

Reference No: REEL/TSDF/MANERI/EC/20-21/02 Date: July 22, 2020

To The Member Secretary Expert Appraisal Committee (Infra-2) Ministry of Environment, Forest and Climate Change Indira Paryavaran Bhavan, Jor Bagh Road New Delhi – 110003 Ramky Enviro Engineers Limited Corporate Office: 13th Floor, Ramky Grandiose Ramky Towers, Gachibowli Hyderabad - 500 032, Telangana T: +91 40 2301 5000 F: +91 40 2301 5100 www.ramkyenviroengineers.com

Towards sustainable growth

Subject:Submission of Additional Details - Integrated Common Hazardous Waste Treatment,
Storage, Disposal & Recycling Facility at Industrial Growth Center (IGC), Maneri Village,
Mandla District, Madhya Pradesh by M/s Ramky Enviro Engineers Limited.

Reference:

2. Proposal No. IA/MP/MIS/117811/2019

1. File No. 10-40/2019-IA-III

3. Minutes of 48th EAC (Infra-2) Meeting held on January 29, 2020 (Agenda Item No. 48.4.3.)

Respected Sir,

During the appraisal of our proposal for 'Environmental Clearance' in 48th EAC meeting held on 29th January, 2020, the EAC deliberated upon the EIA Report submitted by the project proponent and observed some deficiencies. The EAC asked us to review the EIA and resubmit the Revised EIA Report addressing the deficiencies.

We are hereby submitting the Revised EIA Report (*attached with this letter*) duly addressing all the deficiencies identified by the EAC. Summary of Changes made in the EIA Report based on the deficiencies identified by the Hon'ble EAC are presented in Table -1 below:

S.No.	Deficiency identified by the Hon'ble EAC	Improvements made in the Revised EIA Report.
1	The EIA does not give details of industries, their nature and type of hazardous waste generated that will go into proposed TSDF.	Annual hazardous waste inventory in the state of Madhya Pradesh, published by MPPCB for the past few years has been taken into consideration for estimating the future waste quantity (details provided in Chapter 1, Section 1.3.1.). Different types of industries in the state of Madhya Pradesh in different regions are listed out in Table 1.4 in Chapter 1. Different kinds of hazardous wastes expected to be treated at the proposed facility from different kinds of industries are presented in Table 1.5.
2	There is mix up of units in the EIA report. Both British system (acres) and metric system square meters) are used in the report. Single system need to be used.	The EIA report has been revised with all the units presented in metric system only.

Table – 1: Summary of changes made in the Revised EIA Report



S.No.	Deficiency identified by the Hon'ble EAC	Improvements made in the Revised EIA Report.
3	Fresh water requirement for various	As advised, the possibility of using treated water to the
	activities like gardening, incineration,	maximum extent has been looked at, by providing
	biomedical waste treatment etc, need to	additional tertiary treatment systems to make use of
	be justified. Explore the possibility of use	treated water reuse for all the processes within TSDF.
	of treated wastewater for such activity.	Also, it is now proposed to utilize only the treated water
		for gardening/greenbelt development purposes. Similarly,
		for stabilization operations, it is proposed to use only the
		treated water. For incineration, it is proposed to meet
		$2/3^{rd}$ of the water requirement through treated water
		only. The revised water requirement details are presented
		in Table 2.5. in Chapter 2.
4	There is no data of quantity of different	Information on different types of waste that would go
4	There is no data of quantity of different	
	type of waste that would go into	into incinerator (such as pesticide wastes, phenolic wastes
	incinerator. There is no mention of the	etc.) has been provided in Section 2.5.5 in Chapter 2.
	capacity of incinerator in the project	Capacity of incinerator (2,500 kg/hr) and the capacities of
	description.	all other proposed facilities are now mentioned in
		the project description(s) given in Chapter 2 .
5	The project description indicates	It is proposed to generate 2 MW of power from
	generation of 2 MW of power each from	renewable energy (solar power project) and another 2
	renewable and Waste to Energy. Lay out	MW of power from high calorific value hazardous waste
	plan does not reflect the location of the	streams/alternate fuel produced from the Alternate Fuel
	facility. There is no clarity on how the	and Raw Material Facility (AFRF). The proposed location
	industry is going to achieve this. The EIA	of the waste to energy plant is shown in the layout of the
	report is silent on Waste to Energy system	project (presented in Figure 2.3 in Chapter 2). Section 2.9
	to be adopted and power generation from	and Section 2.10 in Chapter 2 provide detailed
	Renewable sources.	description of the Solar Power Plant and the Waste to
	Kenewable sources.	Energy Plant respectively.
6	In baseline data collection, report	
0	· · ·	To understand the local micrometeorology, an automatic
	mentions that data is generated during	weather station (solar powered) was installed at the
	October to December but is silent on all	proposed site for collecting the data - Temperature,
	other aspects like frequency of collection.	Relative Humidity, Wind Speed and Wind Direction. The
	There is no clarity-if data (including micro-	weather station was programmed to record and
	meteorology) is collected twice a week or	
	for the entire duration of the period of	automatically save the readings on an hourly basis. The
	study.	primary data thus collected during the entire study period
		(October to December 2019) has been summarized and
		presented in Table 3.1 in Chapter 3.
		Ambient air quality monitoring stations were selected on
		the basis of surface influence, demographic influence and
		meteorological influence. During the study period,
		monitoring was carried out twice per week for 12 weeks
1		
		at each sampling station for all the twelve parameters
		at each sampling station for all the twelve parameters
		listed in the National Ambient Air Quality (NAAQ)
		listed in the National Ambient Air Quality (NAAQ) Standards. Sulphur dioxide (SO_2) , Oxides of Nitrogen
		listed in the National Ambient Air Quality (NAAQ)
		listed in the National Ambient Air Quality (NAAQ) Standards. Sulphur dioxide (SO ₂), Oxides of Nitrogen (NO _x), Particulate Matter (PM<2.5 μ m, PM<10 μ m), Lead,
		listed in the National Ambient Air Quality (NAAQ) Standards. Sulphur dioxide (SO ₂), Oxides of Nitrogen (NO _x), Particulate Matter (PM<2.5 μ m, PM<10 μ m), Lead, Ammonia (NH ₃), Benzene (C ₆ H ₆), Benzo(a)Pyrene, Arsenic,
		listed in the National Ambient Air Quality (NAAQ) Standards. Sulphur dioxide (SO ₂), Oxides of Nitrogen (NO _x), Particulate Matter (PM<2.5 μ m, PM<10 μ m), Lead, Ammonia (NH ₃), Benzene (C ₆ H ₆), Benzo(a)Pyrene, Arsenic, and Nickel were sampled on 24 hour basis. Carbon
		listed in the National Ambient Air Quality (NAAQ) Standards. Sulphur dioxide (SO_2) , Oxides of Nitrogen (NO_x) , Particulate Matter (PM<2.5 μ m, PM<10 μ m), Lead, Ammonia (NH_3) , Benzene (C_6H_6) , Benzo(a)Pyrene, Arsenic, and Nickel were sampled on 24 hour basis. Carbon monoxide and Ozone (O_3) were sampled on 8 hour basis.
		listed in the National Ambient Air Quality (NAAQ) Standards. Sulphur dioxide (SO ₂), Oxides of Nitrogen (NO _x), Particulate Matter (PM<2.5 μ m, PM<10 μ m), Lead, Ammonia (NH ₃), Benzene (C ₆ H ₆), Benzo(a)Pyrene, Arsenic, and Nickel were sampled on 24 hour basis. Carbon
		listed in the National Ambient Air Quality (NAAQ) Standards. Sulphur dioxide (SO_2) , Oxides of Nitrogen (NO_x) , Particulate Matter (PM<2.5 μ m, PM<10 μ m), Lead, Ammonia (NH_3) , Benzene (C_6H_6) , Benzo(a)Pyrene, Arsenic, and Nickel were sampled on 24 hour basis. Carbon monoxide and Ozone (O_3) were sampled on 8 hour basis.

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S.No.	Deficiency identified by the Henthle FAC	Improvements made in the Deviced FIA Depart
5.10.	Deficiency identified by the Hon'ble EAC	Improvements made in the Revised EIA Report.
		presented in Tables 3.5 to 3.9 in Chapter 3. The water
		sampling, noise and soil samplings were carried out once
		in the specified season of October to December 2019.
		Table 3.12 and Table 3.13 in Chapter 3 present the
		summary of analysis results for ground water and surface
		water samples respectively. Table 3.15 presents the
		noise monitoring data and Table 3.18 presents the soil
		analysis results.
7	No quality assurance of Ecological data	The ecology and biodiversity data and the list of fauna is
/	No quality assurance of Ecological data. For example-Dalbergia latifolia is said to	revisited and necessary corrections were carried out and
	be present in the buffer zone but	presented in Section 3.8 of Chapter 3.
	common name is indicated as Sitasal	presented in Section 5.6 of Chapter 5.
	(spelling error) D. sisoo is different from	
	D. latifolia. Among fauna, Green Parakeet	
	(Psittacara holochlorus) is mentioned. The	
	species of parakeet mentioned is native of	
	Central America and not found in India.	
8	Impacts and mitigation does not mention	The quantification and expected incremental rise due to
	incremental increase (for each parameter	air emissions from TSDF processes were estimated for
	like air, water, noise, vibration etc,) due to	PM, SO ₂ , and NO _x parameters. The isopleths depicting the
	project and project related activities.	impact zones around the project site were given in
	Quantification is the need in an EIA and	Section 4.6.3 in Chapter 4. Similarly, Section 4.7 in
	mitigation recommended should	Chapter 4 presents the details of water requirement,
	correspond to the impacts. Treatment	wastewater generation and water balance. Section 4.14
	descriptions are schematic flow sheets	in Chapter 4 presents the proposed Odour Management.
	and do not mention the capacities or	
	mass balance. While mentioning odour	
	control it only mentions, as care shall be	
	taken to avoid smell nuisance. What kind	. 65
	of care is to be mentioned.	
9	Additional studies (chapter 7) cover Risk	As suggested, Chapter 7 has been revised. Findings from
	and disaster. It is a stand-alone chapter	chapters 4 and 7 have now been integrated.
	and findings of this chapter are not	
	integrated on chapter 4-impact and	G
	mitigation.	

We request you to kindly consider the Revised EIA Report and issue Environmental Clearance at the earliest.

Thanking you.

Yours faithfully,



Authorized Signatory Ramky Enviro Engineers Limited

RESPL/REEL-MANDLA/I/013

ENVIRONMENTAL IMPACT ASSESSMENT

for

Proposed Integrated Common Hazardous Waste Treatment, Storage, Disposal and Recycling Facility at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh

Final Report









Proponent

Ramky Enviro Engineers Limited Gachibowli, Hyderabad

Consultant

Ramky Enviro Services Private Limited (NABET Certificate No: NABET/ EIA/1922/ RA 0140)



July 2020

Environmental Impact Assessment

for

Proposed Integrated Common Hazardous Waste Treatment, Storage, Disposal and Recycling Facility at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh Final Report









Submitted To

Ministry of Environment, Forest & Climate Change Indira Paryavaran Bhawan, Jor Bagh Road, New Delhi - 110003

Submitted by

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FOREWORD

Ramky Enviro Engineers Limited (REEL), proposes to establish an Integrated Common Hazardous Waste Treatment, Storage, Disposal and Recycling Facility at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh which includes secured landfill, landfill after treatment, Hazardous waste incineration, bio-medical waste management, alternative fuel and raw material facility, E-waste recycling facility, drum decontamination recycling plant, used/spent oil recycling, lead recycling, paper recycling, plastics recycling , solvent recovery, aluminium dross reprocessing facility, spent pot liner (carbon and refractory portion) reprocessing and disposal , renewable energy and waste to energy facilities. The facility is proposed to be established in an area of 8 Hectares. The power requirement for the project is estimated to be around 375 kVA and the total water requirement is estimated to be around 120 KLD, which will be met through Audyogik Kendra Vikas Nigam (Jabalpur) Limited/ tankers/ borewell. The total cost of the project is Rs. 40 Crores.

With a view to assess the potential environmental impacts due to the proposed facility, M/s. REEL retained Ramky Enviro Services Private Limited (RESPL), Hyderabad, to conduct Rapid Environmental Impact Assessment (REIA) study of the proposed project as a prerequisite to preparation of appropriate Environmental Management Plan (EMP).

The REIA report presents details of baseline data covering post monsoon season monitoring for air, noise, water, soil, land, ecology and socio-economic components of environment with a view to identify, predict and evaluate the potential impacts due to the proposed project. A detailed EMP has also been delineated to mitigate the adverse impacts.

The co-operation and the assistance rendered by the officials of REEL, in preparation of this report are greatly acknowledged.

Dr.B. Chakradhar Head of the Department Ramky Enviro Services Private Limited

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UNDERTAKING BY PROJECT PROPONENT



Ramky Enviro Engineers Limited Corporate Office: 13th Floor, Ramky Grandiose Ramky Towers, Gachibowli Hyderabad - 500 032, Telangana T: +91 40 2301 5000 F: +91 40 2301 5100 www.ramkyenviroengineers.com

Towards sustainable growth

UNDERTAKING

As per MoEFCC Office Memorandum No. J-11013/41/2006-IA.II(I) dated October 05, 2011, We, Ramky Enviro Engineers Limited, Project Proponent of the "proposed Integrated Common Hazardous Waste Treatment, Storage, Disposal & Recycling Facility at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh", hereby declare that we have engaged Ramky Enviro Services Private Limited, accredited by QCI/NABET (Certificate No. NABET/ EIA/1922/ RA 0140), as EIA Consultant for preparation of Environmental Impact Assessment (EIA) Report. The EIA Report has been prepared in compliance with the Terms of Reference (F.No.10-40/2019-IA.III dated December 05, 2019). We hereby certify that the data/information presented in the report is factually correct and that we own the contents (information and data) of the EIA Report.

For Ramky Enviro Engineers Ltd

Sarjiv K

Authorized Signatory

UNDERTAKING BY CONSULTANT



Ramky Enviro Services Private Limited (Wholly Owned Subsidiary Company of Ramky Enviro Engineers Ltd.) Corporate Office: 12th Floor, Ramky Grandiose Ramky Towers, Gachibowli, Hyderabad - 500 032, Telangana, India. T:+91 40 2301 5000(B), +91 40 2301 5369 (D) T/Fax:+91 40 2980 0121, E:consultancy@ramky.com www.ramkyenviroengineers.com

Towards sustainable growth

UNDERTAKING

We, Ramky Enviro Services Private Limited, accredited EIA Consultant by QCI/NABET (Certificate No. NABET/EIA/1922/RA 0140), hereby declare that we have prepared the EIA Report for the "Proposed Integrated Common Hazardous Waste Treatment, Storage, Disposal & Recycling Facility at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh by Ramky Enviro Engineers Limited". We hereby certify that the prescribed Terms of Reference (vide F.No. 10-40/2019-IA.III dated December 05, 2019) have been complied with and that the data/information presented in the report is factually correct.

Dr. B. Chakradhar Head of the Department



QCI –NABET Accreditation Certificate of Consultant



Quality Council of India

National Accreditation Board for Education & Training



CERTIFICATE OF ACCREDITATION

Ramky Enviro Services Private Limited

 Ramky Grandiose, Ramky Towers Complex, Gachibowli, Hyderabad – 500032, Telangana

Accredited as **Category - A** organization under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations: Version 3 for preparing EIA-EMP reports in the following Sectors:

	Sector Description		Sector (as per)	
SI. No.			MoEFCC	Cat.
1	Mining of minerals including Open cast/ Underground mining	1 .	1 (a) (i)	Α
2	Onshore Oil and gas exploration, development & production	2	1 (b)	А
3	Thermal power plants	4	1 (d)	Α
4	Petrochemical based processing (processes other than cracking & reformation and not covered under the complexes)	20	5 (e)	A
5	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	21	5 (f)	A
6	Industrial estates/ parks/ complexes/ Areas, export processing zones(EPZs), Special economic zones (SEZs), Biotech parks, Leather complexes	31	7 (c)	A
7	Common hazardous waste treatment, storage and disposal facilities (TSDFs)	32	7 (d)	A
8	Bio-medical waste treatment facilities	32A	7 (da)	В
9	Common effluent treatment plants (CETPs)	36	7 (h)	В
10	Common municipal solid waste management facility (CMSWMF)	37	7 (i)	В
11	Building and construction projects	38	8 (a)	В
12	Townships and Area Development projects	39	8 (b)	В

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RA AC minutes dated July 26, 2019 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/19/1045 dated August 28, 2019. The accreditation needs to be renewed before the expiry date by Ramky Enviro Services Private Limited, Hyderabad, following due process of assessment.

