှု မရှိစေရေး ဆောင်ရွက်မည့် အစီအစဉ်အကျဉ်းချုပ်ကို List of Commitment အနေဖြင့် အခန်း (၉)၊ အပိုဒ်ခွဲ (၉.၂)၊ စာမျက်နှာ (၉-၅) တွင် ထည့်သွင်းဖော်ပြထားပါသည်။ IEE အစီရင်ခံစာပြင်ဆင်ရာတွင် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း အပိုဒ် (၃၆) ပါ အစီအစဉ်အတိုင်း ရေးသားတင်ပြထားပါသည်။	

ANNEX 3 – ENVIRONMENTAL BASELINE MEASUREMENTS

ENVIRONMENTAL BASELINE MEASUREMENTS

Summary of Overall Timeline of Baseline Studies

Previous environmental baseline studies have been carried out by Lucky Bird Environmental Studies & Geo-Informatic Solutions in 2014 for the EIA study of the factory owned by Kaung Kin Kyal Chout Pwint Co., Ltd. After the factory is handed over by Myanmar Shin Shin Metal Co., Ltd, Mon State Environmental Conservation Department has been regularly carrying out the environmental quality monitoring activities especially the air quality, from 2018 to 2020.

During the preparation of IEE report, the EnvO study team has conducted necessary baseline survey (i.e. on-site noise level measurement, indoor air quality measurement and effluent quality) to determine the actual environment conditions and to reflect in the impact and risk assessment. The following figure illustrates the timeline of environmental baselines studies which were carried out from 2014 to 2021.

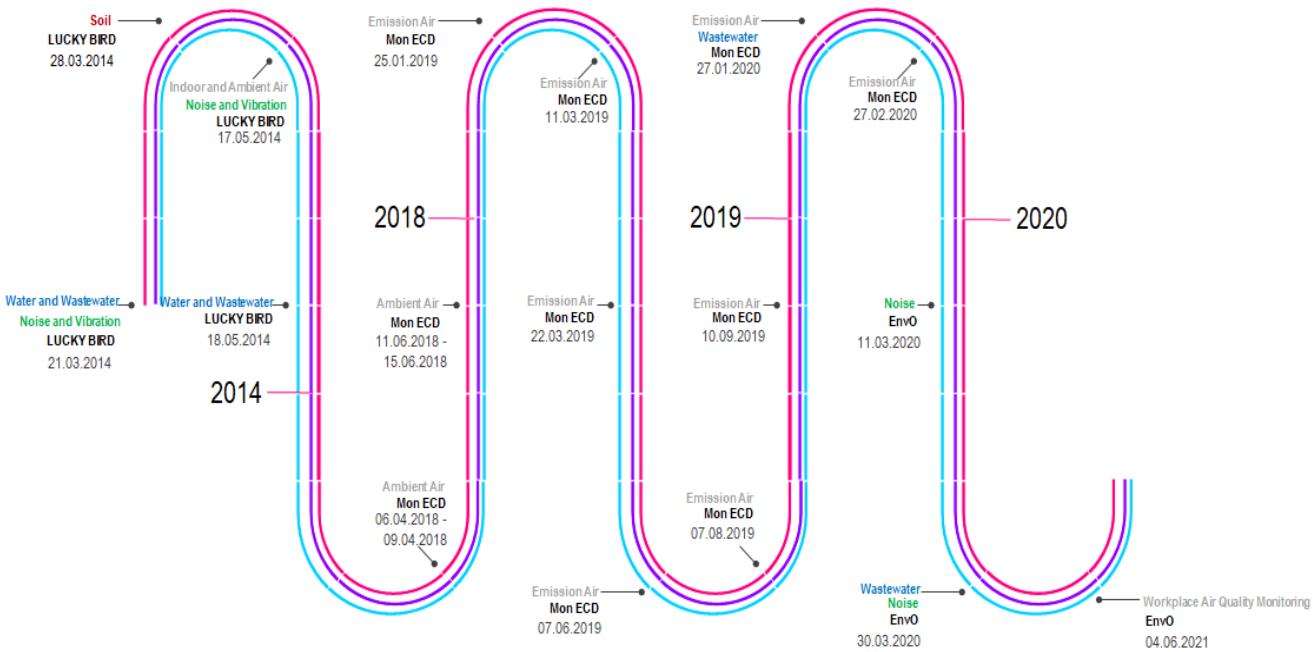

Figure 1. Timeline of Environmental Baseline Studies (March, 2014 to June, 2021)

Source: EnvO Study Team

Although a series of monitoring activities have been carried out, it is difficult to determine the changes in environmental conditions in last 6 years due to the inconsistencies in monitoring locations, frequencies, methods and conditions. Based on the lessons learnt from previous activities, recommendations have been made to improve monitoring performance of the proposed project. Moreover, recommendations made here will also be incorporated into relevant part of EMP and EMoP of the IEE report.

Results of Baseline Studies (Conducted by Lucky Bird Environmental Studies & Geo-Informatic Solutions)[17]

The results of baseline studies carried out in the previous EIA study stage are described under the following sections. As the study time was in March, 2014 when the environmental regulations such as EIA procedures, NEQG, etc. have not been established yet in Myanmar, there were limitations in monitoring technology, parameters and equipment in conducting baseline survey. Therefore, it is difficult to evaluate the environmental baseline conditions based on those monitoring results. However, the study was conducted with the best available technology and with the monitoring equipment, locally available at that time.

Air Quality

Air quality baseline survey was carried out on 17-05-2014 when the factory was in test run condition. A total of eight tests were conducted at four different locations. It was done in order to determine the air quality at workplace while the factory is in operation and to know the status of ambient air quality near the project site. The tests were run to monitor the levels of Sulfur Dioxide (SO_2), Carbon Monoxide (CO) and Nitrogen Dioxide (NO_2). The monitoring locations and results are described in the following tables.

Table 1. Description of Air Quality Monitoring Points

Test No	Monitoring Points	Coordinates*	Targeted Quality	Description**	Reasons for Choosing the Monitoring Point
Test 1	AQ - 1	16°28'36.52" N 97°40'34.24" E	Air Quality in Workplace	Near Roasting Line of Antimony Ore	To check whether the smoke and flue gas emitted from the production processes are dispersed in the workplace or not.
Test 2					
Test 3	AQ - 2	16°28'36.30" N 97°40'34.69" E		Roasting Line of Coal (within 10 meters of the main working area)	
Test 4	AQ - 3	16°28'36.66" N 97°40'34.46" E		Between Coal Roasting Line and Antimony Ore Roasting Line	
Test 5					
Test 6					
Test 7	AQ - 4	16°28'42.63" N 97°40'38.71" E	Ambient Air Quality	Rubber Plantation Field about 205 meters North of the Factory	To check the status of ambient air quality nearby the project site.
Test 8					

Source: Lucky Bird Environmental Studies & Geo-Informatic Solutions

Note: AQ refers "Air Quality"

Note*: Coordnate points are predicted based on the descriptions in previous EIA report.

Note**: As the areas described here are the areas of previous factory in 2014, it is not the same layout with the current factory.

[17] Original documents of laboratory analysis results can be found in previous EIA report prepared by Lucky Bird Environmental Studies & Geo-Informatic Solutions in 2014.

Table 2. Air Quality Baseline Survey Results

Sample Point	Duration	Parameters and Monitored Values (ppm & mg/m³)					
		Carbon Monoxide		Sulphur Dioxide		Nitrogen Dioxide	
		Max	Min	Max	Min	Max	Min
Survey Date - 17-05-2014							
AQ - 1	10:15 am to 10:45 am 11:00 am to 11:30 am (30 minutes Each)	-	-	0.25 ppm (0.71 mg/m³)	0.13 ppm (0.37 mg/m³)	-	-
AQ - 2	2:15 pm to 2:45 pm (30 minutes Each)	-	-	0.25 ppm (0.71 mg/m³)	0.19 ppm (0.54 mg/m³)	-	-
AQ - 3	3:00 pm to 3:30 pm 3:50 pm to 4:20 pm 4:30 pm to 5:00 pm (30 minutes Each)	-	26 ppm (32.51 mg/m³)	-	-	-	-
AQ - 4	5:15 pm to 5:45 am 5:45 pm to 6:15 am (30 minutes Each)	-	-	-	0.16 ppm (0.42 mg/m³)	-	-
NEQG Guideline Values (Ambient Air Quality)				0.5 mg/m3 (10 mins)		0.2 mg/m3 (1 hr)	

mg/m3 = 0.0409*ppm*molecular weight
Source: Lucky Bird Environmental Studies & Geo-Informatic Solutions

Judgement on Air Quality Monitoring Results

Based on the results by comparing with NEQG guideline values, it was found that short-time maximum monitoring values of SO_2 are higher than the guideline values. The highest values were tested at the time when the furnace is starting fire and adding fuel (coal) to the furnace. This is the time when there was an incomplete combustion was occurred in a short period and may emit pollutants (mainly CO, NOx and SO_2) than the normal operation time. Moreover, it might be due to the accumulation of dust and smoke when the doors of the furnace are opened. When the operation becomes normal, it can be found that the SO_2 values were not deducted (See monitoring results of AQ-3 measured during 3:00 pm to 5:00 pm). The SO_2 values near the rubber plantation area which is about 205 meters away from the factory is under the NEQG guideline values.

Evaluation and Recommendations

Based on the air quality baseline results, it is important to close the openings of furnaces (roasting and smelting furnaces) at the beginning of fire and let the fume and smoke to emit through the stack in order not to accumulate pollutants in the working area which might affect the occupational health of the workers. The nature of combustion in furnace may emit pollutants (mainly CO and SO_2) temporarily. However short-term emission may not be a significant impact to the environment.

Water and Wastewater Quality

Water and wastewater quality monitoring were carried out on 21.03.2014 and 18.05.2014. A total of six samples were taken from respective locations. Some of the parameters were tested onsite with test kits and for the other parameters, samples were collected and tested at ISO TECH Laboratory. The monitoring locations and results are described in the following tables.

Table 3. Description of Water and Wastewater Quality Monitoring Points

No	Monitoring Points	Collection Date	Targeted Quality	Description of Monitoring Points
1	WQ -1	21.03.2014	Water Quality	Water for factory use and worker's accommodation use (tube well water)
2	WQ -2	21.03.2014	Wastewater Quality	Water which has been reacted with antimony ore for 24 hours to know the results when the

No	Monitoring Points	Collection Date	Targeted Quality	Description of Monitoring Points
				antimony ore will be stored uncovered in the rainy season.
3	WQ -3	18.05.2014	Wastewater Quality	Water which is circulating inside the production processes stored inside water exchange tank
4	WQ -4	18.05.2014	Wastewater Quality	Water from pond (low-lying area about 12.6 meters east from the factory) to know the results of stormwater quality which is passing though the factory compound
5	WQ -5	18.05.2014	Water Quality	Surface water from Attaran River
6	WQ -6	18.05.2014	Water Quality	Attaran River Water at 6 feet depth

Source: Lucky Bird Environmental Studies & Geo-Informatic Solutions

Note: WQ refers "Water Quality"

Table 4. Results of Water Quality at WQ – 1, WQ – 5 and WQ – 6 Points

No	Test Parameters	Unit	Water Sampling Points			NEQG Guideline[18]
			WQ - 1	WQ - 5	WQ - 6	
1	Ammonia	mg/l	-	-	-	10
2	Ammonium	mg/l	-	-	-	-
3	Arsenic	mg/l	Nil	Nil	Nil	0.1
4	Bicarbonate	mg/l as $CaCO_3$	-	-	-	-
5	BOD	mg/l	-	-	-	50
6	Calcium	mg/l	-	-	-	-
7	Calcium Hardness	mg/l as $CaCO_3$	-	-	-	-
8	Carbonate	mg/l as $CaCO_3$	-	-	-	-
9	Chloride	mg/l	7	-	-	-
10	Chlorine (Residual)	mg/l	-	-	-	0.2
11	COD	mg/l	-	-	-	250
12	Color (True)	TCU	Nil	-	-	-
13	Conductivity	micro S/cm	19	-	-	-
14	Copper	mg/l	-	-	-	0.5
15	Cyanide	mg/l	-	-	-	0.1*
16	Dissolved Oxygen	mg/l	-	-	-	-
17	Dissolved Solids	mg/l	-	-	-	-
18	Fluoride	mg/l	Nil	Nil	Nil	20
19	Iron	mg/l	0.35	2.33	3.28	3.5
20	Lead	mg/l	Nil	Nil	Nil	0.1
21	Magnesium Hardness	mg/l as $CaCO_3$	-	-	-	-
22	Manganese	mg/l	Nil	-	-	-
23	Methyl Orange Acidity	mg/l	-	-	-	-
24	Nitrate	mg/l	Nil	Nil	Nil	-
25	pH		5.9	8.1	8.4	6 – 9*
26	Phenolphthalein Acidity	mg/l	-	-	-	-

[18] Effluent Levels for Wastewater, Storm Water Runoff, Effluent and Sanitary Discharges (General Application)

No	Test Parameters	Unit	Water Sampling Points			NEQG Guideline[18]
			WQ - 1	WQ - 5	WQ - 6	
27	Phenolphthalein Alkalinity	mg/l as $CaCO_3$	-	-	-	-
28	Phosphate	mg/l	-	-	-	-
29	Salinity	ppt	-	-	-	-
30	Silica	mg/l	-	-	-	-
31	Sodium Chloride	mg/l	-	-	-	-
32	Sulphate	mg/l	Nil	47	23	-
33	Suspended Solids	mg/l	-	461	519	50
34	Total Alkalinity	mg/l as $CaCO_3$	-	-	-	-
35	Total Hardness	mg/l as $CaCO_3$	4	-	-	-
36	Total Solids	mg/l	-	-	-	-
37	Turbidity	NTU	2	-	-	-
38	Zinc	mg/l	-	-	-	0.2

Source: Lucky Bird Environmental Studies & Geo-Informatic Solutions

Table 5. Results of Wastewater Quality at WQ – 2, WQ – 3 and WQ – 4 Points

No	Test Parameters	Unit	Water Sampling Points			NEQG Guideline[19]
			WQ - 2	WQ - 3	WQ - 4	
1	Ammonia	mg/l	-	1.46	-	10*
2	Ammonium	mg/l	-	1.55	-	-
3	Arsenic	mg/l	Nil	Nil	Nil	0.2
4	Bicarbonate	mg/l as $CaCO_3$	-	1	226	-
5	BOD	mg/l	-	70	96	50*
6	Calcium	mg/l	-		-	-
7	Calcium Hardness	mg/l as $CaCO_3$	-	456	74	-
8	Carbonate	mg/l as $CaCO_3$	-	Nil	Nil	-
9	Chloride	mg/l	-	90	19	-
10	Chlorine (Residual)	mg/l	-	Nil	Nil	0.2*
11	COD	mg/l	-	160	224	50
12	Color (True)	TCU	-	60	90	-
13	Conductivity	micro S/cm	-	5090	590	-
14	Copper	mg/l	-	Nil	Nil	0.1
15	Cyanide	mg/l	-	Nil	Nil	0.1*
16	Dissolved Oxygen	mg/l	-	4.0	-	-
17	Dissolved Solids	mg/l	-	3210	377	-
18	Fluoride	mg/l	-	0.3	0.7	5
19	Iron	mg/l	1.8	4.62	8.26	3.5*
20	Lead	mg/l	Nil	Nil	Nil	0.1
21	Magnesium Hardness	mg/l as $CaCO_3$	-	224	34	-
22	Manganese	mg/l	-	1.5	2.2	-
23	Methyl Orange Acidity	mg/l	-	Nil	Nil	-

[19] Effluent Levels for nickel, copper, lead, zinc and aluminum smelting and refining
* Wastewater, Storm Water Runoff, Effluent and Sanitary Discharges (General Application)

No	Test Parameters	Unit	Water Sampling Points			NEQG Guideline[19]
			WQ - 2	WQ - 3	WQ - 4	
24	Nitrate	mg/l	-	Nil	3.6	-
25	pH		-	2.5	6.9	6 – 9*
26	Phenolphthalein Acidity	mg/l	-	30	2	-
27	Phenolphthalein Alkalinity	mg/l as $CaCO_3$	-	Nil	Nil	-
28	Phosphate	mg/l	-	Nil	-	-
29	Salinity	ppt	-	3.0	0.3	-
30	Silica	mg/l	-	2	4	-
31	Sodium Chloride	mg/l	-	149	31	-
32	Sulphate	mg/l	12	850	75	-
33	Suspended Solids	mg/l	-	99	537	20
34	Total Alkalinity	mg/l as $CaCO_3$	-	1	226	-
35	Total Hardness	mg/l as $CaCO_3$	-	680	108	-
36	Total Solids	mg/l	-	3309	914	-
37	Turbidity	NTU	-	131	710	-
38	Zinc	mg/l	-	-	Nil	0.2

Source: Lucky Bird Environmental Studies & Geo-Informatic Solutions

Judgement on Water Quality Monitoring Results

There is no significant monitoring results of WQ – 1, WQ – 5 and WQ – 6 except for the fact that suspended solids level are higher than the NEQG guideline values[18]. Nevertheless, the suspended solids levels in the natural river water are always higher especially flowing in the delta regions of Myanmar. The acidity of WQ – 1, tube well water is slightly lower than guideline values but it would not make any effect on the environment or upon the human.

The wastewater monitoring results of WQ – 3 and WQ – 4 could not give certain answer as most of the tested parameters are not guided in NEQG guideline values as the test was done before the time that the guideline was not legitimated. BOD and COD values are higher than the NEQG guideline values[19]. WQ – 3 is the location where water is circulating and reusing again in the process. Therefore, BOD and COD values could be higher in the re-circulating water inside the system. WQ – 4 is water from the pond and it is obvious that the exceeded COD is correlated with increasing concentrations of chlorophyll in the pond as per natural phenomena.

Suspended solid in the WQ - 4 might be high due to the soil particles in pond and WQ – 3 might be because of the dusts residues in water generated from the cleaning and housekeeping activities. Iron levels in both WQ – 3 and 4 are higher which might be resulted from the higher concentration of iron in antimony ore and the residues. pH level in water which was reacted with antimony ore is found to be highly acidic. However, toxic materials such as lead and mercury are not presented in the wastewater tested at that time.

Evaluation and Recommendations

Based on the water quality baseline results, it is recommended to store antimony ore inside the roofed place and with impermeable layered base (i.e. concrete ground) in order not to interact with water which could lead to the water pollution.

In order to know the current condition of wastewater and stormwater generated from the proposed project, water samples are taken during the period of IEE study (March, 2020), the results are described in Annex – 6 and considered in the relevant Impact Assessment in Chapter (5).

Soil Quality

Soil sample was collected from the field which is near the factory (3 feet depth underneath the soil) and tested at Land Use Division, Department of Agriculture, Ministry of Agriculture, Livestock and Irrigation on 28.03.2014. The purpose of monitoring is to record soil condition before the operation of the factory. From the results, it was found out that the soil type is Clay Alluvium and slightly acidic. The soil texture is sand (1%), silt (27%) and clay (70%) and others (2%). The calcium, magnesium and potassium composition of the soil is below the normal condition and cannot provide fertilizing value for agriculture.

Noise and Vibration

Noise and vibration monitoring were conducted twice by means of auto detectable sound tester. During the first time (21.03.2014), one generator and some air blowers were under operation. The results are 83.5 dB in the middle of the factory compound and 92.9 dB from generator.

The second time (17.05.2014) was conducted during the full capacity operation of the factory. The results are shown in the following table.

Table 6. Results of Noise Measurement

No	Source of Noise	Date	Minimum Value	Maximum Value	IFC EHS General Guideline	
					LA_{eq}, 8h*	Maximum LA_{max}, Fast**
1	Crushing Coal and Antimony Ore	17.05.2014	75 dB	84 dB	85 dB	110 dB
2	Crushing Machine		-	94.1 dB		
3	Air Blowers		83.6 dB	87.5 dB		
4	Operation of Fume Motor		84 dB	90 dB		
5	Roasting Lines		-	75 dB		
6	Noise inside Main Workplace		-	96.2 dB		
7	Noise in the Middle of the Factory		83.1 dB	91.9 dB		
8	Noise at the Entrance of the Factory		55 dB	68 dB		

Source: Lucky Bird Environmental Studies & Geo-Informatic Solutions
Note*: Limit of Noise Equivalent Level (LAeq) for a duration of 8 hr specified by IFC for Heavy Industries
Note*8: Limit of Average Maximum Sound Level (LAmax) specified by IFC for Heavy Industries

For vibration, it was found that operation of crushing machine caused vibration. The crushing machine had vibration intensity of 7.4 Mercalli Intensity Scale. Vibration intensity at a distance of 1m from it had average value of 0.7 Mercalli Intensity Scale and Maximum 2.0 Mercalli Intensity Scale.

Judgement on Noise and Vibration Monitoring Results

The main source of noise is discovered to be from the operation of air blowers which are used in the production processes (roasting furnace and smelting furnace), crushing machines and generators. This is the condition when the factory was in test run stage and the generators have not been positioned inside the designated room yet. The monitoring results showed the exceedance of noise level defined for workplace noise exposure in 8-hr average by IFC. Due to the nature of crushing machine, an insignificant vibration might be emitted. However, it would not make any impact upon human especially the workers and the environment.

Evaluation and Recommendations

In order to know the current noise emanating status from the proposed project as pervious conditions have been changed and improved significantly, spot check noise measurement was done during the IEE preparation period (March, 2020). The results are described in Annex (7) and considered in relevant impact assessment (Chapter 5) and risk assessment (Chapter 6).

Results of Baseline Studies (By Mon State ECD)

Summary of Overall Timeline (Air Quality Monitoring)

Mon State Environmental Conservation Department (ECD) has carried out air quality monitoring works such as ambient, and emission air quality monitoring starting from December 2018. Since then, Mon State ECD has instructed MSS factory to control the emissions in accordance with the National Environmental Emission Quality Guidelines. The following timeline shows the air quality monitoring works of Mon State ECD. It can be seen that there are two times of ambient air quality monitoring in 2018, six times of emission air quality monitoring in 2019 and two times of emission air quality monitoring in 2020.

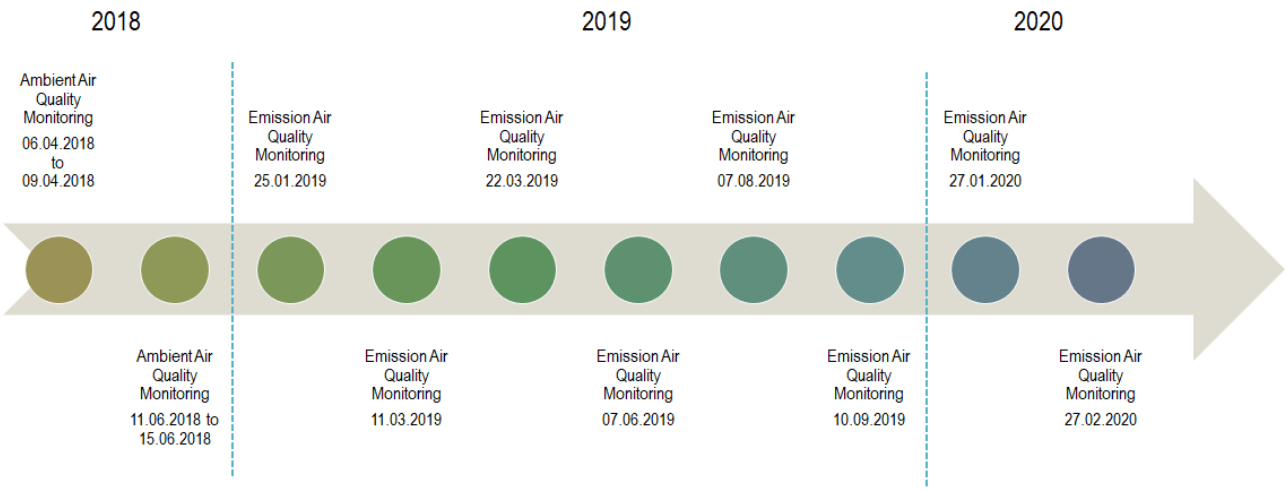

Figure 2. Timeline of Air Quality Monitoring by Mon State ECD (November 2017 to February 2020)

Source: EnvO Study Team

Ambient Air Quality

Ambient air quality monitoring results measured by Mon State Environmental Conservation Department are described in the following table. It is observed that the monitoring point is located near the MSS factory and the ambient air quality is continuously monitored for 3 to 4 days. The detailed information about monitoring activities together with the results are described in the following table.

Table 7. Ambient Air Quality Results

No.	Parameter (mg/m³)		Nitrogen Dioxide	Sulphur Dioxide	Ozone	Carbon Monoxide	PM_{10}	$PM_{2.5}$
1.	Location/ Sample Point	Near Myanmar Shing Shing Factory	0.01933	0.01008	0.07595	0.42613	0.18933	0.05771
	Date - Duration	6.4.2018 – 9.4.2018 (72 hours)						
2.	Location/ Sample Point	Near Myanmar Shing Shing Factory	0.01348	0.02105	0.03703	-	0.05331	0.01426
	Date - Duration	11.6.2018 -15.6.2018 (96 hours)						
Guideline Value (NEQG)			0.2 (1 hour)	0.02 (24 hour)	0.1 (8-hour daily maximum)	-	0.05 (24 hour)	0.025 (24 hour)

Source: Mon State ECD

Judgement on Ambient Air Quality Monitoring Results

Based on the two times monitoring results, it was found that the NO_x, and Ozone are well within the NEQG guideline values while SO_2 monitoring results in June, 2018 is slightly over (~ 0.001) the guideline values. Two parameters of Particulate Matter, PM 10 and PM 2.5 are observed to be exceeded over NEQG guideline values in April, 2018 and PM 10 result is just slightly over (~ 0.003) the guideline values.

As there are many variables influencing the exceedance of Particulate Matter results than the NEQG guideline value, it is difficult to find out the exact reason. It may be because of many factors not only from the operation of MSS – for example, due the location of monitoring point which might be nearer to the PM emission source such as kitchen or earth road, due to dump firing which is most common in Mon State, or may be emission of other factories located inside the Mawlawmyine Industrial Zone.

If it is considered to be from MSS, it might be not from the point source emission (i.e. emission from stack) due to the stack height which is high enough to emit the smoke into the atmosphere and not to disperse nearby factory area. It is also important to identify the diffuse emission sources near the monitoring location such as identifying whether the emission is from coal grinding area, vehicle moving area, generators, etc. or not.

Evaluation and Recommendations

Received information about ambient air quality monitoring is not sufficient enough to make evaluation and therefore it cannot be said that the exceedance of PM 10 and PM 2.5 is related to the MSS factory or not. In coming monitoring activities, it is recommended to record the wind speed and wind direction at the time of measuring ambient air quality in order to identify the source of pollutant emission when the equipment is showing the exceeded values. When choosing the monitoring point, it is suggested not to choose near the areas of temporary or permanent pollution source – for example, near the road where vehicles are frequently passing, near the kitchen where the use of coal stove may present, near the location where leaves or garbage are usually burnt, etc. The location of the monitoring should represent the location of the community which may have the potentials to get affected by the pollutants.

Emission Air Quality

Emission air quality monitoring results measured by Mon State Environmental Conservation Department are described in the following table.

