

Chapter 1.

Introduction and Project Description

Introduction

This project has been granted environmental clearance letter no. MoEF Letter No. : F.No.10-73/2010-IA.III. dated the 9/01/13. by the Ministry of Environment and Forest.

Project Description

Salient Features:

The project is of Municipal Solid Waste Management facility. The proposed plant is a 165.39 MTPD municipal solid waste processing plant in which composting (63 MTPD) is to process the Municipal solid waste of Aizawl City by SIPMIU at Tuirial which is approx. 20 km away from Aizawl City. The component includes Collection, Segregation, Composting and land filling. The technology used for its process is “accelerated aerobic composting under controlled condition”.

Waste Water and Rainwater:

The leachate collection layer is provided in the granular soil (drainage) layer or the bottom linear the system. The collection layer shall comprise of a network of perforated lateral pipes laid a slope of 2% and 20 m c/c spacing. These laterals collect leachate and transfer it to the HDPE header pipe, which is laid at a slope of 1%. The header pipe ultimately transfers the leachate into the Leachate collection sump. The general arrangement of header and laterals is provided in the layout plan of MSW landfill.

The landfill receives municipal solid waste only. All operations are planned in such a way that generation of liquid waste is low and the leachate directly reaches the leachate collection sump for treatment. Apart from the leachate generated as a result of inflow of rainwater into the landfill, the seepage from the moisture content present in the solid waste and the moisture present in the daily soil cover are the few sources of leachate generation. 10 % evaporation has been considered.

Parking:

The site has adequate parking facilities.

Project Status

Project site is in Post- constructional phase.

Purpose of the Report

This six-monthly report is being submitted as per the condition stipulated in the Environmental Clearance letter.

Further, the study will envisage the environmental impacts that have generated in the local environment due to the project.

The environmental assessment is being carried out to verify:-

- That the project does not have any adverse environmental impacts in the project area and its surrounding.
- Compliance with the conditions stipulated in the Environmental Clearance Letter.
- That the Project Management is implementing the environmental mitigation measures as suggested in the approved Form-1, Form-1A, Environmental Management Plan (EMP) and building plans.
- The project proponent is implementing the environmental safeguards in true spirit.
- Any non-conformity in the project with respect to the environmental implication of the project.

Chapter 2.

Part- A General Conditions:

Sl. No	General Conditions	Compliance
1	Full support shall be extended to the officers of this ministry/Regional Office at Shillong by the project proponent during inspection of the project for monitoring purposes by furnishing full details and action plan including action taken reports in respect of mitigation measures and other environmental protection activities	Complied
2	A six-Monthly monitoring report shall need to be submitted by the project proponents to the Regional Office of this Ministry at Shillong regarding the implementation of the stipulated conditions.	It will be submitted regularly.
3	Ministry of Environment & Forests or any other competent authority may stipulate any additional conditions or modify the existing ones, if necessary, in the interest of environment and the same shall be complied with.	No modifications were made.
4	The Ministry reserves the right to revoke this clearance if any of the conditions stipulated are not complied with the satisfaction of the Ministry.	Noted
5	In the event of a change in project profile or change in the implementation agency, a fresh reference shall be made to the Ministry of Environment and Forests.	Noted
6	The project proponents shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of start of land development work.	Complied
7	A copy of the clearance letter shall be marked to concern Panchayat/local NGO, if any, from whom any suggestion/ representation have been made received while processing the proposal.	It can be issued as required
8	State Pollution Control Board shall display a copy of the clearance letter at the Regional Office, District Industries Centre and Collector's Office/ Tehsildar's office for 30 days.	State Pollution Control Board will be informed.
9	These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act 1974, the Air	Noted

PART -B Specific Conditions:

Sl. no	SPECIFIC CONDITIONS	ACTION TAKEN	REMARKS
1	The “Consent to Establish” shall be obtained from the Board under Air and Water Act a copy shall be submitted to the Ministry before start of any construction work at the site.	“Consent to Establish” was granted by Mizoram Pollution Control Board, Aizawl, Mizoram vide letter No: H88088/Poltn/9(154)2015-MPCB/151 dated 7th Sept. 2018.	Document attached and will be renewed at the time of expiration.
2	Existing landfill site shall be closed scientifically.	Due to some technical issues and circumstances the existing landfill cannot be closed during the monitoring period. Meanwhile the stock Point has to be properly segregated first in order to utilized the landfill to the fullest. Segregation has been started for the stock Point.	The Main Landfill will be closed scientifically as per the Environmental Clearance Condition.
3	The proponent shall ensure that the project fulfills all the provisions of Solid Wastes (Management and Handling) Rules, 2000 including collection and transportation design, etc.	Waste collection was done by PPP mode at point to point conducted by each local council in every locality. The wastes were collected by dry and wet segregation. The vehicle (158) plies around different 85 (local council) localities every day except on Sunday. The vehicles were properly covered and some vehicles were specially designed for garbage truck. Segregation is not done properly at the source which needs to be improved in the future. Waste management at source have been practiced immediately using the Locality “Ramhlun South” as the Pilot program. Door to door collection of segregated wastes has been practiced for this area. Non segregated wastes are rejected and returned to the owners by the collectors. They have employed unskilled labor from the	As instructed during the monitoring, immediate action is taken on the deplorable conditions at the entry site. Segregation and Bailing of recyclable waste has been started. Picture attached.

		revenue of sanitation fee and contribution by every house hold. This labor swept the street and pick up the garbage from sanitation point to dumping truck. If this is found satisfactory it will be practices in other localities.	
4	The gas generated from Landfill facility shall be collected and disposed/utilized per rules.	Gas generation plan is under process and will be implemented as soon as possible.	Will be done as given in Environment Management Plan (Document attached)
5	The Leachates from the facility shall be collected and treated to meet the prescribed standards before disposal.	Leachates collection point was made and was collected. But treatment was not given which will be check and practice. Appropriate secondary waste treatment plant will be use immediately. The effluent discharged will be monitored at a regular interval.	Testing results of leachates is attached as "Effluent water testing results". Leachates quality exceeds the standard given by MSWM rules 2000. Leachate Treatment was given Environment Management Plan. (Document attached)
6	The depth of the Landfill site shall be decided based on the ground water table at the site.	No Ground water Potential.	Map indicating Ground Water Potential attached.
7	An on-site Emergency Management shall be prepared and implemented.	On-site Emergency Management Plan was prepared and implemented effectively.	Documents attached.
8	Periodic ground water/soil monitoring to check the contamination in and around the site shall be carried out.	Ground water/Soil monitoring has been done in and around the site.	Data attached for Water, Air, Noise and Soil monitoring.
9	Odour control measures shall be carried out.	Covering the landfill weekly with soil to reduce odours from newly	Detailed Odour control Plan will

		deposited wastes will be carried out once the main Landfill is in full operation.	be done as given in Environment Management Plan. (Document attached)
10	Green Belt of at least 20% of total area shall be providing all around the unit.	Green Belt is maintained surrounding the unit. The estimation of the No. of Trees and Vegetation is under process.	Data on Green Belt Area will be submitted on the next Compliance Report. After evaluation and calculation, If area is below 20% of total area, Plantation will be maintained.
11	The Project proponent will set up separate environmental management cell for effective implementation of the stipulated environmental safeguards under the supervision of a Senior Executive.	Under Process.	Under Process. Separate Environmental Management Cell will be setup as soon as possible.

Details of Environmental Monitoring

1. AMBIENT AIR QUALITY MONITORING

Ambient Air Quality Monitoring Stations

Ambient air quality monitoring has been carried out at Five locations in the month of November, 2022 . This will enable to have an analytical understanding about air quality and the changes in the air environment in the study area with respect to the condition prevailing. The location of the ambient air quality monitoring station is given in **Table**.

Details of Ambient Air Quality Monitoring Stations

S. No	Location Code	Location Name/ Description	Environmental Setting
1.	A1	Tuirial SWM project site	Landfill site
2	A2	Tuirial SWM 1 km north from project site	Residential
3	A3	Tuirial SWM 1 km South from project site	Residential
4	A4	Tuirial SWM 1 km North east from project site	Residential
5	A5	Tuirial SWM 1.2km South east from project site	Residential

Ambient Air Quality Monitoring Methodology

Monitoring was conducted in respect of the following parameters:

- Particulate Matter 2.5 (PM 2.5)
- Particulate Matter 10 (PM 10)
- Sulphur Dioxide (SO₂)
- Oxides of Nitrogen (NO₂)
- Carbon Monoxide (CO)

The duration of sampling of PM_{2.5}, PM₁₀, SO₂ and NO_x was 8 hourly continuous sampling per day and CO was sampled for 1 hours continuous, thrice in 24 hour duration monitoring. The monitoring was conducted for one day at the location. This is to allow a comparison with the National Ambient Air Quality Standards.

The air samples were analyzed as per standard methods specified by Central Pollution Control Board (CPCB) and IS: 5182. The techniques used for ambient air quality monitoring and minimum detectable levels are given in the Table.

Fine Particulate Sampler (Greentech High Volume Air Sampler) instruments have been used for monitoring Particulate Matter 2.5 (PM2.5 i.e. <2.5 microns), and Respirable Dust Sampler was used for sampling Respirable fraction (<10 microns), gaseous pollutants like SO₂, and NO_x. Bladder and Aspirator bags were used for collection Carbon monoxide samples. Gas Chromatography techniques have been used for the estimation of CO.

Table: Techniques used for Ambient Air Quality Monitoring

S. No.	Parameter	Technique	Technical Protocol
1	Particulate Matter 2.5	Fine Particulate Sampler (Greentech High Volume Air Sampler), Gravimetric Method	IS-5182 (Part-IV)
2	Particulate Matter 10	Respirable Dust Sampler (Greentech High Volume Air Sampler), with cyclone separator, Gravimetric Method	IS-5182 (Part-23)
3	Sulphur dioxide	Modified West and Gaeke	IS-5182 (Part-II)
4	Nitrogen dioxide	Jacob & Hochheiser	IS-5182 (Part-VI)
5	Carbon Monoxide	Gas Chromatography	IS-5182 (Part-X)

AMBIENT NOISE MONITORING

Ambient Noise Monitoring Locations

The main objective of noise monitoring in the study area is to assess the present ambient noise levels in project site due to various construction allied activities and increased vehicular movement. A preliminary reconnaissance survey has been undertaken to

identify the major noise generating sources in the area. Ambient noise monitoring was conducted at 1 locations in the month of September, 2016, as given in below.

Details of Ambient Noise Monitoring Stations

S. No.	Location Code	Location Name/ Description	Present Landuse
1.	L-1	Tuirial SWM project site	Landfill Site
2	L-2	Tuirial SWM 1 km South from project site	Residential
3	L-3	Tuirial SWM 1 km North from project site	Residential
4	L-4	Tuirial SWM 1 km Northeast from project site	Residential

Methodology of Noise Monitoring

Noise levels were measured using integrated sound level meter Noise meter HP-822A. The integrating sound level meter is an integrating/ logging type with Octave filter attachment with frequency range of 31.5 to 16000 Hz. This instrument is capable of measuring the Sound Pressure Level (SPL), Leq and octave band frequency analysis.

Noise level monitoring was carried out continuously for 2 hours. The noise levels were monitored on working days only. During each hour Leq were directly computed by the instrument based on the sound pressure levels.

GROUNDWATER AND SURFACE WATER QUALITY MONITORING

Groundwater Quality Monitoring Locations

No Potential Groundwater Resources in the Area.

Surface Water and Waste Water:

Surface Water samples were collected from five location and waste water from two Location sites . The sample were analyzed for various parameters to compare with the standards for drinking water as per IS: 10500 for Surface water sources. The details of water sampling locations are given in **Table**.