Sr. Director, NABET Dated: August 28, 2019

Certificate No. NABET/ EIA/1922/ RA 0140 Valid till 21.05.2022

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.

NABL CERTIFICATE





National Accreditation Board for Testing and Calibration Laboratories

(A Constituent Board of Quality Council of India)



CERTIFICATE OF ACCREDITATION

HYDERABAD WASTE MANAGEMENT PROJECT LABORATORY

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2017

"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

TSDF AT 684/1, Dundigal Village, Dundigal Gandimaisamma Mandal, Medchal District, Telangana

in the field of

TESTING

Certificate Number Issue Date TC-5067 27/02/2019

Valid Until 26/02/2021

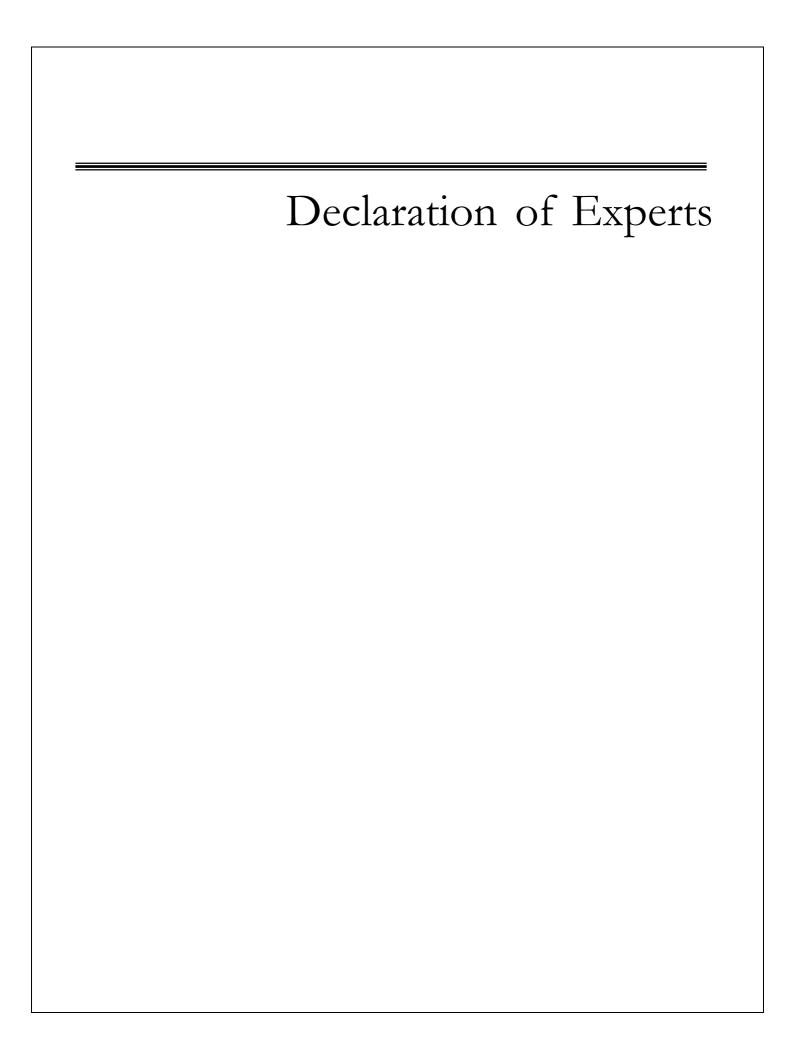
This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL. (To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Signed for and on behalf of NABL



89076970100030002480

N. Venkateswaran Chief Executive Officer



Declaration by Experts contributing to the EIA – "<u>Integrated Common Hazardous Waste</u> <u>Treatment, Storage and Disposal and Recycling Facility at Industrial Growth Center (IGC),</u> <u>Maneri (V), Mandla (D), Madhya Pradesh by M/s. Ramky Enviro Engineers Limited.</u>"

I, hereby, certify that I was a part of the EIA team in the following capacity that developed this EIA report.

EIA Coordinator:

Name

: Mr. Subash Koduri

Sign & Date

SUNE 108 100 06/01/2020

Period of involvement:August 2019 - Till dateContact information:subash.k@ramky.com

:

Functional Area Experts:

s.	Functional	Name of the		Involvement		
No	o Area Expert Period		Task	Sign & Date		
1	AP	Mr. V. Vijay Kumar	Aug 2019– Till date	Selecting ambient air monitoring sites based on IMD data, review of the meteorological data and AAQ data, suggesting air pollution control measures.	VE-UITS 06/1/2020	
2	WP	Ms. R. Radhika	Aug 2019– Till date	Identification of water monitoring sites, estimating water requirement, suggesting recycling of water, wastewater treatment methods & disposal schemes.	d. Radhile 06/01/2020	
3	SHW	Dr. B. Chakradhar	Aug 2019– Till date	Inventorization of Hazardous waste, suggesting treatment options viz., landfill, incineration, stabilization, process	Pale Mass	
4	SE	Dr. Harish Srivatsava	Aug 2019– Till date	Generating primary SE data, livestock inventory and impacts, conducted focused group discussions, taken public opinion on the project. Identified villages wise amenities and needs.	4000 06/11/2020	

5	EB	Ms. S. Swathy	Aug 2019– Till date	Collected secondary data from forest/ agricultural/ fisheries department, generation of primary flora and fauna data from study area & core area, ground trothing for ecological assessment, development of status report, suggesting species for greenbelt development.	Contry i
6	HG	Mr. Mallikarjuna Rao	Aug 2019– Till date	Well inventory to understand the depth of weathering, thickness of fracture zones, yield of wells, depth to water level monitoring data analysis, water level fluctuation based on pre monsoon and post monsoon depth to water level data collected from secondary sources. Physiography of the site area, general trend of surface water and ground water flow direction, ground water utilization status, identification of anticipated impacts on environment and suggest suitable conservation/mitigation measures — monitoring mechanism.	Culous 2020
7	GEO	Mr. Mallikarjuna Rao	Aug 2019– Till date	Describe the regional geology and structure of the area which will have bearing on the ground water occurrence and movement - vulnerability to seismicity – assessment of possible impacts due to the geological setting of the area.	Acqui Gulanna 12020
8	AQ	Dr. B. Chakradhar	Aug 2019– Till date	Meteorological & Air Pollution dispersion studies, suggesting environmental management plan for air pollution control measures.	Bolle 6/11/2020

9	LU	Mr. Uttam Kumar Bhunia	Aug 2019– Till date	Remote sensing based land use and land cover assessment – ground truth verification - identification of impacts on environment due to change of land use – suggest conservation measures and monitoring mechanism.	n'al
10	RH	Dr. B. Chakradhar	Aug 2019– Till date	Identification of process & storage tank hazards by using FETI criteria, pool fire accidents from diesel storage and lethality damages, DMP and EPP for onsite & offsite were provided.	Red 6/11/2020
11	NV	Dr. Hemanth Rajkumar	Aug 2019– Till date	Identification of noise source, sampling location, calculation of noise equivalents, comparing with NAAQs standards, suggesting noise mitigation measures and environmental management plan.	Demate objoitzoité

Declaration by the Head of the accredited consultant organization/ authorized person:

I, <u>Dr. B. Chakradhar</u>, hereby, confirm that the above mentioned experts prepared the EIA Report for the "<u>Integrated Common Hazardous Waste Treatment, Storage and Disposal and Recycling</u> <u>Facility at Industrial Growth Center (IGC), Maneri (V), Mandla (D), Madhya Pradesh by</u> <u>M/s. Ramky Enviro Engineers Limited.</u>" I also confirm that the consultant organization shall be fully accountable for any misleading information mentioned in this statement.

Signature Name Designation Name of the EIA Consultant Organization NABET Certificate No. & Issue Date : Head of the department- Consultancy division : Ramky Enviro Services Private Limited : NABET/EIA/1922/ RA 0140 dated August 28, 2019 QCI-NABET Scheme for Accreditation of EIA Consultant Organizations: Version 3

Annexure – IE

Format for information on Team Member

(only for in-house employees)

Name of project: "Integrated Common Hazardous Waste Treatment, Storage and Disposal and Recycling Facility at Industrial Growth Center (IGC), Maneri (V), Mandla (D), Madhya Pradesh

1. Name and address of EIA consultant organization

M/s. Ramky Enviro Services Private Limited Ramky Grandiose, Ramky Tower Complex, Gachibowli, Hyderabad – 500 032

- a. Head Office : ✓
- b. Branch Office/s :

2. Name of the head of the organization with designation

Dr. B. Chakradhar Head of the Department

3. Contact details with name of the contact person

a. Name of Contact person	Dr. B. Chakradhar
Address	M/s. Ramky Enviro Services Private Limited
	Ramky Grandiose,
	Ramky Tower Complex, Gachibowli,
	Hyderabad – 500 032

b. Tel. No.	040 23015369	Mob. : <u>+91-9000604455</u>
c. Email	drchakradhar@ramky.com	Alt. Email : <u>vvijaykumar@ramky.com</u>

d. Website <u>www.ramky.com</u>

1

4. Team Members proposed

Sl.no	Name	Qualification [#]	EC/ FAE	Sector/ FA	Approved Sr. Expert	Jobs to be assigned
With	EIA Coordinator					
1	Mr. Anil Kumar Gadale	Masters in Environmental Planning, School of Planning and Architecture, CEPT Campus, Ahmedabad. Year of passing- 1994	EC	32	Mr. Subash Koduri	Assisted in fulfilling the compliance of ToR, organizing & planning baseline monitoring for all environmental components along with compilation and Interpretation of field data, identification of adverse impacts &EMP. Assist in EIA & EMP report preparation.
With	Functional Area E	xpert				
1	Mr. Anil Kumar Gadale	Masters in Environmental Planning, School of Planning and Architecture, CEPT Campus, Ahmedabad. Year of passing- 1994	FAE	AQ	Dr. B. Chakradhar	Assisted FAE in collection of micrometeorological parameters at site, preparation of wind rose & frequency distribution. Analyzing primary & secondary metrological data. Estimation of air pollutant for modeling & GLC maps and preparation of EIA & EMP report.
	54 A			LU	Mr. Uttam Kumar Bhunia	Assisted FAE in collection of GPS readings for identification of toposheets and satellite imagery, preparation of base map from toposheets, preparation of monitoring location map and preparation of EIA & EMP report.

Sl.no	Name	Qualification [#]	EC/ FAE	Sector/ FA	Approved Sr. Expert	Jobs to be assigned
2	Mr. Subash Koduri	Master of Science in Environmental Engineering, Missouri University of Science and Technology, Rolla, Missouri, USA. Year of passing - 2006	FAE	SHW	Dr. B. Chakradhar	Worked closely with the FAE for (a) identification of different streams of hazardous waste generated from the treatment processes, including incineration ash, incineration slag, distillation residue from solvent recovery plant, (b) listing out different storage areas required for landfill waste, incinerable waste etc. based on their compatibility.
		M.Tech- Energy and Environmental Engineering, VIT University, Vellore, Tamil Nadu. Year of passing - 2012	FAE	WP	Ms. R. Radhika	Assisted FAE in estimating of wastewater loads and preparation of water balance and suggested suitable treatment scheme.
	Mr. Seshagiri Rao	M.Sc. – Geology, Osmania University, Hyderabad. Year of passing – 1995	FAE	HG	Mr. Mallikarjuna Rao	Study on natural surface drainage and hydrogeological conditions, depth to water levels, storm water runoff estimate, storm water management plan and measures; impacts on surface and ground water resources of proposed development, provided suitable mitigations for sustainability of groundwater resource.
			Ĩ	Geo	Mr. Mallikarjuna Rao	Study on type of topography, soil and existing rock formations. Geological and geomorphological characters of surface

Sl.no	Name	Qualification [#]	EC/ FAE	Sector/ FA	Approved Sr. Expert	Jobs to be assigned
	-					and subsurface formations in and around project site area. Extent of weathered formation. Seismicity of site area. Impact on soil and land due to proposed development, provided suitable mitigations for sustainability of resource.
5	Ms. Anusha Manikonda	Master of Science- Environmental Engineering, Illinois Institute of Technology, Chicago, USA. Year of passing -2018	FAE	RH	Dr. B. Chakradhar	Assisted FAE in analyzing risks, qualitative and quantitative (ALOHA), associated with the operations at site. Suggesting mitigation measures, disaster management plan and emergency preparedness plan for the same.
6	Mr. Sharath Baabu T	M.Tech - Energy and Environmental Engineering, VIT University, Vellore, Tamil Nadu. Year of passing- 2014	FAE	NV	Dr. Hemanth Rajkumar	Assisted FAE in identification of noise sources, sampling locations. Calculation of noise equivalents based on the baseline studies and suggesting suitable mitigation measures.

[#] Qualification – Bachelor degree in Technical subjects and Master's degree in Science, Humanities and other subjects, year of passing and name of university

Declaration by the employer

We have carefully read the provisions in respect of 'Team Members' in the NABET's Scheme for accreditation of EIA Consultants organizations and commit to abide by the same. The conformity of eligibility of the candidates proposed as Team Member in respect of qualification and other aspects has been verified by us at our end. We confirm that the information provided in the application is correct to the best of our knowledge and belief.

We understand that in case the information provided is found wrong/mis-leading, it may result in cancellation of accreditation granted to the organization.

Signature

Name (authorized signatory)

Designation

Organization

Date

Dr. B. Chakradhar Head of the Department M/s. Ramky Enviro Services Private Limited 08.01.2020

Terms of Reference (TOR)

F.No.10-40/2019-IA.III Government of India Ministry of Environment, Forest and Climate Change (IA.III - Section)

Indira Paryavaran Bhawan, JorBagh Road, New Delhi - 110003 Date: 5th December, 2019

To,

Shri Sanjiv Kumar, National Head – IWM

M/s Ramky Enviro Engineers Limited

Ramky Enviro Engineers Limited 13th Floor Ramky Grandiose, Ramky Tower Complex, Gachibowli Hyderabad - 500032 Email: <u>consultancygroup@ramky.com</u>

Subject: Integrated Common Hazardous Waste Treatment, Storage, Disposal & Recycling Facility at Industrial Growth Center (IGC), Maneri Village, Mandla District, Madhya Pradesh by M/s Ramky Enviro Engineers Limited - Terms of Reference - regarding.

Sir,

This has reference to your online proposal No. IA/MP/MIS/117811/2019 dated 13th September, 2019, submitted to this Ministry for grant of Terms of Reference (ToR) in terms of the provisions of the Environment Impact Assessment (EIA) Notification, 2006.

2. The proposal for 'Integrated Common Hazardous Waste Treatment, Storage, Disposal & Recycling Facility'at Industrial Growth Center (IGC), Maneri Village, Mandla District, Madhya Pradesh by M/s Ramky Enviro Engineers Limited was considered by the Expert Appraisal Committee (Infra-2) in the Ministry in its 45th meeting held during 17-18 October, 2019. The details of the project, as per the documents submitted by the project proponent, and also as informed during the above said EAC meeting, are reported to be as under:

i. Ramky Enviro Engineers Limited (REEL) proposes to establish an Integrated Common Hazardous Waste Treatment, Storage, Disposal & Recycling Facility in an area of 19.77 acres (8 Ha.) at plot no. 11, 12, 13, 14, 18, 19, 20, 21, 27, 28, 29, 31, 32, 33, 34, 35, 36, 43 and 44, at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh.