Table 8. Emission Air Quality Results

No.	Parameter		Sulphur Dioxide		Nitrogen Oxide	
			Max	Min	Max	Min
			(mg/m³)		(mg/m³)	
1.	Location/ Sample Point	Stack	235.1	48.91	3.15	0
	Date - Duration	25.1.2019 (15:00 to 16:40) (1 hour 20 minutes)				
2.	Location/ Sample Point	Stack	229.2	53	8.32	3.31
	Date - Duration	11.3.2019 (15:26 to 16:40) (1 hour 24 minutes)				
3.	Location/ Sample Point	Stack	189.2	82.6	14.08	7.27
	Date - Duration	22.3.2019 (13:10 to 15:20) (2 hour 10 minutes)				
4.	Location/ Sample Point	Stack	1205.81	71.5	12.94	4.03
	Date - Duration	7.6.2019 (14:29 to 15:14) (45 minutes)				
5.	Location/ Sample Point	Stack	26.6	22.31	39.15	9.43
	Date - Duration	7.8.2019 (13:35 to 14:45) (1 hour 10 minutes)				
6.	Location/ Sample Point	Stack	31.46	22.594	76.456	16.161
	Date - Duration	10.9.2019 (13:40 to 15:20) (1 hour 40 minutes)				
7.	Location/ Sample Point	Stack	3167	760.3	17.94	6.418
	Date - Duration	27.1.2020 (12:05 to 13:05) (1 hour)				
8.	Location/ Sample Point	Stack	25.454	22.308	39.329	13.252
	Date - Duration	27.1.2020 (11:00 to 12:10) (1 hour 10 minutes)				
NEQG Guideline Value of Air Emission Levels for Nickel, Copper, Lead, Zinc and Aluminum Smelting and Refining – Varying by Metal Type/ Smelting Process			200	50	300	100

ppm=22.4× mg/m³ ÷ molecular weight of gas (at 1 atm and 0 degree Celsius)
Source: Mon State ECD
Note: Monitoring results are unit-converted from PPM to mg/m³ for comparing with NEQG Guideline Values.

Judgement on Emission Air Quality Monitoring Results

During 2019 to 2020, it is found that emission monitoring was undertaken for about 8 times and results received for four time was remarkable. Out of 8 times, the maximum limit of SO_2 was exceeded than the NEQG guideline values for four times and the minimum limit was exceeded for two times. NOx values are found to be very well under the guideline values.

In fact, it is difficult to make judgement on the quantitative results of monitoring without considering the other important factors such as method of monitoring, duration of monitoring, quality assurance of the monitoring device and the skillful staff who is capable to do monitoring and analyzing data. For example, the minimum sampling duration of SO_2 and NO (emission from stack) should be 1 hour per run and sampling should be conducted a minimum of two test runs in order to get the representative sampling results[20]. To minimize the process variables, tests should be made when there is a constant flow through the chimney when the factory is operating at greater than 50% of the maximum capacity (i.e. in condition when two out of four furnaces are running). The location of sampling device should be placed at the location after the abatement equipment (e.g. wet scrubber) is installed.

Moreover, it is important to consider the fluctuations in velocity, flue gas temperature or pollutant concentration due to the variation in process (i.e. beginning of the furnace operation, fuel feeding time, running of furnace in parallel, etc.) and understand the nature of emission during the time of monitoring. Then, that information will be useful in making analysis and the evaluation of the results. Moreover, specific considerations shall be made to identify whether the multi-point sampling is necessary or not. If the stratification exists (e.g. notably after the junction of several different streams), the gaseous emission determination will require multi-point sampling. In case where stratification does not exist, single point sampling at one quarter the diameter across the stack should be considered representative of the gaseous emission provided it is far enough from the side of the stack to eliminate effects from stack walls.

For test 1 and test 2, it is found that only the maximum limit is slightly higher than the NEQG values. Nevertheless, for test 4 and test 7, both the maximum and minimum results are found to be significantly higher than the results. It might be because of the malfunctioning of the wet scrubber operation at the time of monitoring or maybe at the beginning of wet scrubber operation when the reagent is not mixed well in the wet scrubber and is not be able to control the SO_2 emission emitted from the furnaces.

From the emission monitoring results undertaken by the ECD, the results of CO are excluded in the discussion because there may be a huge gap in determination of the monitoring values. Unlike other gaseous pollutants, determination of CO concentration is unique and it is necessary to consider the volume fraction of Carbon Dioxide and the temperature of gas introduced to the analyzer when converting the values of reading (ppm) into concentration at standard condition (mg/m^3). Moreover, it is expected that CO may be emitted from the operation of furnaces only in the time of in-complete combustion (i.e. when black smoke is emitted at the beginning of furnace operation or feeding fuel at low temperature) for a while and it would not be significant throughout the time of operation. During the normal operation, only the CO_2 resulted from the combination of carbon in coal and oxygen in air, is expected to be generated.

[20] Emission testing methodology for air pollution (epa.sa.gov.au)

Evaluation and Recommendations

Due to the monitoring results and based on the site investigation undertaken during the time of IEE study, it is found that the systematic management of wet scrubber operation is necessary for the MSS factory. Therefore, EnvO study team has prepared the SOP for Wet Scrubber Operation, attached as a sub-plan in the Annex – 5 of IEE report. By using this SOP, it is expected to control the SO_2 emission well in the future and will significantly reduce the amount of SO_2 emission through the stack.

For upcoming air emission monitoring activities, it is strongly recommended to conduct by considering the important monitoring procedures. As a reference, "The Emission Testing Technology for Air Pollution" published by the South Australia, EPA (Emission testing methodology for air pollution (epa.sa.gov.au) is suggested to use for the technical recommendations. If the monitoring results show the exceeded values at the time of monitoring at project site, it is recommended to check the wet scrubber to know whether it is properly worked or not. It can be done by simply testing the pH values of scrubbing liquid or opacity of smoke as described in the SOP (Annex – 5). Regular record keeping and monitoring of the performance of wet scrubber will ensure that the wet scrubber will be well operating in accordance with the guidance values set out by the MONREC, ECD.

Wastewater Quality

The wastewater quality monitoring by Mon State Environmental Conservation Department was carried out on 27.01.2020 by taking samples from water cooling tank and drainage. A total of eight parameters were measured and the results are shown in the following table.

Table 9. Results of Wastewater Quality

No	Parameters	Unit	Location of Monitoring		Guideline Value (NEQG)
			Water Cooling Tank	Drainage	
1	pH	S.U	8.48	7.034	6 – 9
2	ION	mol/l	8.380	0.284	-
3	Conductivity	mS/cm	0.253	0.75	-
4	Oxidation Reduction Potential	mV	-60.6	28.7	-
5	Total Dissolved Solids	mg/l	134	401	-
6	Resistivity	Ω.cm	39.5	13.31	-
7	COD	mg/l	124	113	50
8	Copper	mg/l	0.07	0.25	0.1

Source: Mon State ECD
Note "_" are the values which are not identified by the NEQG.

Judgement on Wastewater Quality Monitoring Results

It is found that a total of 8 parameters are tested by the ECD. Out of those, only two parameters are comparable with the NEQG Guideline Values. Then it was found that COD from both water-cooling tank and drainage are over the NEQG guideline values. Moreover, Copper from drainage is exceeded than the NEQG guideline values.

It is expected that COD is higher because of two reasons: (1) the origin of water may contain high values of COD as it is taken from the Attaran River. The COD values in the river water may vary in accordance with the

seasons – COD values is usually lower in rainy season and higher in dry season. (2) the circulating nature of water inside the process. The re-circulating water inside the process may increase the COD levels gradually as it is reusing in the process again and again. COD values in drain water is higher due to its nature of unalter water. Higher copper values in the drain line is expected to be from the farming activities undertaken at adjacent farm lands.

Evaluation and Recommendations

Based on the monitoring results, it is difficult to evaluate whether there is any impact to the environment from the effluent discharge of the MSS factory. Therefore, wastewater sampling has undertaken during the study of IEE to find out the current status of effluent discharged from the MSS factory and the receiving water inside the earth drain. Wastewater monitoring activities are described in the Annex – 6 and the results are thoroughly discussed in Section 5.2.3. For upcoming wastewater monitoring, it is recommended to monitor the recommended parameters identified in Section 2.3.3.

ANNEX 4 – AIR QUALITY ASSESSMENT RELATED CALCULATIONS

AIR QUALITY ASSESSMENT RELATED CALCULATIONS

Calculation of Emission of Sulfur Dioxide

The emission of sulfur dioxide is calculated based on the following equation based on the fuel analysis as per the guidance of Emission Estimation Technique Manual by the National Pollutant Inventory (NPI), Australia[21]. This assumes the complete conversion of sulfur (present in fuel) to sulfur dioxide. In other word, the resulted amount gives the maximum possible sulfur dioxide emission from MSS.

$$E_{SO2} = Q_f * C /100 * (MW_p /EW_f)$$

where: E = annual emissions of pollutant SO_2, ton/yr
Q_f = fuel use, ton/yr
MW_p = molecular weight of SO_2 emitted, g/mole 64 g/mole
EW_f = elemental weight of SO_2 in fuel, g/mole; 32 g/mole
C = concentration of pollutant SO_2 in fuel, weight percent,

By adding known values and simplifying the equations,

$$E_{SO2}= Q_f * C/100 * (64/32)$$
$$E_{SO2}= Q_f * C/100 * (2)$$

$$E_{SO2}= 0.02 * Q_f * C$$

Emission from Coal and Coke Used in Roasting and Smelting Lines

Q = fuel (Coal and Coke) use, tonnes/yr
C = concentration of Sulfur in fuel, weight percent, %

For Coal Fuel,

$$E_{SO2} = 0.02 * Q_f * C$$
$$= 0.02* ((67*9) \text{ tonnes/yr}) * (0.5\%)$$
$$= 6.03 \text{ ton/yr}$$

For Coke Fuel,

$$E_{SO2} = 0.02 * Q_f * C$$
$$= 0.02* ((133*9) \text{ tonnes/yr}) * (0.73\%)$$
$$= 17.5 \text{ ton/yr}$$

Emission from Antimony Ores Used in Roasting Line

Q = Antimony Ore use, tonnes/yr
C = concentration of Sulfur in Antimony Ore, weight percent, %

[21] National Pollutant Inventory (NPI) Emission Estimation Technique (EET) Manual for Combustion Engines - Version 1.2 – 14 June 2002 (unitar.org)

$E_{SO2} = 0.02 * Q_f * C$
$= 0.02* ((60*9)$ tonnes/yr$) * (0.8\%)$
$= 8.6$ ton/yr

Annual Total Emission = 6.03 + 17.5 + 8.6 =31.13 ton/year

Therefore, a total of (31.13) tonnes of sulfur dioxide will be emitted per year from MSS.

Stack Height Calculation

As per the Emission Regulations (India, 1998), any plants except Thermal Power Plant, can use the following formula to estimate the minimum stack height based on the sulfur dioxide emission.

$$H = 14\ (Q)^{0.3}$$

Q (kg/hr) = sulfur dioxide emission
H (meters) = minimum stack height

The calculation is as follow;
H = 14* (Total Emission of SO_2 per year*24/220)$^{0.3}$
H = 14* (31.13*24/220) $^{0.3}$
H = 20.2 m (66.3 ft)

It is found that the minimum height of 20.2 m (66.3 ft) is required to cover the emission of sulfur dioxide (SO_2) from the operation processes.

ANNEX 5 – STANDARD OPERATING PROCEDURES (WET SCRUBBER)

SOP FOR WET SCRUBBER OPERATION

The proper operation of wet scrubber is crucial in controlling the emissions before emitting from the stack to the environment. Hence, this procedure is prepared by the EnvO Study Team to help the operators in MSS factory to evaluate the wet scrubber performance at the earliest possible stage and able to conduct the measures in time as needed.

The wet scrubber installed at MSS factory was built by the experienced technicians and has been running manually by the operators. Therefore, this document mainly focuses on the procedures which are suitable for the conventional wet scrubber like the one which is installed at MSS factory and targets the checkpoints which can easily be detectable by the operators with visual check or simple instruments (pH meter/pH paper).

Operational Basic Requirements

Estimated Amount of Soda Ash Feed

The main function of the wet scrubber, the absorption reaction begins with the Sulphur Dioxide (SO_2) dissolving in the soda ash solvent. Chemical reactions made during the absorption of SO_2 are described in the following.

$$SO_2 + Na_2CO_3 \rightarrow Na_2SO_3 + CO_2$$
$$Na_2CO_3 + SO_2 + H_2O \rightarrow 2NaHSO_3$$

By looking at the stochiometric ratio (SR), the amount of soda ash required to feed can be estimated. Stochiometric ratio (SR) is the ratio of the actual amount of soda ash feed, to the theoretical amount required to neutralize the SO_2 and other acidic pollutants in the flue gas. Theoretically, based on the chemical equation, one mole of Na_2CO_3 is required per mole of SO_2 to be removed. Therefore, SR can be defined as 1.

In practice, however, it is usually necessary to feed more than the stoichiometric amount of the reagent (Soda Ash). As the wet scrubber used in the MSS factory is the conventional one, SR value 1.2 is recommended to calculate the amount of soda ash required. (i.e. if the amount of SO_2 emission is 1 kg, the required amount of soda ash is 1.2 kg).

The estimated amount of required reagent (Soda Ash) may vary with the amount of fuel use per day and the sulphur content contains in each fuel type. Therefore, it should be calculated on a daily basis based on the factors such as number of production lines to be used and the type of fuel. Before the required amount of soda ash is calculated, the operator should estimate how much fuel will be used for that day. The examples of calculations are described in the following.

Table – 1 Calculation of Required Amount of Soda Ash

Estimation of Daily SO_2 emission from Roasting Lines SO_2 Emission from Coal = 0.02 x Amount of Coal Use (kg per day) x Sulphur Content in Coal = kg SO_2 Emission from Coke = 0.02 x Amount of Coke Use (kg per day) x Sulphur Content in Coke = kg SO_2 Emission from Antimony Ore = 0.02 x Amount of Antimony Ore Use (kg per day) x Sulphur Content in Antimony Ore = kg Total Daily SO_2 Emission from Roasting Line = (SO_2 Emission from Coal + SO_2 Emission from Coke + SO_2 Emission from Antimony Ore) = kg **Note: Amount of fuel use should cover for all the production lines (i.e. Roasting Line 1, Line 2 and Line 3) intended to run for one day.**
Estimation of SO_2 emission from Smelting Lines SO_2 Emission from Coal = 0.02 x Amount of Coal Use (kg per day) x Sulphur Content in Coal = kg SO_2 Emission from Coke = 0.02 x Amount of Coke Use (kg per day) x Sulphur Content in Coke = kg **(OR)** SO_2 Emission from Diesel = 0.02 x Amount of Diesel Use (kg per day) x Sulphur Content in Diesel = kg Total Daily SO_2 Emission from Smelting Line = (SO_2 Emission from Coal + SO_2 Emission from Coke) **(OR)** (SO_2 Emission from Diesel) = kg **Note: Amount of fuel use should cover for all the production lines (i.e. Smelting Line 1 and Line 2) intended to run for one day.**
Required Amount of Reagent (Soda Ash) Amount of Soda Ash Required per day = 1.2 x (Amount of Estimated SO_2 per day) = 1.2 x (Total Daily SO_2 Emission from Roasting Line + Smelting Line) = kg

Scrubbing Liquid pH

Scrubbing liquid pH is the most important in the wet scrubber operation to control the SO_2 emission. Based on the laboratory analysis[22] on FGD system which use soda ash as a reagent, the removal efficiency becomes constant and effective when the pH level is between 7 and 7.5. Please see the following figure.

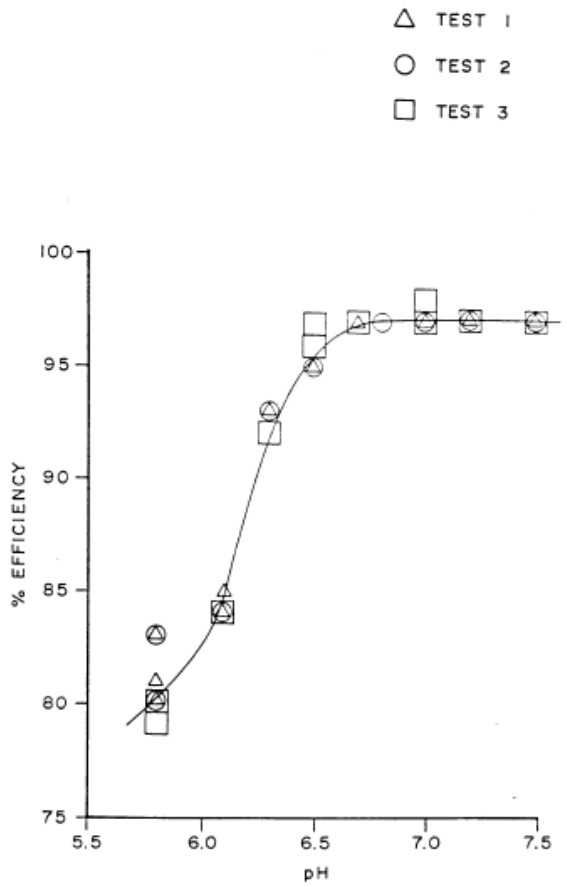

Figure – 1 Wet Scrubber Efficiency and pH

Hence, it is recommended to maintain the pH level in the clarifier tanks to be in the range of 7 to 8 in order to get the maximum efficiency of the wet scrubber for removing the gaseous pollutants, especially the SO_2.

[22] The applicability of Soda Ash Manufacturing, Wastes to Flue Gas Desulfurization by James Edwin Scroggins, B.S., May, 1984

Monitoring Indicators

To have the efficient performance of wet scrubber, the following basic indicators needs to be checked regularly. Therefore, the following monitoring activities must be carried out by the assigned worker for the wet scrubber.

Monitoring the pH Value of Scrubbing Liquid

The pH for an alkaline scrubber is recommended to keep between **7 and 8** to get the best removal efficiency for the SO_2. Monitoring shall be undertaken at 3 clarifier tanks which are connected to the scrubbing towers.

Table - 2 Monitoring Requirement for the pH value of Scrubbing Liquid

Monitoring Parameter	Monitoring Location	Frequency	Inspection Method
pH Value of scrubbing liquid from all three clarifiers	Three Clarifier Tanks	One Time before starting the wet scrubber operation. Three (3) times per day after starting the wet scrubber operation. **Total (4) Times per Day**	**<u>Using Tool</u>** pH paper or Litmus paper
Checkpoints and Measures			
Measure pH of scrubbing liquid from each clarifier → 1. If pH range is between 7 and 8, proceed the normal operation. 2. If pH is higher than 8, add freshwater to dilute the solution until it gets pH ranges within 7 to 8 → Measure pH again. → If pH ranges from 7 to 8, proceed the normal operation. 3. If pH is lower than 7, prepare more scrubbing liquid and add it to the clarifier tanks until it gets pH ranges within 7 to 8 → Measure pH again. → If pH ranges from 7 to 8, proceed the normal operation.			

Source: EnvO Study Team

How to measure pH by using pH paper/Litmus paper?

- Dip the end of the pH strip into the scrubbing liquid.
- After a couple of seconds, remove the paper and compare the color of the pH strip to the color chart provided with the pH paper kit.

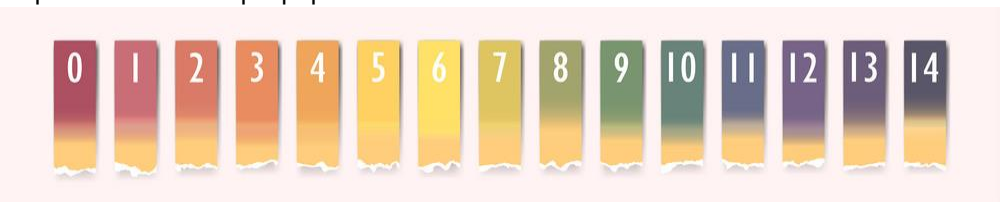

Figure - 2 Color chart of the pH level

Table – 3 Monitoring Record for pH Value of Scrubbing Liquid of Clarifier ( )

Day	Month	pH Level (Initial)	Corrected pH Level (Initial)	pH Level (1st Time)	Corrected pH Level (1st Time)	pH Level (2nd Time)	Corrected pH Level (2nd Time)	pH Level (3rd Time)	Corrected pH Level (3rd Time)	Signature
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
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26										
27										
28										
29										
30										
31										

Source: EnvO Study Team / Note: pH Values shall be recorded for all three clarifiers by using this record form for each clarifier.

Opacity of Smoke from the Stack

In order to prove that the bag filters and the wet scrubber are well functioning, the visual emission measurement using the Ringelmann method is recommended to use to monitor the opacity of smoke emitted from the stack. The apparent darkness of a smoke represents the concentration of the particulate matter contains in the flue gas.

Table – 4 Monitoring Requirement for Opacity of Smoke

Monitoring Parameter	Monitoring Location	Frequency	Inspection Method
Opacity of Smoke from the Stack	From a place where observer can see a clear view of the emission from the stack.	Once per every month (0.5 hr period per record during the day time)	Visual Check by using the Ringlemann Smoke Chart (as explained below)

How to measure smoke density (percentage) by using Ringlemann Smoke Chart?

To use the chart, it is supported on a level with the eye, at such a distance from the observer that the lines on the chart merge into shades of gray, and as nearly as possible in line with the stack. The observer glances from the smoke, as it emits from the stack, to the chart and notes the number of the chart most nearly corresponding with the shade of the smoke, then records this number with the time of observation as provided in the table below. A clear stack is recorded as No. 0, and 100 percent black smoke as No. 5.

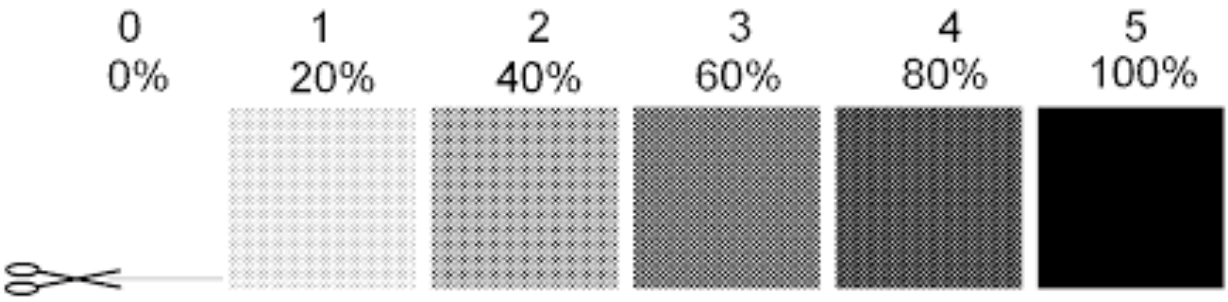

Figure - 3 Ringlemann Smoke Charts (Bar Type)

Note: Cut along the edge shown, hold at arm's length and compare the smoke source with the cut edge.

Table – 5 Ringlemann Smoke Observation Record

Recorded by – **Date –** **Point of Observation –** **Distance to Stack (Approximately) –** **Wind Direction -**		
Measurement Number	**Time**	**Observed Ringelmann Number**
(Example) **00**	**10:01**	**2**
01		
02		
03		
04		
05		
06		
07		
08		
09		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
Total		( )

Source: EnvO Study Team

$$Percentage\ of\ Smoke\ Density = \frac{Total\ of\ Observed\ Ringelmann\ Numbers\ \times\ 0.02\ \times 100\ \%}{Number\ of\ Observations}$$

$$Percentage\ of\ Smoke\ Density = \frac{(\qquad)\ \times\ 0.02\ \times 100\ \%}{30}$$

$$= \qquad \%$$

Record Keeping

It is needed to keep a proper record of absorbent (soda ash) use in the wet scrubber operation on daily and monthly basis by using the Table (6) and (7). Moreover, monthly smoke density observation results shall be recorded with the Table (8).

Table – 6 Daily Record of Absorbent (Soda Ash) Use

Day	Month	Absorbent Use for Clarifier (1) (kg)	Absorbent Use for Clarifier (2) (kg)	Absorbent Use for Clarifier (3) (kg)	Total (kg)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					

Source: EnvO Study Team

Table – 7 Monthly Record of Absorbent (Soda Ash) Use

Year	Month	Amount of Absorbent Use (kg)	Note
	January		
	February		
	March		
	April		
	May		
	June		
	July		
	August		
	September		
	October		
	November		
	December		

Source: EnvO Study Team
Note: If there are any changes in monthly absorbent usage, the reason of changes shall be recorded under Note Column.

Table – 7 Monthly Record of Smoke Density

Year	Month	Smoke Density (%)	Note
	January		
	February		
	March		
	April		
	May		
	June		
	July		
	August		
	September		
	October		
	November		
	December		

Source: EnvO Study Team
Note: If there are any changes in monthly smoke density results, the reason of changes shall be recorded under Note Column.

References

1. Flue Gas Desulfurization Inspection and Performance Evaluation Manual, US EPA, October 1985
2. Visible Emission Evaluation Procedures Course, Student Manual, US EPA, January 1995
3. The Applicability of Soda Ash Manufacturing Wastes to Flue Gas Desulfurization, May 1984

ANNEX 6 – WASTEWATER SAMPLING AND MEASUREMENT RESULTS

WASTEWATER SAMPLING AND MEASUREMENT RESULTS

Water use for the factory is obtained from Attaran River. Water is circulated within the factory which is mainly used for cooling down the condensing chambers. There is no specific wastewater generation from the operation process and it is recirculating inside the production processes. Effluent (wash water) generated from cleaning of working environment and washing bag filters is initially passed the settling tank to recover the antimony dust and then it is connected to the cooling tank to combine with water to be recirculated. Only the small amount of effluent overflown from the settling tank and cooling tank is discharged outside.

To know the status of effluent quality in order to examine how it could affect the environment, sampling and quality testing was conducted. Wastewater was collected with the standard sampling procedures and sent to the laboratories within 6 hours with adequate preservations.

Sampling Points

During the first site visit of the EnvO Study Team, the following three locations were chosen as wastewater sampling points which cover the wastewater release points and the wastewater retaining in the earth drains.

i. MSS-1: Wash water in Settling Tank
ii. MSS-2: Cooling Tank
iii. MSS-3: Earth Drain

Respective photos showing the sampling points can be seen in the following figure.