Details of Water Quality Monitoring Station

S. No.	Location Code	Location Name/ Description
1.	WW 1	Location 1(Tuirial SWM)
2.	WW 2	Location 6(Tuirial SWM)
3	SW 3	Location 1 (Tuirial River)
4	SW 4	Location 2 (Luite)
5	SW 4	Location 3(Tuikhur at Tuirial village)
6	SW 5	Location 4(Muthi River)
7	SW 6	Location 5(Perrenial stream near the project site)

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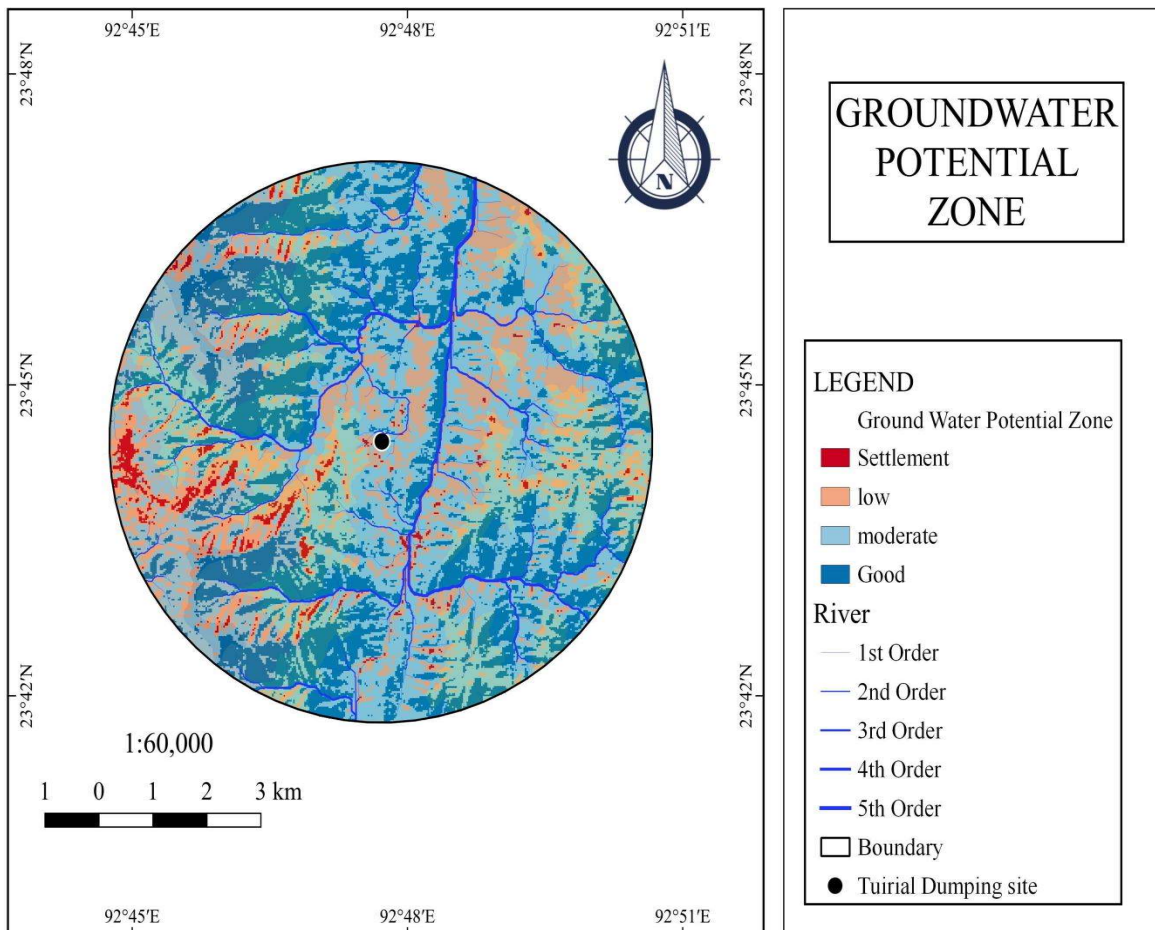


Fig: Ground Water Potential Zone.

SOIL MONITORING

Soil Monitoring Locations

The objective of the soil monitoring is to identify the impacts of ongoing project activities on soil quality and also predict impacts, which have arisen due to execution of various constructions allied activities. Accordingly, a study of assessment of the soil quality has been carried out.

To assess impacts of ongoing project activities on the soil in the area, the physico-chemical characteristics of soils were examined by obtaining soil samples from selected points and analysis of the same. One sample of soil was collected from the project site for studying soil characteristics, the location of which is listed in **Table**.

Details of Soil Quality Monitoring Location

S. No.	Location Code	Location Name/ Description
1.	L1	Tuirial SWM L1 (Top Left)
2.	L2	Tuirial SWM L2 (Center)
3.	L3	Tuirial SWM L3 (Top Right)
4.	L4	Tuirial SWM L4 (Bottom right)
5.	L5	Tuirial SWM L5 (Bottom left)

Methodology of Soil Monitoring

The sampling has been done in line with IS: 2720 & Methods of Soil Analysis, Part-1, 2nd edition, 1986 of American Society for Agronomy and Soil Science Society of America. The homogenized samples were analyzed for physical and chemical characteristics (physical, chemical and heavy metal concentrations). The soil samples were collected in the month of September, 2016.

The samples have been analyzed as per the established scientific methods for physico- chemical parameters. The heavy metals have been analyzed by using Atomic Absorption Spectro-photometer and Inductive Coupled Plasma Analyzer.

TEST RESULTS:

AIR QUALITY:

LOCATION 1:A1

Sampling Location: Tuirial SWM project site

Sample Description: Ambient air quality

Type of Sampling: Continuous

Nature of Sample: Air Quality

Duration of sampling: 8 hours

Date of sampling: 17th November 2022

Sl. No	Parameters	Methods of Analysis	Unit	CPCB Limit (Concentration) ($\mu\text{g}/\text{m}^3$)	Location 1	Comments
1	PM10	IS 5182 PART 23: 2006	$\mu\text{g}/\text{m}^3$	100	30	Within prescribed limit
2	PM2.5	CPCB, 2011 NAAQS monitoring analysis guidelines, Vol-1	$\mu\text{g}/\text{m}^3$	60	14	Within prescribed limit
3	SO2	IS 5182 PART 23: 2006	$\mu\text{g}/\text{m}^3$	80	<1	Within prescribed limit
4	NOX	IS 5182 PART 23: 2006	$\mu\text{g}/\text{m}^3$	80	7	Within prescribed limit
5	CO	IS 5182 PART 23: 2006	$\mu\text{g}/\text{m}^3$	4	3	Within prescribed limit

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LOCATION 2:

Sampling Location: Tuirial SWM 1 km north from project site

Sample Description: Ambient air quality

Duration of sampling: 8 hours

Type of Sampling: Continuous

Date of sampling: 17th November 2022

Nature of Sample: Air Quality

Sl. No	Parameters	Methods of Analysis	Unit	CPCB Limit (Concentration (µg/m3)	Location 1	Comments
1	PM10	IS 5182 PART 23: 2006	µg/m3	100	38	Within prescribed limit
2	PM2.5	CPCB, 2011 NAAQS monitoring analysis guidelines, Vol-1	µg/m3	60	17	Within prescribed limit
3	SO2	IS 5182 PART 23: 2006	µg/m3	80	BDL	Within prescribed limit
4	NOX	IS 5182 PART 23: 2006	µg/m3	80	8	Within prescribed limit
5	CO	IS 5182 PART 23: 2006	µg/m3	4	2	Within prescribed limit

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LOCATION 3:

Sampling Location: Tuirial SWM 1 km South from project site

Sample Description: Ambient air quality

Duration of sampling: 8 hours

Type of Sampling: Continuous

Date of sampling: 17th November 2022

Nature of Sample: Air Quality

Sl. No	Parameters	Methods of Analysis	Unit	CPCB Limit (Concentration) ($\mu\text{g}/\text{m}^3$)	Location 1	Comments
1	PM10	IS 5182 PART 23: 2006	$\mu\text{g}/\text{m}^3$	100	27	Within prescribed limit
2	PM2.5	CPCB, 2011 NAAQS monitoring analysis guidelines, Vol-1	$\mu\text{g}/\text{m}^3$	60	13	Within prescribed limit
3	SO2	IS 5182 PART 23: 2006	$\mu\text{g}/\text{m}^3$	80	<1	Within prescribed limit
4	NOX	IS 5182 PART 23: 2006	$\mu\text{g}/\text{m}^3$	80	6	Within prescribed limit
5	CO	IS 5182 PART 23: 2006	$\mu\text{g}/\text{m}^3$	4	1	Within prescribed limit

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LOCATION 4:

Sampling Location: Tuirial SWM 1 km North east from project site

Sample Description: Ambient air quality

Duration of sampling: 8 hours

Type of Sampling: Continuous

Date of sampling: 17th November 2022

Nature of Sample: Air Quality

Sl. No	Parameters	Methods of Analysis	Unit	CPCB Limit (Concentration ($\mu\text{g}/\text{m}^3$))	Location 1	Comments
1	PM10	IS 5182 PART 23: 2006	$\mu\text{g}/\text{m}^3$	100	32	Within prescribed limit
2	PM2.5	CPCB, 2011 NAAQS monitoring analysis guidelines, Vol-1	$\mu\text{g}/\text{m}^3$	60	16	Within prescribed limit
3	SO ₂	IS 5182 PART 23: 2006	$\mu\text{g}/\text{m}^3$	80	<1	Within prescribed limit
4	NO _X	IS 5182 PART 23: 2006	$\mu\text{g}/\text{m}^3$	80	8	Within prescribed limit
5	CO	IS 5182 PART 23: 2006	$\mu\text{g}/\text{m}^3$	4	2	Within prescribed limit



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LOCATION 5:

Sampling Location: Tuirial SWM 1.2km South east from project site

Sample Description: Ambient air quality

Duration of sampling: 8 hours

Type of Sampling: Continuous

Date of sampling: 17th November 2022

Nature of Sample: Air Quality

Sl. No	Parameters	Methods of Analysis	Unit	CPCB Limit (Concentration) ($\mu\text{g}/\text{m}^3$)	Location 1	Comments
1	PM10	IS 5182 PART 23: 2006	$\mu\text{g}/\text{m}^3$	100	26	Within prescribed limit
2	PM2.5	CPCB, 2011 NAAQS monitoring analysis guidelines, Vol-1	$\mu\text{g}/\text{m}^3$	60	15	Within prescribed limit
3	SO2	IS 5182 PART 23: 2006	$\mu\text{g}/\text{m}^3$	80	<1	Within prescribed limit
4	NOX	IS 5182 PART 23: 2006	$\mu\text{g}/\text{m}^3$	80	5	Within prescribed limit
5	CO	IS 5182 PART 23: 2006	$\mu\text{g}/\text{m}^3$	4	1	Within prescribed limit

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NOISE QUALITY:

LOCATION 1.

Sampling Location: Tuirial SWM project site

Sample Description: Noise quality


Duration of sampling: 2 hours

Type of Sampling: Continuous

Date of sampling: 17th November 2022

Numbers of parameters: 1

Sl. No	Parameters	Time	Equipment	Methods	Readings			Comments
1	Noise level	11am – 1pm	Noise meter HP- 822A	IS:10988- 1984 Indian standard	Leq 65	Lmin 42	Lmax 74	With prescribe limit


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LOCATION 2.

Sampling Location: Tuirial SWM 1 km South from project site

Sample Description: Noise quality


Duration of sampling: 2 hours

Type of Sampling: Continuous

Date of sampling: 17th November 2022

Numbers of parameters: 1

Sl. No	Parameters	Time	Equipment	Methods	Readings			Comments
					Leq	Lmin	Lmax	
1	Noise level	12am – 2pm	Noise meter HP- 822A	IS:10988- 1984 Indian standard	57	38	64	With prescribe limit

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LOCATION 3.

Sampling Location: Tuirial SWM 1 km North from project site

Sample Description: Noise quality

Duration of sampling: 2 hours

Type of Sampling: Continuous

Date of sampling: 17th November 2022

Numbers of parameters: 1

Sl. No	Parameters	Time	Equipment	Methods	Readings			Comments
					Leq	Lmin	Lmax	
1	Noise level	9am – 11am	Noise meter HP- 822A	IS:10988- 1984 Indian standard	59	40	67	With prescribe limit



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LOCATION 4.