S. No.	Facility	Capacity
1	Secured Landfill (Direct Landfill)	250 TPD
2	Landfill after Treatment	400 TPD
3	Incineration*	55 TPD
4	Bio Medical Waste Treatment	12.5 TPD
5	Alternative Fuel and Raw Material Facility (AFRF)	55 TPD
6	E-Waste Recycling Facility (with Precious Metal Recovery)	82 TPD
7	Drum Decontamination Recycling Plant	10 TPD
8	Used / Spent Oil Recycling Facility	54 KLD
9	Lead Recycling Facility	65 TPD
10	Paper Recycling Facility	10 TPD
11	Plastics Recycling Facility	10 TPD
12	Solvent Recovery Facility	27 KLD
13	Aluminium Dross Reprocessing Facility	165 TPD
14	Spent Pot Liner (Carbon Portion) Reprocessing Facility	165 TPD

ii. Facilities proposed to be developed as part of this project include:

No. IA/MP/MIS/117811/2019

J. Bone

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15	Spent Pot Liner (Refractory Portion) Reprocessing and Disposal Facility	165 TPD
16	Renewable Energy	2 MW
17	Waste to Energy	2 MW

- iii. As per the Notification issued by the Ministry of Environment, Forest and Climate Change (MoEF&CC) S.O. 1533, dated 14.09.2006 and its subsequent amendments, the proposed project falls under Project Activity 7(d) - Common Hazardous Waste Treatment, Storage and Disposal Facilities (TSDFs), Category 'A' - All Integrated facilities having incineration and landfill or Incineration alone.
- iv. It is proposed to develop greenbelt in an area of not less than 33% of the total area. Greenbelt shall be developed with specific species as per CPCB's 'Guidelines for Developing Greenbelts (PROBES/75/1999-2000)'.
- v. The capital cost for the proposed project is estimated to be Rs. 40 Crores.
- vi. The total water requirement is estimated to be about 120 KLD, which will be met through Audyogik Kendra Vikas Nigam (Jabalpur) Limited/tankers/borewell. It is proposed to treat all the wastewater and leachate within the project premises and it is proposed to reuse the treated water (Zero Liquid Discharge).
- vii. The power requirement is estimated to be about 375 kVA. Power will be supplied by Madhya Pradesh State Electricity Board (MPSEB) and sufficient quantity of DG sets will be used for emergency power backup.
- viii. It is proposed to equip the incinerator facility with Continuous Emission Monitoring System (CEMS) and the emission data shall be transmitted to SPCB/CPCB.

3. The project/activity is covered under category A of item 7(d) 'Common hazardous waste treatment, storage and disposal facilities (TSDFs)' of the Schedule to the EIA Notification, 2006 and its subsequentamendments, and requires appraisal at Central level by sectoral EAC.

4. The project proponent informed the EAC that M/s Ramky Enviro Engineers Limited (REEL), considering the increasing trend in hazardous waste generation in the state of Madhya Pradesh, and considering the need for different disposal/recycling methods for different waste streams, proposes to establish an Integrated Common Hazardous Waste Treatment, Storage, Disposal & Recycling Facility in an area of 19.77 acres (8 hectares) at plot no. 11, 12, 13, 14, 18, 19, 20, 21, 27, 28, 29, 31, 32, 33, 34, 35, 36, 43 and 44 (total 19 plots) at Industrial Growth Centre (IGC), Maneri Village, Mandla District, Madhya Pradesh (Notified Industrial Area).

5. The EAC, in its meeting held on 17-18 October, 2019, after detailed deliberations, recommended the project for grant of Terms of Reference as specified by the Ministry as Standard ToR in April, 2015 for the said project/activity for preparation of EIA-EMP report. On the basis of the recommendation of EAC and the submission given by the project proponent, the Ministry of Environment, Forest and Climate Change hereby accords ToR to the project 'Integrated Common Hazardous Waste Treatment, Storage, Disposal & Recycling Facility at Industrial Growth Center (IGC)'Maneri Village, Mandla District, Madhya Pradesh by M/s Ramky Enviro Engineers Limited for preparation of the Environment Impact Assessment (EIA) Report and Environment Management Plan (EMP) with the following specific and general conditions in addition to Standard ToR provided at **Annexure**:

- (i) Importance and benefits of the project.
- (ii) The E.I.A. would address to the conformity of site to the stipulations as made in the Hazardous and other Wastes (Management, handling and trans-boundary

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movement) Rules, 2016 and will have a complete chapter indicating conformity to the said rules.

- (iii) Project proponents would also submit a write up on how their project proposal conform to the stipulations made in the "Protocol for Performance evolution and monitoring of the Common Hazardous Waste Treatment Storage and Disposal facilities including common Hazardous Waste incinerators", published by the CPCB on May 24, 2010.
- (iv) Status of compliance to the provisions of the *Hazardous* and Other *Wastes (Management* and Transboundary Movement) *Rules,* 2016, and Bio-Medical Waste Management Rules, 2016.
- (v) Details of various waste management units with capacities for the proposed project.
- (vi) List of waste to be handled and their source along with mode of transportation.
- (vii) Other chemicals and materials required with quantities and storage capacities.
- (viii) Details of temporary storage facility for storage of hazardous waste at project site.
- Details of pre-treatment facility of hazardous waste at TSDF.
- (x) Details of air emissions, effluents, hazardous/solid waste generation and their management.
- (xi) Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract).
- (xii) Process description along with major equipments and machineries, process flow sheet (quantitative) from waste material to disposal to be provided.
- (xiii) Hazard identification and details of proposed safety systems.
- (xiv) Details of Drainage of the project up to 5 km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of Flood Level of the project site and maximum Flood Level of the river shall also be provided.
- (xv) Ground water quality monitoring in and around the project site.
- (xvi) The Air Quality Index shall be calculated for base level air quality.
- (xvii) Status of the land purchases in terms of land acquisition Act and study the impact.
- (xviii) Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land.
- (xix) R&R details in respect of land in line with state Government policy.
- (xx) Details of effluent treatment and recycling process.
- (xxi) Leachate study report and detailed leachate management plan to be incorporated.
- (xxii) Action plan for measures to be taken for excessive leachate generation during monsoon period.
- (xxiii) Action plan for any pollution of ground water is noticed during operation period or post closure monitoring period.
- (xxiv) Detailed Environmental Monitoring Plan as well as Post Closure Monitoring Plan.
- (xxv) Submit details of Bio Medical Waste to be handled and the other facilities operating within 75 km area.
- (xxvi) A certificate of adequacy of available power from the agency supplying power to the project along with the load allowed for the project.

(xxvii) A detailed Plan for green belt development.

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- (xxviii) A certificate from the local body supplying water, specifying the total annual water availability with the local authority, the quantity of water already committed, the quantity of water allotted to the project under consideration and the balance water available. This should be specified separately for ground water and surface water sources, ensuring that there is no impact on other users.
- (xxix) Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof shall also be included. Has the unit received any notice under the Section 5 of Environment (Protection) Act, 1986 or relevant Sections of Air and Water Acts? If so, details thereof and compliance/ATR to the notice(s) and present status of the case.
- The project proponents shall satisfactorily address to all the complaints/suggestions that have been received against the project till the date of submission of proposals (XXX)for Appraisal.
- Plan for Corporate Environment Responsibility (CER) as specified under Ministry's Office Memorandum vide F.No. 22-65/2017-IA.III dated 1st May 2018 shall be (xxxi) prepared and submitted along with EIA Report.
- (xxxii) A tabular chart with index for point wise compliance of above ToRs.

General Guidelines:

- The EIA document shall be printed on both sides, as for as possible. (i)
- All documents should be properly indexed, page numbered. (ii)
- Period/date of data collection should be clearly indicated. (iii)
- Authenticated English translation of all material provided in Regional languages.
- (iv)The letter/application for EC should quote the MoEF&CC File No. and also attach a (v) copy of the letter prescribing the ToR.
- The copy of the letter received from the Ministry on the ToR prescribed for the project (vi) should be attached as an annexure to the final EIA-EMP Report.
- The final EIA-EMP report submitted to the Ministry must incorporate the issues in ToR. The index of the final EIA-EMP report, must indicate the specific chapter and (vii) page no. of the EIA-EMP Report where the specific ToR prescribed by Ministry. Questionnaire related to the project (posted on MoEF&CC website) with all sections duly filled in shall also be submitted at the time of applying for EC.
- Grant of ToR does not mean grant of EC. (viii)
- The status of accreditation of the EIA consultant with NABET/QCI shall be specifically mentioned. The consultant shall certify that his accreditation is for the (ix)sector for which this EIA is prepared.
- On the front page of EIA/EMP reports, the name of the consultant/consultancy firm along with their complete details including their accreditation, if any shall be (X) indicated. The consultant while submitting the EIA/EMP report shall give an undertaking to the effect that the prescribed ToRs (ToR proposed by the project proponent and additional ToR given by the MoEF&CC) have been complied with and the data submitted is factually correct (Refer MoEF&CC Office memorandum dated 4th August, 2009).
- While submitting the EIA/EMP reports, the name of the experts associated with/involved in the preparation of these reports and the laboratories through which (xi) the samples have been got analysed should be stated in the report. It shall clearly be indicated whether these laboratories are approved under the Environment (Protection) Act, 1986 and the rules made there under (Please refer MoEF&CC Office Memorandum dated 4th August, 2009). The project leader of the EIA study shall also be mentioned.

(xii) All the ToR points as presented before the Expert Appraisal Committee (EAC) shall be covered.

6. The above ToR should be considered for the project proposed Integrated Common Hazardous Waste Treatment, Storage, Disposal & Recycling Facility at Industrial Growth Center (IGC), Maneri Village, Mandla District, Madhya Pradesh by M/s Ramky Enviro Engineers Limited, in addition to all the relevant information as per the 'Generic Structure of EIA' given in Appendix III and IIIA in the EIA Notification, 2006. Public hearing is exempted for the project as per para 7(i) III Stage (3)(i)(b) of EIA Notification, 2006 for preparation of EIA/EMP Report, being site is located in the Notified industrial area.

7. The project proponent shall submit the detailed final EIA/EMP prepared as per ToR to the Ministry for considering the proposal for Environmental Clearance within 3 years as per the MoEF&CC O.M. No.J-11013/41/2006-IA.II(I) (P) dated 08.10.2014.

8. The consultants involved in preparation of EIA/EMP report after accreditation with Quality Council of India/National Accreditation Board of Education and Training (QCI/NABET) would need to include a certificate in this regard in the EIA/EMP reports prepared by them and data provided by other Organization(s)/ Laboratories including their status of approvals etc. vide Notification of the MoEF&CC dated 19.07.2013.

9. The prescribed Terms of Reference (ToR) would be valid for a period of three years for submission of the EIA/EMP Reports.

10. This issues with the approval of the Competent Authority.

. Taose (Dr. Subrata Bose) Scientist 'F'

Copy to:

The Member Secretary, Madhya Pradesh Pollution Control Board, E-5, Arera Colony, Paryavaran Parisar, Bhopal - 462 016.

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Annexure

7(d): STANDARD TERMS OF REFERENCE FOR CONDUCTING ENVIRONMENT IMPACT ASSESSMENT STUDY FOR COMMON HAZARDOUS WASTE TREATMENT, STORAGE AND DISPOSAL FACILITIES (TSDFS) AND INFORMATION TO BE INCLUDED IN EIA/EMP REPORT

- 1) Reasons selecting for the site with details of alternate sites examined/rejected/selected on merit with comparative statement and reason/basis for selection. The examination should justify site suitability in terms of environmental damages, resources sustainability associated with selected site as compared to rejected sites. The analysis should include parameters considered along with weightage criteria for short-listing selected site.
- Submit the details of the road/rail connectivity along with the likely impacts and mitigative measures
- Submit the present land use and permission required for any conversion such as forest, agriculture etc
- Examine the details of transportation of Hazardous wastes, and its safety in handling.
- 5) Examine and submit the details of on line pollutant monitoring.
- Examine the details of monitoring of Dioxin and Furan.
- 7) MoU for disposal of ash through the TSDF.
- MoU for disposal of scrubbing waste water through CETP.
- 9) Examine and submit details of monitoring of water quality around the landfill site.
- 10) Examine and submit details of the odour control measures.
- 11) Examine and submit details of impact on water body and mitigative measures during rainy season.
- 12) Environmental Management Plan should be accompanied with Environmental Monitoring Plan and environmental cost and benefit assessment. Regular monitoring shall be carried out for odour control.
- 13) Water quality around the landfill site shall be monitored regularly to examine the impact on the ground water.
- 14) The storage and handling of hazardous wastes shall be as per the Hazardous Waste Management Rules.
- 15) Submit details of a comprehensive Disaster Management Plan including emergency evacuation during natural and man-made disaster.

- 16) Public hearing to be conducted for the project in accordance with provisions of Environmental Impact Assessment Notification, 2006 and the issues raised by the public should be addressed in the Environmental Management Plan. The Public Hearing should be conducted based on the ToR letter issued by the Ministry and not on the basis of Minutes of the Meeting available on the website.
- 17) A detailed draft EIA/EMP report should be prepared in accordance with the above additional TOR and should be submitted to the Ministry in accordance with the Notification.
- Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.
- 19) The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.
- 20) Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure, project proponent can refer to the model ToR available on Ministry website http://moef.nic.in/Manual/Incinerator

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Terms of reference (TOR) Compliance

ToR Compliance

S. No	ToR Points	Compliance
Addition	al ToR	
i.	Importance and benefits of the project	A major concern about the hazardous wastes is that, they need to be disposed of in a secured manner in view of their toxic nature, environmental pollution and wide range of health hazards. Having an integrated facility would minimize the risk involved in waste transportation and waste movement.
		The proposed project will facilitate a one stop solution for management of all types of wastes (Hazardous, Bio-medical, E-waste, etc) at a common treatment facility. The proposed project will meet the needs of industries, commercial establishments and health care establishments situated in Mandla and surrounding districts of Madhya Pradesh. The proposed facility focuses on resource recovery (such as AFRF) and recycling (spent oil, solvent etc.).
ii.	The EIA would address to the conformity of site to the stipulation as made in the Hazardous and other Waste (Management, handling and transboundary movement) Rules, 2016 and will have a complete chapter indicating conformity to the said rules.	Table 5.1 in Chapter 5 presents details of rejection/knock-out Criteria and Table 5.2 in Chapter 5 presents details of the site selection criteria. Table 5.3 in Chapter 5 presents the site evaluation of the proposed site. Based on the analysis of site evaluation criteria, the site got a weightage of 73 on a scale of 100 and it is falls under class Good.
iii.	Project proponent would also submit a write up on how their project proposals conform to the stipulations made in the "Protocol for Performance evolution and monitoring of the Common Hazardous Waste Treatment Storage and Disposal facilities including common	The "Protocol for Performance evaluation and monitoring of the Common Hazardous Waste Treatment Storage and Disposal facilities including common Hazardous Waste incinerators", as per CPCB HAZWAMS//2010-2011 dt: May 24 th , 2010 is attached as Annexure I. As the proposed facility is a green-field project and in the design stage only, the information provided

S. No	ToR Points	Compliance
	Hazardous Waste incinerators", published by the CPCB on May 24, 2010.	in the Protocol may be considered as tentative.
iv.	Status of compliance to the provisions of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and Bio-Medical Waste Management Rules, 2016.	The proposed facility shall be established and operated in compliance with the Hazardous and other Wastes (Management and Transboundary Movement) Rules, 2016, Bio- Medical Waste Management Rules, 2016 and E-waste (Management) Rules, 2016.
ν.	Details of various management	The proposed project details are given below.
	units with capacities for the	S.No. Facility Capacity
	proposed project.	1 Secured Landfill (Direct Landfill) 250 TPD
		2 Landfill after Treatment 400 TPD
		3 Hazardous Waste Incineration 55 TPD
		4 Bio Medical Waste Treatment 12.5 TPD
		Alternative Fuel and 5 Raw Material Facility 55 TPD (AFRF)
		E-Waste Recycling 6 Facility (with Precious 82 TPD Metal Recovery)
		7Drum Decontamination Recycling Plant10 TPD
		8 Used / Spent Oil Recycling Facility 54 KLD
		9 Lead Recycling Facility 65 TPD
		10 Paper Recycling Facility 10 TPD
		11PlasticsRecyclingFacility10 TPD
		12SolventRecovery27 KLDFacility27 KLD
		13Aluminium Reprocessing FacilityDross 165 TPD
		Spent Pot Liner (Carbon 14 Portion) Reprocessing 165 TPD Facility
		Spent Pot Liner 15 (Refractory Portion) 165 TPD Reprocessing and