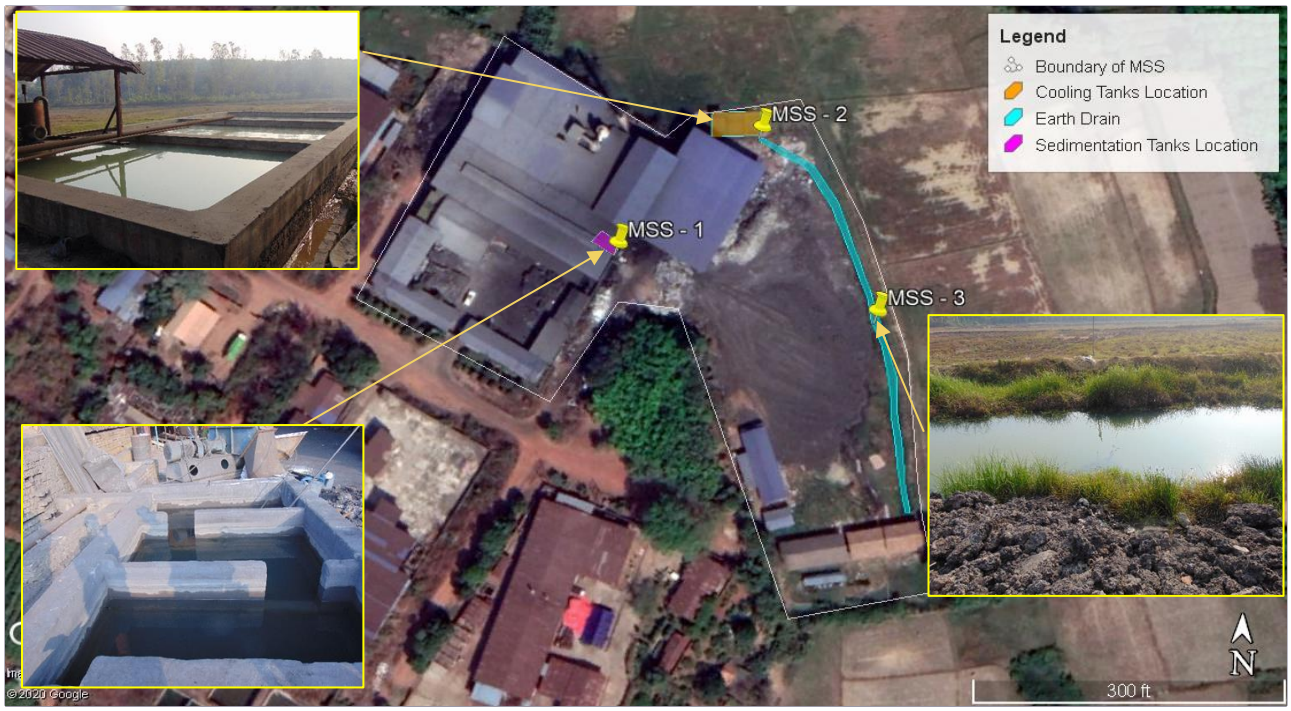

Figure 1. Wastewater Sampling Points Location with relevant Photos

Source: EnvO Study Team based on Google Earth Pro

The water sample at MSS-1 is taken from final partition of settling tank to evaluate the quality of wash water. The water sample at MSS-2 is taken from the overflown water of the cooling tanks where water is cooled down to be reused in the operation. The water sample at MSS-3 is taken from the middle of earth drain where it is assumed as the mixing zone that the effluent generated from the factory and the storm water run-off is properly mixed. The above-mentioned three samples were examined and measured both on-site for some parameters and at the laboratory for further analysis.

Table 1. Description of Wastewater Sampling Points

Sampling Point	Date and Time	Coordinates	Location of Sample Collection	Description
MSS-1	30.03.2020 (7:30 AM)	16° 28' 35.6376" N, 97° 40' 34.7196" E	Final Partition of Sedimentation Tanks	Settling tank is where wash water from bag filters and floor cleaning are collected. It includes three settling tanks (two partitions) made up with concrete.
MSS-2	30.03.2020 (7:45AM)	16° 28' 37.1928" N, 97° 40' 36.3936" E	Overflown of Cooling Tanks	The cooling tank receives wastewater from the cooling system process lines and contain three tanks. After cooling the wastewater down to reduce temperature into some extent, it is recirculated in the process lines again and overflow is discharged.
MSS-3	30.03.2020 (8:12AM)	16° 28' 35.274" N, 97° 40' 37.5312" E	Middle of Earth Drain	The earth drain is where the final discharge route of effluent from the project to the outside of the factory. Stormwater passing the factory compound and nearby land areas is flowing into the earth drain.

Source: EnvO Study Team

Measuring Parameters

There are no specific effluent guidelines for the antimony smelting and refinery industrial sector. Hence, the EnvO Study Team decided to measure thirteen parameters mentioned under “Base Metal Smelting and Refining” in National Environmental Quality (Emission) Guidelines as a primary concern. Moreover, three additional parameters from “BAT Guidance Note on Non-ferrous Metals and Galvanizing” prepared by Ireland, EPA are adopted.

Therefore, a total of sixteen parameters are measured on-site and laboratories. Reliability, creditability and availability of required parameters are the priorities in choosing the laboratories to test the wastewater quality. ALARM Ecological Laboratory and SGS (Myanmar) Laboratory were chosen. The measuring parameters are shown in the following table.

Table 2. Measuring Parameters and their Corresponding Guideline Values

No	Parameter	Unit	Method of Measurement	NEQG Guideline Value	BAT Guideline Value	Laboratory
1	Aluminum	mg/l	Laboratory	0.2	-	ALARM
2	Arsenic	mg/l	Laboratory	0.05	-	ALARM
3	Cadmium	mg/l	Laboratory	0.05	-	ALARM
4	Chemical Oxygen Demand	mg/l	Laboratory	50	-	ALARM
5	Copper	mg/l	Laboratory	0.1	-	ALARM

No	Parameter	Unit	Method of Measurement	NEQG Guideline Value	BAT Guideline Value	Laboratory
6	Fluoride	mg/l	Laboratory	5	-	ALARM
7	Lead	mg/l	Laboratory	0.1	-	ALARM
8	Mercury	mg/l	Laboratory	0.01	-	SGS
9	Nickel	mg/l	Laboratory	0.1	-	ALARM
10	Oil and Grease	mg/l	Laboratory	10	-	ALARM
11	pH	S.U.	On site and Laboratory	6-9	-	ALARM
12	Temperature increase	°C	On site	<3	-	
13	Total Nitrogen	mg/l	Laboratory	-	5-25	ALARM
14	Total Phosphorus	mg/l	Laboratory	-	2	SGS
15	Total Suspended Solids	mg/l	Laboratory	20	-	ALARM
16	Zinc	mg/l	Laboratory	0.2	-	ALARM

Source: EnvO Study Team

Methodology of Measurements

On-site Measurements

Some parameters which are more reliable to measure on-site such as pH, Temperature, Total Dissolved Solid and Electric Conductivity are measured with portable water quality testing devices. The testing devices used for on-site measurement are TDS Meter and pH Meter. The detail information of measuring devices is described in the following figure and table.

Figure 2. TDS Meter and pH Meter Used for Onsite Measurement

Source: Equipment Supplier

Table 3. Description of On-site Wastewater Testing Devices

Items	TDS Meter	pH Meter
Model	pH-100	3-in-1 TDS & EC
Device Description	The most distinct feature is that the pH value and temperature value can be read at the same time	The Health Metric 3-in-1 TDS & EC Meter is a professional instrument that can be used to test TDS (total dissolved solids

Items	TDS Meter	pH Meter
	during the operation. (* from the manual of device)	– ppm reading), conductivity (us/cm reading) and temperature. (*from the manual of device)

Source: EnvO Study Team

Laboratory Measurements

As mentioned in above, fifteen parameters out of sixteen were measured at ALARM Ecological and SGS (Myanmar) Laboratories. The measurement methods corresponded with parameters are shown in the following table.

Table 4. Methods Used for Quality Measurements

No	Parameter	Method	Laboratory
1	Aluminum	Lovibond SpectroDirect Method No. 40	ALARM
2	Arsenic	Lovibond Arsenic test kit code no-400700	ALARM
3	Cadmium	AAS, Shimadzu AA-6200 Cd (228.8 nm)	ALARM
4	Chemical Oxygen Demand	Lovibond SpectroDirect Method N0.130-132	ALARM
5	Copper	AAS, Shimadzu AA-6200 Cu (324.8 nm)	ALARM
6	Fluoride	Lovibond SpectroDirect Method No.170	ALARM
7	Lead	AAS, Shimadzu AA-6200 Pb (283.3 nm)	ALARM
8	Mercury	In house based on Standard methods for the examination of water & wastewater APHA, AWWA & WEF, 22nd ed, 2012;3030 & 3112B-Cold Vapor Atomic Absorption Spectrometric method and User's Guide of Agilent Vapor Generation – Analytical Notes (Mercury)	SGS
9	Nickel	Lovibond SpectroDirect Method 256	ALARM
10	Oil and Grease	Hexane Extraction Method	ALARM
11	pH	Electrode Method (Approved by EPA, ISO, ASTM), Hanna electrode meter Certified by 2014 EMS, Certified by QMS	ALARM
12	Total Nitrogen	Lovibond SpectroDirect Method No.280, 281	ALARM
13	Total Phosphorus	Standard methods for the examination of water & wastewater APHA, AWWA & WEF, 22nd ed, 2012;4500-P E.Ascorbic Acid Method	SGS
14	Total Suspended Solids	Lovibond SpectroDirect Method No.383	ALARM
15	Zinc	Lovibond SpectroDirect Method No.400	ALARM

Source: EnvO Study Team

(a) Record of Sample Collection and On-site Measurements

The recorded photos of sampling and on-site measurements are described in following figures.

(a) Wastewater Sampling

(b) Wastewater Sampling

(c) pH and temperature measuring

(d) TDS and EC measuring

Figure 3. Photo Records of MSS-1 Wastewater Sampling and On-site Measurement

Source: EnvO Study Team

(a) Wastewater Sampling

(b) Wastewater Sampling

(c) pH and Temperature measuring

(d) TDS and EC measuring

Figure 4. Photo Records of MSS-2 Wastewater Sampling and On-site Measurement

Source: EnvO Study Team

(a) Wastewater Sampling

(b) Wastewater Sampling

(c) pH and Temperature measuring

(d) TDS and EC measuring

Figure 5. Photo Records of MSS-3 Wastewater Sampling and On-site Measurement

Source: EnvO Study Team

As the wastewater was collected from Mawlamyine, it needs around 6 hours for the samples to be sent to the laboratories at Yangon. The samples were preserved with low light penetrated glass bottles, full loaded (not to have voids or air inside the sample bottles), labelled to respective sample points and stored in the ice box, full packed with ice to retain the temperature of water samples which might affect the quality. The following figure shows the preservations taken throughout the transfer route.

Figure 6. Preservation of Sample throughout the transfer route

Source: EnvO Study Team

Results of Measurement

Results of On-site Measurements

The parameters measured at the site are shown in the following table in comparison with National Environment Quality (Emission) Guideline Values.

Table 5. Results of On-Site Wastewater Measurements

Monitoring Points	Parameters			
	pH Meter		TDS Meter	
	pH (S.U.)	Temperature (°C)	TDS (ppm)	EC (μs/cm)
MSS-1	8.76	28.4	501	1002
MSS-2	8.33	39.4	378	756
MSS-3	7.11	31.4	572	1144
NEQG Guideline Value	6-9	> 3 degree Celsius	-	-

Source: EnvO Study Team

Results of Laboratory Measurements

The parameters measured at the laboratories are shown in the following table comparing with National Environment Quality (Emission) Guideline Values.

Table 6. Results of Laboratory Wastewater Measurements

No	Test Parameter	Unit	MSS-1 Laboratory Result	MSS-2 Laboratory Result	MSS-3 Laboratory Result	NEQG Guideline Value	BAT Guideline Value
1	Aluminum	mg/l	0.08	0.01	0.02	0.2	-
2	Arsenic	mg/l	**0.25**	**0.25**	**0.5**	0.05	-
3	Cadmium	mg/l	ND	ND	ND	0.05	-
4	Chemical Oxygen Demand	mg/l	**160**	**140**	**310**	50	-
5	Copper	mg/l	ND	ND	0.02	0.1	-
6	Fluoride	mg/l	0.4	0.36	0.7	5	-
7	Lead	mg/l	ND	ND	ND	0.1	-
8	Mercury	mg/l	<0.1	<0.1	<0.1	0.01	-
9	Nickel	mg/l	< 0.2	<0.2	<0.2	0.1	-
10	Oil and Grease	mg/l	5	7	3	-	10
11	pH	S.U	7.7	7.7	7.1	6-9	-
12	Total Nitrogen	mg/l	11.4	19.8	12.8	-	5-25
13	Total Phosphorus	mg/l	0.698	0.082	0.433	-	2
14	Total Solids	mg/l	579	465	648	-	-
15	Zinc	mg/l	0.05	0.04	0.02	0.2	-

Source: EnvO Study Team

Note: Bolded Values show the exceedance over NEQG Guideline Values

Values with blue words cannot be evaluated due to the testing incapability of the laboratory

Original Lab Result Sheets

The original lab results for each wastewater test parameters and sample points are attached in the following.

(1) MSS – 1 Lab Results

ALARM Ecological Laboratory
Water Testing Result Report

Report Number : EL-WR-20-00667 **Date : 01-04-20**

Client Information
Client Name : **Dr Ei Ei Mon**
Organization : **EnvO Environmental Management Consulting Services Co.,Ltd**
Client ID : **LC-10-017**
Registration Date & Time : **30-03-20**
Contact :
Testing Purpose : **Monitoring**

Sample Information
Sample ID : WS-20-00645
Sample Name : **MSS - 1**
Sample Type / Source : **Treated**
Sampling Date & Time : **30-04-20** 7:20 AM
Sample Location : **Mawlamyine**
Latitude :
Longitude :

Testing Results

This laboratory analysis report is based solely on the sample submitted by the client unless client took our sampling service. This report shall not be reproduced except in full, without written approval of the laboratory

Sr.	Quality Parameters	Results	Units	Emission Standard	Remarks
1	pH	7.7	S.U	6.0 - 9.0 (d)	Normal
2	Total Solids	579	mg/L	-	-
3	COD	160	mg/L	≤250 (d)	Normal
4	Aluminium	0.08	mg/L	-	-
5	Arsenic	0.25	mg/L	≤0.1 (d)	Above the limit
6	Cadmium	ND	mg/L	≤0.1 (d)	LOD=0.01
7	Copper	ND	mg/L	≤ 0.5 (d)	LOD=0.02
8	Lead	ND	mg/L	≤ 0.1 (d)	LOD=0.1
9	Zinc	0.05	mg/L	≤2 (d)	Normal
10	Nickel	<0.2	mg/L	≤0.5 (d)	Normal
11	Fluoride	0.4	mg/L	≤20 (d)	Normal
12	Oil & Grease	5	mg/L	≤10 (d)	Normal
13	Total Nitrogen	11.4	mg/L	-	-

"ND"= Not Detected	"LOD"= Lower limit of detection	"-" = No Reference Standard
Tested by	Checked by	Approved by
Daw May Myat Khine Lab. Technician II Ecological Laboratory ALARM	Daw Lin Myat Myat Aung Lab. Technician I Ecological Laboratory ALARM	Dr. Aye Aye Win Laboratory In-Charge Ecological Laboratory (ALARM)

Building A-2, Kan Street, Hlaing Township, Yangon, Myanmar.Tel: 01-503301, 01-503302, 09 407496078
Email: aelab@alarmmyanmar.org| website: www.alarmmyanmar.org

SGS

ANALYSIS REPORT

ORIGIN

Job Ref : 2000179/2020
Date : 02/04/2020
Page : 1 of 1

Sample Described as : **Environmental Water**
Client Name : Emvo Environment Management Consulting Services Co., Ltd.
Sample Received Date : 30.March.2020
Sample Brought By : Client
Sample Marking : MSS 1
Sample Location : Mawlamyaing
Analysed Date : 01.April.2020
Lab Code No. : 096/20

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012;4500-P E.Ascorbic Acid Method	0.01	mg/L	0.698
2	Mercury	In house based on Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012; 3030 &3112B -Cold Vapor Atomic Absorption Spectrometric method and User's Guide of Agilent Vapor Generation - Analytical notes (Mercury)	0.1	mg/L	<0.1

********** End of Report **********

SGS (Myanmar) Limited

(Nu Nu Yi)
Manager

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t +95(1) 654 795, 654 796, 654 864, 654 865 e sgs.myanmar@sgs.com

Member of SGS Group(SGS SA)

(2) MSS – 2 Lab Results

ALARM Ecological Laboratory
Water Testing Result Report

Report Number : EL-WR-20-00668 **Date : 01-04-20**

Client Information

Client Name : **Dr Ei Ei Mon**
Organization : **EnvO Environmental Management Consulting Services Co.,Ltd**
Client ID : **LC-10-017**
Registration Date & Time : **30-03-20**
Contact :
Testing Purpose : **Monitoring**

Sample Information

Sample ID : WS-20-00646
Sample Name : **MSS - 2**
Sample Type / Source : **Treated**
Sampling Date & Time : **30-04-20** 8:00 AM
Sample Location : **Mawlamyine**
Latitude :
Longitude :

Testing Results

This laboratory analysis report is based solely on the sample submitted by the client unless client took our sampling service. This report shall not be reproduced except in full, without written approval of the laboratory

Sr.	Quality Parameters	Results	Units	Emission Standard	Remarks
1	pH	7.7	S.U	6.0 - 9.0 (d)	Normal
2	Total Solids	465	mg/L	-	-
3	COD	140	mg/L	≤250 (d)	Normal
4	Aluminium	0.01	mg/L	-	-
5	Arsenic	0.25	mg/L	≤0.1 (d)	Above the limit
6	Cadmium	ND	mg/L	≤0.1 (d)	LOD=0.01
7	Copper	ND	mg/L	≤ 0.5 (d)	LOD=0.02
8	Lead	ND	mg/L	≤ 0.1 (d)	LOD=0.1
9	Zinc	0.04	mg/L	≤2 (d)	Normal
10	Nickel	<0.2	mg/L	≤0.5 (d)	Normal
11	Fluoride	0.36	mg/L	≤20 (d)	Normal
12	Oil & Grease	7	mg/L	≤10 (d)	Normal
13	Total Nitrogen	19.8	mg/L	-	-

"ND"= Not Detected	"LOD"= Lower limit of detection	"-" = No Reference Standard
Tested by	Checked by	Approved by
Daw May Myat Khine Lab. Technician II Ecological Laboratory ALARM	Daw Lin Myat Myat Aung Lab. Technician I Ecological Laboratory ALARM	Dr. Aye Aye Win Laboratory In-Charge Ecological Laboratory (ALARM)

Building A-2, Kan Street, Hlaing Township, Yangon, Myanmar.Tel: 01-503301, 01-503302, 09 407496078
Email: aelab@alarmmyanmar.org| website: www.alarmmyanmar.org

SGS

ANALYSIS REPORT

ORIGINAL

Job Ref : 2000179/2020
Date : 02/04/2020
Page : 1 of 1

Sample Described as	:	**Environmental Water**
Client Name	:	Emvo Environment Management Consulting Services Co., Ltd.
Sample Received Date	:	30.March.2020
Sample Brought By	:	Client
Sample Marking	:	MSS 2
Sample Location	:	Mawlamyaing
Analysed Date	:	01.April.2020
Lab Code No.	:	097/20

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012;4500-P E.Ascorbic Acid Method	0.01	mg/L	0.082
2	Mercury	In house based on Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012; 3030 &3112B -Cold Vapor Atomic Absorption Spectrometric method and User's Guide of Agilent Vapor Generation - Analytical notes (Mercury)	0.1	mg/L	<0.1

********** End of Report **********

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(3) MSS – 3 Lab Results

ALARM Ecological Laboratory
Water Testing Result Report

Report Number : EL-WR-20-00669 **Date : 01-04-20**

Client Information

Client Name : **Dr Ei Ei Mon**
Organization : **EnvO Environmental Management Consulting Services Co.,Ltd**
Client ID : **LC-10-017**
Registration Date & Time : **30-03-20**
Contact :
Testing Purpose : **Monitoring**

Sample Information

Sample ID : WS-20-00647
Sample Name : **MSS - 3**
Sample Type / Source : **Raw**
Sampling Date & Time : **30-04-20** 8:20 AM
Sample Location : **Mawlamyine**
Latitude :
Longitude :

Testing Results

This laboratory analysis report is based solely on the sample submitted by the client unless client took our sampling service.
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Sr.	Quality Parameters	Results	Units	Emission Standard	Remarks
1	pH	**7.1**	**S.U**	6.0 - 9.0 (d)	Normal
2	Total Solids	**648**	**mg/L**	-	-
3	COD	**310**	**mg/L**	≤250 (d)	Above the limit
4	Aluminium	**0.02**	**mg/L**	-	-
5	Arsenic	**0.5**	**mg/L**	≤0.1 (d)	Above the limit
6	Cadmium	**ND**	**mg/L**	≤0.1 (d)	LOD=0.01
7	Copper	**0.02**	**mg/L**	≤ 0.5 (d)	Normal
8	Lead	**ND**	**mg/L**	≤ 0.1 (d)	LOD=0.1
9	Zinc	**0.02**	**mg/L**	≤2 (d)	Normal
10	Nickel	**<0.2**	**mg/L**	≤0.5 (d)	Normal
11	Fluoride	**0.7**	**mg/L**	≤20 (d)	Normal
12	Oil & Grease	**3**	**mg/L**	≤10 (d)	Normal
13	Total Nitrogen	**12.8**	**mg/L**	-	-

"ND"= Not Detected	"LOD"= Lower limit of detection	"-" = No Reference Standard
Tested by	Checked by	Approved by
Daw May Myat Khine Lab. Technician II Ecological Laboratory ALARM	Daw Lin Myat Myat Aung Lab. Technician I Ecological Laboratory ALARM	Dr. Aye Aye Win Laboratory In-Charge Ecological Laboratory (ALARM)

Building A-2, Kan Street, Hlaing Township, Yangon, Myanmar.Tel: 01-503301, 01-503302, 09 407496078
Email: aelab@alarmmyanmar.org| website: www.alarmmyanmar.org

SGS

ANALYSIS REPORT

ORIGINAL

Job Ref : 2000179/2020
Date : 02/04/2020
Page : 1 of 1

Sample Described as	:	**Environmental Water**
Client Name	:	Emvo Environment Management Consulting Services Co., Ltd.
Sample Received Date	:	30.March.2020
Sample Brought By	:	Client
Sample Marking	:	MSS 3
Sample Location	:	Mawlamyaing
Analysed Date	:	01.April.2020
Lab Code No.	:	098/20

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012;4500-P E.Ascorbic Acid Method	0.01	mg/L	0.433
2	Mercury	In house based on Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012; 3030 &3112B -Cold Vapor Atomic Absorption Spectrometric method and User's Guide of Agilent Vapor Generation - Analytical notes (Mercury)	0.1	mg/L	<0.1

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Consideration of Wastewater Measurement Results

Wastewater measurement results are evaluated in Chapter (5) of the IEE report. Mitigation measures to control the potential water quality impact are proposed under each relevant section.

ANNEX 7 – NOISE MEASUREMENT AND RESULTS

NOISE MEASUREMENT AND RESULTS

Noise Measuring Points

Noise level was measured to be considered in assessing the environmental impacts which could be possibly raised from the proposed project. To understand the noise emanating nature of the factory, spot check method was used for the monitoring. It was undertaken not only in the working area but also at the boundary points of the factory compound. Noise measuring points within the factory and at boundary points are presented below in Figure 1 and Figure 2 respectively.

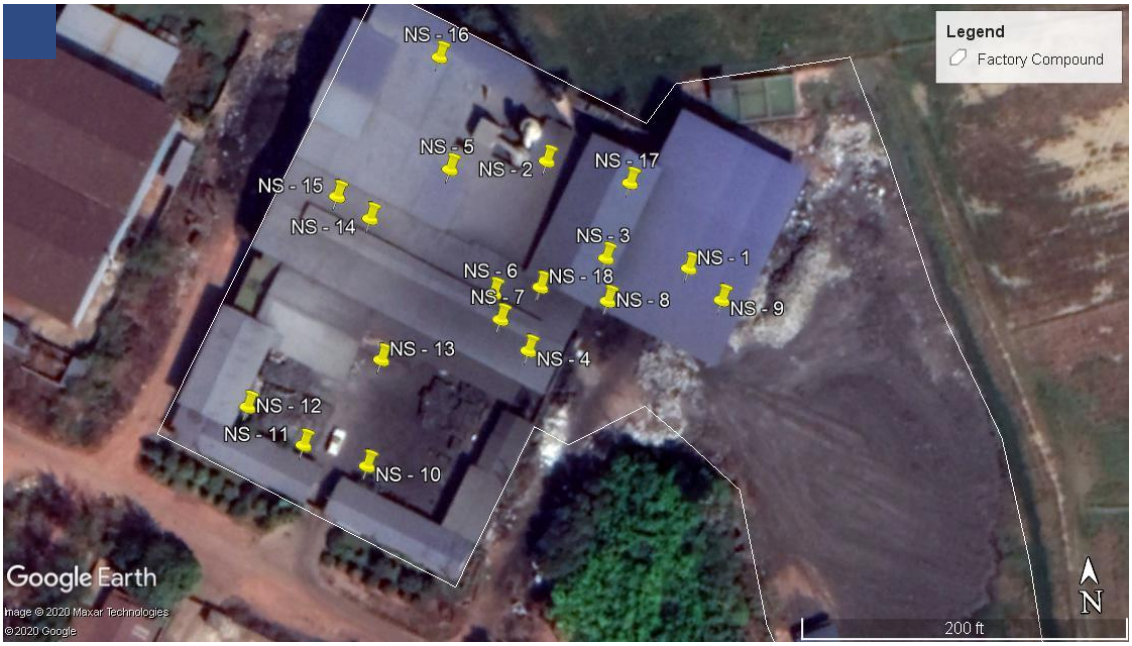


Figure 1. Location of Noise Measuring Points within the Factory

Source: EnvO Study Team based on Google Earth Pro

Figure 2. Location of Noise Measuring Points at Factory Boundary

Source: EnvO Study Team based on Google Earth Pro

Methodology of Measurements

The measuring location is mainly divided into two section: (1) Within the Factory and (2) Boundary. Measurement is taken at an assigned location for one or two minutes as spot check measurement which is generally adequate to estimate the nature of noise sources related to its noise level which is necessary to consider in assessing the noise impact. Noise Level is measured by using TEKCOPLUS SLM-24 noise measuring device. The detail information of noise meter is shown in the following table.

Figure 3. Noise Measuring Device: TEKCOPLUS SLM-24

Source: EnvO Study Team

Table 1. Description of Noise Measuring Device

Items	Noise Monitoring Device
Model	TEKCOPLUS SLM-24
Device Description	This sound meter can read between 30dB~130dB, while reducing the effects of wind noise to produce more accurate readings.

Source: EnvO Study Team

Figure 4. Photos of Noise Level Measurement at MSS Factory

Results of Noise Measurements

Noise levels was measured at the total of 29 points (18 points inside the factory and 11 points at boundary of factory compound) during the site visit in March, 2020.

Within Factory (Working Area)

The noise levels, measured at working place inside the factory are shown in the following table comparing with the guideline values for working area recommended by International Finance Corporation (IFC).

Table 2. Results of Noise Level within Factory

Monitoring Points	Description	Unit	Noise Level	Guideline Values IFC Noise Limits (dB(A))
NS-1	Raw material crushing and grinding area	dBA	92.4	85
NS-2	Wet scrubber	dBA	80.4	
NS-3	Roasting Line	dBA	77.6	
NS-4	Roasting Furnace (near blower)	dBA	86.6	
NS-5	Cooling Pipe area	dBA	84.4	
NS-6	Roasting Furnace (near blower)	dBA	85.8	
NS-7	Roasting Furnace (near blower)	dBA	91.3 (1m) 91.1 (2m) 84.8 (3m)	
NS-8	By-product piling	dBA	82.1	
NS-9	Raw material crushing and grinding area	dBA	81.2	
NS-10	Office	dBA	63.5	

Monitoring Points	Description	Unit	Noise Level	Guideline Values IFC Noise Limits (dB(A))
NS-11	Office	dBA	63.3	
NS-12	Office	dBA	62.4	
NS-13	Raw Material Piling	dBA	81.4	
NS-14	Smelting Furnace	dBA	77.2	
NS-15	Smelting Furnace	dBA	76.7	
NS-16	Bag House	dBA	74.1	
NS-17	Roasting Line	dBA	80.2	
NS-18	Roasting Line	dBA	80.5	

Source: EnvO Study Team
Note: Noise levels written in red words show the exceedance than guideline values.