Sampling Location: Tuirial SWM 1 km Northeast from project site

Sample Description: Noise quality

Duration of sampling: 2 hours

Type of Sampling: Continuous

Date of sampling: 17th November 2022

Numbers of parameters: 1

Sl. No	Parameters	Time	Equipment	Methods	Readings			Comments
					Leq	Lmin	Lmax	
1	Noise level	12pm – 2pm	Noise meter HP-822A	IS:10988-1984 Indian standard	65	45	75	With prescribe limit



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SOIL QUALITY:

Sampling Location: Tuirial SWM L1 (Top Left)

Sample Description: Soil Quality

Type of Sampling: Once

Nature of Sample: Soil Quality

Quantity of sample: 300g

Date of sampling: 17th November 2022

TEST REPORT

Sl. No	Parameters	Unit	Location 1
1	Colour		Brown
2	pH		6.21
3	Bulk Density	g/cm ³	1.16
4	Moisture Content	%	23.9
5	Water Holding Capacity		1.45
6	Sand	%	64.8
7	Silt	%	12
8	Clay	%	24.2
9	Texture	Class	Sandy Clay Loam
10	Respiration	mg CO ₂ m ⁻² h ⁻¹	173
11	Soil organic Carbon	%	5.65
12	Total Nitrogen	mg/kg	20.49
13	Available Phosphorus	mg/kg	14.21
14	Exchangeable Potassium	mg/kg	118
15	Sodium (Excheangable)	mg/kg	31.8
16	Calcium (Excheangable)	mg/kg	281.87
17	Magnesium (Excheangable)	mg/kg	366.89
18	Manganese (Excheangable)	mg/kg	193.11
19	Ammonium	mg/g	5.8

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Sampling Location: Tuirial SWM L2 (Center)

Sample Description: Soil Quality

Type of Sampling: Once

Nature of Sample: Soil Quality

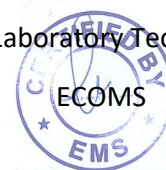
Quantity of sample: 300g

Date of sampling: 17th November 2022

TEST REPORT

Sl. No	Parameters	Unit	Location 2
1	Colour		Brownish Yellow
2	pH		6.24
3	Bulk Density	g/cm ³	1.56
4	Moisture Content	%	22.7
5	Water Holding Capacity		1.13
6	Sand	%	80.8
7	Silt	%	10
8	Clay	%	10
9	Texture	Class	Loamy Sand
10	Respiration	mg CO ₂ m ⁻² h ⁻¹	109
11	Soil organic Carbon	%	3.58
12	Total Nitrogen	mg/kg	21.89
13	Available Phosphorus	mg/kg	19.38
14	Exchangeable Potassium	mg/kg	492
15	Sodium (Excheangable)	mg/kg	98.7
16	Calcium (Excheangable)	mg/kg	217.94
17	Magnesium (Excheangable)	mg/kg	225.33
18	Manganese (Excheangable)	mg/kg	122.6
19	Ammonium	mg/g	5.1

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Sampling Location: Tuirial SWM L3 (Top Right)

Sample Description: Soil Quality

Quantity of sample: 300g

Type of Sampling: Once

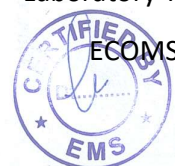
Date of sampling: 17th November 2022

Nature of Sample: Soil Quality

TEST REPORT

Sl. No	Parameters	Unit	Location 3
1	Colour		Brownish Yellow
2	pH		5.87
3	Bulk Density	g/cm ³	1.14
4	Moisture Content	%	22.2
5	Water Holding Capacity		1.35
6	Sand	%	77.8
7	Silt	%	10
8	Clay	%	12.2
9	Texture	Class	Sandy Loam
10	Respiration	mg CO ₂ m ⁻² h ⁻¹	138
11	Soil organic Carbon	%	5.43
12	Total Nitrogen	mg/kg	23.43
13	Available Phosphorus	mg/kg	20.35
14	Exchangeable Potassium	mg/kg	144
15	Sodium (Excheangable)	mg/kg	14
16	Calcium (Excheangable)	mg/kg	453.1
17	Magnesium (Excheangable)	mg/kg	315.22
18	Manganese (Excheangable)	mg/kg	173.3
19	Ammonium	mg/g	5.6

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Sampling Location: Tuirial SWM L4 (Bottom right)

Sample Description: Soil Quality

Quantity of sample: 300g

Type of Sampling: Once

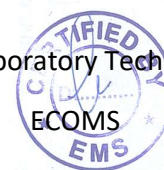
Date of sampling: 17th November 2022

Nature of Sample: Soil Quality

TEST REPORT

Sl. No	Parameters	Unit	Location 4
1	Colour		Yellowish Brown
2	pH		6.11
3	Bulk Density	g/cm ³	1.45
4	Moisture Content	%	25
5	Water Holding Capacity		1.63
6	Sand	%	45.5
7	Silt	%	26
8	Clay	%	28.5
9	Texture	Class	Loam
10	Respiration	mg CO ₂ m ⁻² h ⁻¹	149
11	Soil organic Carbon	%	4.98
12	Total Nitrogen	mg/kg	21.76
13	Available Phosphorus	mg/kg	24.17
14	Exchangeable Potassium	mg/kg	236
15	Sodium (Excheangable)	mg/kg	14.6
16	Calcium (Excheangable)	mg/kg	143.19
17	Magnesium (Excheangable)	mg/kg	202.32
18	Manganese (Excheangable)	mg/kg	102.1
19	Ammonium	mg/g	4.9

Laboratory Technician



Zemabawk North

ECO-MANAGEMENT SERVICES

Aizawl-796017

(ECOMS MIZORAM)

Reg No: RF-MZ 451 of 2020-2021

Pan:AAIFE6941L

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Sampling Location: Tuirial SWM L5 (Bottom left)

Sample Description: Soil Quality

Quantity of sample: 300g

Type of Sampling: Once

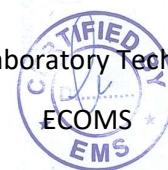
Date of sampling: 17th November 2022

Nature of Sample: Soil Quality

TEST REPORT

Sl. No	Parameters	Unit	Location 5
1	Colour		Brownish Yellow
2	pH		5.92
3	Bulk Density	g/cm ³	1.91
4	Moisture Content	%	19.8
5	Water Holding Capacity		1.15
6	Sand	%	86.8
7	Silt	%	5
8	Clay	%	8.2
9	Texture	Class	Loamy Sand
10	Respiration	mg CO ₂ m ⁻² h ⁻¹	145
11	Soil organic Carbon	%	5.66
12	Total Nitrogen	mg/kg	23.65
13	Available Phosphorus	mg/kg	18.98
14	Exchangeable Potassium	mg/kg	362
15	Sodium (Excheangable)	mg/kg	22.6
16	Calcium (Excheangable)	mg/kg	369.63
17	Magnesium (Excheangable)	mg/kg	276.26
18	Manganese (Excheangable)	mg/kg	131.9
19	Ammonium	mg/g	4.2

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WATER QUALITY:

Waste Water:

Sampling Location: Location 1(Tuirial SWM)

Coordinates: 23° 44'45"N

92° 47'50"E

Sample Description: Leachate

Type of Sampling: Once

Nature of Sample: Waste water quality

Quantity of sample: 2 Litres

Date of sampling: 17th November 2022

TEST REPORT

Parameters	Units	Standard	L1
Colour			Dark green
Odour			Decayed
Temperature	°C		22
pH		5.5-9	7.48
Turbidity	NTU	NA	1176
Electrical Conductivity	µS	NA	2171
Total Dissolve Solids	Mg/L	2100	1400
Total Suspended Solids	Mg/L	200	60
Alkalinity	Mg/L	NA	1200
Hardness	Mg/L	NA	120
Calcium	Mg/L	NA	19.2
Magnesium	Mg/L	NA	100.8
Free Carbondioxide	Mg/L	NA	14
Sulphate	ppm	NA	11.93
Phosphate	ppm	NA	2.053
Nitrate-N	ppm	NA	32.1
Ammonia-N	ppm	50	67
Chloride	Mg/L	600	530
Dissolve Oxygen	Mg/L	NA	0.8
Biological Oxygen Demand	Mg/L	100	248
Chemical Oxygen Demand	Mg/L	250	1120

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Sampling Location: Location 6(Tuirial SWM)

Coordinates: 23° 44'39"N

92° 47'51"E

Sample Description: Leachate

Quantity of sample: 2 Litres

Type of Sampling: Once

Date of sampling: 17th November 2022

Nature of Sample: Waste water quality

TEST REPORT

Parameters	Units	Standard	W1
Colour			Yellowish
Odour			Decayed
Temperature	°C		22
pH		5.5-9	7.34
Turbidity	NTU	NA	63
Electrical Conductivity	µS	NA	854
Total Dissolve Solids	Mg/L	2100	1000
Total Suspended Solids	Mg/L	200	40
Alkalinity	Mg/L	NA	280
Hardness	Mg/L	NA	460
Calcium	Mg/L	NA	32
Magnesium	Mg/L	NA	428
Free Carbondioxide	Mg/L	NA	12
Sulphate	ppm	NA	37.6
Phosphate	ppm	NA	3.6
Nitrate-N	ppm	NA	31
Ammonia-N	ppm	50	48.68
Chloride	Mg/L	600	520
Dissolve Oxygen	Mg/L	NA	7
Biological Oxygen Demand	Mg/L	100	218
Chemical Oxygen Demand	Mg/L	250	768

Laboratory Technician ECOMS



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Surface Water:

Sampling Location: Location 1 (Tuirial River)

**Coordinates: 23° 43'04"N
 92° 47'58"E**

Sample Description: Surface water Quality

Quantity of sample: 2 Litres

Type of Sampling: Once

Date of sampling: 17th November 2022

Nature of Sample: Water Quality

TEST REPORT

Parameters	Units	Standard	Recommended	TR
Colour	Hazen	5 to 15	IS 10501	Clear
Odour		Agreeable	IS 10502	Odourless
Temperature	°C	<40	ISI	21
pH		6.5-8.5	ICMR / BIS	6.33
Turbidity	NTU	1	IS 10500	32
Electrical Conductivity	µS	300	ICMR	129
Total Dissolve Solids	Mg/L	100	WHO	14
Total Suspended Solids	Mg/L	75	ICMR / BIS	31
Alkalinity	Mg/L	600	CPCB	80
Hardness	Mg/L	300	CPCB	68
Calcium	Mg/L	75	BIS	16
Magnesium	Mg/L	30	BIS	52
Free Carbondioxide	Mg/L			6
Sulphate	ppm	200	CPCB	27.94
Phosphate	ppm	5	ICMR	BDL
Nitrate-N	ppm	150	ICMR	BDL
Ammonia-N	ppm	50	CPCB	BDL
Chloride	Mg/L	45	ICMR / BIS	30
Dissolve Oxygen	Mg/L	4.0-6.0	WHO	16.8
Biological Oxygen Demand	Mg/L	<2	CPCB	0.6
Chemical Oxygen Demand	Mg/L	10	WHO	7.68

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Sampling Location: Location 2 (Luite)**Coordinates: 23° 45'30"N****92° 48'01"E****Sample Description: Surface water Quality****Quantity of sample: 2 Litres****Type of Sampling: Once****Date of sampling: 17th November 2022****Nature of Sample: Water Quality****TEST REPORT**

Parameters	Units	Standard	Recommended	Sample H
Colour	Hazen	5 to 15	IS 10501	Cloudy
Odour		Agreeable	IS 10502	Odourless
Temperature	°C	<40	ISI	23.5
pH		6.5-8.5	ICMR / BIS	6.36
Turbidity	NTU	1	IS 10500	29
Electrical Conductivity	µS	300	ICMR	22
Total Dissolve Solids	Mg/L	100	WHO	0.032
Total Suspended Solids	Mg/L	75	ICMR / BIS	0.03
Alkalinity	Mg/L	600	CPCB	30
Hardness	Mg/L	300	CPCB	20
Calcium	Mg/L	75	BIS	7.2
Magnesium	Mg/L	30	BIS	57.6
Free Carbondioxide	Mg/L			2
Sulphate	ppm	200	CPCB	8.39
Phosphate	ppm	5	ICMR	0.024
Nitrate-N	ppm	150	ICMR	0.017
Ammonia-N	ppm	50	CPCB	0.304
Chloride	Mg/L	45	ICMR / BIS	28.97
Dissolve Oxygen	Mg/L	4.0-6.0	WHO	8.8
Biological Oxygen Demand	Mg/L	<2	CPCB	1.2
Chemical Oxygen Demand	Mg/L	10	WHO	0.28