S. No	ToR Points	Compliance
		Disposal Facility
		16 Renewable Energy 2 MW
		17 Waste to Energy 2 MW
vi.	List of waste to be handled and	Waste to be handled at the proposed facilit
	their source along with mode of	includes: (a) hazardous waste from industrie
	transportation.	such as still bottom residues, process sludge
		spent carbon, evaporation salts, ETP sludge
		incineration ash, slags, spent catalysts
		resins, expired drugs, (b) biomedical wast
		from healthcare establishments and othe
		sources, (c) spent solvents, used oil, pape
		plastics, drums, lead acid batteries, aluminur
		dross, spent pot liner etc. from industries an
		other sources.
		The mode of transportation is through
		The mode of transportation is throug dedicated trucks. Specially designed fleet
		shall be utilized for collection of waste so that
		chance of spillage is minimized during transit
		Manifest system shall be followed as per th
		provisions in Hazardous and other Wast
		(Management, handling and transboundar
		movement) Rules, 2016. The details are give
		in Chapter 2.
vii.	Other chemicals and materials	Typical reagents that would be used for th
	required with quantities and	stabilization process include lime, fly asl
	storage capacities.	bentonite (clay), cement, saw dust, etc., i combination with sodium silicate solution,
		required to create additional bindin
		properties of the wastes. Diesel shall b
		required for DG sets, incineration etc. Boiler
		(coal fired) shall be required for spent solver
viii.	Details of tomporary storage	recycling, used oil recycling etc. Temporary storage of hazardous wastes wi
VIII.	Details of temporary storage facility for storage of hazardous	be done in a covered shed, having elevate
	waste at project site.	concrete floor having drains all around t
		collect the leachate.
		Wastes containing ignitable, reactive an non-compatible characteristics will be store
		separately.
		. ,

S. No	ToR Points	Compliance
		Wastes containing volatile solvents or other low vapour pressure chemicals will be adequately protected from direct exposure to sunlight.
		Storage of incinerable hazardous waste: Adequate storage space will be provided with 15 m distance between storage sheds, fire break of at least 4 m between two blocks of stacked drums, maximum of 300 tons of waste storage limit in a block of drums, at least 1 m clear space between two adjacent rows of drums in a pair for routine inspection
ix.	Details of pre-treatment facility of hazardous waste at TSDF	purpose. The hazardous waste as received will be segregated on the basis of the characteristics and subjected to either direct landfilling/ stabilization followed by landfilling/ incineration.
		The waste is pre-treated/ stabilized into non leachable materials before it is deposited into a secured landfill. This involves immobilization of leachable materials by fixation as non-reactive solids. The treated wastes shall then be assessed for compatibility with other wastes before being landfilled. The details are given in Chapter 2 , Section 2.5 .
х.	Details of air emissions, effluents, hazardous/solid waste generation and their Management	Briefly, the major source of air emission during the construction phase is fugitive dust generation. Other sources include loading and unloading of materials, top soil removal, vehicle movement on unpaved roads, civil constructions etc. During operational phase, gaseous emissions would be discharged from incinerator stack, boiler stack, DG set stack which would be treated using APCDs. Details of air emissions and their management during development and operation phases are given in Chapter 4, Section 4.6. Details of

S. No	ToR Points	Compliance
xi.	Requirement of water, power,	effluents and treatment are given in Chapter 4, Section 4.7. Solid waste management for the proposed project is given in Chapter 4, Section 4.5.5. The total water requirement is 120 KLD,
	with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract).	including treated water. The fresh water is supplied through Audyogik Kendra Vikas Nigam Limited/tankers/borewell. Power required is 375 kVA which would be supplied by Madhya Pradesh State Electricity Board (MPSEB). Details of man-power, water, power requirement and their source are given in Chapter 2. Tables 2.4, 2.5 & 2.6. Water balance table and flow chart are given in Chapter 4 as Table 4.4 & Figure 4.5.
xii.	Process description along with major equipment and machineries, process flow sheet (quantitative) from waste material to disposal to be provided.	Process description for the proposed facilities such as secured landfill, stabilization, incineration, solvent recovery facility, paper and plastics recycling facilities and others are presented in detail in Chapter 2 . The equipments and machineries, process flow sheet are discussed under Sections 2.5, 2.6, 2.7, 2.8, 2.9 and 2.10.
xiii.	Hazard identification and details of proposed safety systems.	Hazard identification Assessment of pool fire scenario based on leakage of HSD and other solvents proposed has been carried out. Contamination of soil and water due to leakage of contaminants, release of toxic gases from incinerator/landfill and various situations like spillage of waste during transport, collision of vehicles etc have been studied.
		The proposed safety systems for various emergency situations like fire/foam hydrants, warning systems and control centers, fire pumps etc have been recommended. The details are given in Chapter 7, Section 7.4. Preventive and control measures have also been provided.

S. No	ToR Points	Compliance
		General prevention measures for other hazards like fire, electrical accidents and mock drill monitoring is given in Section 7.4 .
xiv.	Details of drainage of the project up to 5 km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of flood level of the project site and maximum flood level of the river shall also be provided.	The drainage system is showing dendritic type of drainage pattern. The topographic elevation, in the study area within 5 km radius, is ranging from 430 to 650 m amsl (meters above mean sea level), and at site it is ranging from 453 to 461 m amsl. Jhamil Nadi is located 0.6 km (W) and Gaur Nadi is located 2.1 km (N) from the site. The detailed drainage map of study area is shown in Figure 7.6 .
xv.	Ground water quality monitoring in and around the project site	Ground water samples were collected from 9 locations and from various sources like hand pumps and bore wells etc within the study area. Important physical and chemical parameters including heavy metals were analyzed. The details of groundwater analysis are given in Chapter 3 , Section 3.4.1 and 3.4.2. The results are shown in Table 3.12 .
xvi.	The Air quality index shall be calculated for base level air quality	Air quality index has been calculated for base level air quality data collected in 8 locations is given in Chapter 3 Table 3.10a, 3.10b
xvii.	Status of the land purchases in terms of land acquisition act and study the impact.	MP AKVN has allotted an area of 8 hectares Plot no 11, 12, 13, 14, 18, 19, 20, 21, 27, 28, 29, 31, 32, 33, 34, 35, 36, 43 and 44 at Industrial Growth Centre (IGC), Maneri
xviii.	Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land	village. It shall be noted that MP Industrial Development Corporation Limited (Formerly MP AKVN), while allotting the land, has clubbed all the above plot numbers to a single plot and named it as Plot No. 2, without any change in the land area. Supporting documents are provided as Annexure 2.
xix.	R&R details in respect of land in line with state Government policy.	No R&R is involved. The proposed site is located in an industrial area developed by MP AKVN.

S. No	ToR Points	Compliance
XX.	Details of effluent treatment and recycling process	The effluents generation is expected to be around 64 KLD which shall be treated and reused within the facility. Domestic wastewater shall be sent to septic tank followed by soak pit. Detailed water balance table given in Chapter 4 Table 4.4 and water balance flow diagram in Figure 4.5 .
xxi.	Leachate study report and detailed leachate management plan to be incorporated.	Leachate is expected to be generated from the secured landfill and stabilization operations. Special care shall be taken during monsoon to avoid excess leachate generation. Leachate generated shall be utilized for spraying back on the landfill and the excess leachate, after appropriate treatment, shall be disposed of in the spray drier attached to the incinerator. Details of leachate management are provided in Chapter 4 Section 4.7.1 & 4.7.2.
xxii.	Action plan for measures to be taken for excessive leachate generation during monsoon period	The landfill cells which are in operation shall be temporarily covered with 1mm HDPE lines to prevent rain water contact during monsoon. The landfill cells which have been completely filled with waste shall be capped before onset of monsoon. The waste shall be stored in the temporary storage sheds during rainy days. The stored waste shall be quickly shifted into the operational part of the landfill during non- rainy days and immediately covered with liners without any gaps in between. Major portion shall be covered under temporary liners to avoid generation of any leachate. Proper storm water drainage shall be ensured. Garland drainage shall be provided. Runoff from the landfill shall be connected to a lined first flush retention pond. The water

S. No	ToR Points	Compliance
		in the pond shall be tested to ensure the quality meeting to the discharge standards for utilizing for greenbelt. Action plan for excessive leachate generation during monsoon period is attached as Annexure 3
xxiii.	Action plan for any pollution of ground water is noticed during operation period or post closure monitoring period	All possible measures shall be adopted at the proposed facility to avoid groundwater contamination. Groundwater monitoring wells (piezometric wells) shall be installed around the landfill site. Trend analysis shall be carried out on a regular basis and if any significant deviation is observed, studies shall be carried out to identify the possible source of contamination. Appropriate remedial measures shall be taken up immediately. However, chances of groundwater contamination from the landfill are expected to be minimal due to the fact that the landfill shall be developed with double liner system with clay etc., in line with the CPCB HAZWAMS//2010-2011 dt: May 24 th , 2010.
xxiv.	Detailed Environmental Monitoring Plan as well as Post Closure Monitoring Plan.	Environmental monitoring plan as well as post closure monitoring plan have been given in detail in Chapter 6 .
XXV.	Submit details of Bio Medical Waste to be handled and the other facilities operating within 75 km area.	The Biomedical waste treatment facility is being proposed to treat biomedical waste up to 12.5 TPD. The other facilities being operated within 75 km area are M/s. Elite Engineers, Jabalpur.
xxvi.	A certificate of adequacy of available power from the agency supplying power to the project along with the load allowed for the project.	The proposed project is located in Industrial Growth Centre (IGC), total power shall be supplied by Madhya Pradesh State Electricity Board.
xxvii.	A detailed plan for green belt development	Detailed greenbelt development plan is given in Chapter 9 Section 9.5
xxviii.	A certificate from the local body supplying water, specifying the total annual water availability with the local authority, the	Water required for the facility shall be obtained from MP AKVN supply. Secondary sources of water shall be external tankers /borewells.

S. No	ToR Points	Compliance
	quantity of water already	
	committed the quantity of water	
	allotted to the project under	
	consideration and the balance	
	water available. This should be	
	specified separately for ground	
	water and surface water source,	
	ensuring that there is no impact	
	on the other users.	
xxix.	Any litigation pending against the	No litigation pending against the project
	project and /or any direction	
	/order passed by any court of	
	law against the project, if so,	
	details thereof shall also be	
	included. Has the unit received	
	any notice under the section 5 of	
	environment (Protection) Act,	
	1986 or relevant sections of air	
	and water acts? If so, details	
	thereof and compliance/ATR to	
	the notice(s) and present status	
	of the case.	
XXX.	The project proponents shall	Noted and shall be complied.
	satisfactorily address to all the	
	complaints/suggestions that	
	have been received against the	
	project till the date of submission	
	of proposals for appraisal	
xxxi.	Plan for Corporate Environment	Corporate Environment Responsibility (CER)
	Responsibility (CER) as specified	as specified under ministry's office
	under Ministry's Office	memorandum vide F.No 22-65/2017-IA.III
	Memorandum vide F.No. 22-	dated 1 st May 2018, Rs. 80 Lakhs (i.e 2% of
	65/2017-IA.III dated 1 st May	the project cost) shall be allotted for CER
	2018 shall be prepared and	activities. Details are given in the Chapter 9
	submitted along with EIA report.	Section 9.6 and Table 9.6.
xxxii.	A tabular chart with index for	Noted and followed.
	point wise compliance of above	
	ToRs.	

S. No	ToR Points	Compliance	
Standard	Standard ToR		
i.	Reasons for selecting the site with details of alternate sites examined/rejected/selected on merit with comparative statement and reason/basis for selection. The examination should justify site suitability in terms of environmental damages, resources sustainability associated with selected site as compared to rejected sites. The analysis should include parameters considered along with weightage criteria for short-listing selected site.	The proposed site is located in Industrial Growth Centre, Maneri. The proposed site meets the site selection criteria given in HAZWAMS/25/2002-2003, according to the CPCB guidelines is carried out and presented in Chapter 5 , Table 5.1 . Based on the analysis of site evaluation criteria, the site got a weightage of 73 on a scale of 100 and it is falls under class Good . The details are given under section 5.1.2 .	
ii.	Submit the details of the road/rail connectivity along with the likely impacts and mitigative measures	The site is well connected to all the nearby places. National Highway NH-30 Mandla to Jabalpur road is located 14.8 km W from the site. State Highway SH-22 Kumdam to Jabalpur road is located 12.2 km N from the site. The nearest railway station is Jabalpur junction at a distance of approx. 28 km NW. The nearest airport is Jabalpur airport 17 km NW. Traffic details are given in Chapter 3 Section 3.6 the service for the roads is very good and hence there is no adverse effect due to this project.	
iii.	Submit the present land use and permission required for any conversion such as forest, agriculture etc.	The proposed site is located in the Industrial Growth Centre, Maneri village, Mandla district (i.e., Industrial Land Use). Conversion of land use not required.	
iv.	Examine the details of transportation of Hazardous wastes, and its safety in handling.	The Transportation of hazardous waste & safety measures during handling will be followed as per the Guidelines prescribed for Transportation of Hazardous Waste – Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. The transport of hazardous wastes shall be in	

S. No	ToR Points	Compliance				
		accordance with the provisions of these rules and the rules made by the Central Government under the Motor Vehicles Act.				
		1988 and other guidelines issued from time				
		to time in this regard. The occupier shall provide the transporter with the relevant information in Form 9 , regarding the hazardous nature of the wastes				
		and measures to be taken in case of an emergency and shall label the hazardous				
		wastes containers as per Form 8. The seven copy manifest system and TREM card system are followed as per 2016 Rules. The details are given in Chapter 2, under section 2.5.2.				
		With regards to safety, the occupier handling hazardous or other wastes and operator of TSDF shall ensure that the hazardous and				
		other wastes are packaged in a manner suitable for safe handling, storage and transport as per the guidelines issued by the Central Pollution Control Board from time to time. Labeling shall be done as per Form 8.				
ν.	Examine and submit the details of on line pollutant monitoring.	Online pollutant monitoring will be provided as per CPCB guidelines for monitoring particulate matter, SO ₂ , NOx and CO from the incinerator stack. Necessary provision will be made in the incinerator stack for providing online monitoring equipment				
vi.	Examine the details of monitoring of dioxin and furan.	Monitoring of dioxins and furans in the stack emissions will be carried out by third party MoEF&CC recognized laboratory as per MoEF&CC guidelines.				
vii.	MoU for disposal of ash through the TSDF.	The ash generated from the incinerator will be disposed to the secured landfill area of the project site. Hence MoU for ash disposal is not required.				
viii.	MoU for disposal of scrubbing waste water through CETP.	As this is a zero discharge facility, the scrubbed wastewater generated from				

S. No	ToR Points	Compliance			
		alkaline scrubber will be disposed through spray drier / quencher which will be further used for control of dioxin and furan generation. Hence there is no need of MoU for disposal of scrubbing wastewater.			
ix.	Examine and submit details of monitoring of water quality around the landfill site.	Groundwater quality around the landfill site shall be periodically checked through the monitoring bore wells. Trend analysis shall be carried out on a regular basis to ensure no significant variation in water quality. During the baseline studies, groundwater samples were collected and analysed. The details are given in Chapter 3 Section 3.4			
x.	Examine and submit details of the odor control measures.	Generally, odors can be managed by dilution of odorant by odor counteraction or neutralized by spraying herbal spray around odor generation areas at regular intervals. The landfill area under operation will be covered daily with layer of earth, clay or a similar material. Details of odour control measures are given in Chapter 9, Section 9.3.2.			
xi.	Examine and submit details of impact on water body and mitigative measures during rainy season.	There are no water bodies in the proposed site. The nearest water bodies include: Jhamil Nadi is 0.6 km (W) and Gaur Nadi is located 2.1 km (N). As the proposed facility adopts Zero Liquid Discharge, possibility of contamination of water bodies will be very minimal. Water from storm water collection pond shall be utilized for greenbelt and other applicable purposes.			
xii.	Environmental Management Plan should be accompanied with Environmental Monitoring Plan and environmental cost and benefit assessment. Regular monitoring shall be carried out for odor control.	Detailed Environmental Management Plan is provided in Chapter 9. Budgetary provision of Rs. 4 Crores (capital cost) and Rs. 40 Lakhs (recurring cost) is allocated towards EMP for environmental protection and safety measures. The EMP along with budget is given in Chapter 6, Table 6.5 .			
xiii.	Water quality around the landfill	The water quality around the landfill site shall			