At Boundary of Factory Compound

The noise levels, measured at the boundary of MSS are shown in the following tables comparing with NEQG guideline values. Here, the receptor is categorized to be as industrial and commercial since the proposed factory is located within the Industrial Zone of Mawlamyine.

Table 3. Results of Noise Level at MSS Boundary

Monitoring Points	Description	Unit	Noise Level	Guideline Values (NEQG)
Boundary				**Receptors - Industrial, Commercial**
NS-B-1	West Side of Factory	dBA	55.8	70
NS-B-2	Office	dBA	51.5	
NS-B-3	Factory Gate	dBA	55.7	
NS-B-4	Back of laboratory	dBA	52.9	
NS-B-5	Small wood of rubber trees	dBA	63.6	
NS-B-6	By-product piling	dBA	69.3	
NS-B-7	Cooling tanks	dBA	48.9	
NS-B-8	Cooling tanks	dBA	66.5	
NS-B-9	Workers Canteen	dBA	58.8	
NS-B-10	Workers Canteen	dBA	58.6	
NS-B-11	Workers Houses	dBA	55.8	

Source: EnvO Study Team

Consideration of Noise Measurement Results

Noise measurement results at boundary points are evaluated in Chapter (5) and workplace noise results are in Chapter (6) of IEE report respectively. Mitigation measures to control the exceeded noise levels are proposed under each relevant section.

ANNEX 8 – MSDS OF CHEMICALS

MSDS OF CHEMICALS

The summary of MSDS of chemicals used in MSS are described in the following table. The chemicals can be differentiated as chemicals used in factory operations and in laboratory. There are two types of chemicals used in factory operation (smelting and wet scrubber) and six types of chemicals used for laboratory purposes.

Table 1. The Summary of MSDS of Chemicals Used in MSS

No	Name of Chemicals	Hazard Profile and Measures		Website Links where detailed MSDS can be Accessed
1.	Soda Ash Light Na_2CO_3	**Health Effects**	Cause irritation to the eyes and skin.	**http://www.waterguardinc.com/files/90347712.pdf**
		Storage and Handling	Always store in tightly sealed, properly labeled, original container, store in a cool, dry well-ventilated area away from heat, moisture and incompatibles.	
		First Aid Procedures	Eyes: Wash with large amounts of cool running water for at least 15 minutes. Seek medical attention as necessary. Skin: Wash skin with soap and water. If irritation persists, seek medical attention. Inhalation: For excessive inhalation, move to fresh air. If breathing is difficult, seek medical attention. Ingestion: Do not induce vomiting. Seek medical attention immediately.	
		Accidental Release Measures	Ventilate area of spill. Wear appropriate PPE. Sweep up and containerize for reclamation or disposal. Avoid dust dispersal during cleanup operation.	
		Disposal Measures	Dispose of container and unused contents in accordance with local requirements.	
		Fire Fighting Measures	No Special Procedure.	
		Precautions	Avoid contact with acids.	
2.	Monoammonium Phosphate $NH_4H_2PO_4$	**Health Effects**	Cause eye irritation, slightly irritation of skin and dusts may cause upper respiratory tract irritation. Ingestion may cause abdominal cramps, nausea, vomiting, diarrhea.	**https://www.tigersul.com/wp-content/uploads/2019/01/Innophos-MAP-SDS.pdf**
		Storage and Handling	Avoid direct or prolonged contact with skin and eyes. Store in an area that is cool, dry, well-ventilated, and in close containers.	

No	Name of Chemicals	Hazard Profile and Measures		Website Links where detailed MSDS can be Accessed
		First Aid Procedures	Eyes: Hold eyelids open and wash with a steady, gentle stream of water for at least 15 minutes. Seek medical attention as necessary. Skin: Wash skin with plenty of soap and water. If irritation persists, seek medical attention. Inhalation: For excessive inhalation, move to fresh air. If breathing is difficult, seek medical attention. Ingestion: Give 2-3 glasses of water to drink and do not induce vomiting. Seek immediate medical attention.	
		Accidental Release Measures	Sweep or vacuum up and place in an appropriate closed container. Avoid creation of dusty conditions. Clean up residual material by washing area with water and detergent.	
		Disposal Measures	Dispose of container and unused contents in accordance with local requirements.	
		Fire Fighting Measures	Firefighters should wear approved self-contained breathing apparatus and full protective clothing.	
		Precautions	Under fire conditions, hazardous decomposition of oxides of nitrogen and phosphorus can occur. Avoid dusting conditions, extreme heat and extreme humidity conditions.	
3.	Sodium Fluoride F Na	**Health Effects**	Toxic if swallowed, cause skin irritation and serious eye irritation.	**https://www.fishersci.com/shop/msdsproxy?productName=S299100&**
		Storage and Handling	Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from acids.	
		First Aid Procedures	Eyes: Rinse immediately with plenty of water. Seek immediate medical attention. Skin: Rinse skin immediately with plenty of water for at least 15 minutes. Inhalation: Move to fresh air. If the person is not breathing, give artificial respiration, do not use mouth-to-mouth method. Seek immediate medical attention. Ingestion: Do not induce vomiting. Seek immediate medical attention.	
		Accidental Release Measures	Ensure adequate ventilation. Avoid dust formation. Do not flush into surface water or sanitary sewer system. Sweep up or vacuum up spillage and collect in suitable container for disposal.	
		Disposal Measures	Dispose of in accordance with local regulations.	
		Fire Fighting Measures	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide fire extinguishers.	

No	Name of Chemicals	Hazard Profile and Measures		Website Links where detailed MSDS can be Accessed
		Precautions	Keep product and empty container away from heat and sources of ignition.	
4.	Potassium Sulphate K_2O_4S	**Health Effects**	Dust may cause mechanical irritation to eye, ingestion may cause gastrointestinal irritation with nausea, vomiting and diarrhea and inhalation may cause respiratory tract irritation.	**https://s3-us-west-2.amazonaws.com/drugbank/msds/DB01345.pdf?1528239576#:~:text=Ingestion%3A%20May%20cause%20gastrointestinal%20irritation,to%20be%20a%20chronic%20hazard.&text=Eyes%3A%20In%20case%20of%20contact,for%20at%20least%2015%20minutes.**
		Storage and Handling	Wash thoroughly after handling. Minimize dust generation and accumulation. Store in a cool, dry place. Keep container closed when not in use.	
		First Aid Procedures	Eyes: In case of contact, immediately wash eyes with plenty of water for at least 15 minutes. Seek medical attention. Skin: Wash skin with plenty of water. Remove contaminated clothing and shoes. Seek medical attention if irritation develops and persists. Wash clothing before reuse. Inhalation: Move to fresh air. If not breathing, give artificial respiration. Seek medical attention. Ingestion: If swallowed, do not induce vomiting. Never give anything by mouth to an unconscious person. Seek medical attention.	
		Accidental Release Measures	Vacuum or sweep up material and place into a suitable disposal container. Avoid generating dusty conditions. Provide ventilation.	
		Disposal Measures	Dispose of in accordance with local regulations. Empty containers must be decontaminated before returning for recycling.	
		Fire Fighting Measures	Firefighters should wear approved self-contained breathing apparatus.	
		Precautions	No special precautions.	
5.	Cerium (IV) Sulfate CeO_8S_2	**Health Effects**	Cause skin irritation, serious eye irritation and respiratory irritation.	**https://www.nwmissouri.edu/naturalsciences/sds/c/Cerium%20IV%20sulfate.pdf**
		Storage and Handling	Keep container tightly in a dry and well-ventilated place. Keep in a dry place as it is moisture sensitive.	
		First Aid Procedures	Eyes: Immediately wash eyes with plenty of water for at least 15 minutes. Seek medical attention. Skin: Wash off with soap and plenty of water. Seek medical attention. Inhalation: Move to fresh air. If not breathing, give artificial respiration. Seek medical attention.	

No	Name of Chemicals	Hazard Profile and Measures		Website Links where detailed MSDS can be Accessed
			Ingestion: Never give anything by mouth to an unconscious person. Rinse mouth with water. Seek medical attention.	
		Accidental Release Measures	Avoid dust formation. Do not let product enter drains. Sweep up and shovel. Keep in suitable, closed containers for disposal.	
		Disposal Measures	Dispose of in accordance with local regulations.	
		Fire Fighting Measures	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide fire extinguishers.	
		Precautions	Avoid moisture.	
6.	Methyl Orange Indicator Solution $C_{14}H_{14}N_3NaO_3S$	**Health Effects**	May cause skin, eye and respiratory irritation.	**https://www.cdhfinechemical.com/images/product/msds/43_1892059653_MethylOrangeIndicatorSolution-MSDS.pdf**
		Storage and Handling	Keep away from sources of ignition. Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.	
		First Aid Procedures	Eyes: Rinse thoroughly with plenty of water for at least 15 minutes. Seek medical attention. Skin: Wash off with soap and plenty of water. Seek medical attention. Inhalation: Move to fresh air. If not breathing, give artificial respiration. Seek medical attention. Ingestion: Do not induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Seek medical attention.	
		Accidental Release Measures	Remove all sources of ignition. Beware of vapors accumulating to form explosive concentrations. Do not let product enter the drains. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal.	
		Disposal Measures	Burn in a chemical incinerator equipped with an afterburner and scrubber. Dispose of in accordance with local regulations.	
		Fire Fighting Measures	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide fire extinguishers.	
		Precautions	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources.	
7.	Hydrochloric Acid HCl	**Health Effects**	Inhalation may cause damage to mucous membranes in noise, throat, lungs and bronchial system; harmful as swallowed and cause severe skin and eye burns.	**http://sds.chemtel.net/webclients/safariland/finished_goods/Pioneer%20Foren**

No	Name of Chemicals	Hazard Profile and Measures		Website Links where detailed MSDS can be Accessed
		Storage and Handling	Use only in well-ventilated areas. Keep away from incompatible materials. Wash thoroughly after handling. Use caution when combining with water. Store in a cool, dry, ventilated area. Keep containers tightly closed and upright. Keep away from food and drink.	**sics%20-%20PF021%20-%20PF022%20-%20Hydrochloric%20Acid.pdf**
		First Aid Procedures	Eyes: Rinse thoroughly with plenty of water for at least 15 minutes. Seek medical attention. Skin: Wash off with soap and plenty of water. Seek medical attention. Inhalation: Move to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth method. Seek medical attention. Ingestion: Do not induce vomiting. If vomiting occurs, keep head low so that vomit does not enter lungs. Never give anything by mouth to an unconscious person. Rinse mouth with water. Seek medical attention.	
		Accidental Release Measures	Dike the spilled material, where this is possible. Absorb spill with an inert material (dry sand, earth, cloth) and place in a suitable non-combustible container for disposal. Do not use combustible materials, such as saw dust. Clean contaminated surface thoroughly. Neutralize spill area and wash with soda ash or lime. Never return spills in original containers for re-use. Prevent entry into waterways, sewer, basement or confined areas.	
		Disposal Measures	Incinerate the material under controlled conditions in an approved incinerator. Dispose of in accordance with local regulations.	
		Fire Fighting Measures	Use water, dry powder, foam, carbon dioxide fire extinguishers.	
		Precautions	Fire may produce irritating, corrosive and/or toxic gases. Containers may be hazardous when empty since they retain product residues (vapors, liquids). Do not add water to acid. Always add acid to water while stirring to prevent release of heat, stream and fumes.	

No	Name of Chemicals	Hazard Profile and Measures		Website Links where detailed MSDS can be Accessed
8.	Sulfuric Acid (Concentrated) H_2SO_4	**Health Effects**	Eye contact: Immediate pain, severe burns and corneal damage, which may result in permanent blindness. Skin contact: Cause burns and brownish or yellow stains. Concentrated solutions may cause second or third degree burns with severe necrosis. Prolonged and repeated exposure to dilute solutions may cause irritation, redness, pain and drying and cracking of the skin. Inhalation: Cause respiratory irritation and at high concentrations may cause severe injury, burns or death. Ingestion: Cause severe irritation or burns of the mouth, throat and esophagus.	**http://www.northeastern.edu/wanunu/WebsiteMSDSandSOPs/MSDS/Msds_Sulfuric_Acid.pdf**
		Storage and Handling	Good general ventilation should be provided to keep vapor and mist concentrations below the exposure limits. Keep ignition sources away from sulfuric acid storage, handling and transportation equipment. Use extreme care while diluting with water. Keep container tightly closed.	
		First Aid Procedures	Eyes: Immediately wash eyes with running water for a minimum of 20 minutes. Hold eyelids open during washing. If irritation persists, repeat washing. Seek medical attention immediately. Do not transport victim until the recommended washing period is completed unless washing can be continued during transport. Skin: Immediately wash skin with running water for a minimum of 20 minutes. Start washing while removing contaminated clothing. If irritation persists, repeat washing. Seek medical attention immediately. Do not transport victim until the recommended washing period is completed unless washing can be continued during transport. Inhalation: Move to fresh air. Give artificial respiration only if breathing has stopped. Do not use mouth-to-mouth method. Give CPR if there is no pulse and no breathing. Seek medical attention immediately. Ingestion: Do not induce vomiting. If victim is alert, rinse mouth and give ½ to 1 glass of water to dilute the material. If spontaneous vomiting occurs, lean victim forward with head down to avoid breathing in of vomitus, rinse mouth and administer more water. Immediately transport victim to an emergency facility.	

No	Name of Chemicals	Hazard Profile and Measures		Website Links where detailed MSDS can be Accessed
		Accidental Release Measures	Cover with dry earth, sand or other non-combustible material or absorb with an inert dry material. Neutralize the residue with a dilute solution of sodium carbonate, lime or other suitable neutralizing agent.	
		Disposal Measures	Dispose of in accordance with local regulations.	
		Fire Fighting Measures	Use dry earth, sand. Do not use water and metal powder. Extinguish by wearing self-contained breathing apparatus.	
		Precautions	Extremely corrosive. Harmful or fatal if swallowed. Concentrated sulfuric acid will react with many organic materials and may cause fire due to the heat of the reaction.	

Chemicals used in factory operations

Chemicals used in laboratory

Source: MSDS of chemicals

ANNEX 9 – DETAILED SUB PLANS

ANNEX 9-A: SOLID WASTE MANAGEMENT PLAN

SOLID WASTE MANAGEMENT PLAN

Objective and Scope

This plan aims to set a systematic management of solid waste generated from the MSS factory particularly for the waste which is hazardous for the environment and human beings. It will also ensure and guide proper collecting, handling, storing and disposal of waste at the MSS factory by proposing the additional measures to be conducted by the MSS. In addition, this plan identifies the monitoring activities and prepare the required record form for monitoring the management of solid waste. This SWMP is primarily based on the concept of 3R system – "Reduce, Reuse and Recycle", which approaches and find way and plan this SWMP under this concept.

- Reduce the waste source and amount as much as possible
- Reuse waste as much as possible
- Recycle the available waste as much as possible

As per the results of solid waste assessment conducted in Chapter 5, the plan outlines to strengthen the weakness of the current solid waste management practice at MSS Factory referring to the international guidelines for management of waste from smelting sector.

Responsible Team

This management plan shall be carried out as one of the mitigation measures which is proposed in the EMP. EHS Team has the full responsibility of undertaking the instructions, practices and activities defined under this SWMP (Solid Waste Management Plan). Responsible person for each activity is defined at the respective sections of plan.

Management of Industrial and Domestic Waste

Industrial Waste

(i) Waste Slag from Roasting and Smelting Lines

Table 1 – Hazardous Solid Waste Management Procedure at MSS (Waste Slag)

Step	Proposed Mitigation Measures	Additional Requirement to be conducted by MSS
(1) Slag 1		
Step 1	Transport the generated slag into the designated cooling area. (Shown in Figure – 1).	• Suggested that the designated areas such as cooling area of slag (1), cooling area of slag (2), etc. are labelled in the warehouse.
Step 2	Cool down the slag in separate and designated pile for slag (1) and slag (2).	• Record the weight of reused slag every time in balance sheet (Table - 10) when antimony content is greater than 1%
Step 3	Slag (1) are pressed and packed into the sacks for the storage after cooling. This must be carried out in the storage area.	• Avoid the using of improper sacks
Step 4	Store the packed slag in warehouse without any contact with rain.	-

Step	Proposed Mitigation Measures	Additional Requirement to be conducted by MSS
Step 5	Sell the slag (1) and (2) if there is any demand from the third-party buyers.	• Communicate with the buyer of slag (1) pyit sar – such as cement companies for timely sale. • Record the weight of sold slag every time in balance sheet (Table - 10) • Avoid selling the slag to buyers who want to use them for paving purpose without any liner layer.
Step 6	Dispose the slag to the secure landfill.	• Record the weight of disposed sold slag every time in balance sheet (Table - 10)
	If the project proponent would like to dispose at the bare land inside the project area:	• Install a clay or concrete liner system before landfilling at bare land • Record the weight of disposed slag every time in balance sheet (Table-10)
(2) Slag 2		
Step 1	Transport the generated slag into the designated cooling area. (Shown in Figure – 1).	• Suggested that the designated areas such as cooling area of slag (1), cooling area of slag (2), etc. are labelled in the warehouse.
Step 2	Cool down the slag in separate pile for slag (1) and slag (2).	-
Step 4	Store the slag without any contact with rain.	-
Step 5	Dispose the slag to the secure landfill.	• Record the weight of disposed slag every time in balance sheet (Table - 10)

Source: EnvO Study Team

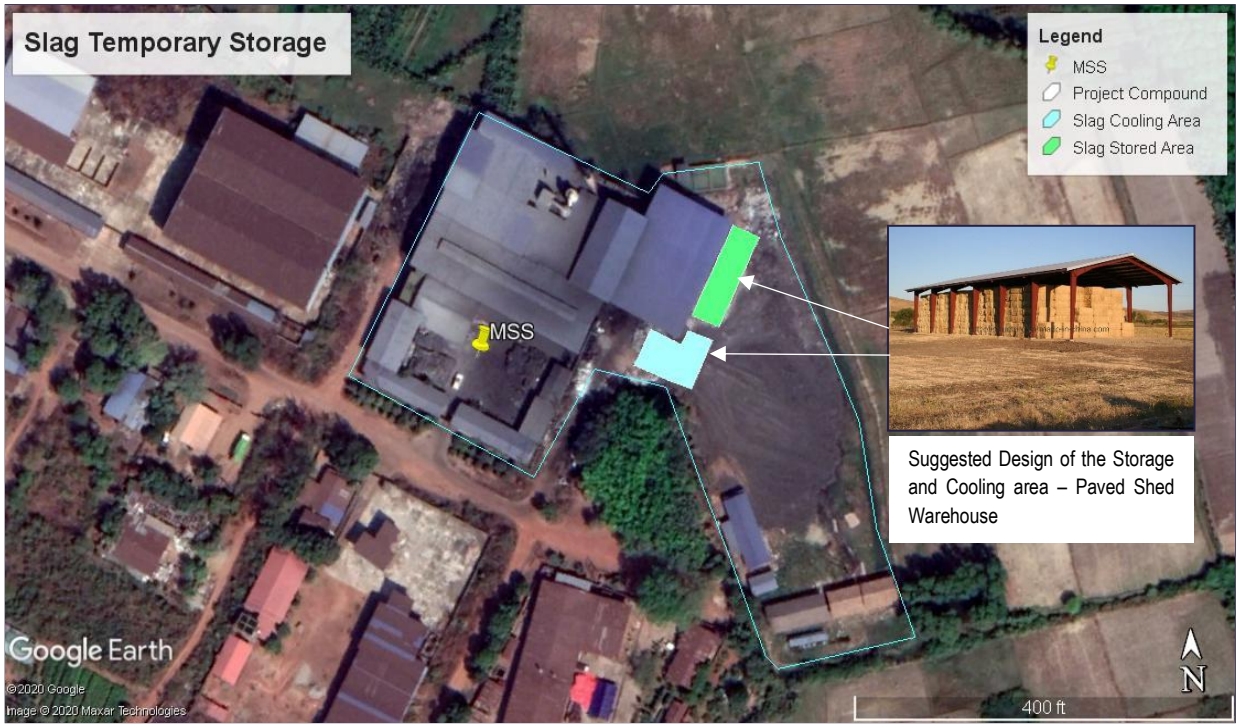


Figure 1 – Proposed slag storing area and cooling area

Source: EnvO Study Team based on Google Earth Pro

(ii) Sludge from Wet Scrubber and Settling Tanks

Table 2 – Hazardous Solid Waste Management Procedure at MSS (Sludge)

Step	Proposed Mitigation Measures	Additional Requirement to be conducted by MSS
(3) Slag from Wet Scrubber and Settling Tanks		
Step 1	-To remove regularly the sludge from the wet scrubber every two months particularly when the function of wet scrubber has malfunction -To remove regularly the sludge from the settling tanks when thick deposit of the slag (e.g. one-third of the height of the tank) is observed in the settling tanks	• To wear gloves while taking out the sludge • To test the properties (heavy metal contents including antimony) of the sludge • To recycle the sludge with antimony content (>1%) into the roasting line
Step 2	-To pack the sludge with the sacks and temporarily store in a place with paving under roof	• To designate a place for temporary storage of the sludge from wet scrubber
Step 3	-To dispose the packed sludge at the landfill site or sell out to the third party for reuse it	• To engage with the buyers (third party) for selling the sludge timely for recycling (e.g. brick production, cement industry)

(iii) Empty Chemical Containers

Table 3 – Hazardous Solid Waste Management Procedure at MSS (Empty Chemical Containers)

Step	Proposed Mitigation Measures	Additional Requirement to be conducted by MSS
(4) Empty Chemical Containers		
Step 1	Label the empty containers.	-
Step 2	Store in places without any direct sunlight and contact to the soil. (chemical storage warehouse with separate pile of empty containers and chemical containers).	• It is okay to be stored in the area where the containers are stored currently.
Step 3	Avoid disposing to the environment, resell them to the other third-party buyers.	• Seek the buyer source to resell the empty containers for the other purpose use.

Source: EnvO Study Team

(iv) Used Machineries Part

Table 4 – Hazardous Solid Waste Management Procedure at MSS (Used Machineries Part)

Step	Proposed Mitigation Measures	Additional Requirement to be conducted by MSS
(5) Used Machineries Part – (used ducts)		
Step 1	Temporarily store the used machineries part in the warehouse the same as where the slag store.	• Avoid disposing these wastes recklessly at the project site.
Step 2	Avoid disposing to the environment, resell them to the other third-party buyers.	• Seek the buyer source (may be iron smelter or any other) to resell the empty containers for the other purpose use.

Source: EnvO Study Team

Domestic Waste

Non-hazardous solid waste at MSS Factory is planned to be managed as per the following step by step procedure.

Table 5 – Non-hazardous Solid Waste Management Procedure at MSS

Step	Proposed Mitigation Measures	Additional Requirement to be conducted by MSS
(1) Non – recyclable waste (Here, non-recyclable wastes mean wastes that cannot be resold to the third buyers.)		
Step 1	Dispose the wastes into the waste bins around the project compound.	• Provide domestic waste bins at least in the area presented in the below Figure – 1. Waste bins are better provided with cover.
Step 2	Regularly check the bins occasionally and if full, dispose to the collection point which is established at the MSS. (In Figure – 1)	• Collection point must be covered in normal time. • Collection point should be masonry tank which must be paved at every dimensions or number of plastic bins.
Step 3	Wates are collected by the local CDC in every two weeks or occasionally when the collection point becomes full.	• Make a record of every disposal by using form in Table - 9.
(2) Recyclable waste (Here recycled waste defined as wastes that can be resold to the third buyer – papers, steels etc.)		
Step 1	Seek the source of the recyclable waste buyers within the local. (for used paper, bottles, organic wastes resulted from kitchen for feeding pigs)	-
Step 2	Enforcing workers and their families to collecting the recyclables, by not disposing into the waste bin. - Recyclables are collected from the workers in every two months.	• Any incentives or provision as an exchange with the recyclables that workers collected. (e.g. point collection program)

Source: EnvO Study Team

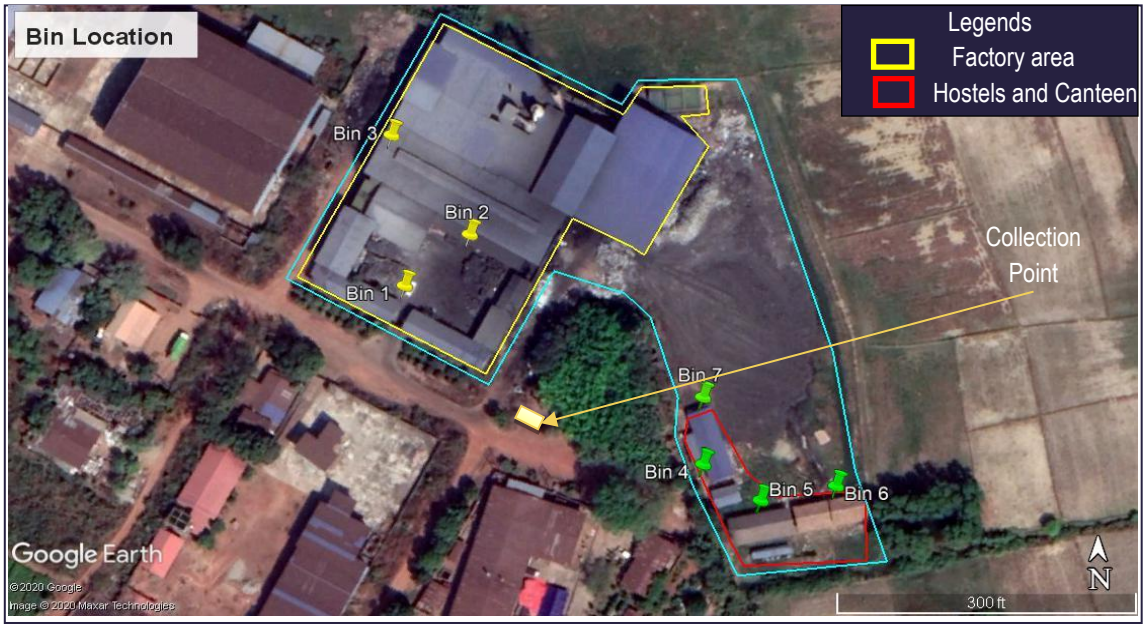


Figure 2 – Explored Waste Bins Location and Collection Point

Source: EnvO Study Team based on Google Earth Pro

Necessary Documents for Monitoring

The following documents are prepared to be used in the monitoring process of waste management.

Table 6 – Documents for Monitoring

No.	Forms to be used	Frequency	Responsible Person
Hazardous Solid Waste			
1.	Waste Inventory – Recording (To know amount generated, store on -site and disposed) Mainly for slag (1) and (2)	Daily	EHS Supervisor -A labor at assign
2.	Slag Balance Sheet (to balance out the generated slag, sold slag, reused slag and disposed slag) – as slag is the major waste source from the metal processing	Monthly	EHS Supervisor
Non-Hazardous Solid Waste			
3.	Waste Disposal Record	Weekly or Occasionally	EHS Supervisor

Source: EnvO Study Team

Waste Inventory – Record Form

As a basic requirement, MSS shall make a practice of recording waste inventory for each month to identify the recovery rate or waste generation in MSS. Therefore, a form of waste inventory is prepared for the MSS EHS Management Team.