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Sampling Location:Location 3(Tuikhur at Tuirial village)**Coordinates: 23° 43'07"N****92° 47'56"E****Sample Description: Surface water Quality****Quantity of sample: 2 Litres****Type of Sampling: Once****Date of sampling: 17th November****2022****Nature of Sample: Water Quality****TEST REPORT**

Parameters	Units	Standard	Recommended	TK
Colour	Hazen	5 to 15	IS 10501	Clear
Odour		Agreeable	IS 10502	Odourless
Temperature	°C	<40	ISI	19
pH		6.5-8.5	ICMR / BIS	5.93
Turbidity	NTU	1	IS 10500	18
Electrical Conductivity	µS	300	ICMR	129
Total Dissolve Solids	Mg/L	100	WHO	10
Total Suspended Solids	Mg/L	75	ICMR / BIS	40
Alkalinity	Mg/L	600	CPCB	20
Hardness	Mg/L	300	CPCB	84
Calcium	Mg/L	75	BIS	24
Magnesium	Mg/L	30	BIS	60
Free Carbondioxide	Mg/L			8
Sulphate	ppm	200	CPCB	189.6
Phosphate	ppm	5	ICMR	BDL
Nitrate-N	ppm	150	ICMR	BDL
Ammonia-N	ppm	50	CPCB	BDL
Chloride	Mg/L	45	ICMR / BIS	30
Dissolve Oxygen	Mg/L	4.0-6.0	WHO	14.2
Biological Oxygen Demand	Mg/L	<2	CPCB	0.8
Chemical Oxygen Demand	Mg/L	10	WHO	6.72


 Laboratory Technician
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Sampling Location: Location 4(Muthi River)

Coordinates: 23° 45'38"N

92° 48'28"E

Sample Description: Surface water Quality

Quantity of sample: 2 Litres

Type of Sampling: Once

Date of sampling: 17th November

2022

Nature of Sample: Water Quality

TEST REPORT

Parameters	Units	Standard	Recommended	M1
Colour	Hazen	5 to 15	IS 10501	Cloudy
Odour		Agreeable	IS 10502	Odourless
Temperature	°C	<40	ISI	20
pH		6.5-8.5	ICMR / BIS	6.74
Turbidity	NTU	1	IS 10500	158
Electrical Conductivity	µS	300	ICMR	207
Total Dissolve Solids	Mg/L	100	WHO	40
Total Suspended Solids	Mg/L	75	ICMR / BIS	50
Alkalinity	Mg/L	600	CPCB	120
Hardness	Mg/L	300	CPCB	180
Calcium	Mg/L	75	BIS	40
Magnesium	Mg/L	30	BIS	140
Free Carbondioxide	Mg/L			6
Sulphate	ppm	200	CPCB	26.2
Phosphate	ppm	5	ICMR	BDL
Nitrate-N	ppm	150	ICMR	2
Ammonia-N	ppm	50	CPCB	0.053
Chloride	Mg/L	45	ICMR / BIS	20
Dissolve Oxygen	Mg/L	4.0-6.0	WHO	8.4
Biological Oxygen Demand	Mg/L	<2	CPCB	1.2
Chemical Oxygen Demand	Mg/L	10	WHO	3.52

Laboratory Technician
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Sampling Location: Location 5(Perrenial stream near the project site)**Coordinates: 23° 44'32"N****92° 47'56"E****Sample Description: Surface water Quality****Quantity of sample: 2 Litres****Type of Sampling: Once****Date of sampling: 17th November****2022****Nature of Sample: Water Quality****TEST REPORT**

Parameters	Units	Standard	Recommended	F
Colour	Hazen	5 to 15	IS 10501	Cloudy
Odour		Agreeable	IS 10502	Odourless
Temperature	°C	<40	ISI	23
pH		6.5-8.5	ICMR / BIS	6.18
Turbidity	NTU	1	IS 10500	156
Electrical Conductivity	µS	300	ICMR	43
Total Dissolve Solids	Mg/L	100	WHO	0.036
Total Suspended Solids	Mg/L	75	ICMR / BIS	0.01
Alkalinity	Mg/L	600	CPCB	40
Hardness	Mg/L	300	CPCB	40.2
Calcium	Mg/L	75	BIS	4
Magnesium	Mg/L	30	BIS	24
Free Carbondioxide	Mg/L			4
Sulphate	ppm	200	CPCB	21.92
Phosphate	ppm	5	ICMR	0.019
Nitrate-N	ppm	150	ICMR	0.027
Ammonia-N	ppm	50	CPCB	0.736
Chloride	Mg/L	45	ICMR / BIS	39.99
Dissolve Oxygen	Mg/L	4.0-6.0	WHO	8.4
Biological Oxygen Demand	Mg/L	<2	CPCB	0.7
Chemical Oxygen Demand	Mg/L	10	WHO	4.32

Laboratory Technician

ECOMS



OFFICE OF THE MIZORAM STATE POLLUTION CONTROL BOARD
AIZAWL, MIZORAM

NO OBJECTION CERTIFICATE (CONSENT TO ESTABLISH)
(RENEWED)

No. H.88088/Poltn/9(154)/2015-MPCB/151 : Dated Aizawl, the 7th September, 2018
Validity: 10.8.2018 - 9.8.2019

NO OBJECTION CERTIFICATE (CONSENT TO ESTABLISH) granted to the **Project Director, State Investment Program Management & Implementation Unit (SIPMIU), Government of Mizoram** for setting up of **COMPOST PLANT WITH ENGINEERED LANDFILL**, having a capacity of 150 tons/day for Solid Wastes Management of Aizawl City at **Tuirial, Mizoram** under Section 21 of Air (Prevention & Control of Pollution) Act, 1981 and Section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 is hereby **renewed for another one (1) year with effect from 10th August, 2018** with reference to the application No. W-11020/7/2017-PD/SIPMIU (NERCCDIP)/56 Dt. 17.08.2018.

All the conditions stipulated in the original certificate shall remain same and shall be strictly complied with.

**GREEN
CATEGORY**

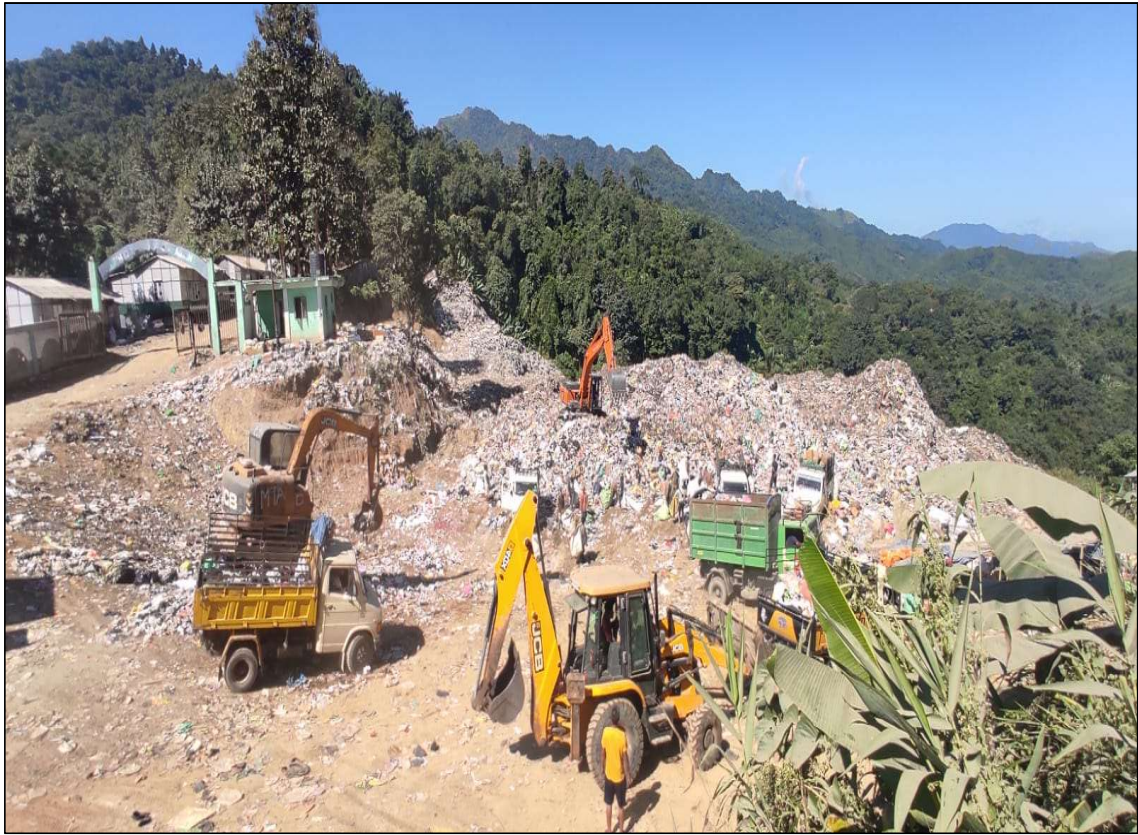
Memo No. H.88088/Poltn/9(154)/2015-MPCB/151 :
Copy to: **Project Director, State Investment Program Management & Implementation Unit (SIPMIU), Government of Mizoram** with reference to the application No. W-11020/7/2017-PD/SIPMIU (NERCCDIP)/56 Dt. 17.08.2018

Sd/-C.LALDUHAWMA
Member Secretary
Mizoram Pollution Control Board
Dated Aizawl, the 7th September, 2018
(Signature)
(C.LALDUHAWMA)
Member Secretary
Mizoram Pollution Control Board

Mizoram State Pollution Control Board, New Secretariat Complex, Thlabual Pong, Khatla, Aizawl, Mizoram-796001
Ph.No.2336173/2336599 Fax:2336591 Email:mspcb@mizoram.gov.in Website: http://www.mspcb.miz.gov.in

Office of the Program Director
SIPMIU (NERCCDIP)
Aizawl: Mizoram
Receipt No. 148
Date 20/11/18
Section _____

Consent to Establish.



Entry Site and Stock point under operation for Segregation





Segregation and Bailing of recyclable waste has been started.





Main Landfill Site.



Collection of Samples.





Collection of Samples.



Leachate collection site.

ANEXXURE

ANEXXURE 1.

Environmental Management Plan

7.1 Structure of EMP

Environmental Management Plan (EMP) is the key to ensure a safe and clean environment. The desired results from the environmental mitigation measures proposed in the project may not be obtained without a management plan to assure its proper implementation and function. The EMP envisages the plans for the proper implementation of mitigation measures to reduce the adverse impacts arising out of the project activities. EMP has been prepared addressing the issues like:

- Pollution control/mitigation measures for abatement of the undesirable impacts caused during the construction and operation phase of the project.
- Details of management plans (landscape plan, solid waste management plan etc)
- Institutional set up identified/recommended for implementation of the EMP
- Post project environmental monitoring programme to be undertaken

7.2 Site Selection Criteria and Mitigation Measures

The dumping site used by Municipal Council had been proposed for onsite development of municipal solid waste management facilities has been evaluated on the basis of criteria as per CPHEEO table – 7.1. All the features as described in the criteria proposed by CPHEEO have been investigated for the chosen site. The identified area of the site (leaving 100 m distance from the river) does not have any negative parameters to be rejected based on evaluation criteria. Hence the site has been taken for detailed investigation and mitigation measures are proposed in next section.