S. No	ToR Points	Compliance
	site shall be monitored regularly to examine the impact on the	be monitored for important physical and chemical parameters including heavy metals
	ground water.	regularly to examine the impact on groundwater as per EC and State PCB Consent conditions at regular intervals (monthly) by providing piezometers around the landfill including upstream and downstream sides.
xiv.	The storage and handling of hazardous wastes shall be as per the Hazardous Waste Management Rules.	Storage and handling of hazardous wastes shall be as per the Hazardous Waste Management Rules 2016. Records of hazardous and other wastes handled at the TSDF shall be maintained (Form 3) and file annual returns in Form 4 to the concerned SPCB. Details of storage and handling of hazardous wastes are given in Chapter 9 , Table 9.10.
xv.	SubmitdetailsofacomprehensiveDisasterManagementPlanincludingemergencyevacuationduringnatural and man-made disaster.	The Disaster Management Plan including precautions to be taken during natural and manmade disasters are given in Chapter 7 , Section 7.8 .
xvi.	Public hearing to be conducted for the project in accordance with provisions of Environmental Impact Assessment Notification, 2006 and the issues raised by the public should be addressed in the Environmental Management Plan. The Public Hearing should be conducted based on the ToR letter issued by the Ministry and not on the basis of Minutes of the Meeting available on the web-site.	Public hearing is exempted for the project as per para 7(i) III stage (3)(i)(b) of EIA Notification, 2006 for preparation of EIA/EMP report, as the site is located in Notified Industrial Area.
xvii.	A detailed draft EIA/EMP report should be prepared in accordance with the above additional TOR and should be submitted to the Ministry in	The EIA report is prepared in accordance with the Terms of Reference recommended by MoEF&CC (both additional TOR and standard TOR). The report has been prepared in line with the generic structure prescribed in the

S. No	ToR Points	Compliance				
	accordance with the Notification.	EIA Notification.				
	Details of litigation pending	As per the current status, there are no				
	against the project, if any, with	litigations/judicial issues pending against the				
xviii	direction/order passed by any	proposed project.				
	Court of Law against the Project					
	should be given					
	The cost of the Project (capital	The capital cost of the project is Rs. 40				
	cost and recurring cost) as well	Crores . Budgetary provision of Rs. 4 Crores (capital cost) and Rs. 40 Lakhs (recurring cost)				
xix	as the cost towards	is allocated towards EMP for environmental				
	implementation of EMP should	protection and safety measures. The detailed				
	be clearly spelt out.	budget implementation for EMP is given in				
		Chapter 6, Table 6.5.				
	Any further clarification on	All the studies/activities in the TOR were				
	carrying out the above studies including anticipated impacts	completed in detail and presented in the EIA report. No further clarification is required for				
xx.	due to the project and mitigative	carrying out the studies suggested.				
	measure, project proponent can	can ying out the studies suggested.				
	refer to the model TOR available					
	on Ministry website					
General G	Guidelines for ToR					
	The EIA document shall be	Noted and Complied				
(i)	printed on both sides as far as					
	possible					
	All documents should be	Noted and Complied				
(ii)	properly indexed, page					
	numbered.					
		The baseline study was carried out during				
()	Period/date of data collection	Post monsoon season from October 2019 –				
(iii)	should be clearly indicated.	December 2019. Details of period/date of				
		study have been mentioned clearly in the report.				
	Authenticated English translation	Noted and Complied				
(iv)	of all material provided in					
()	Regional languages					
	The letter/application for	Noted and Complied				
	environmental clearance should					
(v)	quote the SEAC file no. and also					
	attach a copy of the letter					
	prescribing the ToR.					

S. No	ToR Points	Compliance			
(vi)	The copy of the letter received from Ministry on the ToR prescribed for the project should be attached as an Annexure to	MoEF&CC has given TOR vide No. F. No.10- 40/2019-IA.III dated December 05, 2019. Copy of the letter received from Ministry, on the TOR prescribed is attached after			
	the Final EIA – EMP Report.	Declaration of Experts.			
(vii)	The final EIA-EMP report submitted to the Ministry must incorporate the issues mentioned in ToR. The index of the EIA-EMP report must indicate the specific ToR prescribed by the Ministry and the issue raised in the Public Hearing has been incorporated. Questionnaire related to the project (posted on MoEF&CC website) with all sections duly filled in shall also be submitted at the time of applying for EC.	Noted and Complied			
(viii)	Grant of ToR does not mean grant of EC	Noted			
(ix)	The status of accreditation of the EIA consultant with NABET or QCI shall be specifically mentioned. The consultant shall certify that his accreditation is for the sector for which this EIA is prepared.	Noted and Complied			
(x)	On the front page of EIA/EMP reports the name of the consultant/ consultancy firm along with their complete details including their accreditation, if any shall be indicated. The consultant while submitting the EIA/EMP report shall give an undertaking to the effect that the prescribed ToRs (ToR proposed by Project proponent and additional ToR given by	Noted and Complied			

S. No	ToR Points	Compliance
	MoEF&CC) have been complied	
	with and the data submitted is	
	factually correct. (Refer	
	MoEF&CC Office Memorandum	
	dated 4 th August, 2009).	
	While submitting the EIA/EMP	Noted and Complied
	reports, the name of the experts	
	associated with/involved in the	
	preparation of these reports and	
	the laboratories through which	
	the samples have been got	
	analysed should be stated in the	
	report. It shall clearly be	
(xi)	indicated that these laboratories	
	are approved under the	
	Environment (Protection) Act,	
	1986 and the rules made there	
	under (Please refer MoEF&CC	
	Office Memorandum dated 4 th	
	August, 2009). The project leader	
	of the EIA study shall also be	
	mentioned.	
	All the ToR points as presented	Noted and Complied
(xii)	before the Expert Appraisal	
(////	Committee (EAC) shall be	
	covered.	

MINUTES OF THE 48th MEETING OF THE EAC INFRASTRUCTURE -2) HELD ON 29th JANUARY 2020

MINUTES OF THE 48th MEETING OF THE EXPERT APPRAISAL COMMITTEE (INFRASTRUCTURE-2) HELD ON 28-29 JANUARY, 2020

Venue: Conference Hall (Indus), Jal Wing, Ground Floor, Ministry of Environment, Forest and Climate Change, Indira Paryavaran Bhawan, Jor Bagh Road, New Delhi - 3

Day- 1: Tuesday, 28th January, 2020

Time: 10:30 AM

48.1 **Opening Remarks of the Chairman**

48.2 Confirmation of the Minutes of the 47th Meeting of the EAC (Infra-2) held on 26-27 December, 2019 at New Delhi.

The minutes of the 47th Meeting of the EAC (Infra-2) held on 26-27 December, 2019, was confirmed.

48.3 Consideration of Proposals

Agenda item No. 48.3.1.

Construction of new Terminal building (T3) & allied works at Biju Patnaik International Airport (B.P.I), Bhubaneswar by M/s Airports Authority of India - Terms of Reference

(IA/OR/MIS/131282/2019; F.No. 10-6/2020-IA-III)

48.3.1.1. The project proponent and the accredited Consultant M/s Gaurang Environmental Solutions Pvt. Ltd. gave a detailed presentation on the salient features of the project and informed that:

- (i) The proposal is for grant of Terms of Reference (ToR) proposed construction of New Domestic Terminal (T3) Building & allied works {Separate service block, landscaping, Sewage treatment plant (STP), Under Ground (UG) water storage tanks & PHE works} at BPI Airport, Bhubaneswar by Airports Authority of India, BPI Airport, Bhubaneshwar. The proposed expansion project is located at Biju Patnaik International Airport (BPI), Bhubaneswar, District Khordha, Odisha.
- (ii) The project/activity has applied under category A of item 7(a) 'Air Ports' of the Schedule to the EIA Notification, 2006 and its amendments. The Aerodrome Reference Point (ARP) Coordinates of the Aerodrome (AD) are Latitude 20°14'48" N and Longitude 85°49'07" E.
- (iii) Environmental Clearance had been obtained for existing terminal building vide letter F.No. 10-17/2008-IA.III dated 07.05.2008.
- (iv) The total airport area is 340.73 Ha and the area earmarked for the proposed expansion works is 10.085 Ha (service block: 1.24 Ha) within the existing airport premises. There is no additional requirement of land for the proposed developmental works.
- (v) The details of proposed new terminal building are as below. The plot area for proposed expansion is 1,00,850 sqm. (10.085 ha). Total built up area of the new terminal building will be 64,650 sqm. The number of floors will be Ground, Mezzanine & First. The height of terminal building will be 34.5 m. The green area will be approx. 12850 sqm. Details of other built up area are as under:

Particular	Detail
Service Block Area	Service Block: 2550 sqm.
	Pump Room: 2550 sqm.
	Basement for Plumbing Tanks & substation area: 2850 sqm
	Ground Floor for Electrical Sub: 1205 sqm
	First Floor staff office area: 595 sqm

(vi) AAI is following GRIHA (Green Rating for Integrated Habitat Assessment) system for sustainable and environment friendly design. The new terminal building will be constructed as per the ECBC

clarification on further requirement of Environmental Clearance in view of the EC granted to the project proponent vide letter dated 19.09.2014. In view, the Committee opined that the Ministry may also seek opinion of the State Government in the matter.

In view of the foregoing observations, the EAC recommended to defer the proposal. The proposal shall be reconsidered after the above details are addressed and submitted.

Agenda item No. 48.4.3.

Integrated Common Hazardous Waste Treatment, Storage, Disposal & Recycling Facility at Industrial Growth Center (IGC), Maneri Village, Mandla District, Madhya Pradesh by M/s Ramky Enviro Engineers Limited - Environmental Clearance

(IA/MP/MIS/117811/2019; F.No. 10-40/2019-IA-III)

48.4.3.1. The project proponent and the accredited Consultant M/s Ramky Enviro Services Private Ltd. gave a detailed presentation on the salient features of the project and informed that:

(i) Ramky Enviro Engineers Limited (REEL) proposes to establish an Integrated Common Hazardous Waste Treatment, Storage, Disposal & Recycling Facility in an area of 19.77 acres (8 Ha.) at plot no. 11, 12, 13, 14, 18, 19, 20, 21, 27, 28, 29, 31, 32, 33, 34, 35, 36, 43 and 44, at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh. It shall be noted that MP Industrial Development Corporation Limited (Formerly MP AKVN), while allotting the land, has clubbed all the above plot numbers to a single plot and named it as Plot No. 2, without any change in the land area.

S. No.	Facility	Capacity	
1	Secured Landfill (Direct Landfill)	250 TPD	
2	Landfill after Treatment	400 TPD	
3	Incineration*	55 TPD	
4	Bio Medical Waste Treatment	12.5 TPD	
5	Alternative Fuel and Raw Material Facility (AFRF)	55 TPD	
6	E-Waste Recycling Facility (with Precious Metal Recovery)	82 TPD	
7	Drum Decontamination Recycling Plant	10 TPD	
8	Used / Spent Oil Recycling Facility	54 KLD	
9	Lead Recycling Facility	65 TPD	
10	Paper Recycling Facility	10 TPD	
11	Plastics Recycling Facility	10 TPD	
12	Solvent Recovery Facility	27 KLD	
13	Aluminium Dross Reprocessing Facility	165 TPD	
14	Spent Pot Liner (Carbon Portion) Reprocessing Facility	165 TPD	
15	Spent Pot Liner (Refractory Portion) Reprocessing and Disposal Facility	165 TPD	
16	Renewable Energy	2 MW	
17	Waste to Energy	2 MW	
* Comm	non incinerator for Hazardous Waste and Bio Medical Waste		

(ii) Facilities proposed to be developed as part of this project include:

- (iii) The total water requirement is estimated to be about 120 KLD. Water requirement shall be met through MP Industrial Development Corporation Limited (formerly known as AKVN)/Tankers/Bore well. It is proposed to treat all the wastewater and leachate within the project premises and it is proposed to reuse the treated water (Zero Liquid Discharge). The power requirement is estimated to be about 375 kVA.
- (iv) Power will be supplied by Madhya Pradesh State Electricity Board (MPSEB) and sufficient quantity of DG sets will be used for emergency power backup.

- (v) Secured Landfill shall be established in-line with the CPCB's 'Criteria for Hazardous Waste Landfills (HAZWAMS/17/2000-01)'. All possible measures shall be adopted at the proposed facility to avoid groundwater contamination. Groundwater monitoring wells (piezometric wells) shall be installed around the landfill site.
- (vi) Incinerator shall be equipped with air pollution control devices such as spray drier, wet alkaline scrubber etc. with a minimum stack height of 30 m to meet the emission standards. It is proposed to equip the incinerator facility with Continuous Emission Monitoring System (CEMS) and the emission data shall be transmitted to SPCB/CPCB.
- (vii) Leachate is expected to be generated from the secured landfill and stabilization operations. Special care shall be taken during monsoon to avoid excess leachate generation. Leachate generated shall be utilized for spraying back on the landfill and the excess leachate, after appropriate treatment, shall be disposed of in the spray drier attached to the incinerator. Greenbelt shall be developed in an area of not less than 33% of the total area. Greenbelt shall be developed with specific species as per CPCB's 'Guidelines for Developing Greenbelts (PROBES/75/1999-2000)'.
- (viii) ToR for the project was granted by MoEFCC vide letter F.No 10-40/2019-IA-III dated 05.12.2019.
- (ix) Public Hearing was exempted as per para 7(i) III stage (3)(i)(b) of EIA Notification, 2006 for preparation of EIA/EMP report, as the site is located in Notified Industrial Area.
- (x) Investment/Cost of the project: Rs. 40 Crores.
- (xi) Employment potential: During Construction and Operation phase Managerial staff -15, Skilled and semi-skilled manpower 75 and indirect employment during operation will be around 100 persons.
- (xii) Benefits of the project: Facilitating better management of hazardous wastes, provides a one stop solution for the management of various types of wastes, Minimizes pollution load on environment with an additional benefit of green and clean surroundings, Possibility for recovery of materials thereby conserving the natural resources, Management of wastes is relatively easier and economically viable at a common facility, Most viable option in the absence or availability of expertise, Reduced environmental liability due to captive storage of hazardous waste in the premises of industries, Better occupational health and safety at individual industry level and Prevention of natural resource contamination.

48.4.3.2. The EAC noted the following:-

- (i) The proposal is for grant of Environmental Clearance to the project 'Integrated Common Hazardous Waste Treatment, Storage, Disposal & Recycling Facility at Industrial Growth Center (IGC), Maneri Village, Mandla District, Madhya Pradesh by M/s Ramky Enviro Engineers Limited.
- (ii) The project/activity is covered under category A of item 7(d) 'Common hazardous waste treatment, storage and disposal facilities (TSDFs)' of the Schedule to the EIA Notification, 2006 and its subsequent amendments, and requires appraisal at Central level by sectoral EAC.
- (iii) ToR for the project was granted by MoEFCC vide letter F.No 10-40/2019-IA-III dated 05.12.2019.
- (iv) Public Hearing was exempted as per para 7(i) III stage (3)(i)(b) of EIA Notification, 2006 for preparation of EIA/EMP report, as the site is located in Notified Industrial Area.

48.4.3.3. The EAC deliberated upon the EIA Report submitted by the project proponent and observed a number of deficiencies as follows:

a. The EIA does not give details of industries, their nature and type of hazardous waste generated that will go into proposed TSDF.