Table 7 – Hazardous Waste Inventory – Recording Form for a Month

Responsible Person - A Labor at Roasting and Smelting Assign					Responsible Person - EHS Supervisor	
No.	Date	Item (အမျိုးအစား)	Frequency စွန့်ပစ်သော ဂေါအရေအတွက်	Remarks မှတ်ချက်	Total amount* စုစုပေါင်း အလေးချိန်*	Checked By (Signature)
1		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
2		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
3		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
4		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
5		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
6		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
7		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
8		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				

Responsible Person - A Labor at Roasting and Smelting Assign					Responsible Person - EHS Supervisor	
No.	Date	Item (အမျိုးအစား)	Frequency စွန့်ပစ်သော ဂေါ်အရေအတွက်	Remarks မှတ်ချက်	Total amount* စုစုပေါင်း အလေးချိန်*	Checked By (Signature)
9		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
10		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
11		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
12		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
13		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
14		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
15		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
16		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
17		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
18		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
19		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
20		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
21		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
22		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
23		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
24		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
25		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				

Responsible Person - A Labor at Roasting and Smelting Assign					Responsible Person - EHS Supervisor	
No.	**Date**	**Item** (အမျိုးအစား)	**Frequency** စွန့်ပစ်သော ဂေါ်အရေအတွက်	**Remarks** မှတ်ချက်	**Total amount*** စုစုပေါင်း အလေးချိန်*	**Checked By (Signature)**
26		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
27		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
28		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
29		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
30		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
31		Slag (1) - ပစ်စာ				
		Slag (2) -ချော်ခဲ				
စုစုပေါင်း(တန်)						

Note: *Total Amount = Wt. at a frequency (ton) × Total Frequency
မှတ်စု= တစ်ဂေါ်လှည်းစာစံတိုင်းထားသော အလေးချိန် (တန်) * ဂေါ်အရေအတွက်

Source: EnvO Study Team

Slag Balance Sheet

Table 8 – Monthly Slag Balance Sheet

No.	**Year** (to be filled)	**Month**	**Slag Generated(ton)** (*got from the total amount of hazardous waste inventory)	**Sold Out (ton)**	**Reused(ton) in the Furnaces**	**Disposed(ton)**
1.		January				
2		February				
3		March				
4		April				
5		May				
6		June				
7		July				
8		August				
9		September				
10		October				
11		November				
12		December				
Total (Annual)						

Source: EnvO Study Team

Waste Disposal Record Form

Table 9 – Waste Disposal Record

No.	Date	Waste Collected from CDC (or) Disposed by MSS	Pay Slip – Any Receipt (If Any)	Checked By (Signature)	Remarks

Source: EnvO Study Team

ANNEX 9-B: OCCUPATIONAL HEALTH AND SAFETY (OHS) PLAN

OCCUPATIONAL HEALTH AND SAFETY PLAN

The occupational health and safety plan provide procedures to reduce the risks upon health and safety of workers and enhance better occupational health and safety in MSS Factory. The plan covers the anticipated occupational hazards assessed in Chapter 6 including the following types of occupational hazards: (i) Indoor Air Quality (ii) Heat Exposure (iii) Chemical Exposure (iv) Noise (v) Physical Hazards and (vi) Communicable Diseases.

In accordance with the instructions specified in section 26 and 30 of Occupational Safety and Health Law (2019) and relevant sections in Chapter III and Chapter IV of Factories Act 1951, the occupational health and safety plan is prepared. The administrative team of MSS factory will act as occupational health and safety management team and is responsible for overall management and implementation of the occupational health and safety plan.

This occupational health and safety plan aim to provide the safety measures needed to be adopted by MSS factory, monitoring activities for the compliance measures and the implementation programs for capacity development in health and safety of the workers. This plan will help to reduce the occupational hazards by developing hazards mitigation measures and monitoring activities in potential working areas exposed to the occupational hazards.

1. Occupational Safety Policy of MSS Factory

MSS factory has drawn its occupational safety policy by considering the saying “Safety First - Prevention First”. In the policy, it is stated that the priority of the factory is to implement safety measures in every production stage in order to ensure safety of workers.

(က) လုပ်ငန်းခွင်လုံခြုံရေးစီမံခန့်ခွဲမှုဝါဒ

“ဘေးကင်းလုံခြုံရေးသည် အဓိက ကြိုတင်ကာကွယ်ရေးသည် ပထမ” ဟူသော စကားရပ်သည်စက်ရုံ၏ မူဝါဒဖြစ်ပြီး တိကျပြတ်သားစွာ အကောင်အထည်ဖော်ဆောင်ရွက်မည်ဖြစ်သည်။ လုပ်ငန်းအဆင့်ဆင့်တွင် ဘေးကင်းလုံခြုံရေးအတွက် ဝန်ထမ်းတိုင်းသည် သတ်မှတ်ထားသော စည်းကမ်းချက်များကို တင်းကြပ်စွာ လိုက်နာဆောင်ရွက်စေရေးကို ပထမဦးစားပေးလုပ်ငန်းအဖြစ် သတ်မှတ်သည်။

Figure 1 Occupational Safety Policy of MSS Factory

Source: Project Proponent

2. Currently Practicing Safety Measures by MSS Factory

MSS factory has set out occupational safety measures to be implemented at workplace in order to fulfill its policy. Some of the relevant safety measures currently practicing in MSS factory includes -

- The factory operation team must carry out daily inspection for safety of factory and workers.
- All the working teams (roasting, smelting, etc.) shall be composed of a supervisor and carry out occupational safety measures by team.
- All the new workers must be given trainings for good safety measures to be practiced.
- A worker without wearing necessary personal protective equipment shall not be allowed to work.
- Worker who has consumed alcohol or other drugs shall be prohibited for working.

- No one except responsible personnel should enter transformer room, storage room and other prohibited areas.
- No one except well-trained workers shall work with machines, equipment or industrial vehicle driving.
- All the equipment, tools, machines and electrical appliance shall be placed at their respective locations.
- No worker is allowed to jump down from a moving vehicle.
- If a worker notice about equipment, machine failure, life threatening hazards and fire hazard, he must inform to responsible person immediately.
- All workers must cooperate in emergency situations for control and evacuation activities.
- All workers must follow safety measures by the factory and keep the habit of returning the equipment at their respective places after work.
- Any uninstructed operation is prohibited in the factory.

Figure 2 Occupational Safety Measures of Myanmar Shing Shing Factory

Source: Project Proponent

3. Structure of Occupational Health and Safety Management Team

The administrative team of MSS factory will act as the core team for the implementation of occupational health and safety plan. The organizational structure of occupational health and safety management team is shown in the following figure.

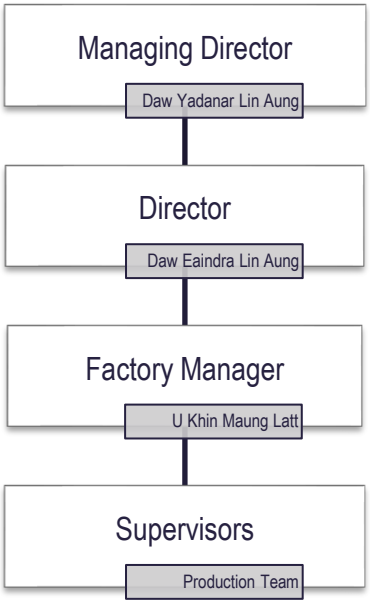


Figure 3 Organizational Structure of Occupational Health and Safety Management Team (As of July 2021)
Source: EnvO Study Team

The Managing Director and Director will act as the policy maker and overall supervision of implementing Occupational Health and Safety Plan ensuring that the policy and plan are properly implemented within the factory.
The factory manager will perform as a communicator and overall management of implementing the safety plan. His responsibility also includes reporting the performance of the operations. The supervisors will be responsible for ensuring the safety of their respective team members. They are also responsible for accident recording, investigation and identifying causes to make certain no recurrence of accidents.

4. Occupational Health and Safety Management Works

In Chapter 6, a number of occupational hazards, which are related to occupational health and safety in base metal smelting and refining factory, are assessed. Each of them is rated according to their significant risk levels and recommendations are given to reduce the likelihood and/or consequence of each risk. Therefore, the mitigation measures need to be adopted by occupational health and safety management team to reduce the extent of occupational hazards in different working areas, are described under this section.

Table 1 Occupational Health and Safety Management Works

Workplace	Related Hazards	Mitigation Measures to be Implemented by Management Team	Measures to be followed by Workers	Recommended Monitoring
Coal Grinding Area	1. Dust 2. Noise 3. Physical Hazard	• Provision of dust masks • Mounting warning sign to wear masks	• Wearing dust masks while working near grinding area	• Dust in Workplace • Noise

Workplace	Related Hazards	Mitigation Measures to be Implemented by Management Team	Measures to be followed by Workers	Recommended Monitoring
		• Mounting warning sign as significant noise area • Making limited access to coal grinding area except responsible workers • Marking 3 m distance line from coal grinding machine • Regular cleaning and maintenance of grinding machine • Providing eye shields or googles • Prohibit eating and smoking at coal grinding area.	• Staying back from 3 m distant line from coal grinding machine • Wearing eye shields or googles while working near grinding machine • Following rules and regulations	• Accident and Near miss record
Roasting Furnaces, Smelting Furnaces and Casting	1. Dust and Smoke 2. Heat Exposure 3. Physical Hazard	• Ensure furnace doors are closed at the beginning and operation of furnace to avoid dust and smoke accumulation in workplace. • Making limited access to casting area except responsible workers • Provision of protective clothing and heat resistant gloves • Providing eye shields or googles • Provision of mechanical ventilation such as cooling fans • Provision of sufficient drinking water, electrolyte drinks and prohibiting consumption of alcoholic beverages to reduce dehydration • Allow workers to take breaks or change tasks at any point if they feel too hot or uncomfortable.	• Wearing protective clothing and heat resistant gloves during furnace operation • Ensuring not to stay in the leeward direction of fume from casting area • Staying at a distance of 1.5 m – 2 m away from the furnace • Wearing eye shields while working near furnace • Following rules and regulations • Avoid consumption of Alcoholic beverages to prevent dehydration	• Dust and Smoke • Accident and Near miss record
Bag House	1. Dust 2. Confined Space	• Having limited Access to bag house in limited time frame • Regular housekeeping in bag house and avoiding temporary storage of other things • Provision of cover materials for antimony	• Asking permit from supervisor before entering the bag house • Wearing respirators while entering inside the bag house	• Ventilation inside the Bag House

Workplace	Related Hazards	Mitigation Measures to be Implemented by Management Team	Measures to be followed by Workers	Recommended Monitoring
		oxide powder collection through openings • Adopting permit to enter bag house • Ensuring atmosphere inside the bag house is ventilated to assure sufficient oxygen content in air.		
Chemical Storage Room Laboratory	1.Chemical Exposure	• Provision of PPE and chemical resistant gloves • Provision of emergency shower and eye wash near chemical storage room • Limited access to chemical storage area except authorized persons • Storing chemicals separately as per their MSDS requirements • Keeping ignition sources away from chemical storage area • Tightly closing containers • Keeping chemicals in cool areas out of direct sunlight • Triple rinsing of empty containers with water • Provision of chemical handling trainings	• Wearing PPE and chemical resistant gloves while handling and working with chemicals • Following rules and regulations	• Visual inspection of chemical storage room on a regular basis • Accident record
Slag Temporary Storage Area	1. Heat Exposure 2. Physical Hazard	• Provision of protective clothing and heat resistant gloves • Designating route and area for temporary slag storage area • Having limited access to temporary storage area (signage and barriers) except authorized persons	• Wearing protective clothing and heat resistant gloves while handling and disposal of slags	• Accident and Near miss record
Air Blower	1. Noise	• Mounting warning sign as high noise area near the air blowers • Marking 3 m distance line from air blowers • Checking and cleaning fans and filters of blowers on a regular basis to	• Staying back 3 m distance line from air blower	• Noise Monitoring Record

Workplace	Related Hazards	Mitigation Measures to be Implemented by Management Team	Measures to be followed by Workers	Recommended Monitoring
		reduce unnecessary noise from blowers.		
Project Site	1. Physical Hazards 2. Communicable Diseases	• Housekeeping in a timely manner; day to day housekeeping activities, planned and non-routine activities • Round check before starting work by factory manager • Fixation of storage areas of raw materials, products and by-products • Cleaning of wet floor immediately • Removing trailing wires from the work floor • Mending holes • Provision of safe workplace conditions • Systematic recording of entry and leaving from the factory • Maintenance of water supply, sanitation systems, pumps and wells • Regular cleaning and maintenance of toilets using chlorine-based disinfectant • Providing properly purified water with clean container	• Follow housekeeping rules and regulations • Personal hygiene and food safety precautions by chef	• Accident and Near miss record • Workers' Attendance Record • Housekeeping Record
Vehicle Driving	1. Physical Hazards	• Allowing to only trained drivers • Driving with minimum speed (3 miles per hour) at uneven ground • Informing workers at the time of forklift operation • Marking separated route for forklift movement	• Drivers shall follow safe driving practices	• Accident and Near miss record
Project Site 1. Office 2. Laboratory 3. Working Area 4. Worker's Accommodation 5. Canteen	1. Communicable Diseases (Covid-19)	• Placing Awareness Posters • Providing handwash stations and materials • Providing safe work conditions in accordance with instruction from	• Following strictly on preventive measures	• Receiving regular or periodic inspection from MOHS

Workplace	Related Hazards	Mitigation Measures to be Implemented by Management Team	Measures to be followed by Workers	Recommended Monitoring
		Ministry of Health and Sports (MOHS)		

Source: EnvO Study Team

5. Occupational Health and Safety Monitoring Plan

After implementing occupational health and safety management measures, some hazards may need continuous monitoring activities for effective control and therefore, monitoring requirements are also set out as shown in abovementioned table. Those activities are needed to carry out by the occupational health and safety management team as described in the Chapter 8 of IEE report in details.

6. Implementation Programs

Enforcement Programs

For the enforcement of health and safety improvement, MSS factory has enacted fines on workers considering the conditions such as:

- The workers will have to pay 2,000 Kyats for not wearing necessary PPE completely and 10,000 Kyats for not wearing at all.
- The workers who have consumed alcohol and came to work, shall be punished by defining a fine of 1,0000 Kyats and will be fired on the second time.

General Safety Training

All the workers who work in the production process should be provided with sufficient information to protect their health from hazardous factors or substances which may be present at the workplace, in a form and language that they understand and sufficient training to understand the information and to take necessary protective measures. The extent of instruction and training should be appropriate to the duties, understanding and literacy of the workers, and sufficiently detailed to ensure that workers understand both the safety requirements and the reasons for these requirements.

New workers would receive specific training regarding the purposes and hazards of the chemicals, materials and processes with which they will be working in the form of practical on-the-job training. The need for retraining and/or further training of existing workers should be considered in case of any changes in production procedures. The trainings should be delivered by the factory manager (after receiving necessary explanation from external OHS Expert) or by the external OHS Expert.

The regular trainings to be implemented in MSS factory for preventing occupational hazards are

- Practical on-the-job training including safety measures to new workers covering but not limited to
  - Safe working procedures for Furnace operation
  - Safe working procedures for Grinding machine operation
  - Safe working procedures for Molten Antimony Casting
  - Safe working procedures for Slag Carriage, Storage and Disposal
  - Working Permit

- Chemical Handling (Chemical handling for chemicals used in MSS are described Annex 8 – MSDS of Chemicals. The general chemical handling training should refer the Annex 8).
- Safe Driving

- Retraining of workers in case of changes in procedures

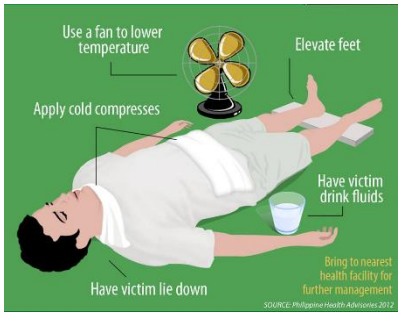
First Aid Training

First aid trainings (first aid for heat stroke, first aid for chemical exposure) are intended for supervisors of production team, occupational health and safety management team. Detailed oriented trainings can be received in collaboration with Township Red Cross Society.

Response on Occupational Hazards

Most occupational hazards may need immediate response like first aid measures to cure injury or to save life. For that hazards, the following responses are prepared to recognize the signs, symptoms and necessary first aid measures.

Table 2 Response on Occupational Hazards

Items	Symptoms	First Aid Procedure
Heat Stroke	• Heavy sweating • Faintness • Dizziness • Fatigue • Weak, Rapid Pulse • Muscle Cramps • Nausea • Headache	• Move the person out of the heat and into an air-conditioned place. • Lay the person down and elevate the legs and feet slightly. • Remove tight or heavy clothing. • Have the person drink cool water or other nonalcoholic beverage. • Apply cold compresses on the body of the person. • Bring to nearest health facility for further treatment.  Source: Philippines Health Advisories 2012
Chemical Exposure	• Irritation • Difficult Breathing	• The first aid measures are different based on the hazard profile of the chemicals. General First aid measures from MSDS of chemicals are described in Annex 8 – MSDS of Chemicals. • The general first aid measures for chemical exposure are Eye: Wash with large quantities of water for about 15 minutes. Skin: Wash with soap and water. Inhalation: Move to fresh air. • Ingestion: Do not induce vomiting.
Physical Hazards	• Physical Injury	• Physical injuries like cuts, wounds should be treated first with first aid procedures. (The basic first aid training is recommended in Emergency Response Plan for emergency security and first aid team.)

Items	Symptoms	First Aid Procedure
		• If cannot be covered by first aid measures, the occupational health and safety management team will manage to deliver the worker to receive hospital treatment.

Source: EnvO Study Team

Some situations may be handled by first aid measures but some situations may lead to requiring hospital treatment. Whether it may need hospital treatment or not, every physical injury or health issue must be recorded in the Accident Record Form or Illness Record Form.

Record Forms

(i) Accident Record Form

All accidents including near-misses shall be recorded in an accident record book. Supervisors of production teams under the management of factory manager are responsible for accident recording.

Table 3 Accident Record Form for Myanmar Shing Shing Factory (မတော်တဆမှု မှတ်တမ်းပုံစံ)

Record No. **မှတ်တမ်း အမှတ်စဉ်.**		
Name – (အမည်) Occupation – (ရာထူး) Date – (နေ့စွဲ) Time – (အချိန်) Location – (နေရာ)		
Description of Accident – (မတော်တဆမှုအကြောင်းရှင်းလင်းဖော်ပြချက်)		
Extent of Injury – (ထိခိုက်မှု ပမာဏ)		
First Aid- (ရှေးဦးပြုစုခြင်း)	☐	
Hospital Treatment (ဆေးရုံတက်ရောက်ကုသခြင်း)	☐	
Sent to Accommodation for Rest (အနားယူစေခြင်း)	☐	
Non-Required (အထက်ပါအကြောင်းအရာများ လိုအပ်မှု မရှိခြင်း)	☐	

Record No. **မှတ်တမ်း အမှတ်စဉ်.**
Actions taken – (ဆောင်ရွက်မှုများ)
Reported by: (တင်ပြသူ)
Checked by: (စစ်ဆေးသူ)

Source: EnvO Study Team

(ii) Illness Record Form

The following illness record form is to be used if there is health related problem happened in workers. Relevant supervisor shall be responsible to fill illness record form or worker under his management.

Table 4 Illness Record Form for MSS Factory (ဖျားနာမှု မှတ်တမ်းပုံစံ)

No. အမှတ်စဉ်	Name of Worker (Patient) လူနာအမည်	Work Responsibility တာဝန်ယူသည့် အလုပ်	Description of Illness ဖျားနာမှု အကြောင်းအရင်း ဖော်ပြချက်	Date ရက်စွဲ	Does the illness require hospital treatment? ဆေးရုံ/ဆေးခန်း သို့ သွားရောက်ပြသခြင်း ရှိ/မရှိ	Duration (days) needed to fully recover ပြန်လည်သက်သာ ရန် ကြာသည့် ရက်ပေါင်း	Name and Responsibility of Data entree မှတ်တမ်းပုံစံ ဖြည့်သူ၏ အမည်နှင့် ရာထူး	Sign လက်မှတ်
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

*** If there is any hospital treatment, Keep the hospital documents and record photos of patient's condition.**

***** ဆေးရုံတက်ရောက်ကုသခြင်းရှိပါက ဆေးမှတ်တမ်းများနှင့် လူနာအခြေအနေများကို မှတ်တမ်းထားရှိရန်။

Source: EnvO Study Team

Health Enhancement Program to Prevent Covid-19

The purpose of occupational health enhancement program is to prevent the spread of communicable disease-Covid-19 in the workplace. The program will mainly include delivering information on Covid-19 and provision of safe workplace conditions, accommodations and canteen according to instructions of Ministry of Health and Sports.

Covid-19 Symptoms

Most Common Symptoms

- Fever
- Dry Cough
- Tiredness

Less Common Symptoms

- Aches and pains
- Sore Throat
- Diarrhea
- Conjunctivitis
- Headache
- Loss of taste or smell
- Rash on skin, or discoloration of fingers or toes

Serious Symptoms

- Difficulty breathing or shortness of breath
- Chest pain or pressure
- Loss of speech or movement

On average it takes 5-6 days from when someone is infected with the virus for symptoms to show, however it can take up to 14 days.

If someone is suspected with the abovementioned Covid-19 symptoms, it shall be informed to the township heath department immediately and followed the instructions exactly.

Specific Instruction from Ministry of Health and Sports

Regarding to the operation of workshops and factories, the Ministry of Health and Sports has released Version 4.0 of criteria for prevention and control of Covid-19 in factories and workplaces on 26th June 2020 as shown in the below figures. The occupational health and safety management team shall well prepare the workplace according to those instructions.

Coronavirus Disease 2019(COVID-19)

ကာကွယ်၊ ထိန်းချုပ်ရေးနှင့်ပတ်သက်၍

စက်ရုံ၊ အလုပ်ရုံများ၊ လုပ်ငန်းခွင်များ၊ အလုပ်ဌာနများနှင့် ဆောက်လုပ်ရေးလုပ်ငန်းခွင်များသို့

လမ်းညွှန်ချက် (Version 4.0)

Updated as of (26-6-2020)

(က) အထွေထွေလိုက်နာဆောင်ရွက်ရမည့်အချက်များ

၁။ နေအိမ်မှအလုပ်လုပ်ရန် ဖြစ်နိုင်သော အလုပ်သမားများကို နေအိမ်များမှသာ အလုပ်လုပ်စေရပါမည်။ (Work from Home)

၂။ နေအိမ်မှအလုပ်လုပ်ရန် မဖြစ်နိုင်သောလုပ်ငန်းခွင်များအတွက် **တစ်ဦးနှင့်တစ်ဦး ခပ်ခွာခွာ နေထိုင်ခြင်း (Physical Distancing) လမ်းညွှန်ကို တိကျစွာ လိုက်နာဆောင်ရွက်ရ ပါမည်။**

- အလုပ်ခွင်တစ်ခုတွင် အလုပ်သမားများကို တတ်နိုင်သမျှ မျက်နှာချင်းဆိုင် အလုပ်မလုပ်စေဘဲ ဘေးတိုက်သာ နေရာချထားပြီး အလုပ်သမား တစ်ဦးနှင့်တစ်ဦး အကြား (၆)ပေခွာ၍ အလုပ်လုပ်စေရမည်ဖြစ်ပြီး (၆)ပေ တိကျသော အကွာအဝေး ရှိစေရန် ကြမ်းပြင်ပေါ်တွင် အမှတ်အသား ပြုလုပ်ထားရပါမည်။
- မဖြစ်မနေ မျက်နှာချင်းဆိုင် အလုပ်လုပ်ကိုင်ရမည်ဆိုပါက အများဆုံး (၁၅)မိနစ်ထက် မပိုစေရန် အထူးသတိပြုပေးပါ။
- အလုပ်သမားများကို အဆိုင်းများခွဲ၍ အလုပ်လုပ်စေပြီး အဆိုင်းတစ်ခုစီတွင် တူညီသော အလုပ်သမားများကိုသာ တာဝန်ချထားပေးရပါမည်။ (Cohorting)
- အလုပ်တက်/ဆင်းသည့် ဝင်ပေါက်/ထွက်ပေါက်များတွင် တစ်ဦးနှင့်တစ်ဦး (၆)ပေ အကွာမှ ခွာ၍ အဝင်အထွက် ပြုလုပ်ရပါမည်။
- ထမင်းစားခန်းတွင် နီးကပ်စွာ စုဝေးစားသောက်ခြင်း မပြုဘဲ တစ်ဦးနှင့် တစ်ဦး မျက်နှာချင်းဆိုင် အနေအထားဖြစ်ပါက အကာအရံများထားရှိရပါမည်။ စားပွဲတစ်ဝိုင်း နှင့်တစ်ဝိုင်းအကြား (၆)ပေ အကွာထားရှိ၍ အကာအရံ(Partition) ထားပေး ရမည်။
- အကယ်၍ လုပ်ငန်းဆောင်ရွက်မှုတစ်ခုခုအတွက် Physical distancing လမ်းညွှန်ကို လိုက်နာဆောင်ရွက်ရန် ခက်ခဲပါက အဆိုပါလုပ်ငန်းဆောင်ရွက်မှုကို ဆက်လက်လုပ်ဆောင်ရန် လိုအပ်ခြင်း ရှိ/မရှိ ဆုံးဖြတ်ပါ။ မဖြစ်မနေဆက်လက်လုပ်ဆောင်ရန် လိုအပ်ပါက ရောဂါကူးစက်မှုအန္တရာယ် လျော့ကျနိုင်စေရေး ဆောင်ရွက်ချက်များကို

1

(ခ) အလုပ်ရှင်များအနေဖြင့် အထွေထွေလိုက်နာဆောင်ရွက်ရမည့်အချက်များအပြင် အောက်ပါတို့ကိုလည်း လိုက်နာ ဆောင်ရွက်ရပါမည်-

၁။ အလုပ်တက်/ဆင်းချိန်များ၌ လူစုလူဝေးမဖြစ်ပေါ်စေရန် အလုပ်ဌာနအလိုက် အလုပ်တက်/ဆင်းစေရန် အချိန်များကိုတတ်နိုင်သမျှ ခွဲခြားသတ်မှတ်ပေးရန်နှင့် အဆိုင်းအလိုက် ထမင်းစားချိန် လွှဲပြောင်းပေးခြင်းတို့ဆောင်ရွက်ပေးရန်၊

5

၂။ ဝန်ထမ်းကြို/ပို့ယာဉ်များကို Physical Distancing မူနှင့်အညီ စီစဉ်ဆောင်ရွက်ပေးရန်၊ ယာဉ်များပေါ်တွင် လက်သန့်စင်ဆေးရည်၊ တစ်ခါသုံးတစ်ရှူး၊ ပါးစပ်နှင့်နှာခေါင်းစည်း (Mask)များ ထားရှိပေးရန်နှင့် လမ်းခရီးတွင် ကျန်းမာရေး အသိပညာပေးအချက်အလက်များကို ရုပ်/သံဖြင့်ပြသခြင်း (သို့မဟုတ်) အသံဖိုင်ဖြင့် ပြောကြားပေးခြင်းများ ဆောင်ရွက်ပေးရန်၊