Table 7.1: Site Selection Criteria and Mitigation Measures

Components	Specified limits as per CPHEEO manual	Aizawl Municipal Solid Waste Site condition	Measures
Lake or pond	More than 200 m from landfill	No	
River/ Canal	More than 100 m	No river or canal is/around the site.	In order to avoid water contamination necessary

	from landfill	However there are two small seasonal streams are	measurements like cemented floor for windrows, leachate collection system, proper cemented drainage network for composting plant and leachate treatment system should be established (please refer EMP) Additionally, a frequent monitoring system to check the water quality of canal should be incorporated.
Flood plain	More than 100 years	No	
Highway	More than 200 m from state or national highway	Yes	National highway NH-54 is approx 2 Km away from proposed site.
Habitation	More than 500 m	Yes	There is no habitation within 4 km radius of proposed site. Proper fencing and boundary wall will restrict the solid waste within the site. Moreover, green belt improves the aesthetic look. Additionally some measures to control dust and odour have already given in management plan.
Public parks	More than 300 m	Yes	There is no nation park within 4 km radius of proposed project site.
Critical Habitat Area	No habitation of endangered or protected species	No	No such species in project area.
Wetlands	Not to be in wetland	No	No such species in project area.
Ground water table	More than 2 m	Yes	Yes it's more than 2 meter.
Airport	More than 20 km	Yes	The nearest Airport is Lengpui, 32 Km from the city.

Water supply well	More than 500 m	No	There is no water supply well within 10 km of radius.
Coastal regulation zone	Not within CRZ	No	No Such area.
Unstable zone	Not within landslide/ fault zone area	Yes	The project site fall in seismic zone v.

Table 7.2: Site Selection Criteria and Mitigation Measures (As per MSWMH2000)

SL N.	Specified as per MSWMH 2000 rule	Aizawl Municipal Solid Waste Site condition
1	In areas falling under the jurisdiction of 'Development Authorities' it shall be the responsibility of such Development Authorities to identify the landfill sites and hand over the sites to the concerned municipal authority for development, operation and maintenance. Elsewhere, this responsibility shall lie with the concerned municipal authority.	Responsible department is UD&PA, in Aizawl very recently (in November 2010) Municipal Council has been formed but till date it is not functioning properly.
2	Selection of landfill sites shall be based on examination of environmental issues. The Department of Urban Development of the State or the Union territory shall co-ordinate with the concerned organisations for obtaining the necessary approvals and clearances.	All the environmental issues have been considered no sensitive feature has been identified. Required statutory clearance shall be taken prior to start of construction work.
3	The landfill site shall be planned and designed with proper documentation of a phased construction plan as well as a closure plan.	It has been planed accordingly.
4	The landfill sites shall be selected to make use of nearby wastes processing facility. Otherwise, wastes processing facility shall be planned as an integral part of the landfill site.	The proposed site is adjacent to existing dumping site. Composting unit has been proposed to establish as a part of Municipal Solid Waste Management Facility.
5	The existing landfill sites which continue to be used for more than five years shall be improved in accordance of the specifications given in this Schedule.	It is planned.
6	Biomedical wastes shall be disposed off in accordance with the Bio-medical Wastes	The proposed facility is only for Municipal Waste.

	(Management and Handling) Rules, 1998 and hazardous wastes shall be managed in accordance with the Hazardous Wastes (Management and Handling) Rules, 1989, as amended from time to time.	Biomedical waste of the Aizawl city will be handled separately.
7	The landfill site shall be large enough to last for 20-25 years.	The proposed land fill site is for 15 years.
8	The landfill site shall be away from habitation clusters, forest areas, water bodies monuments, National Parks, Wetlands and places of important cultural, historical or religious interest.	No such sensitive area within a radius of 10 km. There is no human settlement within radius of 4 km of proposed project site.
9	A buffer zone of no-development shall be maintained around landfill site and shall be incorporated in the Town Planning Department's land-use plans.	A buffer zone of no-development has been proposed within boundary of 500 meters
10	Landfill site shall be away from airport including airbase. Necessary approval of airport or airbase authorities prior to the setting up of the landfill site shall be obtained in cases where the site is to be located within 20 km of an airport or airbase.	The nearest Airport is Lengpui, 32 Km from the city.

7.3 Management of Municipal Solid Wastes (Accordance with MSW rules 2000)

S.no	Parameters	Management (As per MSW rules-2000)
1.	Collection of municipal solid wastes	<p>1. Littering of municipal solid waste shall be prohibited in cities, towns and in urban areas notified by the State Governments. To prohibit littering and facilitate compliance, the following steps shall be taken by the Aizawl Municipal Council.</p> <p>a. Organizing house-to-house collection of municipal solid wastes through any of the methods through community bin collection (central bin), house-to-house collection, collection on regular pre-informed timings and scheduling by using bell ringing. (without exceeding permissible noise levels);</p> <p>b. Devising collection of waste from slums and squatter areas or localities including hotels, restaurants, office complexes and commercial areas;</p> <p>c. Wastes from slaughter houses, meat and fish markets, fruits and vegetable markets, which are biodegradable in nature, shall be managed to make use of such wastes;</p>

		<ul style="list-style-type: none"> d. Bio-medical wastes and industrial wastes shall not be mixed with municipal solid wastes and such wastes shall follow the rules separately specified for the purpose; e. Collected waste from residential and other areas shall be transferred to community bin by small vehicles; f. Horticultural and construction or demolition wastes or debris shall be separately collected and disposed off following proper norms. Similarly, wastes generated at dairies shall be regulated in accordance with the State laws; g. Waste (garbage, dry leaves) shall not be burnt; h. Stray animals shall not be allowed to move around waste storage facilities or at any other place in the city or town and shall be managed in accordance with the State laws. i. The municipal authority shall notify waste collection schedule and the likely method to be adopted for public benefit in a Aizawl City j. It shall be the responsibility of generator of wastes to avoid littering and ensure delivery of wastes in accordance with the collection and segregation system to be notified by the municipal authority.
2.	Segregation of municipal solid wastes	<p>In order to encourage the citizens, municipal authority shall organise awareness programmes for segregation of wastes and shall promote recycling or reuse of segregated materials.</p> <p>The municipal authority shall undertake phased programme to ensure community participation in waste segregation. For this purpose, regular meetings at quarterly intervals shall be arranged by the municipal authorities with representatives of local resident welfare associations and non-governmental organizations.</p>
3.	Storage of municipal solid wastes	<p>Municipal authorities shall establish and maintain storage facilities in such a manner as they do not create unhygienic and insanitary conditions around it. Following criteria shall be taken into account while establishing and maintaining storage facilities, namely :-</p> <ul style="list-style-type: none"> a. Storage facilities shall be created and established by taking into account quantities of waste generation in a given area and the population densities. A storage facility shall be so placed that it is accessible to users; b. Storage facilities to be set up by municipal authorities or any other agency shall be so designed that wastes stored are not exposed to open atmosphere and shall be aesthetically acceptable and user-friendly;

		<ul style="list-style-type: none"> c. Storage facilities or 'bins' shall have 'easy to operate' design for handling, transfer and transportation of waste. Bins for storage of bio-degradable wastes shall be painted green, those for storage of recyclable wastes shall be printed white and those for storage of other wastes shall be printed black; d. Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers.
4.	Transportation of municipal solid wastes	<p>Vehicles used for transportation of wastes shall be covered. Waste should not be visible to public, nor exposed to open environment preventing their scattering. The following criteria shall be met, namely:-</p> <ul style="list-style-type: none"> a. The storage facilities set up by municipal authorities shall be daily attended for clearing of wastes. The bins or containers wherever placed shall be cleaned before they start overflowing; b. Transportation vehicles shall be so designed that multiple handling of wastes, prior to final disposal, is avoided.
5.	Processing of municipal solid wastes	<p>Municipal authorities shall adopt suitable technology or combination of such technologies to make use of wastes so as to minimize burden on landfill. Following criteria shall be adopted, namely:-</p> <ul style="list-style-type: none"> a. The biodegradable wastes shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of wastes. It shall be ensured that compost or any other end product shall comply with standards as specified in Schedule-IV; b. Mixed waste containing recoverable resources shall follow the route of recycling. Incineration with or without energy recovery including pelletisation can also be used for processing wastes in specific cases. Municipal authority or the operator of a facility wishing to use other state-of-the-art technologies shall approach the Central Pollution Control Board to get the standards laid down before applying for grant of authorisation.
6.	Disposal of municipal solid wastes	<p>Land filling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing. Land filling shall also be carried out for</p>

		residues of waste processing facilities as well as pre-processing rejects from waste processing facilities. Land filling of mixed waste shall be avoided unless the same is found unsuitable for waste processing. Under unavoidable circumstances or till installation of alternate facilities, land-filling shall be done following proper norms. Landfill sites shall meet the specifications as given in Schedule –III.
--	--	---

7.4 Proposed environmental mitigation measures

It is imperative to identify the potential impacts likely to occur due to the proposed project at an early stage and their mitigation measures are suggested in order to ensure environmentally sustainable development. A comprehensive approach was adopted for screening out the potential environmental impacts pertinent to the proposed project of municipal solid waste management facility. Significant impacts related to site selection, design, construction and operation & maintenance phases of the proposed project were identified. The major impacts due to different project activities and their mitigation measures have been identified in Chapter 6. As described in chapter 2 the project has three main components:

- Segregation Plant
- Composting Plant
- Landfill and

All these components have some adverse environmental impacts. To control these adverse environmental impacts and to increase the project benefits effective EMP for each component is required separately.

7.5 EMP for Municipal Solid Waste Management Facility:

The significant impacts of different stages (Pre-construction, construction and operation & maintenance phases) of the proposed MSW management facility on different components of environment were identified and their mitigation measures are given below:

7.5.1 Air Quality:

Air quality of the project site and neighboring areas will be affected due to the project activities. Impacts on air quality on different stages of the project and environment management plan for these impacts are given below:

A. Pre-construction Phase:

During pre- construction phase, only the site preparation activities will be carried out. Trees will be cut down (as significant number of trees present within project boundary); no structures needs be demolished at project site. These activities will generate dust. Following management measures shall be used to mitigate dust emission:

- Excavation work will be sprayed with water.
- Workers will be provided with masks for protection against the inhalation of dust and be trained in its use.
- The contractor will take every precaution to reduce the level of dust at the sites involving earthwork, by frequent sprinkling of water.
- Activities causing dust will not be carried out on excessively windy days.

Institutional Responsibility:- Design Supervision Management Consultant (DSMC)/ Contractor.

B. Construction Phase:

During construction of MSW management facility dust and exhaust gases of vehicular emissions may be generated. Management measures proposed are:

Gaseous Emissions

- All vehicles, machinery, equipment and generators used during construction activities shall be in good condition and shall be properly tuned and maintained by the contractor and confirm that pollution emission levels comply with the relevant requirements of SPCB.
- Open burning of any waste from contractor's camps shall be strictly banned.

Dust Emission

The majority of dust problems caused by the construction of the project will be mitigated by implementation of a few simple procedures by the contractor:

- The contractor will take every precaution to reduce the level of dust along construction sites involving earthwork, by frequent sprinkling of water.
- The Contractor will confirm that all crushers used in construction shall conform to relevant dust emission control legislation. Clearance for siting shall be obtained from the SPCB (if it is required to establish). Alternatively, only crushers licensed by the SPCB shall be used.
- Construction activities causing dust will not be carried out on excessively windy days.
- Unsealed routes for earthmoving equipment and general transport will be regularly sprayed with water during dry weather.

- Excavation work will be sprayed with water.
- Construction workers will be provided with masks for protection against the inhalation of dust and be trained in its use.

The management measure shall include agreed timings for movement of construction vehicles in agreement with the local population.

Institutional Responsibility:- Design Supervision Management Consultant (DSMC)/ Contractor.

C. Operation & Maintenance Phase:

The operation phase of this facility will involve movement of waste collection & transfer vehicles and machinery, segregation of waste, composting, fugitive dust & odour emission from waste handling in landfill site, which may result in generation of odour, dust and gaseous emissions.

The management measures for different air pollutants are given below:

Odour:

- Maintaining buffer zone and plantation around the facility.
- The waste should not be stored for more than 24 hours at site. If the waste is stored more than 24 hours the stockpile height should not exceed 3 meters and the area of waste stockpile should have provision for odour control.
- Vehicles carrying solid waste shall be covered.
- It is preferable that the container and bins used for collection of wastes should be of closed type so that the waste is not exposed and thus the possibility of spreading of disease through flies and mosquitoes is minimized.
- Collection system should be properly supervised so that quick and regular removal of waste from the dustbin is practiced.
- Compost plant should have some provision for odour control.
- Waste to be promptly disposed of in appropriate cells of landfill, covered with soil to control release of hazardous gases and unpleasant odour emitting emissions.