- b. There is mix up of units in the EIA report. Both British system (acres) and metric system (square meters) are used in the report. Single system need to be used.
- c. Fresh water requirement for various activities like gardening, incineration, biomedical waste treatment etc, need to be justified. Explore the possibility of use of treated wastewater for such activity.
- d. There is no data of quantity of different type of waste that would go into incinerator. There is no mention of the capacity of incinerator in the project description.
- e. The project description indicates generation of 2 MW of power each from renewable and Waste to Energy. Lay out plan does not reflect the location of the facility. There is no clarity on how the industry is going to achieve this. The EIA report is silent on Waste to Energy system to be adopted and power generation from Renewable sources.
- f. In baseline data collection, report mentions that data is generated during October to December but is silent on all other aspects like frequency of collection. There is no clarity-if data (including micro-meteorology) is collected twice a week or for the entire duration of the period of study.
- g. No quality assurance of Ecological data. For example-Dalbergia latifolia is said to be present in the buffer zone but common name is indicated as Sitasal (spelling error) *D. sisoo* is different from *D. latifolia*. Among fauna, Green Parakeet (*Psittacara holochlorus*) is mentioned. The species of parakeet mentioned is native of Central America and not found in India.
- h. Impacts and mitigation does not mention incremental increase (for each parameter like air, water, noise, vibration etc,) due to project and project related activities. Quantification is the need in an EIA and mitigation recommended should correspond to the impacts. Treatment descriptions are schematic flow sheets and do not mention the capacities or mass balance. While mentioning odour control it only mentions, as care shall be taken to avoid smell nuisance. What kind of care is to be mentioned.
- i. Additional studies (chapter 7) cover Risk and disaster. It is a stand-alone chapter and findings of this chapter are not integrated on chapter 4-impact and mitigation.

The EAC asked the project proponent to review the EIA and resubmit Revised EIA addressing all deficiencies mentioned in above paras.

In view of the foregoing observations, the EAC recommended to defer the proposal. The proposal shall be reconsidered after the above details are addressed and submitted.

SUMMARY OF CHANGES MADE IN THE EIA REPORT BASED ON THE DEFICIENCIES IDENTIFIED BY EAC

Summary of Changes made in the EIA Report based on the deficiencies identified by the Hon'ble EAC during the 48th Meeting of the EAC held on 29th January, 2020 (Agenda item No. 48.4.3.).

S.No.	Deficiency identified by the Hon'ble EAC	Improvements made in the Revised EIA Report.
1	The EIA does not give details of industries, their nature and type of hazardous waste generated that will go into proposed TSDF.	Annual hazardous waste inventory in the state of Madhya Pradesh, published by MPPCB for the past few years has been taken into consideration for estimating the future waste quantity (details provided in Chapter 1, Section 1.3.1.). Different types of industries in the state of Madhya Pradesh in different regions are listed out in Table 1.4 in Chapter 1. Different kinds of hazardous wastes expected to be treated at the proposed facility from different kinds of industries are presented in Table 1.5 .
2	There is mix up of units in the EIA report. Both British system (acres) and metric system square meters) are used in the report. Single system need to be used.	The EIA report has been revised with all the units presented in metric system only.
3	Fresh water requirement for various activities like gardening, incineration, biomedical waste treatment etc, need to be justified. Explore the possibility of use of treated wastewater for such activity.	As advised, the possibility of using treated water to the maximum extent has been looked at, by providing additional tertiary treatment systems to make use of treated water reuse for all the processes within TSDF. Also, it is now proposed to utilize only the treated water for gardening/greenbelt development purposes. Similarly, for stabilization operations, it is proposed to use only the treated water. For incineration, it is proposed to meet 2/3 rd of the water requirement through treated water only. The revised water requirement details are presented in Table 2.5. in Chapter 2.
4	There is no data of quantity of different type of waste that would go into incinerator. There is no mention of the capacity of incinerator in the project description.	Information on different types of waste that would go into incinerator (such as pesticide wastes, phenolic wastes etc.) has been provided in Section 2.5.5 in Chapter 2 . Capacity of incinerator (2,500 kg/hr) and the capacities of all other proposed facilities are now mentioned in the project description(s) given in Chapter 2 .
5	The project description indicates generation of 2 MW of power each from renewable and Waste to Energy. Lay out plan does not reflect the location of the facility. There is no clarity on how the industry is going to achieve this. The EIA report is silent on Waste to Energy system to be adopted and power generation from Renewable sources.	It is proposed to generate 2 MW of power from renewable energy (solar power project) and another 2 MW of power from high calorific value hazardous waste streams/alternate fuel produced from the Alternate Fuel and Raw Material Facility (AFRF). The proposed location of the waste to energy plant is shown in the layout of the project (presented in Figure 2.3 in Chapter 2). Section 2.9 and Section 2.10 in Chapter 2 provide detailed description of the Solar Power Plant and the Waste to Energy Plant respectively.

S.No.	Deficiency identified by the Hon'ble EAC	Improvements made in the Revised EIA Report.
6	In baseline data collection, report mentions that data is generated during October to December but is silent on all other aspects like frequency of collection. There is no clarity-if data (including micro-meteorology) is collected twice a week or for the entire duration of the period of study.	To understand the local micrometeorology, an automatic weather station (solar powered) was installed at the proposed site for collecting the data - Temperature, Relative Humidity, Wind Speed and Wind Direction. The weather station was programmed to record and automatically save the readings on an hourly basis. The primary data thus collected during the entire study period (October to December 2019) has been summarized and presented in Table 3.1 in Chapter 3.
		Ambient air quality monitoring stations were selected on the basis of surface influence, demographic influence and meteorological influence. During the study period, monitoring was carried out twice per week for 12 weeks at each sampling station for all the twelve parameters listed in the National Ambient Air Quality (NAAQ) Standards. Sulphur dioxide (SO ₂), Oxides of Nitrogen (NO _x), Particulate Matter (PM<2.5µm, PM<10µm), Lead, Ammonia (NH ₃), Benzene (C ₆ H ₆), Benzo(a)Pyrene, Arsenic, and Nickel were sampled on 24 hour basis. Carbon monoxide and Ozone (O ₃) were sampled on 8 hour basis. The ambient air quality results for all these pollutants, including comparison with the NAAQ standards, are presented in Tables 3.5 to 3.9 in Chapter 3. The water sampling, noise and soil samplings were carried out once in the specified season of October to December 2019. Table 3.12 and Table 3.13 in Chapter 3 present the summary of analysis results for ground water and surface water samples respectively. Table 3.18 presents the noise monitoring data and Table 3.18 presents the soil analysis results.
7	No quality assurance of Ecological data.	The ecology and biodiversity data and the list of
	For example-Dalbergia latifolia is said to be present in the buffer zone but	fauna is revisited and necessary corrections were carried out and presented in Section 3.8
	common name is indicated as Sitasal	of Chapter 3.
	(spelling error) D. sisoo is different from	
	D. latifolia. Among fauna, Green Parakeet	
	(Psittacara holochlorus) is mentioned.	

S.No.	Deficiency identified by the Hon'ble EAC	Improvements made in the Revised EIA Report.
	The species of parakeet mentioned is native of Central America and not found in India.	
8	Impacts and mitigation does not mention incremental increase (for each parameter like air, water, noise, vibration etc.) due to project and project related activities. Quantification is the need in an EIA and mitigation recommended should correspond to the impacts. Treatment descriptions are schematic flow sheets and do not mention the capacities or mass balance. While mentioning odour control it only mentions, as care shall be taken to avoid smell nuisance. What kind of care is to be mentioned.	The quantification and expected incremental rise due to air emissions from TSDF processes were estimated for PM, SO ₂ , and NO _x parameters. The isopleths depicting the impact zones around the project site were given in Section 4.6.3 in Chapter 4 . Similarly, Section 4.7 in Chapter 4 presents the details of water requirement, wastewater generation and water balance. Section 4.14 in Chapter 4 presents the proposed Odour Management.
9	Additional studies (chapter 7) cover Risk and disaster. It is a stand-alone chapter and findings of this chapter are not integrated on chapter 4-impact and mitigation.	As suggested, Chapter 7 has been revised. Findings from chapters 4 and 7 have now been integrated.

CHAPTER 1

INTRODUCTION

Chapter 1

Introduction

1.1 Introduction

Madhya Pradesh is the second-largest Indian state, covering 9.5% of the area of the country. Industries in Madhya Pradesh are largely natural resources driven. It has abundant natural wealth in the form of Limestone, Coal, Bauxite, Iron, Diamond ore, Silica and so on and crops like Soya, Cotton, Wheat, Paddy, etc. The state has a strong industrial setup in the sectors such as Auto, Textile, Cement, Soya, and Textile processing units. The Major Central Public Sectors Undertaking like BHEL Bhopal, National Fertilizer Ltd. (NFL) Vijaypur Dist. Guna, Gas Authority of India Ltd., (GAIL) Vijaypur Dist. Guna, Security Paper Mill Hoshangabad, Currency Printing Press-Bank Note Press, Dewas, Opium Alkaloid Factory Neemuch, Ordnance Factory Itarsi, Gun Carriage Factory Jabalpur and Nepa Mills, Nepa Nagar, etc. are located in the State.

As per Annual Inventory on Hazardous and Other Waste Management (2018-2019) carried out by Madhya Pradesh Pollution Control Board, the total number of hazardous waste generating industries is 2732 whereas the number of units possessing the authorization is 2713.

Management of pollution and waste generated from the industries has always been a challenging task faced by the country. Ramky Enviro Engineers Ltd (REEL) has been the pioneer in offering solutions for industrial waste management and its secured disposal. Presently it is operating about 15 TSDFs in various states of the country providing waste management services.

1.2 Purpose of the report

The objective of this EIA study report is to describe the aspects of the project which are likely to cause environmental impacts in/around the proposed project area and identification of long-term, short-term, reversible & irreversible impacts on the immediate environment, ecology and ecosystem. Based on impact prediction, a suitable management plan is to be defined that will control and/or minimize the detrimental impacts. It is very much important in the design stage of the project to take into account not only the social and economic aspects of the project but also environmental protection considerations. The environmental impacts of any project must be surveyed, forecasted and evaluated by the project proponent in the process of designing the project. These results and findings are then to be incorporated in the Environmental Impact Assessment (EIA) Report.

Environmental Impact Assessment report has been prepared to comply with the Terms of Reference (ToR) received from MoEF&CC F. No. 10-40/2019-IA.III dated December 05, 2019. As per EIA Notification S.O. No 1533 dated 14^{th} September 2006 and its subsequent amendments, the project falls under Project / Activity 7 (d) Common Hazardous Waste

Treatment, Storage and Disposal Facility (TSDFs), Category "A" (All integrated facilities having incineration & landfill or incineration alone) and requires environmental clearance from Expert Appraisal Committee (EAC), MoEF&CC, New Delhi.

1.3 Identification of project and project proponent

1.3.1 Project

Ramky Enviro Engineers Limited (REEL) proposes to establish an Integrated Common Hazardous Waste Treatment, Storage, Disposal & Recycling Facility in an area of 8 Ha, plot no. 11, 12, 13, 14, 18, 19, 20, 21, 27, 28, 29, 31, 32, 33, 34, 35, 36, 43 and 44, at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh. It shall be noted that Madhya Pradesh Industrial Development Corporation Limited (Formerly Madhya Pradesh Audyogik Kendra Vikas Nigam, i.e., MP AKVN), while allotting the land, has clubbed all the above plot numbers to a single plot and named it as Plot No. 2, without any change in the land area.

Ramky Enviro Engineers Limited has been operating Madhya Pradesh Waste Management Project (TSDF) at Pithampur, Dhar District, Madhya Pradesh, serving the industries in the entire state of Madhya Pradesh, since 2006. Considering the increasing trend in the waste volumes, and to cater to different kinds of hazardous wastes, Ramky has planned for expansion, and obtained Environmental Clearance (vide F.No. 10-50/2017-IA-III dated 23rd May, 2019) which includes: Secured Landfill (75,000 TPA), Stabilization (1,00,000 TPA), Incineration (20,000 TPA) etc. Presently, industries located in all the districts of Madhya Pradesh are sending their hazardous waste for treatment and disposal to MPWMP in Pithampur.

In order to save transportation cost (indirectly reducing the consumption of fuel and vehicular emissions etc.) for the industries, Ramky proposes to establish another facility in Mandla district. The TSDF at Mandla is proposed to serve the industries located close to Mandla, for the next 20 years. To arrive at the treatment capacities, the inventory of hazardous waste generated in Madhya Pradesh published by MPPCB on an annual basis has been taken for several years, from the year 2012-13 through 2018-19 has been studied. The data thus extracted from the inventory data has been presented in **Table 1.1**. As it can be seen from the table below, there has been a significant increase in the hazardous waste quantity in the state.

Description	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Landfillable (MT)	59 <i>,</i> 480	77,752	1,67,584	33,824	1,25,880	1,95,602	1,90,812
Incinerable (MT)	3,030	15,404	10,350	17,676	1,400	25,426	24,292
Recyclable (MT)	-	-	-	-	17,452	2,06,728	2,34,461
Utilizable (MT)	-	-	-	-	-	12,42,316	2,11,474
Reuse/Sale (MT)	3,91,109	2,11,431	1,09,031	38,441	-	-	-
Number of Units (authorized)	1,619	1,568	1,792	1,938	2,222	2,564	2,732

Table 1.1 Annual Inventory on Hazardous and Other Waste Management by MPPCB

Based on experience from Madhya Pradesh Waste Management Project (MPWMP), for the purpose of estimating the future waste quantity, it is considered that the average increase in hazardous waste quantity would be 3% on an annual basis. The estimated quantities, based on this assumption, are presented in **Table 1.2** below.

Description	Inventory Information from MPPCB	Estimated Quantities			
	2018-19	2024-25	2029-30	2034-35	2039-40
Landfillable (MT)	1,90,812	2,27,840	2,64,129	3,06,197	3,54,967
Incinerable (MT)	24,291	29,005	33,625	38,980	45,189
Recyclable (MT)	2,34,460	2,79,958	3,24,548	3,76,240	4,36,165
Utilizable (MT)	2,11,474	2,52,511	2,92,729	3,39,353	3,93,404

Table 1.2 Estimated quantities of hazardous waste generation in Madhya Pradesh

Ramky aims to make the infrastructure available for hazardous waste disposal needs in the state of Madhya Pradesh till the year 2039-40. Ramky wants to be able to achieve this goal through its existing facility (i.e., MPWMP in Pithampur) and the proposed facility at Mandla. Accordingly, the capacities for the Mandla facility have been proposed, with an aim to meet the treatment capacity for the estimated waste quantities in the year 2039-40.

Table 1.3 Treatment capacity vs estimated waste quantity

Description	MPWMP	Mandla*	Total	Estimated Waste
				Quantity 2039-40
Landfill (MT)	1,75,000	1,95,000	3,70,000	3,54,967
(Direct Landfilling and Landfill				
after Treatment)				
Incineration [#] (MT)	20,000	20,000	40,000	45,189

*considering about 300 days of operational days in a year for Landfilling (with 250 TPD for Direct Landfilling and 400 TPD for Landfilling after Stabilization).

It is anticipated that some portion of waste currently being incinerated may be redirected to the AFRF stream for co-processing in cement industries etc.

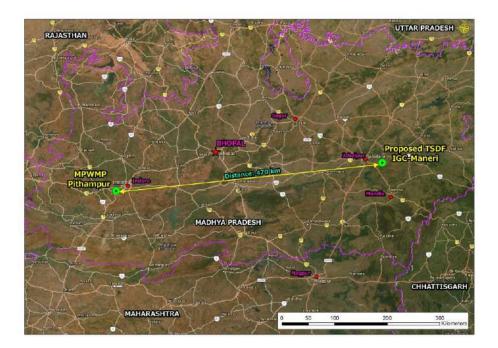


Figure 1.1 Map showing distance between Existing facility (MPWMP) and proposed facility

The primary objective of this project is to provide a facility that will be a one-stop solution for the management of industrial hazardous waste. The proposed facility shall provide waste management services to different kinds of industries located in the state of Madhya Pradesh, with focus on resource recovery (AFRF, solvent recovery etc.). Proposed project activities consist of collection, transportation, treatment, storage, reuse, recycle, blending and disposal of industrial hazardous wastes, biomedical waste, spent solvent recovery, used oil recovery, alternate fuel & raw material facility, recycling of used lead-acid batteries, waste plastic & paper, e-waste, etc.