၃။ နေ့စဉ်အလုပ်တက်/ဆင်းသော အလုပ်သမားများ၏ ဆက်သွယ်ရန် လိပ်စာနှင့် ဖုန်းနံပါတ်များကို လိုအပ်ပါက အချိန်မရွေးဆက်သွယ်နိုင်ရန် အဆင်သင့်ပြုစုထားရန်၊

၄။ လိုအပ်သော တစ်ကိုယ်ရေသုံးအကာအကွယ်ပစ္စည်းများကို အလုံအလောက် ထောက်ပံ့ပေးရန်၊

၅။ လက်ဆေးကန်များကို လုံလောက်စွာစီစဉ်ဆောင်ရွက်ပေးရန်၊ စနစ်တကျ လက်ဆေးမှုကို အထောက်အကူပြုစေသော ဆပ်ပြာ၊ ရေ၊ လက်သန့်စင်ဆေးရည်၊ တစ်ရှူးစက္ကူ စသည် တို့ကို အလုံအလောက် ထောက်ပံ့ပေးရန်နှင့် လက်ဆေးရာနေရာတိုင်းတွင် စနစ်တကျ လက်ဆေးနည်းပိုစတာများကို ကပ်ထားပေးရန်၊

၆။ စားဖိုဆောင် ဝန်ထမ်းများ၏ တစ်ကိုယ်ရေသန့်ရှင်းရေးနှင့် ၎င်းတို့၏ ကျန်းမာရေးဆိုင်ရာ ကိစ္စရပ်များ (ဖျားနာခြင်း၊ ချောင်းဆိုးခြင်း၊ အသက်ရှရခက်ခဲခြင်းနှင့် အားအင်ကုန်ခမ်းခြင်း စသည်တို့) အတွက် အထူးသတိပြုကြပ်မတ်ဆောင်ရွက်ပေးရန်၊

၇။ လူအများ မကြာခဏထိတွေ့ရာနေရာများ(ဥပမာ-စားပွဲမျက်နှာပြင်များ)၊ ဝန်ထမ်းများ နေ့စဉ်အသုံးပြုသောပစ္စည်းကိရိယာများကို မကြာခဏ ပိုးသတ်သန့်စင်နိုင်ရေးနှင့် ကြမ်းခင်း နေရာများကို အနည်းဆုံးတစ်ရက်လျှင်တစ်ကြိမ် ပိုးသတ်သန့်စင်နိုင်ရေး စီစဉ်ဆောင်ရွက်ရန်၊

၈။ ပိုးသတ်သန့်စင်ရာတွင် ဆပ်ပြာ၊ရေတို့ဖြင့် ဦးစွာဆေးကြောပြီးနောက် 0.1% Hypochlorite Solution ဖြင့်လည်းကောင်း၊ သတ္တုမျက်နှာပြင်များကို (70-90%) Ethyl Alcohol ဖြင့် လည်းကောင်း အလုပ်ဆိုင်းတစ်ချိန်နှင့် တစ်ချိန် အကြား (အလုပ်ဆိုင်းတစ်ချိန်ပြီးတိုင်း) တွင် စနစ်တကျ ပိုးသတ်သန့်စင်ရန်၊

(ဂ) အလုပ်သမားများအနေဖြင့် အထွေထွေလိုက်နာဆောင်ရွက်ရမည့်အချက်များအပြင် အောက်ပါတို့ကိုလည်း လိုက်နာဆောင်ရွက်ရပါမည်-

၁။ **ဝန်ထမ်းကြိုပို့ယာဉ်များဖြင့်သာ တတ်နိုင်သမျှ အလုပ်တက်/ဆင်းပြုလုပ်ရန်နှင့် အများသုံး ယာဉ်များကို ဖြစ်နိုင်လျှင် အသုံးမပြုရန်၊**

၂။ အဆောင်များတွင်နေထိုင်သော အလုပ်သမားများအနေဖြင့် Physical distancing လမ်းညွှန်အပါအဝင် ကျန်းမာရေးနှင့် အားကစားဝန်ကြီးဌာနမှ ထုတ်ပြန်ထားသော လမ်းညွှန်ချက်များအားလုံးကို **လုပ်ငန်းခွင်တွင်သာမက နေထိုင်ရာအဆောင်များတွင်ပါ တိကျစွာလိုက်နာဆောင်ရွက်ရန်။**

(ဃ) အလုပ်သမားကြီးကြပ်ရေးမှူးများအနေဖြင့် အထွေထွေလိုက်နာဆောင်ရွက်ရမည့်အချက်များအပြင် အောက်ပါတို့ကိုလည်း လိုက်နာဆောင်ရွက်ရပါမည်-

၁။ မိမိဌာနရှိ ဝန်ထမ်းများစနစ်တကျ လက်ဆေးတတ်စေရေး သရုပ်ပြသင်ကြား ကြီးကြပ်ရန်နှင့် သံသယဖြစ်ဖွယ် လက္ခဏာများရှိ/မရှိ အမြဲမပြတ် စောင့်ကြည့်ရန်၊

၂။ လုပ်ငန်းခွင်သို့ လာရောက်သောအလုပ်သမားအရေအတွက်ကို နေ့စဉ်မှတ်တမ်းတင်ရန်၊

၃။ သံသယလူနာတွေ့ရှိပါက ကျန်းမာရေးဌာနသို့ ကြိုတင်ဖုန်းဆက်အကြောင်းကြား၍ ပို့ဆောင်ပေးရန်။

7

Figure 4 Instruction from Ministry of Health and Sports for Factories and Workplaces on 19 April 2020

Source: www.mohs.gov.mm

In addition to preparing of workplace according to instructions from Ministry of Health and Sports, the following awareness posters should be posted at locations easily visible to all workers and ensure all precautionary practices are implemented in daily operation of the factory.

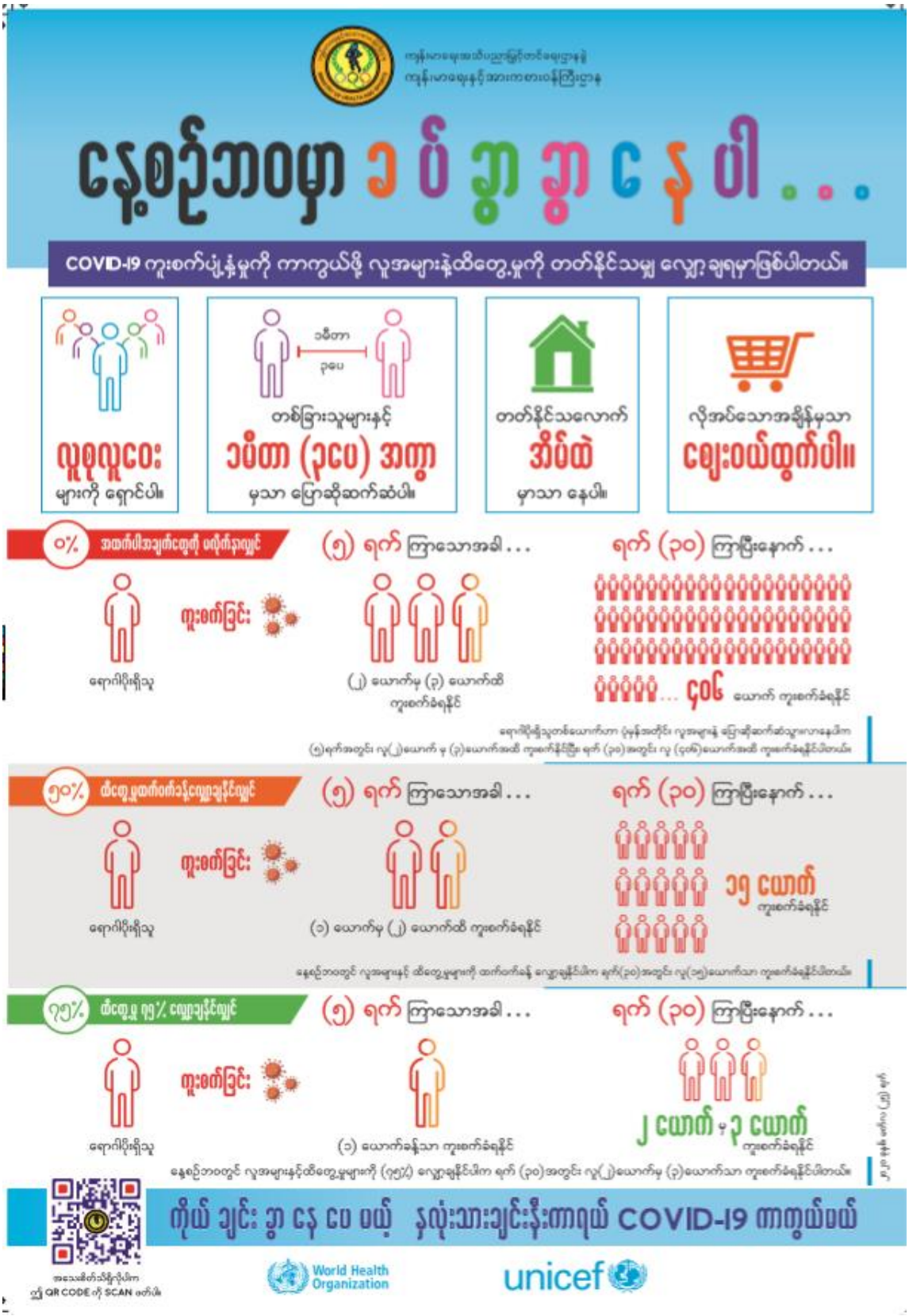


Figure 5 Poster on Social Distancing

Source: www.mohs.gov.mm

Figure 6 Poster on How to Wash Hands

Source: www.who.int

Figure 7 Poster on Cough Etiquette

Source: www.mohs.gov.mm

ANNEX 9-C: EMERGENCY RESPONSE PLAN

EMERGENCY RESPONSE PLAN

An Emergency Response Plan specifies detailed procedures to reduce human injury and damage to property during sudden or unexpected situations. Also, it provides how to act in an emergency and who to contact. Emergency response plan provides operational management for emergency response team members with a general guideline of the expected initial response to an emergency, and an overview of their responsibilities during an emergency. For this plan to be effective, it is important that all personnel who have a role in this plan shall be made aware of its roles and responsibility in an emergency.

This emergency response plan is prepared based on the results of the risk assessment of natural disasters and emergency risks described in Chapter (6) of IEE Report. This emergency response plan deals with the following types of emergencies:

- Fire
- Furnace Explosion
- Natural Disasters such as Flood and others.

The plan is composed of five sections: (1) the overview of emergency safety team, (2) their roles and responsibilities, (3) response procedures to fire hazard and flood risk, (4) implementation trainings and (5) emergency contacts. This emergency response plan is developed in line with section 72 (d) of Myanmar Fire Brigade Rules (2015), section 40 (1) of Factories Act (1951) and section 26(f) and 26(o) of Occupational Safety and Health Law (2019). The emergency response plan will be implemented under the instruction and guidance of related government departments and organizations such as Fire Services Department (FD), Directorate of Industrial Supervision and Inspection (DISI), Factory and General Labor Laws Inspection Department (FGLLID), Department of Metrology and Hydrology (DMH), etc. as necessary.

1. Formation of Emergency Safety Team

The emergency safety team is recommended to be organized with current staff by the company. The Emergency Safety Team is composed of three sub-teams under the management of Emergency Commander. For the role of emergency commander, it is important to have knowledge on overall management of the factory and employees. In addition, the emergency commander should also be someone who is always present at the factory. Therefore, the factory manager (EHS Officer) is recommended to take the role and responsibility of Emergency Commander. All three sub-teams will coordinate with each other team and emergency commander to respond to the emerging emergency situations.

The emergency response and evacuation sub-team will also be act as Reserve Fire Brigade formed in accordance with Section 25 of The Myanmar Fire-brigade Law (2015). MSS factory compound is composed of mainly two areas: working area and workers' accommodation with canteen and the factory is operating with respective shifts alternatively. Therefore, two groups and two assembly points are defined under emergency response and evacuation sub-team and emergency assembly sub-team for the convenience of controlling an emergency situation.

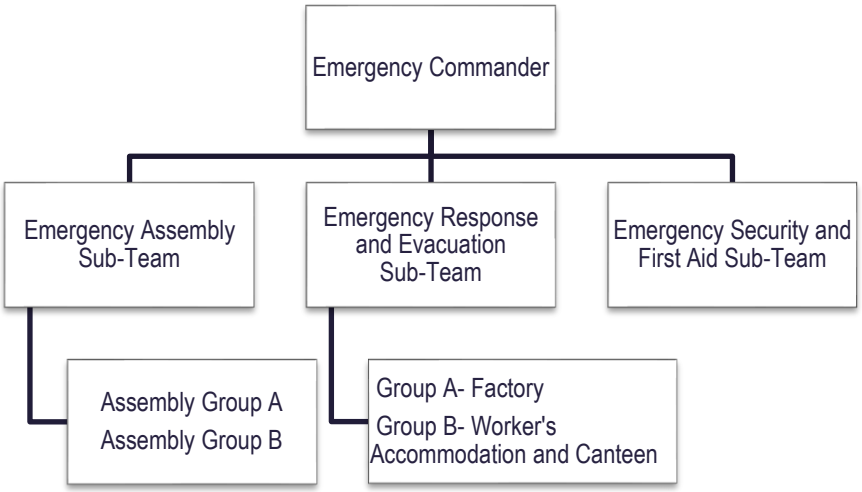


Figure 1. Organization Structure of Emergency Safety Team

Source: EnvO Study Team

2. Responsibility of Emergency Safety Team Members

The following Table 1 shows the responsibilities of emergency safety team members. It presents the main responsibilities, skills needed to be in emergency safety team, and their corresponding tasks to perform in the emergency situation.

Table 1. Responsibilities of Emergency Safety Team Members

Description	Main Responsibility	Skill	Tasks
Emergency Commander	• Command and control any emergency situation occurring within the factory compound	• Familiar with overall management of the factory and always present at the factory	• Manage the three-emergency sub-teams • Make decision for evacuation, informing Fire Services Department, and contacting outside help depending on the seriousness of the emergency conditions as well as availability of emergency supportive contacts described section 5 of this Emergency Response Plan • Manage the clean-up activities after an emergency situation is over and safe to do so
Emergency Assembly Sub-Team	• Gather everyone except the emergency safety team at the	• Assembly Group A: employees working inside factory, office and laboratory and visitors to	• Make roll call quickly • If notice some persons are missing during roll call, inform immediately to

Description	Main Responsibility	Skill	Tasks
(Assembly Group A Assembly Group B)	designated assembly points	be assembled at Assembly Point A which is near to the entrance of the factory • Assembly Group B: everyone who is staying inside or near the workers' accommodation and canteen to be assembled at Assembly Point B which is the open space near the hostel	the emergency response and evacuation sub-team to find them
Emergency Response and Evacuation Sub-Team (Group A – Factory Group B – Worker's Accommodation & Canteen)	• Handle, control and extinguish of any hazard/emergency • Evacuate any injured persons or trapped persons	• Familiar with operation of roasting and smelting, maintenance of equipment and machinery, generator operational control • Trained staffs of firefighting procedures or another emergency procedure • Group A is responsible for controlling emergency situation happened at working area, lab and office Group B is responsible for controlling emergency situation occurred at workers' accommodation and canteen	• Go to the emergency place and control the situation under the command of sub-team leader • Find and evacuate the missing persons and rescue to assembly point
Emergency Security and First Aid Sub-Team	• Securing the entrances of the factory • First aid to injured person(s)	• Security • Trained Staffs for First Aid	• Making sure the security team is stationed at their duty assigned area and securing the entrances of the factory from entering strangers from outside during emergency situation • Give first aid or CPR depending on the seriousness of the injury of the rescued person • Call outside help such as ambulance, fire brigade and police with the acknowledgement of the emergency commander

Source: EnvO Study Team

3. Response Procedures for Each Emergency Situation

Response to Fire Hazard

Figure 2 outlines the detailed procedures how to inform about fire starting to develop and how should the workers, visitors and emergency safety team response on the sound of fire alert.

HOW TO RESPOND TO A FIRE HAZARD	
ANYONE who sees a fire hazard is happening or starting to develop →	Use **HORN** which is at the nearest location to alert everyone inside the factory compound about fire hazard.

WHEN THE SOUND OF HORN IS HEARD

Workers and Visitors
• Stop the work • Switch off equipment/machine that may be using • Leave the workplace • Gather at corresponding assembly point (Only personal belongings like purse and cellphone are allowed to bring along)

Emergency Safety Team	
Emergency Commander	• Command and Manage the operation of three sub-teams • Contact Fire Services Department and outside help (as necessary)
Emergency Response and Evacuation Sub-Team	• Go to the location of fire hazard • Try to extinguish the fire with main task force (responsible groups) • Bring fire-fighting materials such as water pumps, fire extinguishers from other places and stay stand by to assist if fire is not easily under-control • Check if there are operating equipment/machine and try to switch off and control • Search and rescue missing person(s) if reported by Emergency Assembly Sub-Team
Emergency Assembly Sub-Team	• Bring employees attendance sheet, visitor sign in/out book to the assembly point • Make roll call quickly • Inform Emergency Response and Evacuation Sub-Team if missing person(s) are noticed.
Emergency Security and First Aid Sub-Team	• Guard the entrances of the factory • Stay Stand-by at assembly point to give necessary first-aid assistance if there is injured person(s) • Help and Guide outside help (fire brigade, ambulance) to enter the factory compound and location of emergency situation

Figure 2. Response Procedures to a Fire Hazard

Source: EnvO Study Team

During the time of controlling a fire hazard, all the emergency safety team members must be present at the respective locations for the easy and effective communication between sub-teams and emergency commander. The Figure 3 shows the assigned locations of emergency response team members for an example case of fire occurrence inside the factory.

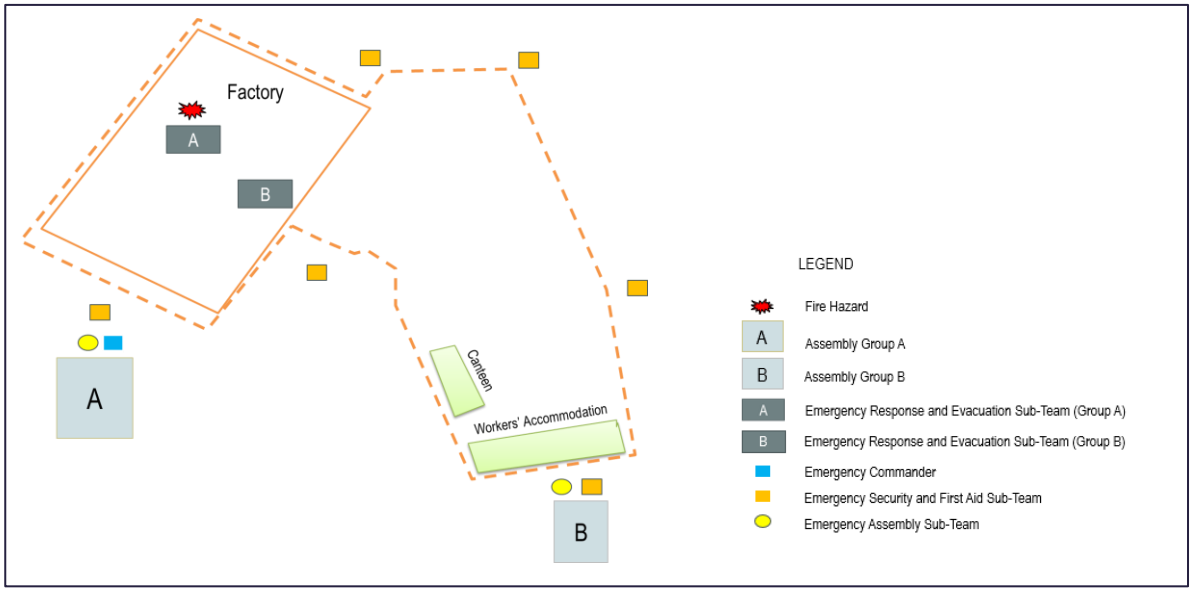


Figure 3. Assigned Locations of Emergency Safety Teams to Control the Fire Hazard (Example Case of Fire Inside Factory)

Source: EnvO Study Team

For example, to control the fire, Emergency Response and Evacuation Sub-Team (Group A-Factory) is trying to extinguish the fire and Group B is waiting stand-by to help Group A with fire extinguishing materials. At the emergency assembly points, the workers and visitors are gathered and the emergency assembly sub-team is doing a roll call. At the same time, the emergency security and first aid sub-team is guarding the entrances. The emergency commander is observing the overall coverage of the response of the emergency control sub-teams.

If the fire occurs in the chemical storage area or the laboratory, special attention must be given for extinguishing fire out of the chemicals as all chemicals do not behave same under fire and different extinguishing methods are required. To be effective in response to fire hazard, the firefighting measures of chemicals are described in the following table.

Table 2. Specific Firefighting Measures for Each Type of Chemicals Used in MSS

No	Name of Chemicals	Specific Fire Fighting Measures	Storage Location
1.	Soda Ash Light Na_2CO_3	No Special Procedure.	Chemical Storage Room
2.	Monoammonium Phosphate $NH_4H_2PO_4$	Firefighters should wear approved self-contained breathing apparatus and full protective clothing.	Chemical Storage Room
3.	Sodium Fluoride F Na	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide fire extinguishers.	Laboratory
4.	Potassium Sulphate K_2O_4S	Firefighters should wear approved self-contained breathing apparatus.	Laboratory
5.	Cerium (IV) Sulfate CeO_8S_2	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide fire extinguishers.	Laboratory
6.	Methyl Orange Indicator Solution $C_{14}H_{14}N_3NaO_3S$	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide fire extinguishers.	Laboratory

No	Name of Chemicals	Specific Fire Fighting Measures	Storage Location
7.	Hydrochloric Acid HCl	Use water, dry powder, foam, carbon dioxide fire extinguishers.	Laboratory
8.	Sulfuric Acid (Concentrated) H_2SO_4	Use dry earth, sand. Do not use water and metal powder. Extinguish by wearing self-contained breathing apparatus.	Laboratory

Note: Chemicals from No-4 to 6 are stored in few quantities for laboratory requirement. Specific fire fighting measures might not be necessary.
Source: MSDS of Chemicals

Response to Furnace Explosion

In Chapter 6, the risk assessment of furnace explosion is carried out and safety measures are recommended to prevent the furnace explosion hazard including housekeeping near furnace area, training, maintenance and cautions to be taken while the furnace is under operation, in rest and maintenance stages. If there is an unexpected furnace explosion, the hazard will lead to fire hazard so the above-mentioned procedure of how to respond to fire hazard should be practiced for furnace explosion hazard.

Response to Flood

The flood in every rainy reason at Mon State is wide spread flood which occurs along the rivers. Although there is no severe flood history in Mawlamyine Industrial Zone, the following basic response procedure is prepared for the workers present at MSS factory at the time of flooding. The response procedures will be carried out in the following manner under the guidance and instruction of Mawlamyine Township Disaster Management Committee as necessary.

Table 3. Response Procedures to a Flood Risk

State of Risk	Emergency Safety Team	Responses
Before Flood	Emergency Commander and leader of Emergency Response and Evacuation Sub-Team	• Watch flood related news, warnings from Department of Metrology and Hydrology and Mawlamyine Township Disaster Management Committee during raining season
	Emergency Assembly Sub-Team	• Collect the information of present employees once the potential to happen the flood is announced and prepare necessary food supplies, drinking water, life jackets, first aid kits and other necessary items
	Emergency Security and First Aid Sub-Team	• Look around the factory and switch off the machine, electrical supply and cover the raw materials, products and ensuring protective covers for materials or equipment which should not be intact of water and patrol around the factory and ensure no one can enter inside the factory and the workers accommodation
During Flood	Emergency Commander and Emergency Response and Evacuation Sub-Team	• Contact search and rescue team of Mawlamyine Township Disaster Management committee if evacuation to emergency shelter is needed • Evacuate all the employees to the emergency shelter (if required)

State of Risk	Emergency Safety Team	Responses
After Flood	Emergency Commander and Emergency Security and First Aid Sub-Team	• Carry out cleanup activities within factory compound under safety measures and precautions

Source: EnvO Study Team

Implementation Trainings

During an emergency situation, it is important to act fast to control and handle the situation. For the effective coordination between sub-teams during a fire outbreak, the following trainings should be given to the responsible emergency safety team members and if possible, all the employees of the Factory. The following trainings are required to provide as the basic and necessary trainings for emergency situations.

Fire Fighting Training

Basically, fire extinguishers are installed and available in the factory. Hence, it is important that all the team members in the Emergency Response and Evacuation Sub-Team know how to put out a fire properly by using fire extinguishers. This kind of training can be received from the township Fire Services Department or from the suppliers of the extinguishers. Using a fire extinguisher properly to put out a fire can prevent injuries and save lives. If use properly, small fire can be controlled completely.

Most fire extinguishers operate with the following P.A.S.S technique. The PASS method uses the word "PASS" as a memory tool to remind the following four steps to be followed to properly operate a fire extinguisher.

1. PULL: Pull the pin to break the temper seal.
2. AIM: Aim low by pointing the extinguisher nozzle at the base of the fire.
3. SQUEEZE: Squeeze the handle to release the extinguishing agent.
4. SWEEP: Sweep from side to side at the base of the fire until to appear to be out. If the fire re-ignites, repeat step 2 to 4.

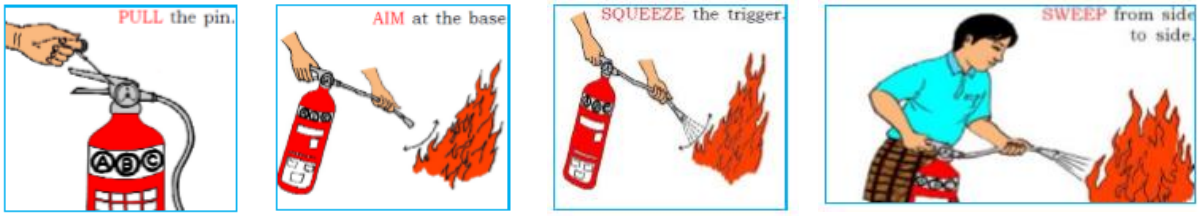


Figure 4. How to Properly Extinguish a Fire by Using Fire Extinguisher

Source: Manual on Fire, Relief and Resettlement Department, UN-Habitat

First-Aid Training

First-Aid Training provides capability to react immediately to a medical emergency situation. When properly trained, a fellow employee can manage basic medical treatment or CPR to save lives. First-Aid procedures are not only useful in case of a fire but also for workplace injuries and during flood. All the emergency security and first-aid sub-team members should receive this training and have a completion

certificate. First-Aid Training can be received from Township Red Cross Society. Basic first aid course (3-5 days) and refresher course (2 days) for commercial first aid trainings are available from Township Red Cross Society.

The emergency security and first aid sub-team members must know how to treat the following general injuries like

- Treating Cuts and Scrapes
- Treating Sprains
- Treating Heat Exhaustion
- Treating Burns
- Performing CPR and other treatments.