Dust and gaseous emissions:

- All vehicles, machinery, equipment and generators used during project activities shall be in good condition and shall be properly tuned and maintained by contractor in order to minimize the exhaust emission.
- Emissions from waste handling areas shall be controlled by provision of covered areas, proper ventilation and by maintaining negative pressure. Herbicides will be sprayed to discourage further decomposition of MSW.
- Water spray system shall be provided around the Site.

- Internal unpaved roads and transportation roads will be sprayed with water to minimize dust.
- Tree plantation on the completed section of the landfill site as well as around the project site should be carried out to reduce the dust emission and minimize adverse aesthetic impact
- Monitoring of the operational performance of the various mitigation /enhancement measures will be carried out as a part of this project.
- Monitoring of various air quality parameters shall be carried out to check the effectiveness of EMP.

Institutional Responsibility:- Design Supervision Management Consultant (DSMC)/ Contractor and after commissioning Aizawl Municipal Council/SIPMIU.

7.5.2 Water Quality:

Project activities will affect the quality of surface as well as ground water. The suggested management plan for water quality and quantity is as follows:

A. Pre-construction Phase:

During pre-construction phase the contractor shall ensure following:

- The proposed site is located in hilly area, so proper embankment design shall be prepared to prevent flooding in rainy season.
- The contractor will arrange the water primary work of pre-construction such as site clearance and construction purpose.
- The contractor will need to comply with the requirements of the state Ground Water Department before extracting ground water and seek their approval for doing so.
- Contractor can use the nearby stream, water which are not in use by community or identified to fill up for the project, but in that case, before using any surface water, contractor will inform the concerned authority/ user (if any) . To avoid disruption / disturbance to other water users, the contractor will extract water from fixed locations.
- The contractor will not be allowed to pump from any irrigation channel and other surface water bodies used by local community.
- Contractors shall design sewage treatment facility for treatment of liquid waste generated from labour camp, wastewater, leachates from Landfill and compost plant.

Institutional Responsibility:- Design Supervision Management Consultant (DSMC)/ Contractor.

B. Construction Phase:

During construction phase the contractor shall ensure the following:

- Contractor will ensure that no construction materials like earth, stone, ash or appendage disposed off so as not to block the flow of water of any water course, and cross drainage channels.

- In addition to the design requirements, the contractor will take all required measures to prevent temporary or permanent flooding of the site or any adjacent area. The Contractor will not excavate beds of any stream/ canals/ any other water body for borrowing earth for embankment construction.
- Contractor will ensure that construction materials containing fine particles stored in an enclosure such that sediment-laden water does not drain into nearby watercourse.
- The contractor will ensure that all construction vehicle parking location, fuel /lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites will be located away from any source of surface water.
- Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the water. Oil interceptor/grease chamber shall be provided for vehicle parking, wash down and refueling areas. Field storage will be in proper bunded areas.
- In all fuel storage and refueling areas, if located on agricultural land or areas supporting vegetation, the topsoil will be stripped, stockpiled and returned after cessation of such storage. Contractor will arrange for collection, storing and disposal of oily wastes to the approved disposal sites. All spills and collected petroleum products will be disposed off in accordance with MoEF and MPCB guidelines.
- Proper drainage system (open or closed) should be prepared to meet the water requirement.
- The project area shall be protected by proper embankment to prevent flooding.
- Proper separate drainage pattern should be prepared to divert the flood water/rain water.

Institutional Responsibility:- Design Supervision Management Consultant (DSMC)/ Contractor.

C. Operation & Maintenance Phase:

During operation and maintenance phase of the landfill following precautions should be taken:

- It will be ensured that all drains are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding.
- Leachates collection system shall be fully operative to prevent the contamination of the ground water of the area. The leachate generated will be collected in the sump/Leachate collection tank and treated by recirculation method.
- To protect the windrows of compost plant from heavy rainfall, the windrow area shall have provision for quick cover.

- All windrow areas should be provided with an impermeable base made of concrete or of compacted clay.
- The base should be 50 cm thick having permeability less than 10 cm per second. The base must be provided with 1 to 2 percent slope and must be encircled by lined drains for collection of leachates/surface water runoff
- Provision of liners (a compacted clay layer) at the landfill site before the start of filling operations.
- Regular checking for functioning of leachates collection, treatment and disposal system.
- Regular monitoring of ground water from the site shall be carried out to check whether any contamination is present.
- The surface water run-off shall be collected and safely treated and disposed off to prevent accumulation of water and avoid breeding of flies, mosquitoes.

Institutional Responsibility:- Aizawl Municipal Council (AMC)/SIPMIU

7.5.3 Soil Quality:

The project site is located on un-used private forest land as well as government land belongs to UD&PA department. The activities of the project can affect the soil quality and change its properties. To mitigate the impacts on soil following precautions management shall be taken by the concern authority:

A. Pre-construction Phase:

The project site is present in low lying /hilly un-used private forest land. Construction of MSW management facility on this site will change the land use of the area. Since, it is the only site available with SIPMIU for the proposed project so some specific precautions shall be taken during designing phase.

- Proper landscaping and vegetation will have to be provided to minimize the impacts on the ecology of the area.
- Baseline study of soil physical & chemical properties shall be done.
- Precautionary measures should be designed to prevent the loss of top soil.
- Identify proper source for soil, required for embankment height and leveling of ground.

Institutional Responsibility:- Design Supervision Management Consultant (DSMC)/ Contractor.

B. Construction Phase:

The construction phase of the proposed facility will involve open excavations from landfill site and the possibility of silt run-off in case of rain. These operations may

cause soil erosion. It may also affect the land value. During rainy period, the eroded soil will transform into slush, which can affect movement of construction vehicles and machinery. Following mitigation measures shall be taken to minimize the negative impacts due to soil erosion:

- Restore/Stabilize all the freshly cut surfaces around the borrow pits, steep slopes and along drainage channels as soon as possible.
- Planning construction activities in such a way so as to avoid cutting of erodible surfaces and earth movement in rainy season.
- Trimming down of slopes.
- The soil removed for landfill construction can be used for leveling of ground and preparing access roads.

Institutional Responsibility:- Design Supervision Management Consultant (DSMC)/ Contractor

C. Operation & Maintenance Phase:

Monitoring of the operational performance of the various mitigation/enhancement measures will be carried out as a part of this project. The indicators selected for monitoring include the survival rate of trees, status of rehabilitation of borrow areas, physico-chemical characteristics of soil etc.

Institutional Responsibility:- AMC/SIPMIU

7.5.4 Noise Quality:

Project activities on the site increase the noise level and affect the surrounding habitants. To control the noise pollution some measures should be taken in every phase of the project.

A. Pre-construction Phase:

During this phase, noise will be generated during demolition work(As minor demolition/removal of tree is required) only. This is short term activity and will not create any hazards/significant impact to the surrounding people.

B. Construction Phase:

The Contractor will confirm the following:

- All plants and equipment used in construction (including the aggregate crushing plant) shall strictly conform to the CPCB noise standards.
- All vehicles and equipment used in construction will be fitted with exhaust silencers.
- Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of

exhaust silencers will be checked and if found defective will be replaced.

- Limits for construction equipment used in the project such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A) (measured at one meter from the edge of equipment in the free field), as specified in the Environment (Protection) rules, 1986.
- Maintenance of vehicles, equipment and machinery shall be regular.
- Providing residents/commuter with advance warning of construction activities.
- Where possible, confining noisy work to normal working hours in the day.
- Providing the construction workers with suitable hearing protection devices like ear plug and provide training them in its use.
- Restricting construction traffic movements during the night time

Institutional Responsibility:- Design Supervision Management Consultant (DSMC)/ Contractor

C. Operation & Maintenance Phase

During operation phase of the project the waste transporting vehicles, compactors etc will generate noise and affect the local residents/commuter. Below mentioned precautionary measures shall be followed by the operator:

- Noise pollution will be monitored as per monitoring plan at sensitive locations. Noise control programs to be enforced strictly.
- Ban use of pressure horns.
- Strict check of silencers and vehicles generating excess noise levels.
- Tree plantation act as noise barrier help in minimizing noise level in the surrounding.

7.5.5 Flora and Fauna

The project site is located adjacent to existing dumping site. Vicinity of site represents open forest area (private). No endangered species of flora and fauna is present in and around the site. But to prevent the damage to domestic flora and fauna some steps shall be taken while execution of the project.

A. Pre-construction Phase:

Significant numbers of trees are expected to be cut as the proposed site is in forest (open & private) forest area. The present area (partly) is being used for dumping of municipal wastes. There are sparse vegetation covers in the proposed project site.

B. Construction Phase

The contractor will take reasonable precaution to prevent his workmen or any other persons from removing and damaging unnecessary flora (plant/vegetation) and fauna (animal) around the site. The site is away from the city and very few domestic animals are present in and around the site (details has been given in chapter 5 ie. **5.9 Biological Environment/Bio Assessment Study area**). There will be no significant negative impact on these animals present at the site and in the vicinity of the area. There are no endangered species of animal or birds in the area, hence, no significant negative impacts are envisaged on the fauna.

C. Operation & Maintenance Phase

During operation and maintenance phase of the project the proper maintenance of the surrounding buffer zone or plantation shall be done. The site shall be properly fenced to avoid the entry of animals. The waste layer shall be covered with proper soil layer daily to avoid the growth of disease causing vectors and also to avoid the birds flock.

7.5.6 Social Environment:

During site selection for the municipal solid waste management facility a numbers of social factors have been taken in to account. A numbers of factors like aesthetics, diseases, odour etc affect the site selection for landfill site. The best site for landfill site has been selected viewing all the available site, away from the densely populated areas. The site is away from airport and the flight path as the birds on the site can cause flight accidents. The final selection of the site have been done by comparing:

- the environmental impacts;
- social acceptance; and
- transportation and landfilling cost

After finalizing the site a number of social factors have been taken into account during different phases of the project to prevent the degradation of social environment.

A. Pre-construction Phase:

During designing phase of MSW management facility all the following social factors are to be addressed:

- Elimination of source of health hazard;
- Substitution of hazardous processes and materials by those which are less hazardous;
- Geographical or physical isolation of hazards from vulnerable communities, for example, by land zonation;

- Use of engineering controls to reduce the health risk. For example, collection containers and bins shall be closed type so that spreading of disease through flies and mosquitoes is minimized;
- Adoption of safe working practices such as regular equipment maintenance;
- Designing of suitable personal protective equipment, such as rubber gloves.
- Surveillance and monitoring of site specific health hazards, general health status of local communities, location and functioning of health services
- Effective designing for maintaining the aesthetic look of the site.

B. Construction Phase

Contractor will provide:

- Protective footwear and protective equipments to all workers employed during construction.
- welder's protective eye-shields to workers who are engaged in welding works
- protective goggles and clothing to workers engaged in stone breaking activities and workers will be seated at sufficiently safe intervals
- Earplugs to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation.
- The contractor will not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with products containing lead in any form.
- The contractor shall do OHS monitoring, environmental health, water supply, sanitary system, drug supply, vector monitoring
- The contractor will ensure that the sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs to the workers.
- The contractor will provide garbage bins in the camps and regularly emptied and disposed off in a hygienic manner as per the comprehensive Solid Waste Management plan for the labor's camp

C. Operation & Maintenance Phase

During operation and maintenance phase the operator will ensure:

- Contractor will confirm routine medical examination, action oriented disease trend analysis, child growth monitoring, OHS monitoring, infant mortality monitoring, vector monitoring, casualty rates etc
- Contractor will ensure the aesthetic value of the site and its surrounding.
- Use closed container for transportation of waste to avoid the spreading of foul odour

- Hazardous waste shall be handle with extra care
- Daily coverage of waste by soil covers in landfill to prevent the growth of disease vectors.
- Spraying of insecticides, rodenticides etc. to control insects, pests and rodents proliferation in the Site.
- Regular check-up of workmen health and provision of necessary vaccinations to prevent the spread of any disease.
- To cope with any fire hazard due to gas combustion or due to failure of gas collection and disposal system fire extinguishers will be provided at the Site.
- An occupational Health & Safety Plan shall be prepared by contractor for operation of site and protection of workers & neighboring areas.
- The workers directly involved in collection and disposal activities should be provided with goggles, gum boots, hand gloves, mask, etc.