There are about 2713 hazardous waste generating industries in Madhya Pradesh. Key industries include: auto and auto components, textile, cement, agro-based industries, pharmaceuticals, mineral-based industries, and manufacturing industries. Different types of industries are as presented in **Table 1.4** below:

Region	Industrial Growth Centres	entres Key Industries		
Gwalior and	Malanpur, Ghirongi, Banmore,	Textile, Food Processing, FMCG and		
Sagar Region	Chainpura, Siddhgawan, Mining			
	Pratapura and Purena			
Bhopal Region	Mandideep, Pillukhedi, Babai, Engineering, Textile, Food			
	Piparia Processing, Electronic System Desig			
	and Manufacturing (ESDM), and IT			
Indore & Ujjain	Pithampur, Kheda, Megh Nagar, Auto, Pharmaceuticals, Textile, Food			
Region	Ujjain, Dewas, Maksi and	Processing, IT/ ITeS and ESDM		

Table 1.4 Different types of industries in Madhya Pradesh

Region	Industrial Growth Centres	Key Industries		
	Jaggakhedi			
Rewa Region	Rewa, Waidhan, Maiher, and Mining, Food Processing, Power a			
	Nandan Tola	Cement		
Jabalpur Region	Borgaon, Maneri, Lamtara and	Defense, Textile, Mining, Food		
	Katni	Processing and Cement		

Different kinds of hazardous wastes expected to be treated at the proposed facility from different kinds of industries are presented in **Table 1.5** below

S.No.	Type of Industry	Expected Hazardous Waste		
1	Fertilizer Industries	Spent catalyst		
		Carbon residue		
		Sludge or residue containing arsenic		
		Chromium sludge from water cooling tower		
2	Oil and natural gas	Drill cuttings excluding those from water based mud		
	industries	Sludge containing oil		
		Drilling mud containing oil		
3	Petrochemical industries	Furnace or reactor residue and debris		
		Tarry residues and still bottoms from distillation		
		Oily sludge emulsion		
		Organic residues		
		Residues from alkali wash of fuels		
4	Petroleum industries	Cargo residue, washing water and sludge containing		
		oil, cargo residue and sludge containing chemicals		
		Sludge and filters contaminated with oil		
		Ballast water containing oil from ships		
5	Industrial operations using	Used or spent oil		
	mineral or synthetic oil as	Wastes or residues containing oil		
	lubricant in hydraulic	Waste cutting oils		
	systems or other			
	Applications			
6	Metal surface treatment or	Acidic and alkaline residues		
	electroplating industries	Spent acid and alkali		
		Spent bath and sludge containing sulphide, Cyanide		
		and toxic metals		
		Sludge from bath containing organic solvents		
		Phosphate sludge		
		Sludge from staining bath		

Table 1.5 Type of hazardous waste expected to be treated at facility

S.No.	Type of Industry	Expected Hazardous Waste	
		Copper etching residues	
		Plating metal sludge	
7	Steel industries	Cyanide-, nitrate-, or nitrite –containing sludge	
		Spent hardening salt	
8	Caustic soda production	Mercury bearing sludge generated from mercury cell	
	industries	process	
		Residue or sludge and filter cakes	
		Brine sludge	
9	Printing press or printing	Process wastes, residues and sludge	
	works industries	Spent solvent	
10	Plastic industries	Spent catalysts	
		Process residues	
11	Production of resins	Wastes or residues (not made with vegetable or animal	
	industries	materials)	
		Spent solvents	
12	Textile Industries	Chemical residues	
13	Wood industries	Chemical residues	
		Residues from wood alkali bath	
14	Dyes and dye-	Process waste sludge/residues containing acid, toxic	
	intermediates industries	metals, organic compounds	
		Dust from air filtration system	
		Spent acid	
		Spent solvent	
		Spent catalyst	
15	Pharmaceutical industries	Process Residue and wastes	
		Spent catalyst	
		Spent carbon	
		Off specification products	
		Date-expired products	
		Spent solvents	
16	Pesticides and Pesticide Process wastes or residues		
	formulation industries	Sludge containing residual pesticides	
		Date-expired and off-specification pesticides	
		Spent solvents	
		Spent catalysts	
		Spent acids	
17	Leather Industries	Chromium bearing residue and sludge	

S.No.	Type of Industry	Expected Hazardous Waste		
18	Electronic Industries	Process residue and wastes		
		Spent etching chemicals and solvents		
19	Pulp and Paper Industries	Spent chemicals		
		Corrosive wastes arising from use of strong acid and		
		bases		
		Process sludge containing adsorbable organic		
		halides(AOX)		
20	Barrels / containers used	Chemical-containing residue arising from		
	for handling of hazardous	decontamination.		
	wastes/chemicals	Sludge from treatment of waste water arising out of		
		cleaning / disposal of barrels /containers		
21	Purification and treatment	Exhaust Air or Gas cleaning residue		
	of exhaust air/gases, water	Spent ion exchange resin containing toxic metals		
	and waste water from the	Chemical sludge from waste water treatment		
	processes in this schedule	Oil and grease skimming		
	and common industrial	Chromium sludge from cooling water		
	effluent treatment plants			
	(CETP's)			

As on today, there is no TSDF in the surrounding state of Chhattisgarh. It is proposed to accept Aluminum Dross, Spent Pot Liner (SPL) and other waste from aluminium industries such as BALCO etc. All applicable rules and regulations shall be followed, including sending a copy of the manifest to the other State Pollution Control Board of the sender (i.e. Copy 7 – Grey), as per and Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

It is proposed to utilize high calorific value waste through generation of AFRF. There is a huge potential for cement industries to accept the AFRF generated at the proposed TSDF and to use the material for co-processing. Cement plants in Madhya Pradesh are encouraged to have co-processing facilities and some plants are already authorized as per the "Guidelines for Environmentally Sound Recycling of Hazardous Wastes" for commonly recyclable hazardous wastes and the SOPs issued under Rule-9 of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 by Central Pollution Control Board, Delhi. The Biomedical waste treatment facility is being proposed to treat biomedical waste up to 12.5 TPD. The other facilities being operated within 75 km area are M/s. Elite Engineers, Jabalpur.

The proposal was considered by the Expert Appraisal Committee (Infra-2) in its 45th Meeting held during 17th-18th October, 2019 for determination of the Terms of Reference (ToR) for undertaking detailed EIA study in accordance with the provisions of the EIA notification dated September 14th, 2006 and subsequent amendments. The EAC has given Terms of Reference

vide F. No.10-40/2019-IA.III dated December 05, 2019. The proposed project details are given in **Table 1.6.**

S. No.	Facility	Capacity
1	Secured Landfill (Direct Landfill)	250 TPD
2	Landfill after Treatment	400 TPD
3	Common Incineration (hazardous waste and bio medical waste)	55 TPD
4	Bio-medical Waste Treatment	12.5 TPD
5	Alternative Fuel and Raw Material Facility (AFRF)	55 TPD
6	E-Waste Recycling Facility (with Precious Metal Recovery)	82 TPD
7	Drum Decontamination Recycling Plant	10 TPD
8	Used / Spent Oil Recycling Facility	54 KLD
9	Lead Recycling Facility	65 TPD
10	Paper Recycling Facility	10 TPD
11	Plastics Recycling Facility	10 TPD
12	Solvent Recovery Facility	27 KLD
13	Aluminium Dross Reprocessing Facility	165 TPD
14	Spent Pot Liner (Carbon Portion) Reprocessing Facility	165 TPD
15	Spent Pot Liner (Refractory Portion) Reprocessing and Disposal Facility	165 TPD
16	Renewable Energy	2 MW
17	Waste to Energy	2 MW

Table 1.6 Details of proposed treatment facilities with capacities

1.3.2 Project proponent

The proposed project will be established and operated by Ramky Enviro Engineers Limited. REEL is the leading provider of comprehensive waste management and environmental services in India. REEL operates 15 hazardous waste management facilities, 20 biomedical waste disposal facilities and over 28 municipal solid waste management facilities. The company is also setting up recycling facilities for metals, oil, solvents, paper, plastic, etc.

1.3.3 Ramky group waste management division

Ramky Waste Management is focused in the fields of Industrial Hazardous Waste Management, Bio-Medical Waste Management and Municipal Solid Waste Management. The group companies have the credit and distinction of having established first-of-its-kind bio-medical waste and hazardous waste management facilities operating on a common platform in the country at Hyderabad. The group today is the leader in waste management in India. The company presently is having 15 hazardous waste management facilities established and operating (some are under construction stage) under the name of:

- > Hyderabad Waste Management Project located at Hyderabad
- > Mumbai Waste Management Limited located at Mumbai
- > West Bengal Waste Management Limited located at Haldia
- > Tamil Nadu Waste Management Limited located at Chennai
- Uttar Pradesh Waste Management Project located at Kanpur
- Coastal Waste Management Project located at Visakhapatnam
- > Rajasthan Waste Management Project located at Udaipur
- > Punjab Waste Management Project located at Chandigarh
- > Karnataka Waste Management Project located at Bangalore
- > Odisha Waste Management Project at Jajpur
- > Balotra Waste Management Project at Barmer
- > Madhya Pradesh Waste Management Project Located at Indore
- > West Bengal Waste Management Limited located at Saltora
- > Tamil Nadu Waste Management Limited located at Madurai
- > Bihar Waste Management Project at Bhojpur.

The hazardous waste management facilities in operation are integrated facilities catering to over 6000 industrial establishments and catering to over 700,000 TPA of industrial hazardous wastes. The facilities comprise of a secured landfill facility in compliance to CPCB National Standard, a waste stabilization facility, incinerator, intractable and temporary stores, leachate treatment facility, advanced laboratory, transport equipment, administrative and other supporting infrastructure. Ramky facilities are serving as role models for waste management facilities in the country today.

The company has design, detailed engineering capability for the above-mentioned capacity as proven from the established facilities. All the facilities are equipped with state of the art laboratories capable of performing comprehensive and fingerprinting analysis. The company deploys complete mechanization in collection and transportation of wastes. Ramky's experience in MSW is also exhaustive in terms of various consultancy projects rendered for Telangana and Karnataka states in addition to the MSW management projects awarded at Haldia, Bangalore, Guwahati, Hyderabad and New Delhi.

In a society where the environment stands on the top of social agenda with economic policies not tied to the same, our effort towards improvement of the environment is seen as a great step towards environmental improvement projects in the country. All the waste management facilities established by the Ramky Group are operated and maintained with high priority towards environment, occupational health and safety aspects. Wherever possible the operations have been automated or mechanized and all the staff working with the waste is provided with adequate and suitable personal protective equipment and regular health checkups.

1.4 Brief description of nature, size, location of the project and its importance to the country and region

The proposed project is targeted to treat scientifically and dispose safely, the hazardous, industrial, bio medical, e-waste etc. along with recovery of spent solvents and oils, recycling of waste paper & plastic and treat other miscellaneous wastes generated from various hazardous waste generating units from different districts of Madhya Pradesh state. The proposed project will be designed in line to meet the following rules.

- The Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and subsequent amendments
- The Bio-Medical Waste Management Rules, 2016 and subsequent amendments
- The Plastic Waste Management Rules, 2016 and subsequent amendments
- E-Waste (Management) Rules, 2016 and subsequent amendments
- Batteries (Management & Handling) Amendment Rules, 2010 and subsequent amendments

The details of the project site are given in **Table 1.7** the location map of the project site is given as **Figure 1.2** and Google image of the project site is shown in **Figure 1.3**.

	Table 1.7 Teatures of the propose		
Land Area	80,000 sq.m (8 Hectares)		
Project Schedule	7(d) – Category A		
	Common Hazardous Waste Treatm	nent, Storage and Disposal Facilities	
	(TSDFs), All integrated facilities hav	ing landfill and incineration including	
	BMW facilities.		
	23° 06' 42.24" N, 80° 13' 06.71" E	23° 06' 32.63" N, 80° 13' 10.87" E	
Land Coordinates	23° 06' 43.85" N, 80° 13' 12.85" E	23° 06' 32.28" N, 80° 13' 10.35" E	
	23° 06' 40.67" N, 80° 13' 13.13" E	23° 06' 27.21" N, 80° 13' 09.89" E	
	23° 06' 40.88" N, 80° 13' 14.52" E	23° 06' 25.80" N, 80° 13' 03.94" E	
	23° 06' 40.11" N, 80° 13' 14.66" E 23° 06' 31.55" N, 80° 13' 02.		
	23° 06' 39.85" N, 80° 13' 13.23" E 23° 06' 32.76" N, 80° 13' 08.47" E		
Project Cost	Rs. 40 Crores		
Elevation	453-461 m above msl		
Nearest Railway	Jabalpur Junction - 28 km (NW)		
Station			
Nearest Town	Jabalpur - 27 km (NW)		
Nearest Habitation	Jhurkhi village - 0.9 km (N)		
Nearest Highway	SH-22 (Kumdam- Jabalpur Rd) - 12.2 km (N)		
	NH-30 (Mandla-Jabalpur Rd) - 14.8 km (W)		
Nearest Airport	Jabalpur Airport - 17 km (NW)		

Table 1.7 Features of the proposed project site

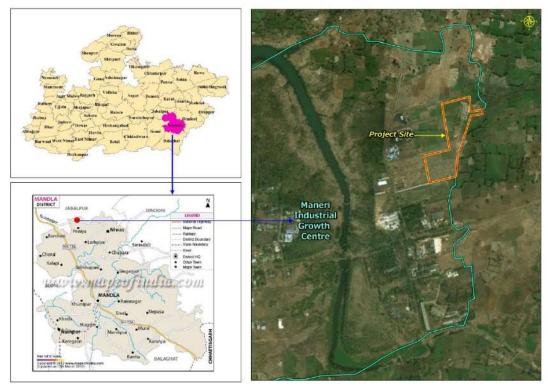


Figure 1.2 Location map of the site

Figure 1.3 Satellite image of the project site



1.4.1 Importance of the project

There is a growing concern all over the country for the disposal of hazardous wastes generated from anthropogenic sources. The waste generators find it difficult to dispose off their hazardous wastes without causing environmental disturbance, as very few appropriate disposal facilities are available. The Government of India has promulgated the Hazardous Waste (Management & Handling) Rules in 1989 through the Ministry of Environment, Forest and Climate Change (MoEF&CC) under the aegis of Environment (Protection) Act 1986. Also in order to encourage the effective implementation of these rules, the MoEF&CC has further amended the rules several times with the emendation made in 2016 being the latest.

The hazardous wastes need to be disposed of in a secured manner in view of their characteristic properties such as, toxicity, corrosivity, ignitability, reactivity and persistence. A wide range of health hazards have been attributed to their contamination. A number of options are available for the treatment and disposal of a variety of hazardous wastes; the options available for hazardous waste management are not being efficiently utilized by the waste generators resulting in severe pollution of air, land, surface and groundwater.

At Treatment Storage Disposal Facility (TSDF), the wastes are collected from the waste generators, treated as per their characteristics and finally disposed of. More than one unit operation may be employed for the treatment and disposal of the wastes at TSDF.

1.5 Scope of the study

The scope of the study is to carry out the Environmental Impact Assessment (EIA) studies to identify, predict and evaluate potential environmental and socio-economic impacts which may result from the ICHWTSDF and to develop suitable Environment Management Plan (EMP) to mitigate the undesirable effects.

1.5.1 Aim of the study

- Establishing the existing environmental conditions, identifying potential environmental impacts and identifying areas of significant environmental concerns due to the project.
- Prediction of impacts on environment, socio-economic conditions of the people etc. due to the project.
- Preparation of Environmental Management Plan (EMP).
- Development of a post-project environmental monitoring program.

The EIA report will be prepared as per the generic structure of Environmental Impact Assessment document given in EIA notification dated 14th September 2006 (and its subsequent amendments), standard TOR given for EIA/EMP report for projects/ activities requiring environmental clearance under EIA notification 2006 and additional TOR given for this project.

CHAPTER 2

PROJECT DESCRIPTION

Chapter 2

Project Description

2.1 Type of the project

The Integrated Common Hazardous Waste Treatment, Storage, Disposal and Recycling Facility which includes waste disposal/ recycling/ recovery or reprocessing units for the treatment of hazardous waste, bio medical wastes, recycling of e-waste, drum decontamination, used/spent oil, lead, paper, plastic and solvent, reprocessing facility for aluminium dross, spent pot liner (carbon and refractory portion), Alternative fuel and raw material recovery, renewable energy and waste to energy. As per EIA Notification S.O. No 1533 dated 14th Sep 2006 and its subsequent amendments, the proposed project falls under Project / Activity 7 (d) Common Hazardous Waste Treatment, Storage and Disposal Facility (TSDFs), Category "A" (All integrated facilities having incineration & landfill or incineration alone). The proposed ICHWTSDF is aimed to cater the needs for safe and scientific disposal of industrial, hazardous and biomedical wastes generated from industries and health care units throughout the state.