The members should also know the location of the first aid boxes in the Factory and request the emergency commander to refill the contents used as per necessary. The basic first aid items to include in the first aid box are individually wrapped sterile, triangular bandages, sterile eye pads, plasters, cleansing wipes, plasters, adhesive tape, disposable nitrile gloves, burn dressings, distilled water for cleaning wound, scissors and so on. Figure 5 shows a sample of small first aid kit prepared by Myanmar Red Cross Society. The Factory should keep the adequate number of first aid kits.

Figure 5. Small First Aid Kit (around 5,800 Myanmar Kyats) Prepared by Myanmar Red Cross Society
Source: https://www.redcross.org.mm

Fire Drill

Fire drill is a training conducted in many workplaces to educate employees about the procedures to follow in the event of a fire emergency that requires evacuation. Fire drill is an opportunity for instruction and practice to prepare for the fire emergency. The fire drill provides clear understanding of roles and responsibilities of emergency safety team members, experience and education.

Fire drill should be conducted one or two times annually. If it is possible to conduct two drills in a year, they should be one announced drill and one surprised drill. Every employee must be involved in fire drill.

Before the Fire Drill

To conduct the fire drill, the emergency commander needs to assure the following considerations before conducting fire drill.

- Performing the fire drill should be informed to local Fire Services Department, industrial zone management committee and other local authorities and receive technical coordination from the Fire Services Department prior to the fire drill.
- Before the fire drill, the emergency commander must check the conditions and locations of fire extinguishing materials.
- The scenario must include a visitor during the time of announced fire drill.
- There must be one or more missing persons need to evacuate by emergency response and evacuation sub-team.
- The missing person(s) must have minor injuries need to be cared by emergency security and first aid sub-team.

During the Fire Drill

During the time of drill, every employee and emergency safety team members must follow the procedure of "How to Response to Fire Hazard" described in this Emergency Response Plan.

After the Fire Drill

There must be an assessment of feedbacks from the workers and emergency safety team members. The emergency commander must hear the comments and keep a record of the comments and solved conditions. The emergency commander should also ask the following questions to the employees and emergency safety team members.

- Locations where employees and team members think more fire extinguishing materials should be placed
- Obstructions during the way of working place to assembly points
- Communications between sub-teams
- Trainings Requirement (First Aid, Evacuation Procedure and etc.)
- Materials Requirement (Fire Fighting Suit, Gloves and etc.)

Fire drill activity must be recorded properly by the emergency commander by considering all the conditions and feedbacks.

Emergency Contact

The following Table 4, Table 5 and Table 6 shows contact numbers of Emergency Fire Station, Police Station, Hospital, Social Affair Organizations in Mawlamyine and Kyaikmaraw Townships. Moreover, the distance from the project site and the arrival time to project site are estimated in order to support the decision of emergency commander for calling the emergency contacts depending upon emergency situations. The Figure 6 shows the routes from emergency supportive stations to the project site. As the contact numbers could be vary in a timely manner, the responsible personnel should update the emergency contact numbers at least on a biannual basis.

Table 4. Emergency Fire Station Contact

No	Nearest Fire Station	Telephone Number	Distance from the Factory	Estimated Arrival Time
1	Mawlamyine Fire Services Department	057 272 40, 057 214 02, 057 217 42	8.7 km	17 min
2	Kyaikmaraw Fire Services Department	057 860 15, 09 353 925 281	17 km	24 min

Source: EnvO Study Team

Table 5. Emergency Police Station Contact

No	Nearest Police Station	Telephone Number	Distance from the Factory	Estimated Arrival Time
1	Mawlamyine Industrial Zone	09 5178508	900m	3 min
2	Mawlamyine Township	057 269 18, 057 247 16, 057 269 83	9.6 km	18 min
3	Kyaikmaraw Township	057 860 04, 057 860 05	18 km	26 min

Source: EnvO Study Team

Table 6. Emergency Contact Numbers of Hospital and Other Organizations

No	Organization	Telephone Number	Distance from the Factory	Estimated Arrival Time
1	Mawlamyine Rescue Organization	09 784 784 199	8.2 km	16 min
2	Mawlamyine General Hospital	09 958 602 694	8 km	16 min
3	Kyaikmaraw General Hospital	057 860 08 (Public Health Department)	16 km	23 min
4	Red Cross (Mawlamyine)	057 270 51	8.2 km	16 min
5	Department of Disaster Management, Mon State	057 202 4825	9.6 km	20 min

Source: EnvO Study Team

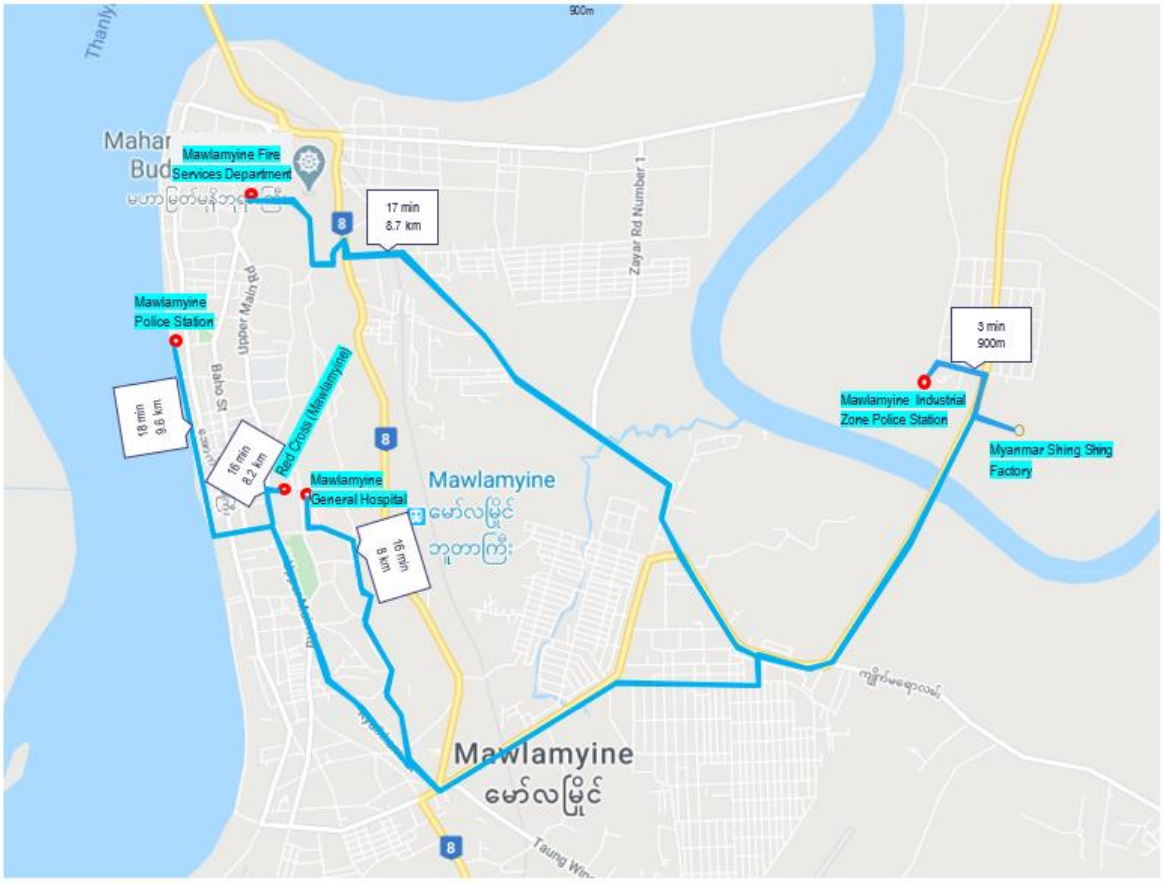


Figure 6. Routes and Estimated Arrival Time from Emergency Supportive Stations to MSS Factory

Source: EnvO Study Team

The factory should arrange the following precaution measures:

(i) The emergency contacts information must be disclosed in the notice board, respective office rooms, laboratory, inside factory, hostel and canteen and well informed to team members.

(ii) In addition to above emergency information, the emergency contact numbers of leader of each emergency sub-team must also be disclosed after the team has been composed with responsible staffs who have received necessary trainings.

(iii) Response to Fire Hazard and Flood Risk should also be printed out and disclosed and explained to every employee working inside the MSS factory Compound.

ANNEX 9-D: GRIEVANCE REDRESS MECHANISM (GRM)

GRIEVANCE REDRESS MECHANISM

1. Current Practices of Managing Complaints

Currently, the MSS factory has announced the public that inquiries about the processes of the factory and other unclarified facts can be addressed by meeting with responsible person from the factory during 9:00 to 16:00 or by means of telephone. The announcement posted in front of the MSS factory contains the phone number and the job description of the responsible person.

Figure 1. Announcement in front of MSS Factory

Source: Project Proponent

During the time of IEE preparation, it is known that the project proponent is attempting to solve grievance from public but it needs to be more systematic, clear and effective.

2. Grievance Redress Mechanism (GRM)

An efficient grievance redress mechanism (GRM) has been developed by the EnvO study team for MSS factory to be able to handle, solve and record any possible complaints in more systematic ways. The GRM include procedures to receive complaints not only from the community but also from the factory workers. It contains -

- Assigned authority for grievance management
- Clear and efficient way to submit grievance by the complainants
- Proper grievance record system
- Timespan to solve or report back of the submitted grievance and
- How it will be informed back to complainants

Procedures for Public Grievance Redress Mechanism

The GRM for public is described in Table 1. The sample grievance submission form and sample page of grievance log book are attached in later section.

Table 1. Public Grievance Redress Mechanism

GRM Process	Procedure
Assigned Personnel for Overall Grievance Management	U Khin Maung Latt Factory Manager 09446608840 The factory manager will be responsible for overall grievance management, and he will report to the upper management authorities of the company (Director and Managing Director) depending upon the level of grievance.
Way to submit grievance	The announcement of GRM will be displayed in front of the factory. The grievance can be submitted via letter or by telephoning to the factory manager. The sample letter forms for grievance submission and mail box will be placed at the entrance of MSS Factory. Grievance letters from the mail box will be collected on every week.
Record System of the grievance	Concerns mentioned in grievance form will be recorded in the grievance log book by the assigned personnel under the management of the factory manager.
Timespan to solve the submitted Grievance	The recorded grievance which is considered as serious issue for the community will be tracked and investigated by forming a team including Factory manager, Managing Director and Director with the technical support and supervisions from other related government departments such as Mawlamyine Industrial Zone Government Committee, Mon State ECD, Fire Services Department, Directorate of Industrial Supervision and Inspection, etc.) The process of solving the issue may take at least 15 working days to 30 working days depending on the nature and complexness of the grievance.
Inform back to the complainant	The complainant will be informed back via telephone or face-to-face discussion after getting the investigation results.

Source: EnvO Study Team

Procedures for Workers' Grievance Redress Mechanism

The GRM for factory workers is described in Table 2. The sample grievance submission form and sample page of grievance log book are attached in later section.

Table 2. Grievance Redress Mechanism for Factory Workers

GRM Process	Procedure
Assigned Personnel for Overall Grievance Management	U Khin Maung Latt Factory Manager 09446608840 He will be responsible for overall grievance management, and upper management authorities of the company (Director and Managing Director) will assist in the grievance management (if necessary).
Way to submit grievance	The grievance can be submitted via letter and private discussion with the factory manager. The sample letter forms for grievance submission and letter box will be placed at the office and work place. Grievance Letters will be collected on a weekly basis by the representative of the worker and reported to both factory manager and director of the factory.
Record System of the grievance	The received grievance will be recorded in the grievance log book.
Timespan to solve the submitted Grievance	The process of solving the issue will take at least 7 working days and will be handled by factory manager and director depending on the nature of the complaint.
Inform back to the complainant	The complainant will be informed back via announcement or private discussion after 15 working days of grievance received.

Source: EnvO Study Team

3. Announcement of Grievance Redress Mechanism (GRM)

Procedures of public GRM shall be displayed on the notice boards that can easily visible by the nearby community, surrounding factories, and the pedestrians. Plus, workers' GRM shall be announced to all the workers by presenting on notice boards, as well as in workshops, changing rooms, canteen and other areas where workers gather.

Necessary Forms for GRM

Public Grievance Submission Form

အများပြည်သူမှ ထိခိုက်နစ်နာမှု တိုင်ကြားရန်ပုံစံ

Grievance (ထိခိုက်နစ်နာမှု တိုင်ကြားခြင်း)		
It is necessary to fill in all the required information in this form. ထိခိုက်နစ်နာမှုတိုင်ကြားရာတွင် အောက်ပါအချက်အလက်အားလုံးကို ပြည့်စုံစွာ ဖြည့်သွင်းပေးပါရန်။		
Date (ရက်စွဲ)		
Name/Organization (အမည်/အဖွဲ့အစည်း)		
Address (နေရပ်လိပ်စာ)		
Grievance (ထိခိုက်နစ်နာမှုအကြောင်းအရင်း)		
Please tick the case* (သက်ဆိုင်သည့်ကိစ္စရပ်ကို အမှန်ခြစ်ပေးရန်) *		Description of Grievance (ထိခိုက်နစ်နာမှုအကြောင်းအရာ ဖော်ပြချက်)
Environment (ပတ်ဝန်းကျင်ဆိုင်ရာ) (Water/ Air/ Soil) (ရေ/ လေ /မြေ)	☐	
Socio-Economic (လူမှုစီးပွားဆိုင်ရာ)	☐	
Health Related (ကျန်းမာရေးဆိုင်ရာ)	☐	
Nuisance (အနှောင့်အယှက်)	☐	
(Odor/ Noise/ Dust, etc.) (အနံ့အသက်/ဆူညံသံ/ဖုန်မှုန့် စသည်ဖြင့်)	☐	
Other (အခြား)	☐	
Telephone Number (ဖုန်းနံပါတ်)		
Signature (လက်မှတ်) The complainant is certain that the above event has happened in real and all the information filled in this form is true. အထက်ပါ ထိခိုက်နစ်နာမှုသည် အမှန်တကယ် ဖြစ်ပွားခဲ့ကြောင်း၊ ဖြည့်သွင်းသော အချက်အလက်များ မှန်ကန်ကြောင်း တာဝန်ယူပါသည်။		
The factory will not consider and take action for the grievance form with incomplete information. အချက်အလက်များ ပြည့်ပြည့်စုံစုံ ဖော်ပြထားခြင်း မရှိသော တိုင်ကြားမှုများကို စက်ရုံမှ ထည့်သွင်းစဉ်းစားမည် မဟုတ်ပါ။		

Source: EnvO Study Team

Public Grievance Log Book (အများပြည်သူမှ တိုင်ကြားလာသည့် ထိခိုက်နစ်နာမှုများအား မှတ်တမ်းတင်ခြင်း)

Sr. No စဉ်	Name/Organization Telephone Number Address (အမည်/အဖွဲ့အစည်း တယ်လီဖုန်းနံပါတ် နေရပ်လိပ်စာ)	Submitted Date (တင်သွင်းခဲ့သည့် ရက်စွဲ)	Received Date (လက်ခံရရှိ သည့်ရက်စွဲ)	Nature of Complaint (ထိခိုက်နစ်နာမှု အကြောင်းအရာ)	Follow-up Actions Taken (ထိခိုက်နစ်နာမှု ဖြေရှင်းလုပ်ဆောင်ချက်များ)	Final Result (နောက်ဆုံး ရလဒ်)	Date of Replying Back to the Complainant (တိုင်ကြားသူထံ အကြောင်းပြန်သည့် ရက်စွဲ)
1							
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10							

Source: EnvO Study Team

Workers' Grievance Submission Form

အလုပ်သမားများမှ ထိခိုက်နစ်နာမှု တိုင်ကြားရန် ပုံစံ

Grievance (ထိခိုက်နစ်နာမှု တိုင်ကြားခြင်း)		
Name (အမည်)		
Position (ရာထူး)		
Date* (ရက်စွဲ)*		
Date that grievance happened* (ထိခိုက်နစ်နာမှုဖြစ်ပွားခဲ့သည့်ရက်စွဲ)*		
Please tick the case* (သက်ဆိုင်သည့်ကိစ္စရပ်ကို အမှန်ခြစ်ပေးရန်) *		Description of Grievance* (ထိခိုက်နစ်နာမှုအကြောင်းအရင်း အသေးစိတ်) *
Wages (လုပ်အားခ)	☐	
Overtime (အချိန်ပို)	☐	
Working Environment (အလုပ်ခွင်)	☐	
Food (အစားအသောက်)	☐	
Accommodation (အဆောင်)	☐	
Holiday (အားလပ်ရက်)	☐	
Other (အခြား)	☐	
Proposed Solution (ဖြေရှင်းစေလိုသည့် နည်းလမ်း)		

Signature
(လက်မှတ်)

The complainant is certain that the above event has happened in real and all the information filled in this form is true.
အထက်ပါ ထိခိုက်နစ်နာမှုသည် အမှန်တကယ် ဖြစ်ပွားခဲ့ကြောင်း၊ ဖြည့်သွင်းသော အချက်အလက်များ မှန်ကန်ကြောင်း တာဝန်ယူပါသည်။

It is required to fill all the information marked *.
*ပြထားသောအချက်အလက်များအားလုံးကို ဖြည့်သွင်းရန် လိုအပ်သည်။

Source: EnvO Study Team

Workers' Grievance Log Book

(အလုပ်သမားများမှ တိုင်ကြားလာသည့် ထိခိုက်နစ်နာမှုများအား မှတ်တမ်းတင်ခြင်း)

Sr. No စဉ်	Submitted Date (တင်သွင်းခဲ့သည့် ရက်စွဲ)	Received Date (လက်ခံရရှိသည့် ရက်စွဲ)	Issue (ကိစ္စရပ်များ)	Actions Taken (အရေးယူဆောင်ရွက်ချက်များ)	Outcome (ရလဒ်)	Closed Case (ပြီးပြတ်သော ကိစ္စရပ်များ)
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Source: EnvO Study Team

ANNEX 10 – WORKPLACE AIR QUALITY MONITORING RESULTS

WORKPLACE AIR QUALITY MONITORING

Workplace Air Quality Monitoring was conducted by EnvO study team in June, 2021 during the time of IEE study. Due to the nature of working process in MSS factory, it is determined that particulate matter would be the major pollutant which might affect the workers' health and safety. Therefore, "PCE- MPC 10 Air Quality Counting Meter" was used to measure the amount of particulate matters (PM 10 and PM 2.5) in the workplace, in order to identify the impacts of it upon the workers.

1. Monitoring Locations

Two locations (one near the roasting line and the another one near the smelting line) were selected to be monitored as those are the locations where the workers may encounter the impact of smoke together with some air pollutants. The monitored locations are illustrated in figure below and recorded photos with relevant descriptions are shown in the table respectively.

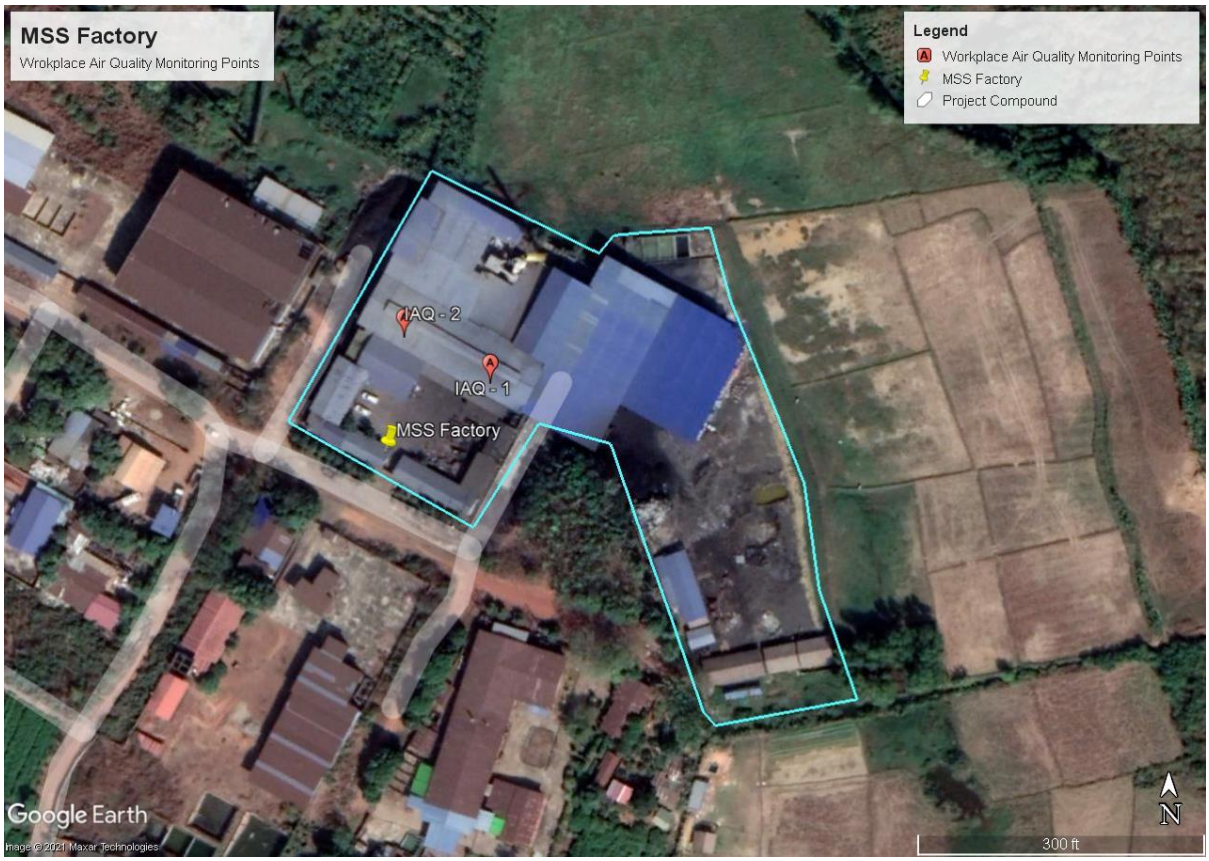


Figure 1 Workplace Air Quality Monitoring Points

Table 1 Description of Workplace Air Quality Monitoring Points

Monitoring Points	Recorded Photos of Workplace Air Quality Monitoring		
IAQ – 1 (Near Roasting Line) **Coordinates -** N 16°28'35.832" E 97°40'34.5576" **Date of Monitoring** – 4th June 2021 **Time of Monitoring** – 8:45 am to 9:57 am (60 mins) **Operation Status –** Both roasting furnaces are in running.			
IAQ – 2 (Near Smelting Line) **Coordinates -** N 16°28'36.696" E 97°40'33.0888" **Date of Monitoring** – 4th June 2021 **Time of Monitoring** – 10:03 am to 11:22 am (60 mins) **Operation Status –** One smelting furnace is in operation and the slags (Chor Khal) are being removed.			

2. Index Values of Monitoring Parameters

In Myanmar, there is no standard or guideline values of indoor air quality or workplace air quality and therefore, Air Quality Index (AQI) specified by US. EPA (as shown in the table below) was used to identify the status of workplace air quality.

Table 2 Air Quality Index Scale by US EPA

AQI	Air Pollution Level	Health Implications	Index Values[23]	
			PM 2.5 (µg/m³)	PM 10 (µg/m³)
0 - 50	Good	Air quality is considered satisfactory, and air pollution poses little or no risk.	0-12	0-54
51 -100	Moderate	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.	12.1-35.4	55-154
101-150	Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects. The general public is not likely to be affected.	35.5-55.4	155-254
151-200	Unhealthy	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.	55.5-150.4	255-354
201-300	Very Unhealthy	Health warnings of emergency conditions. The entire population is more likely to be affected.	150.5-250.4	355-424
301-500	Hazardous	Health alert: everyone may experience more serious health effects.	250.5-500.4	425-604

The classification values of particulate matter (i.e. good, moderate, unhealthy for sensitive groups, unhealthy, very unhealthy, hazardous) are specified based on the 24-hour basis in US. EPA AQI. Based on the nature of operation in MSS factory during the monitoring period (due to travel restriction and less work during covid-19 affected period) and nature of dust dispersion which might be emitted constantly or in a same pattern during the operation, the monitoring time at each point is determined to be 1 hour which could be the represented time of working hours (8 hr) / one shift during the factory operation.

3. Monitoring Results

The hourly averaged monitoring results are summarized in the following table whereas the details of monitoring values at the interval of every two minutes at two monitoring points (IAQ - 1 and IAQ - 2) are described and illustrated in Figure 2 and Figure 3 respectively.