7.5.7 Labour Camp Management:

The contractor will provide, erect and maintain necessary (temporary) living accommodation and ancillary facilities for labour at the location identified for such facilities in pre-construction phase.

The Contractor will provide these facilities within the precincts of every workplace, latrines and urinals in an accessible place, and the accommodation, as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996.

The Contractor will construct and maintain all temporary accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing.

The contractor shall also guarantee the followings:

- Supply of sufficient quantity of potable water in every workplace/labour campsite at suitable and easily accessible places and regular maintenance of such facilities.
- If any water storage tank is provided that will be kept at a distance of not less than 15 m. from any latrine, drain or other source of pollution.
- If water is drawn from any existing well, which is within close proximity of any latrine, drain or other source of pollution, the well will be disinfected before water is used for drinking.
- All such wells will be entirely covered and provided with a trap door, which will be dust proof and waterproof.
- A reliable pump will be fitted to each covered well. The trap door will be kept locked and opened only for cleaning or inspection, which will be done at least once in a month.

Resident Engineer will be required to inspect the labour camp to ensure the compliance of the EMP.

The contractor shall ensure that

- the sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent watercourses take place
- separate latrine and urinals, screened from those from men (and marked in the vernacular) are provided for women workers
- adequate water supply shall be there to all latrines and urinals
- all latrines in workplaces shall have properly designed septic tanks with soak pits and all latrines, and urinals are cleaned at least twice during working hours and kept in a strict sanitary condition
- The designs of septic tanks and soak pits shall be as per the manual on sewerage system prepared by CPHEEO. The designs shall be approved by Resident Engineer.
- The contractor will provide garbage bins in the camps and regularly emptied and disposed off in a hygienic manner as per the comprehensive Solid Waste Management plan for the labour/ contractor's camp approved by the Resident Engineer.
- Contractor will follow all relevant provisions of the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp.
- The site will be left clean and tidy, at the contractor's expense, to the entire satisfaction to the Resident Engineer.

7.5.8 Recommendation for Measures for Pollution Control

The following management measures have been formulated as mitigation measures to overcome any adverse environmental impact due to the project construction, operation and ultimate closure. The proposed measures are in conformity with the Municipal Solid Waste (Management and handling) Rules,2000 under Environment Protection Act 1986.

- A buffer zone of no development will be maintained around the landfill to isolate from adjoining areas. The landfill site will be boundary wall with proper gate and gate so that no person is exposed to health hazards of land fill. A bottom layer of non-permeable lining system at the base and walls of the waste disposal area to arrest leachate percolation to ground water will be provided.
- Incoming waste will be compacted in layers and covered with soil periodically.

- There will be provisions of leachate collection and treatment. There will be provision for prevention of runoff from landfill.
- Periodic health inspection of workers at the landfill site will be organized to put a check on occupational health hazards.
- Plantation of locally adopted non-edible perennial plants that are resistant to drought and extreme temperature and allowed to grow. The selected plant species to have the ability to thrive on low nutrient soil with minimum nutrient addition.
- The landfill site will be boundary wall with proper gate and gate so that no person is exposed to health hazards of land fill.
- A bottom layer of non-permeable lining system at the base and walls of the waste disposal area to arrest leachate percolation to ground water will be provided.

7.5.9 Greenbelt Development

A green belt is provided to mitigate various emissions. Green belts are wide strip of trees and shrubs planted in rows to reduce air velocity thereby facilitating settling of the particular pollutant on the leaf surfaces and allowing absorption of the pollutant gases. It also serves to cool the atmosphere by transpiration from the leaf surfaces and also provide habitat for birds, reptiles and insects. Greenbelts are important habitats for birds and animals, which add to the aesthetic value of the environment. Generally, birds prefer to make their habitat, nest, on trees. Further trees provide shade and hiding place to wild life. The advantages of a green belt are given below:

- Greenbelt helps to restore the ecological balance.
- Greenbelt helps in prevention of soil erosion.
- Greenbelt helps to improve the aesthetics in the area.
- The greenbelt also diminishes noise pollution by absorbing high degree of noise due to their spongy foliar crown.

7.5.10 Selection criteria of Plant species for Green belt development

The selection of plant species for the development depends on various factors such as climate, elevation and soil. The plants should exhibit the following desirable characteristic in order to be selected for plantation.

1. The species should be fast growing and providing optimum penetrability.

2. The species should be wind-firm and deep-rooted.
3. The species should form a dense canopy
4. As far as possible, the species should be indigenous and locally available.
5. Species tolerant to air pollutants like SPM, SO_x and NO_x should be preferred
6. The species should be permeable to help create air turbulence and mixing within the belt

The pollutants namely dust/fugitive emissions, sulphur dioxide, smoke and carbon dioxide along with the noise pollution can be effectively curbed by planting the below mentioned specific floral species. The proposed plantation would include:

Table 7.3: List of Floral Species for Controlling

S.No.	Sulphur Dioxide	S.No.	Dust/Fugitive Emissions
1.	<i>Casuarina equisetifolia</i>	1.	<i>Ficus sp.</i>
2.	<i>Albizia lebbek</i>	2.	<i>Azadirachta indica</i>
3.	<i>Acacia nilotica</i>	3.	<i>Tamarindus indica</i>
4.	<i>Azadirachta indica</i>	4.	<i>Butea monosperma</i>
5.	<i>Delonix regia</i>	5.	<i>Lagerstroemia speciosa</i>
6.	<i>Moringa oleifera</i>	6.	<i>Peltophorum sp.</i>
7.	<i>Eucalyptus sp.</i>	7.	<i>Pterocarpum sp.</i>
8.	<i>Morus Alba</i>	8.	<i>Tectona Grandis</i>
9.	<i>Psidium guauva</i>	9.	<i>Grevillea robusta</i>
10.	<i>Syzygium cumini</i>	10.	<i>Terminilia arjuna</i>
11.	<i>Zizyphus mauritiana</i>	11.	<i>Holoptelea integrifolia</i>
S.No.	Smoke & Carbon monoxide	S.No.	Noise
1.	<i>Alianthus excelsa</i>	1.	<i>Azadirachta indica</i>
2.	<i>Azadirachta indica</i>	2.	<i>Aegel mermelos</i>
3.	<i>Bougainvillea spectabius</i>	3.	<i>Cassia siamea</i>

4.	<i>Cassia fistula</i>	4.	<i>Albizzia procera</i>
5.	<i>Albizia lebbeck</i>	5.	<i>Carris carandas</i>
6.	<i>Delonix regia</i>	6.	<i>Peltophorum inerme</i>
7.	<i>Holoptelea integrifolia</i>	7.	<i>Saraca indica</i>
8.	<i>Moringa oleifera</i>	8.	<i>Syzygium cimunii</i>
9.	<i>Pithecellobium dulce</i>	9.	<i>Tamarindus indica</i>
10.	<i>Polyalthia longifolia</i>	10.	<i>Thivetia puruviana</i>
11.	<i>Derris indica</i>	11.	<i>Pongamia pinnata</i>
S.No.	Plant Species for protection against strong winds	S.No.	For Roadside plantation
1.	<u>Tabernaemontana</u> <i>coronaria</i>	1.	<i>Petophorum inerme</i>
2.	<i>Cadrella toona</i>	2.	<i>Pongamia pinnata</i>
3.	<i>Ficus religiosa</i>	3.	<i>Saraca indica</i>
4.	<i>Dalbergia sissoo</i>	4.	<i>Delonix regia</i>
5.	<i>Borassus flabellifer</i>	5.	<i>Azadirachta indica</i>
6.	<i>Hardwickia binnata</i>	6.	<i>Samania saman</i>
		7.	<i>Cassia nodosa</i>
		8.	<i>Baucinia Latifolia</i>
		9.	<i>Bauncinia variegata</i>
		10.	<i>Acacia auriculiformis</i>

ANNEXURE 2

RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

9.1 Risk Assessment

The proposed land fill site is situated at the outskirts of town. A qualitative assessment of potential hazards posed by landfill site has been summarized in this section.

9.2 Geology Landfill Site

The geophysical investigation indicates the sedimentary basin complex of Assam Shelf and Assam-Arakan. The Assam-Arakan sedimentary basin is a shelf-slope-basinal system. The shelf part of the basin spreads over the Brahmaputra valley. These underground rocks are massive in nature and only top surface exposed to atmosphere is weathered.

The water levels in the area depend upon physiography and Hydrogeological conditions. The general topography of the site is undulating. The slope of the proposed landfill site is more than 10% due to these undulations. The water level of the area is directly related with topographic variations and Hydrogeological conditions. Hence, there is a variation in water level at the site.

9.3 Description of Assessment Methodologies

- a. **Source** - location, nature and likely quantities which has the potential to affect the development.
- b. **Pathway** - the ground and groundwater conditions
- c. **Target** - elements of the development that are sensitive to the effects of landfill

The landfill identified pathway(s), and identified target(s) are then categorized in order to facilitate the assessment process.

9.4 Evaluation of Landfill / Estimation of Leachate Quality and Quantity

On a basis of review of liner systems adopted in different countries, it is recommended that for all MSW landfills the following single composite liner system be adopted (waste downwards) as the minimum requirement.

- A. A leachate drainage layer 30 cm thick made of granular soil having permeability (K) greater than 10^{-2} cm/sec.
- B. A protection layer (of silty soil) 20 cm to 30 cm thick.
- C. A geomembrane of thickness 1.5 mm or more.
- D. A compacted clay barrier or amended soil barrier of 1 m thickness having permeability (K) of less than 10^{-7} cm/sec.

The liner system adopted at any landfill must satisfy the minimum requirements published by regulatory agencies (MOEF / CPCB).

The liner system may have to be more stringent in free draining alluvial soils at locations where water table level is close to the base of the landfill.

The recommendations for the liner system are not expected to be reduced. However in circumstances where it can be proven by subsoil investigations as well as by hydrological investigations that the leachate will not cause harmful impact to the soil as well as ground water, the norms can be reduced after approval by the regulatory authority.

9.5 Migration Pathways

a. Natural Path

The geological formation beneath the landfill essentially comprises basaltic rocks. The air permeability of these rocks is considered relatively low.

There may be some layers of rocks underlying the landfill site. Appropriate treatment on bottom and slopes would be provided. Therefore, these layers will not form a natural pathway

b. Man-made Pathways (Utilities)

There are no man-made pathways (utilities) around the proposed landfill site. Therefore, it is considered that there are no man-made pathways link between the landfill and nearby areas.

c. Targets

During the operation phase of the landfill, significant excavation will not be carried out for the development of landfill in phased manner due to its topography (Hilly terrain) . The excavation is considered not to be a target near the landfill and the deepest excavation will not be undertaken below the existing level. It is anticipated that appropriate structural measures would be taken around the designed excavated area to prevent the ingress of groundwater into the excavations during the course of the development of the landfill site.

9.6 Recommendations for Protection Measures

Some protection measures will be required to protect the proposed landfill site from risks. Recommendations for protection measures to minimize the landfill hazard at the landfill site are proposed and presented as follows :

a. Development Phase

Smoking, naked flames and other sources of ignition should be prohibited within 15 m of any excavations. Signs such as 'No Smoking' and 'No Naked Flame' should be in place in the vicinity of excavations.

All electrical equipment to be used in excavations should be intrinsically safe.

Adequate fire extinguisher, fire-resistant clothing and breathing apparatus should be provided on site.

9.7 Landfill Fire Management

Fires in waste on landfill sites are not uncommon and it is important for site operators to be aware of the dangers, how to treat fires and to address the problems associated with them. All fires on-site should be treated as a potential emergency and dealt with accordingly.

The site should have an emergency tipping area set aside from the immediate working area where incoming loads of materials known to be on fire or suspected of being so can be deposited, inspected and dealt with.

Waste that burn on delivery should be doused with water or more preferably covered progressively with adequate supplies of damp soil/cover followed by cooling and finally removal to its disposal point. It should not normally be allowed to burn itself out as this will give rise to nuisance from smoke & odour and may constitute a health risk. Fire fighting techniques shall be appropriate for the waste type.