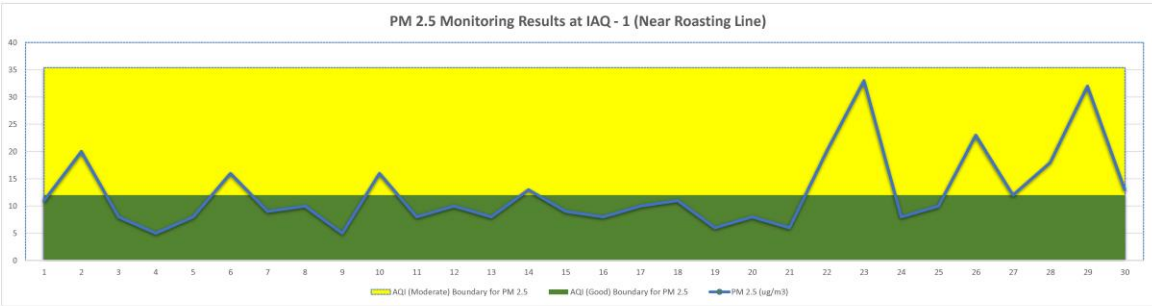
Table 3 Summary of Workplace Air Quality Monitoring Results

Monitoring Points	No	Parameters	Unit	Monitoring Results	Note
IAQ - 1	1	$PM_{2.5}$	µg/ m³	12.5	Throughout the monitoring period at IAQ – 1, both PM 2.5 and PM 10 are mostly in the "Good" status. In addition, the hourly average values are well under the range of "Good".
	2	PM_{10}	µg/ m³	30.6	

[23] Index values for PM 2.5 and PM 10 are referenced from U.S. Environmental Protection Agency, aqi-technical-assistance-document-sept2018.pdf (airnow.gov)

Monitoring Points	No	Parameters	Unit	Monitoring Results	Note
IAQ - 2	1	$PM_{2.5}$	$\mu g/m^3$	54	At IAQ – 2, the hourly average value of PM 2.5 is showing the status of "Unhealthy for Sensitive Groups" and PM 10 is "Moderate". When looking at the figure 3, it can be clearly seen that the monitoring results are fluctuated in a pattern of up and down. It is because of the slag removing activities from the smelting furnace during the time of monitoring.
	2	PM_{10}	$\mu g/m^3$	90.1	

No.	Monitoring Point	IAQ - 1 (Near Roasting Line)							
	Lattitude	N 16°28'35.832"							
	Longitude	E 97°40'34.5576"							
	Measuring Date	4/6/2021							
	Measuring Time	60 minutes (8:45 A.M - 9:57 A.M)							
		PM 2.5 (ug/m3)	PM 10 (ug/m3)	AQI (Good) Boundary for PM 2.5	AQI (Good) Boundary for PM 10	AQI (Moderate) Boundary for PM 2.5	AQI (Moderate) Boundary for PM 10	Temperature (˚C)	Humidity
1	2 min	11	29	12	54	35.4	154	30.4	90.4
2	4 min	20	47	12	54	35.4	154	31.6	87.6
3	6 min	8	19	12	54	35.4	154	32.7	83.6
4	8 min	5	15	12	54	35.4	154	33.3	83.6
5	10 min	8	20	12	54	35.4	154	33.7	81.4
6	12 min	16	38	12	54	35.4	154	34.1	80.8
7	14 min	9	22	12	54	35.4	154	34.4	79.7
8	16 min	10	26	12	54	35.4	154	34.6	79.7
9	18 min	5	15	12	54	35.4	154	34.7	80.1
10	20 min	16	41	12	54	35.4	154	35	78.4
11	22 min	8	21	12	54	35.4	154	35.2	77.9
12	24 min	10	22	12	54	35.4	154	35.3	78.6
13	26 min	8	20	12	54	35.4	154	35.5	77.4
14	28 min	13	35	12	54	35.4	154	35.5	76.7
15	30 min	9	22	12	54	35.4	154	35.7	76.7
16	32 min	8	22	12	54	35.4	154	36	76
17	34 min	10	27	12	54	35.4	154	36.7	74.1
18	36 min	11	29	12	54	35.4	154	37.3	73.5
19	38 min	6	16	12	54	35.4	154	37.6	72.6
20	40 min	8	20	12	54	35.4	154	37.4	73.4
21	42 min	6	21	12	54	35.4	154	37.3	73
22	44 min	20	50	12	54	35.4	154	37.4	71.9
23	46 min	33	71	12	54	35.4	154	37.8	70.9
24	48 min	8	20	12	54	35.4	154	38	70
25	50 min	10	25	12	54	35.4	154	37.9	71.1
26	52 min	23	53	12	54	35.4	154	38	71.8
27	54 min	12	34	12	54	35.4	154	38.4	69.9
28	56 min	18	39	12	54	35.4	154	38.4	70
29	58 min	32	68	12	54	35.4	154	38.5	70.1
30	60 min	13	31	12	54	35.4	154	38.9	68.5
	Average Value	12.46666667	30.6					35.91	76.31333333



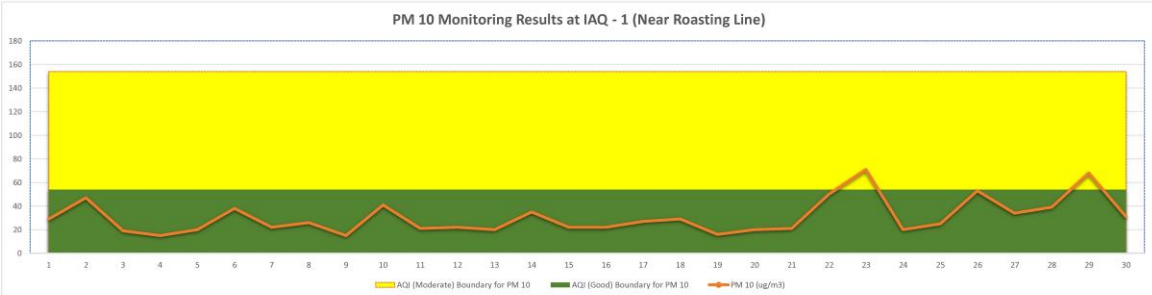
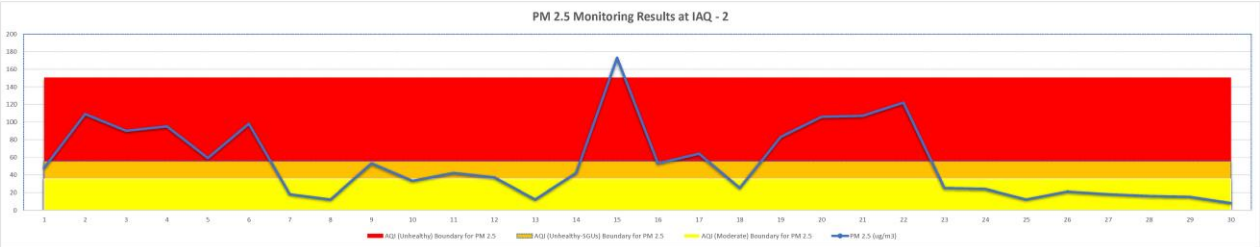


Figure 2 PM 2.5 and PM 10 Monitoring Results at IAQ – 1

No.	Monitoring Point	IAQ - 2									
	Lattitude	N 16°28'36.696"									
	Longitude	E 97°40'33.0888"									
	Measuring Date	4/6/2021									
	Measuring Time	60 minutes (10:03 A.M - 11:22 P.M)									
		PM 2.5 (ug/m3)	PM 10 (ug/m3)	AQI (Good) Boundary for PM 10	AQI (Moderate) Boundary for PM 2.5	AQI (Moderate) Boundary for PM 10	AQI (Unhealthy-SGUs) Boundary for PM 2.5	AQI (Unhealthy-SGUs) Boundary for PM 10	AQI (Unhealthy) Boundary for PM 2.5	Temperature (˚C)	Humidity
1	2 min	48	90	54	35.4	154	55.4	254	150.4	40.3	67.6
2	4 min	109	170	54	35.4	154	55.4	254	150.4	41	66
3	6 min	90	132	54	35.4	154	55.4	254	150.4	42	64.7
4	8 min	95	151	54	35.4	154	55.4	254	150.4	42.8	63.6
5	10 min	59	89	54	35.4	154	55.4	254	150.4	43.5	62.7
6	12 min	98	161	54	35.4	154	55.4	254	150.4	44.2	61.2
7	14 min	18	42	54	35.4	154	55.4	254	150.4	44.5	60.4
8	16 min	12	31	54	35.4	154	55.4	254	150.4	44.4	61
9	18 min	53	90	54	35.4	154	55.4	254	150.4	44.8	60.6
10	20 min	33	71	54	35.4	154	55.4	254	150.4	45.1	59.7
11	22 min	42	80	54	35.4	154	55.4	254	150.4	45	59.9
12	24 min	37	74	54	35.4	154	55.4	254	150.4	44.5	60.6
13	26 min	12	30	54	35.4	154	55.4	254	150.4	43.9	60.4
14	28 min	42	81	54	35.4	154	55.4	254	150.4	43	61.9
15	30 min	173	251	54	35.4	154	55.4	254	150.4	43.2	62.2
16	32 min	53	91	54	35.4	154	55.4	254	150.4	43.1	62.2
17	34 min	64	90	54	35.4	154	55.4	254	150.4	43.1	61.7
18	36 min	25	52	54	35.4	154	55.4	254	150.4	43.1	61.2
19	38 min	83	107	54	35.4	154	55.4	254	150.4	43.4	61.1
20	40 min	106	153	54	35.4	154	55.4	254	150.4	43.5	61.9
21	42 min	107	160	54	35.4	154	55.4	254	150.4	44	61.8
22	44 min	122	187	54	35.4	154	55.4	254	150.4	44.3	61.2
23	46 min	25	54	54	35.4	154	55.4	254	150.4	44.2	61.2
24	48 min	24	51	54	35.4	154	55.4	254	150.4	44	61.8
25	50 min	12	29	54	35.4	154	55.4	254	150.4	43.9	61.4
26	52 min	21	52	54	35.4	154	55.4	254	150.4	44.3	60.6
27	54 min	18	43	54	35.4	154	55.4	254	150.4	44.5	60.4
28	56 min	16	36	54	35.4	154	55.4	254	150.4	44.7	60.1
29	58 min	15	34	54	35.4	154	55.4	254	150.4	44.9	59.7
30	60 min	8	20	54	35.4	154	55.4	254	150.4	44.9	58.7
	To take photo*										
	Average Value	54	90.06666667							43.73666667	61.58333333



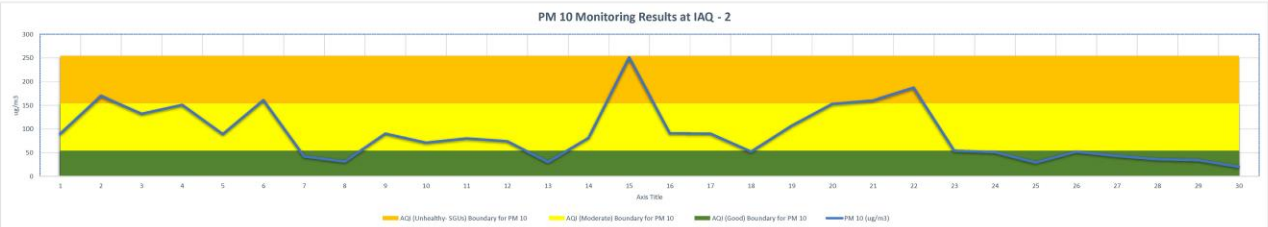


Figure 3 PM 2.5 and PM 10 Monitoring Results at IAQ – 2

Moreover, it is observed that there was an abnormal condition of smoke emission during the starting of fire on roasting furnace. At the beginning of fire after placing the fuels inside the furnace, all the openings of the furnace are left opened when the blower is operating with full capacity. At that time, a massive amount of black smoke was generated though the openings of the furnace and it is dispersed in the workplace area immediately. Although this phenomenon takes about 10 - 15 mins, the pollutant (Particulate Matter) values in the workplace has upraised into ten times on the reading of, “PCE- MPC 10 Air Quality Counting Meter”. Later, due to the ventilation inside the factory (high factory roof and easy-ventilated steel structure), it was found that the black smoke has disappeared from workplace in a couple of minutes after closing the openings of the furnace.

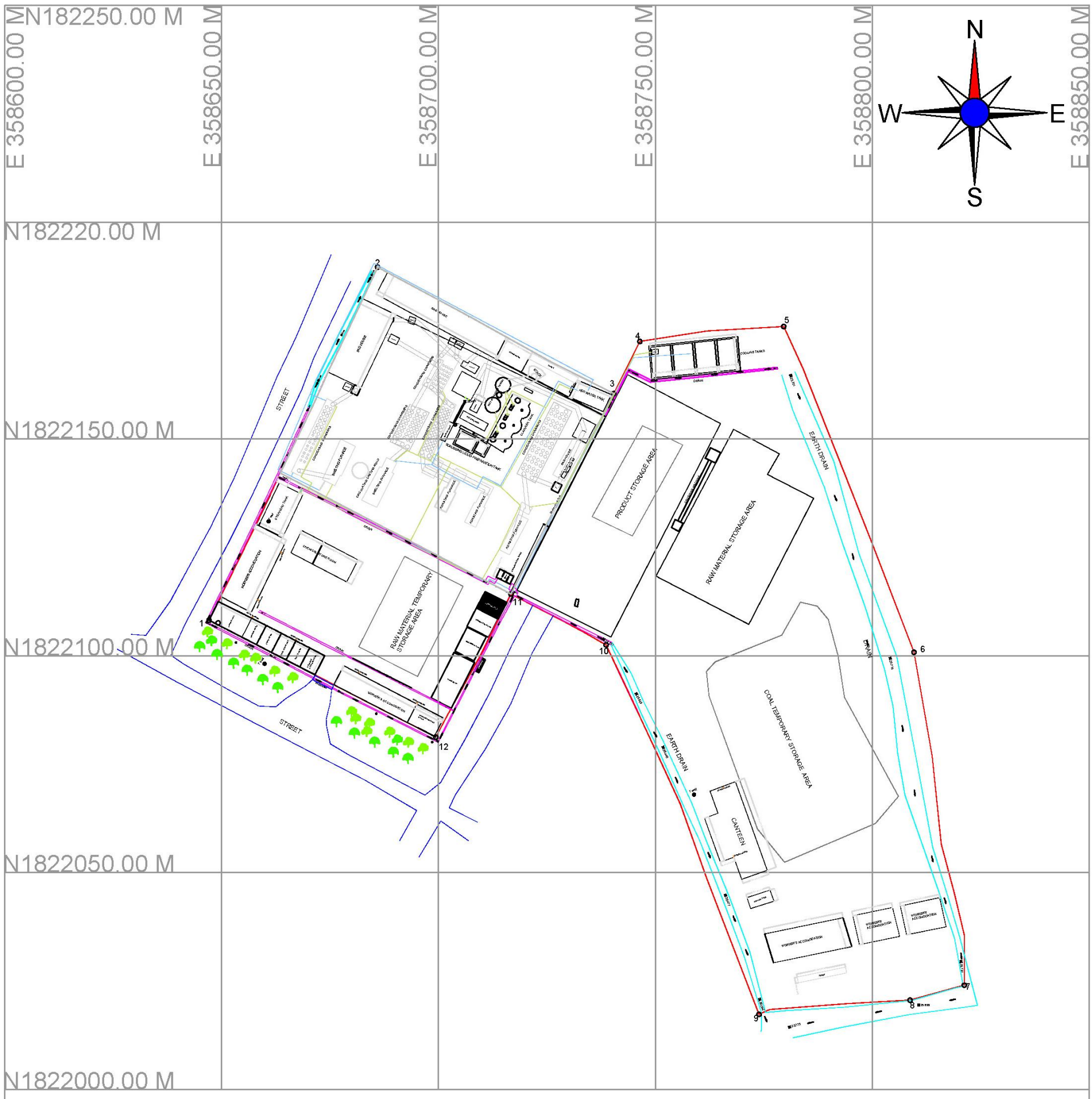
4. Evaluation

In general, the workplace air quality inside the factory seems to be good during the normal and becomes moderate during the time of removing slags (Pyit Sar and Chor Khal) from both roasting and smelting furnaces. However, it would reach to the “Unhealthy” stage for a few minutes when the black smoke is emitted though the openings of furnaces at the time of starting fire. Therefore, it is strongly recommended to emit the black smoke only from the stack after passing though the wet scrubber. Moreover, the recommendations for workers’ health and safety related to the workplace air quality are given in the Section (6.4.1), Risk Assessment of Workplace Air Quality in the IEE report.

ANNEX 11 – FACTORY LAYOUT PLAN

Project Area Layout Map

Myanmar Shing Shing Antimony Smelting and Refinery Factory
(Project Area Layout map)



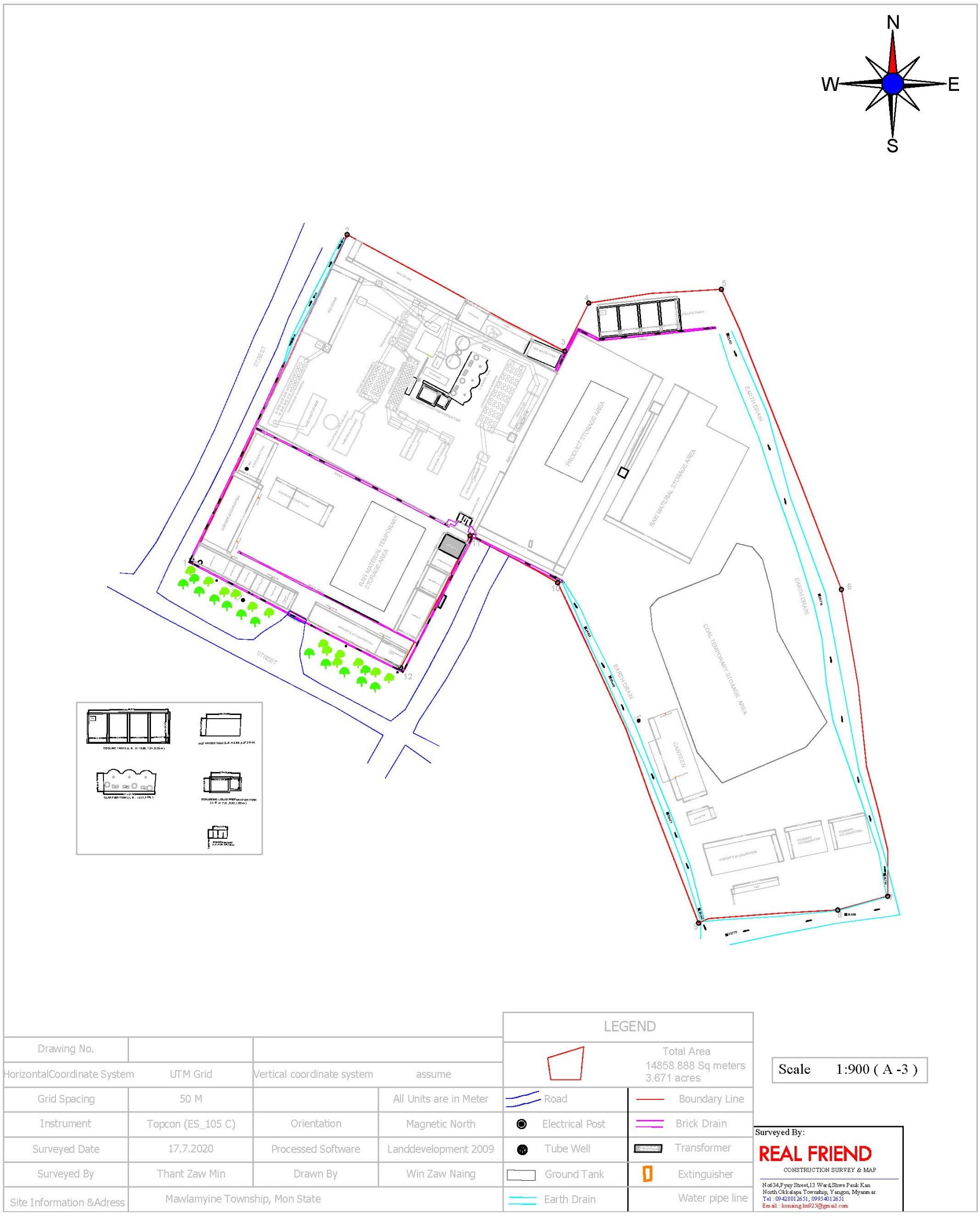
				LEGEND	
Drawing No.				Total Area 14858.888 Sq meters 3.671 acres	
HorizontalCoordinate System	UTM Grid	Vertical coordinate system	assume		
Grid Spacing	50 M		All Units are in Meter	Road	Boundary Line
Instrument	Topcon (ES_105 C)	Orientation	Magnetic North	Electrical Post	Brick Drain
Surveyed Date	17.7.2020	Processed Software	Landdevelopment 2009	Tube Well	Transformer
Surveyed By	Thant Zaw Min	Drawn By	Win Zaw Naing	Earth Drain	Extinguisher
Site Information &Adress	Mawlamyine Township, Mon State			Water Pipe out	Water pipe line

Scale 1:900 (A -3)

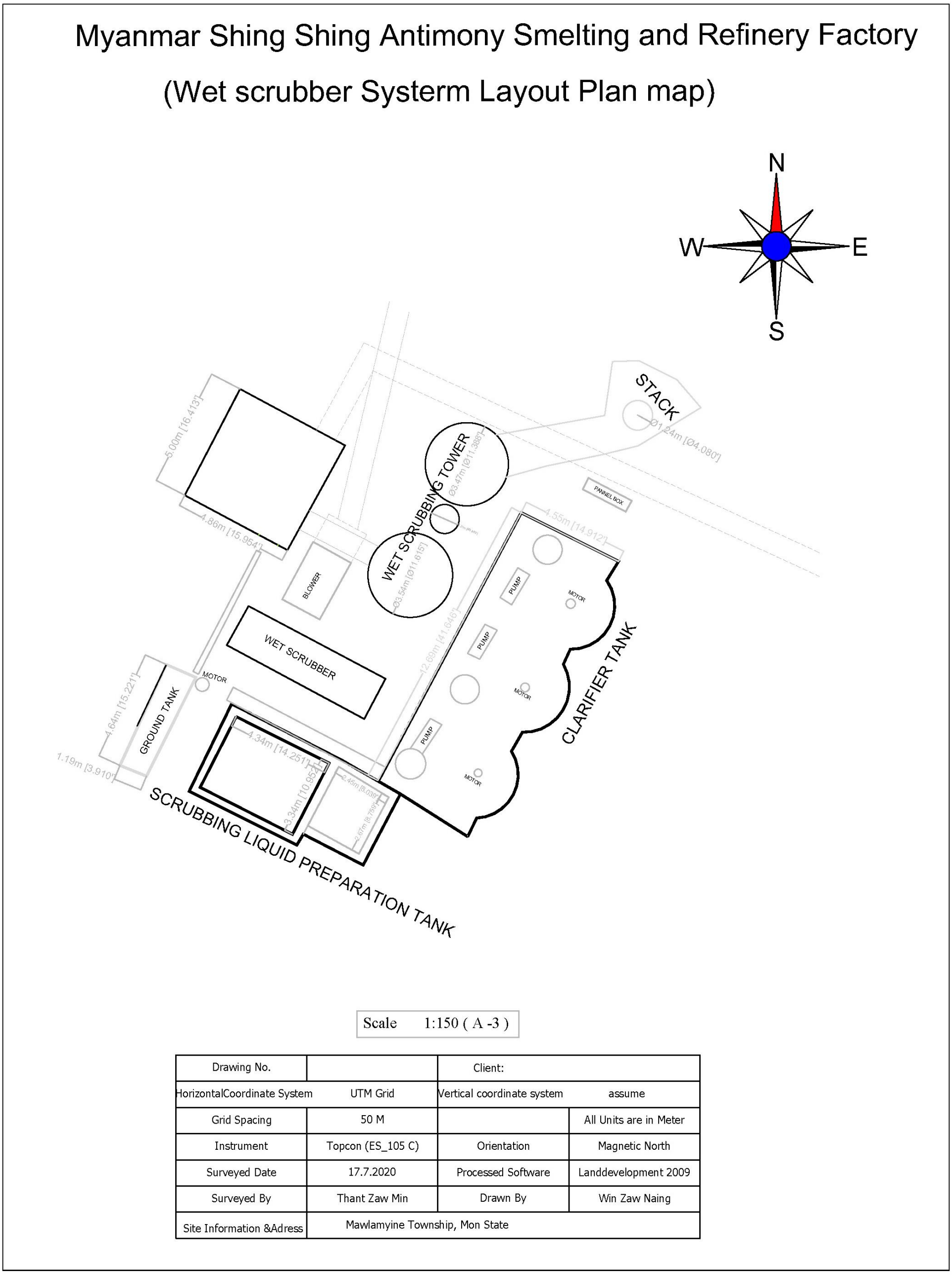
Surveyed By:
REAL FRIEND
CONSTRUCTION SURVEY & MAP
No634,Pyay Street,13 Ward,Shwe Pauk Kan
North Okkalapa Township, Yangon, Myanmar.
Tel : 09428012651, 09954012651
Email : konaing.kn925@gmail.com

Water Drainage Layout Map

Myanmar Shing Shing Antimony Smelting and Refinery Factory
(Water Drainage Systerm Layout map)



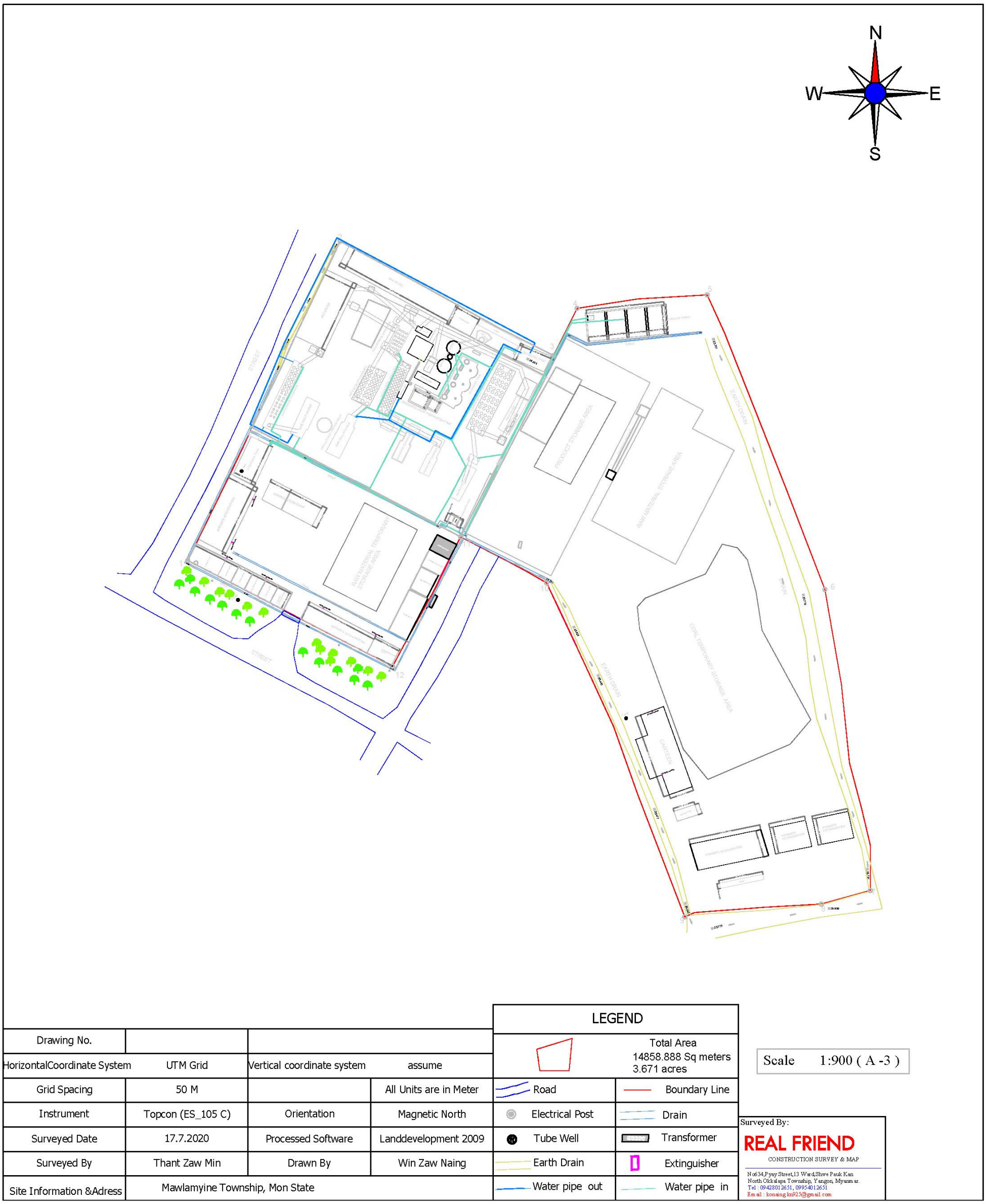
Wet Scrubber System Layout



Drawing No.		Client:	
HorizontalCoordinate System	UTM Grid	Vertical coordinate system	assume
Grid Spacing	50 M		All Units are in Meter
Instrument	Topcon (ES_105 C)	Orientation	Magnetic North
Surveyed Date	17.7.2020	Processed Software	Landdevelopment 2009
Surveyed By	Thant Zaw Min	Drawn By	Win Zaw Naing
Site Information &Adress	Mawlamyine Township, Mon State		

Firefighting System Layout

Myanmar Shing Shing Antimony Smelting and Refinery Factory
(Fire Fighting Layout Plan map)



Drawing No.			
HorizontalCoordinate System	UTM Grid	Vertical coordinate system	assume
Grid Spacing	50 M		All Units are in Meter
Instrument	Topcon (ES_105 C)	Orientation	Magnetic North
Surveyed Date	17.7.2020	Processed Software	Landdevelopment 2009
Surveyed By	Thant Zaw Min	Drawn By	Win Zaw Naing
Site Information &Adress	Mawlamyine Township, Mon State		