Fires within the operational areas are either surface fires or deep seated fires. The former usually occur in recently deposited and as yet uncompacted materials adjacent to the current working areas, whilst the latter are found at depth in material deposited weeks or months earlier. Site operators shall have a plan to deal with each type of fire and have a code of practice for their operations stating exactly how to tackle any outbreak. Regardless of the circumstances, no individual should ever tackle a landfill fire alone. Deep-seated fires require expensive remediation techniques including vertical cut-offs.

9.8 Disaster Management Plan

Disaster management is one of the most important key for the safe operation of landfill site, more so that due to the complex nature of the operations involved. Disaster can be defined as the sudden occurrence of such magnitude as to affect normal pattern of life in the landfill and vicinity causing extensive damage to life and properties. Disaster is an emergent situation which affects or has the potential to

affect personnel working therein, resulting in extensive damage to the property, loss of life and disruption of work. Localised accidents, however, are not to be mixed up with or misunderstood as a disaster.

The development of an effective disaster management plan ensures that unforeseen identified impacts of the proposed development are minimised. In addition, it guarantees an effective basis to assess the source and extent of impacts, if they occur. If the disasters are foreseeable, the efforts to mitigate those disasters can be planned in advance.

At landfill site, an emergency can take place at any time due to disaster by nature or by major accident in the site, despite the installation of various safety devices. The causes of these accidents include:

- Fire
- Explosion

Unlike natural disasters, these can be prevented by proper plan and in case of accident the effect can be minimised by proper emergency response method. An important prerequisite for disaster planning is to foresee an accident scenario, which leads to major fire, explosion, toxic release, their spread or extent and their damage potential.

9.9 Objectives of the Plan

The important elements of Disaster Management planning can be classified as :

- Identifying the disaster potential scenarios and advance planning to combat and minimise the damage.
- Vulnerable zone delineation.
- Assessment of loss probability and its severity.
- To deal with such emergencies expeditiously.
- To act during disaster phase i.e. warning, protective actions like evacuation of personnel.
- To provide rescue relief, assistance to the people affected in the works, community, based on the actual needs and the information collected locally.
- To contain the disaster by isolating the area, fire fighting etc.
- To make efforts to return to normal condition when the situation is controlled.

9.10 Disaster Plan

It is a strategy well evolved, organised and rehearsed to contain the adverse effects of a possible disaster. It aims to mobilise the internal resources and use these with minimal dependence on external agencies for the following purposes:

- To control and contain incidents.
- To safeguard employees and people in the vicinity.
- To inform employees, the general public and the authorities about the hazards/risks assessed, safeguards provided, residual risk, if any, and the role to be played by them in the event of disaster.
- To effect rescue and treatment of casualties.
- To prevent recurrence of such a disaster.
- To establish machinery for review, rectification/modification of the emergency/disaster plan in the light of actual experience.
- To ensure safety of works before personnel re-enter and resume work.
- To work out a plan with all provisions to handle disaster and to provide for emergency preparedness and the periodic rehearsal of the plan.

9.11 Classification of Disaster

Disasters have been classified into three different categories

Industrial:

Following type of disasters are classified in this category:

- Accidental Leakage of methane or other toxic materials.
- Major fire occurrences in landfill site.

National :

Following type of disasters are classified in this category:

- Enemy invasion
- Bomb explosion
- Air raids
- Riots etc.
- Terrorists Acts

Natural:

- Earthquake
- Floods
- Lightning

- Heavy rains (downpour)

9.12 Rescue Team

A rescue Team under the direct supervision of landfill site in-charge is planned. The team will consist of Security personnel, Safety and Services (Maintenance) and Welfare officer. This team will be responsible for prevention as well as for dealing with any kind of disaster. The activity of the team will be as given below:

- To identify various types of disasters/emergencies to which landfill site will be prone to.
- To plan and augment area wise safety and other related facilities, if required, so as to match with the needs.
- To periodically organise mock exercise with respect to disaster plan to check the awareness and preparedness of the concerned agencies/personnel to meet the emergency.
- To prepare a general course of action to be adopted for any disaster/emergency. Further identification of specific steps that need to be taken unique to each type of disaster/emergency.
- To organise rescue operations during and after the emergency/disaster.
- To review the progress status on various activities relating to the compliance of Safety Rules, and communicate to all concerned for compliance.

9.13 Pre-Disaster Stage

The prevention of disaster is of vital importance and is the moral responsibility of each and every individual employed in the landfill site. It can be prevented by observance of precautionary and preventive measures. During pre-disaster stage following points will be followed to avert the occurrence of disaster:

- The emergency operation procedures of the landfill site will be written down so that no confusion is caused in the event of emergency taking place.
- To reduce the probabilities of accidental leakage of methane.
- Smoking will be prohibited in the areas where handling of landfill will be done. **NO SMOKING** boards will be prominently displayed in Local Language ie Mizo and English languages.
- All electrical wiring, fittings, cables, equipment will be checked periodically. Temporary wiring will not be permitted to be installed inside the landfill area. No inflammable material including papers, Oils, wooden racks will be stored within 1 meter of any electrical fittings. No unauthorised person will be allowed to tamper with electrical fittings.

- Welding, Burning, cutting, Chipping, Soldering work, etc will only be carried out by authorised person.
- Necessary compliance with various Statutory Guidelines and other relevant instructions as issued from time to time will be done.
- Safety Department will arrange to educate all concerned regarding operational hazards of non-compliance of the safety guidelines. They will also provide necessary guidance and support in proper implementation of the programmes. They will also arrange mock exercises periodically.
- Safety Department will display at prominent places important telephone numbers and instructions, in Mizo & English languages.

The Security Control Room located at the landfill site will be equipped with the following -

- Sufficient number of copies of On-Site Disaster/Emergency Management Plan.
- Master plan of the landfill site indicating vital locations and possible sources of disaster. .
- Important Telephone numbers
- Emergency lights (portable) and Wireless sets (if required and possible).
- First Aid boxes
- Stretchers, blankets and other essential items at the fire station under the charge of Fire Services **Dep't**.

9.14 Disaster Stage

The most probable disaster which may occur at landfill site is because of accidental leakage and fire. To control leakage and fire the following measures/precautions will be taken at the landfill site:

a. Fire Fighting System

The guidelines as given below for the protection of fire will be followed :

- The landfill's fire protection will consist of structural solutions, fire extinguishing systems and fire alarm systems. The fire extinguishing system will consist of the fire system with fire pumps, distribution pipelines, hydrants and fire hoses and the portable extinguishers.
- The fire alarm system will be a part of the primary systems and take care of the places which are unmanned or will not have any fixed fire extinguishing system.

- The major operation areas shall be equipped with fixed smoke detectors, CO2 extinguisher near the door in the control room.
- All the rooms in the office shall be equipped with fixed smoke detectors.
- The ventilation rooms shall be equipped with fixed smoke detectors. One CO2 extinguisher will be located near the door to ventilation room.
- The fire alarm and detection system shall be designed, installed, maintained and tested according to relevant standards.
- The water for fire fighting shall be stored in the fire water tank (water reservoir).
- CO2 fire extinguishers contain extinguishing carbon dioxide which either by it or under expected conditions of use gives off CO2 to prevent fire.
- Dry fire extinguishers contain extinguishing medium which either by itself or under expected conditions of use will give fine powder to prevent fire to get oxygen.
- As soon as a fire/disaster/emergency takes place inside the premises of landfill, action to be taken by various persons/officials will be as follows :

1. The person noticing a disaster/emergency situation will :

- Raise the alarm by shouting.
- Give message to Safety department on telephone/personally giving full and clear message of accident.
- If the emergency/disaster is small enough for tackling by person alone, immediate attempts to control it by using nearby control equipment.

2. The person arriving next on scene will :

- Inform respective control room on telephone.
- Attempt to control the disaster with due care of personal danger.
- Make sure that exit routes are free and road for approach for rescue vehicles is clear and unobstructed.

3. By other persons of Disaster Area :

- All required persons would not leave the place of disaster and continue their functions and operate essential equipment and emergency systems till ordered to evacuate considering the building/section and the immediate surroundings.
- All other non-essential persons would be evacuated safely and would be collected in safe place of assembly under an executive and should act in accordance with his instructions.

4. Sectional In-charge of the disaster area :

- On hearing the alarm or on receipt of message regarding accident in his area, he will immediately proceed to the scene of the accident in his area.
- He will ensure that Safety Department is informed about the accident and if required, should inform Main/Control Gate Security for sounding hooter.
- He should ensure that all important documents, precious material are salvaged / removed to safe place with the help of his section staff.
- He should decide in consultation with other senior officers present and arrange to switch off power/gas/air or any other equipment or system if so warranted to control the situation.
- He will give top priority to the calls of accident and immediately inform the location of the disaster to the following :
 - Chief Executive Officer
 - Safety Department
 - Main Gate/Safety Officer
 - Welfare Officer
- He will take all necessary steps required in the emergency situation regarding operational control of the landfill site.
- He will guide/assist rescue staff in combating the disaster/emergency situation.
- He will mobilize all spare trained personnel to help in tackling the jobs such as fire, rescue, moving of casualties & salvage operations.

5. All persons of the area Not affected by accident :

- On hearing the alarm sounded or Siren, work in the building and landfill site, will not be stopped, unless specifically told by In-charge of the section.
- All persons of the section are available at their respective work place for any assistance that may be called for till all clear is sounded.
- They will extend their fullest co-operation to meet the situation if called for by affected section.

6. Rescue team :

- On arrival at the scene of the accident, In-charge of rescue team will enquire about the details of accident, quickly size up the situation. Rescue team will immediately operate fixed fire fighting systems or initiate other appropriate action according to situation.
- He will also take action for calling the additional fire brigades from town administration, if required, and co-ordinate with them.

- He will make sure that the necessary water, foam compound, dry powder, carbon dioxide gas, or any other fire fighting agents equipment required according to situation are readily available at the fire spot.
- He will take appropriate action simultaneously to protect the unaffected areas.
- He will direct the fire fighting rescue operations till all clear is given.

7. Security Main Gate:

Security guard of Main Gate on receipt of message of emergency/fire will immediately sound the alarm on Siren in Wavering sound for 5 minutes.

- He will not permit any one to leave/enter Main gate except essential persons of the landfill after thorough check and verification.
- He will arrange to keep the main gate road clear for outside assistance.
- On receipt of ALL CLEAR message from concerned officials of landfill site conducting Emergency/Fire fighting operations, he will sound ALL CLEAR siren by continuous blast of one minute.

8. Security in-charge:

- He will immediately rush to the place of incident and arrange for Security Cordoning.
- He will see that no unwanted personnel approach the place of incident. He will also take charge of security of landfill site's property.
- He will inform police in case of serious accident when casualties are involved in consultation with In-charge (Landfill Site).
- If casualties are involved he will make arrangement to shift them to town Hospital by ambulance or any other available vehicle.

9. Safety Officer:

Safety Officer and his personnel will make available all safety gadgets and personnel protective equipment etc according to the situation at the scene of incident.

- He will see that all persons entering the place of occurrence are wearing protective equipment.
- He will ensure that fire fighting personnel and other persons while fighting emergency/fire is in safe place/position.
- He will make complete note of the incident inform about the incident to the concerned authorities as per statutory provision in consultation with Engineer-in -charge of landfill site.
- He will make arrangement for evacuation of staff if necessary in consultation with Executive Engineer (Landfill Site).

10. Welfare Officer

- He will manage the availability, quality and quantity of canteen Tea, Snacks and Food facilities for staff of the landfill site.
- He will arrange the uniforms for the workers of the landfill site.
- He will co-ordinate the sports activities for the employees of the landfill site.

9.15 Post Disaster Stage

After the incident a report will be prepared regarding occurrence of event/losses incurred and recommendations thereof for restoration of normalcy.

9.16 Reporting of Accidents

Situation in totality will be studied thoroughly, investigated with respect to the cause of the incident, extent of loss of life and property and a detailed report prepared by the individual/team nominated by landfill site authorities for this purpose.

Based on the investigation report, rescue team would finalise time bound programmes for implementation of corrective measures proposed and regularly monitor the progress thereafter. Rescue, medical and welfare operations would be continued by the concerned agencies.