2.2 Need of the project

With the new initiatives of the state government of Madhya Pradesh, on rapid industrialization in various districts of the state, it is likely that the increasing quantity of waste necessitates the establishment of TSDFs with provisions for treatment, storage & disposal of various wastes in different parts of the state. The proposed facility will be established in accordance with the applicable rules and guidelines issued by MoEF&CC for catering the needs of industries and other units at Mandla district as well as its neighboring /nearby districts.

A major concern about the hazardous wastes is that they need to be disposed off in a secured manner in view of their toxic nature, environmental pollution and wide range of health hazards. The project will facilitate a one stop solution for management of all types of wastes at a common treatment facility. The wastes would be collected from the waste generators, treated as per their characteristics and finally disposed off, meeting MoEF&CC guidelines and standards.

2.2.1. Objectives of the proposed project

The main objective of the proposed project is to develop a feasible integrated facility which will cater to the Mandla district and to its neighboring nearby districts in state of Madhya Pradesh and also to a few units of Chhattisgarh (given the fact that at present the Chhattisgarh state does not have a TSDF facility). The overall objectives are to:

- Provide a common platform for the treatment of different kind of wastes
- Ensure that the environmental impacts due to waste disposal are minimized

- Ensure that resource conservation is maximized
- Ensure techno-economic feasibility of the project

2.3 Location of the project

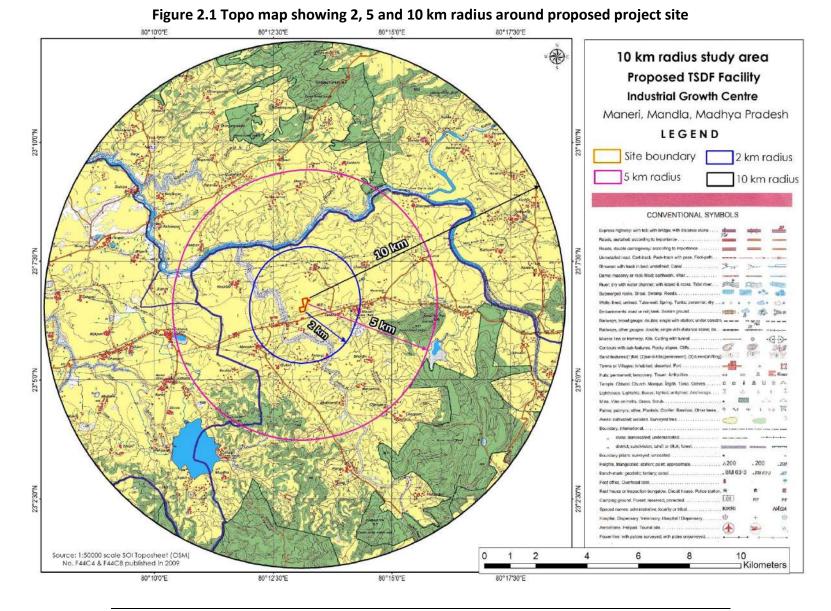
The proposed project will be established at plot no. 11, 12, 13, 14, 18, 19, 20, 21, 27, 28, 29, 31, 32, 33, 34, 35, 36, 43 and 44, IGC, Maneri (V), Mandla (D), Madhya Pradesh. It shall be noted that MP Industrial Development Corporation Limited (Formerly MP AKVN), while allotting the land, has clubbed all the above plot numbers to a single plot and named it as Plot No. 2, without any change in the land area. The topo map showing 2, 5 and 10 km radius around the project site is given as **Figure 2.1**. Site photographs are shown in **Figure 2.2**.

2.3.1 Capacities of the proposed project

The project capacities are given in **Table 2.1.** A detailed layout of the proposed site is shown in **Figure 2.3.** The breakup of each individual unit of the proposed facilities along with size and quantity are given in **Table 2.2.**

S. No.	Facility	Capacity
1	Secured Landfill (Direct Landfill)	250 TPD
2	Landfill after Treatment	400 TPD
3	Common Incineration (for hazardous waste and bio-medical waste)	55 TPD
4	Bio Medical Waste Treatment	12.5 TPD
5	Alternative Fuel and Raw Material Facility (AFRF)	55 TPD
6	E-Waste Recycling Facility (with Precious Metal Recovery)	82 TPD
7	Drum Decontamination Recycling Plant	10 TPD
8	Used / Spent Oil Recycling Facility	54 KLD
9	Lead Recycling Facility	65 TPD
10	Paper Recycling Facility	10 TPD
11	Plastics Recycling Facility	10 TPD
12	Solvent Recovery Facility	27 KLD
13	Aluminium Dross Reprocessing Facility	165 TPD
14	Spent Pot Liner (Carbon Portion) Reprocessing Facility	165 TPD
15	Spent Pot Liner (Refractory Portion) Reprocessing and Disposal Facility	165 TPD
16	Renewable Energy	2 MW
17	Waste to Energy	2 MW

Table 2.1Proposed project facilities & capacities



M/s Ramky Enviro Services Pvt. Ltd.



Figure 2.2 Photographs of the site



Figure 2.3 Layout of the proposed site

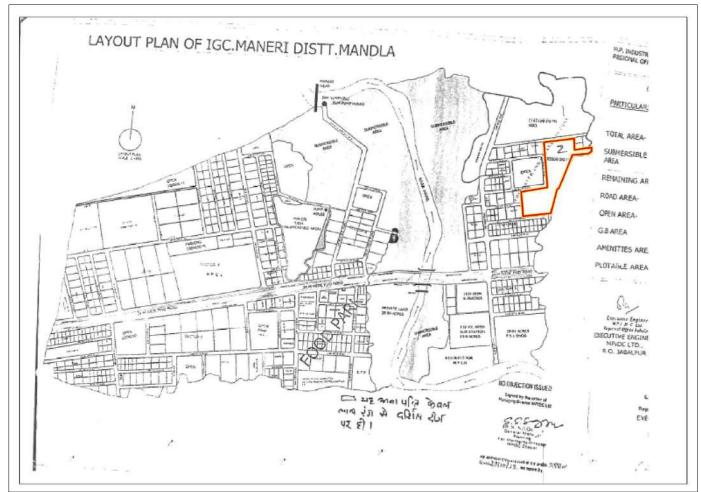


Figure 2.4 Layout of IGC Maneri

S.no	Supporting Infrastructure	Area (Sq.m)
1	Security Room	11.97
2	Underground Sump	9.00
3	Weigh Bridge & Room	11.97
4	Administration Cum Lab Building	264.10
5	Canteen	88.49
6	Electrical Panel Room & D.G Platform	32.58
7	Rainwater collection pond	660.00
8	SPL Reprocessing Facility (Carbon Portion)	750.00
9	SPL Reprocessing & Disposal Facility (Refractory Portion)	750.00
10	Vehicle Tyre Wash	159.84
11	AFRF Shed	323.70
12	Mechanised Waste Stabilization Shed , Temporary Waste Stores	939.95
13	Solvent Recovery/Used Oil Recycling Facility	310.00
14	Tank farm for Incinerator Plant	72.00
15	PCC/MCC/PLC Room	86.92
16	Incinerator Plant	350.00
17	BMW Processing Shed	622.05
18	Area for ETP	39.89
19	Workers Restrooms & Washrooms	40.01
20	Boiler & Cold Storage Shed	194.34
21	LTP Area	131.20
22	Tankfarm for Solvent Recovery / Used Oil Recycling Facility	203.50
23	General Stores & Vehicle Maintenance Shed	332.18
24	Aluminium Dross Reprocessing Facility	500.00
25	Sample Collection Platform	7.48
26	Lead Recycling Facility	794.19
27	Vehicle wash & Parking	100.00
28	E-Waste, Paper, Plastic & Metal Drum Processing Shed	2826.03
29	Landfill	25125.37
30	Leachate Collection Pond	1338.48
31	Area for WTE	2584.35

Table 2.2 List of individual units

2.4 Size of operation and its associated activities

The facilities proposed for the treatment of hazardous waste, bio-medical waste, management of E-waste, alternative fuel and raw material recovery, recycling of used oil, spent solvent, paper, plastic, lead, aluminum dross reprocessing facility, spent pot liner (carbon portion) reprocessing facility, spent pot liner (refractory portion) reprocessing and disposal facility, renewable energy and Waste to Energy.

2.4.1 Land area requirement

The total land area for the proposed project is 8 Ha. Greenbelt will cover 33% of the total area. The details of land area breakup are presented in **Table 2.3**.

Description	Area (Ha)	Area (%)
Landfill	2.51	31.40
Facilities	1.80	22.49
Roads	1.01	12.66
Green belt	2.64	33.00
Parking	0.04	0.45
Total	8.00	100

Table 2.3 Land area breakup

2.4.2 Required manpower

Details of the skilled and unskilled manpower for the proposed project during construction and operational phase are given below in **Table 2.4**.

S.No	Description	Direct	Remarks
1	Managerial staff	15	Indirect employment during operation will be
2	Skilled and semi- skilled	75	around 100 persons
	Total	90	

 Table 2.4 Manpower requirement details

2.4.3 Water requirement

The total water requirement for the proposed project is estimated as 120 KLD out of which 60 KLD will be met through Audyogik Kendra Vikas Nigam (Jabalpur) Limited/tankers/borewell and remaining 60 KLD is treated water. The major part of the treated water is used for greenbelt (24 KLD), stabilization (16 KLD), incineration (16 KLD) followed by truck wheel wash, floor washings.

During rainy season, the fresh water requirement will be 36 KLD only as the 24 KLD consumed for greenbelt will not be required. Hence the water used for greenbelt during non rainy days will be adjusted for remaining requirements. The water balance is given in **Table 2.5**.

S.No	Description	Water requirement (KLD)				Remarks	
5.110	Description	Fresh	Treated	Total	Effluent		
1	Secured Landfill and Stabilization	0	16	16	0	Leachate generated will be treated in LTP & reused for spraying on landfill or disposed through incinerator (spray dryer)	
2	Incineration	8	16	24	20		
3	Biomedical Waste Treatment	4	0	4	3	Spent to ETP for treatment	
4	Alternative Fuel and	5	0	5	4		

 Table 2.5 Water requirement

C No.	Description	Water requirement (KLD)				Remarks
S.No	Description	Fresh	Treated	Total	Effluent	
	Raw Material Facility (AFRF)					
5	Recovery and Recovery Facilities like (E-Waste with PM, Drum Decontamination, Lead, Paper, Plastics)	10	0	10	9	
6	Boiler and cooling tower (Used oil and Solvent Recovery Facility)	20	0	20	17	
7	Aluminum Dross, SPL (Carbon Portion), SPL Refractory Portion Reprocessing Facilities	2	0	2	2	
8	Renewable Energy and Waste to Energy	4	0	4	2	
9	Truck Wheel Wash/Floor Wash etc.	0	4	4	2	
10	Domestic	7	0	7	5	Sent to soak pit/treated in STP
11	Greenbelt	0	24	24	0	
Total 60 60 120 64						
Note: Effective leachate generation after recirculation to the landfill is estimated to be approx. 30 KLD when the facility is operated at full capacity.						

2.4.4 Power and fuel requirement

The details of the power required for operation of the facility and fuel required for running DG sets for emergency use during power failure are given in **Table 2.6**.

Details	Requirement	Remarks		
Power required	375 kVA	Madhya Pradesh State Electricity Board (MPSEB)		
DG set	2x 200 kVA	Used only for emergency power backup		
HSD Fuel for DG set/Incinerator	84 L/hr	Purchased from local dealers		
Coal Boiler	1x2 TPH	Coal shall be purchased from local		
	1x4 TPH	dealers		

 Table 2.6 Power and Fuel Requirement

2.5 Hazardous wastes management and process description

The hazardous wastes to be handled by the proposed project are expected to comprise the following groups:

> Waste oil/used oil/skimmed oil/oily sludge

- ETP sludge
- Sludge from water treatment plants
- > Discarded containers used for chemicals and hazardous substances
- > Date expired / off specific /discarded chemicals and products
- > Ash from Hazardous waste incineration
- > Sludge generation from processing of waste water from recovery/ reuse/ recycle
- Miscellaneous waste like used cotton, gloves, gum boots
- Contaminated filter / filter bags
- Contaminate centrifuge bags
- Spent activated carbon and any other waste
- Tank bottoms residues
- Spent catalysts
- Process dust
- > Dust / particulate from exhaust / flue gas treatment
- Sulphur sludge
- Oil contaminated earth
- Resin residues
- Asbestos containing waste
- Sludge from solar ponds
- > Alkaline and acidic and paint sludges
- Spent resins from DM plant
- Distillation residue / Tarry Waste
- Cooling water sludge

Depending on the nature of the hazardous waste and its characteristics, various types of treatment and disposal methods have been proposed according to the standards.

- > ETP sludge can go to landfill either directly or after stabilization.
- Still bottom residues, process residues and other organic wastes can be sent for incineration including spent carbon depending on the characteristics of the impurities.
- Incineration ash, slags, asbestos and glass fibers are essentially inorganic in nature and can go to landfill directly or with simple stabilization techniques.
- Spent catalysts and resins would have to be characterized on a case-by-case basis to assess their nature and characteristics. However, the percentage of wastes generated through these sources is likely to be very small as most of it is taken back by the manufacturers.
- > Salts will have to be bagged and land filled.
- Based on the above compiled information wastes have been classified by their pathway of disposal:
 - Wastes going to direct landfill
 - o Wastes that require stabilization prior to landfill

- Wastes requiring storage until alternate economically viable techniques are made available.
- Wastes requiring incineration with or without pre treatment

Processing/Recycling/Recovery facilities

The various types of wastes are used to recycle or recovery by the proposed project is expected to comprise the following:

- > E-waste such as TVs, monitors of computer etc.,
- Spent Solvents
 - Isopropyl alcohol
 - o Butanol
 - Toluene etc.
- > Waste oil such as Lubricants, Transformer oil etc.,
- Liquid type incinerable waste
- Solid type incinerable waste
- Waste paper/plastic

The following general guidelines shall relate to daily activities associated with the operations of TSDF:

- > The secured landfill facility shall operate only during daylight hours.
- The landfill will be staged in cells so that the minimum practical area of waste is exposed and maximum practical area of waste has the final cap in place i.e., progressive filling and capping of the landfill ensuring minimization of infiltration of wastes
- The weighbridge at the main entrance will record all movements and weights and receive a waste tracking receipt as required by the waste manifest system.
- The standpipe forming part of the leachate collection system shall be checked regularly for the presence of leachate. Once leachate is detected it shall be regularly pumped out and transferred to the leachate treatment facility on-site. The level of leachate in the standpipe shall not be allowed to rise above the level of the leachate collection system.
- Materials Safety Data Sheets (MSDS) for every chemical used or handled at the landfill shall be provided on the premises.
- Monitoring and auditing of the facility shall be performed on a periodic basis.
- > Met-station shall be installed with a continuous recording system.
- > A security system shall be maintained to avoid trespassing & hazard to the public.
- Once a waste is received at the TSDF, a sample of waste shall be collected at the sampling bay/temporary storage facility and shall undergo laboratory analysis based on which its pathway of treatment/ disposal shall be determined.
- A waste manifest system shall be developed in accordance with the requirement of the regulatory agencies to cover the transportation of the waste to TSDF and to provide a record of waste manifestation. The manifest system shall include details of the waste

generator, waste transporter, quantity of waste, characteristics of waste, description, consistency of waste in terms of physical state and waste category number as per HW (M&H) Rules, 2003 & subsequent amendments

- Each load of waste arriving at the facility shall be located properly and logged to identify its pathway of treatment/ storage/ disposal.
- An inventory shall be maintained at the arrival and departure dates of waste loads in and out of the intractable waste storage area.

The pathways of waste disposal at the site are shown in the form of flowchart in Figure 2.5.

2.5.1 Laboratory facilities

A well-established laboratory shall be proposed and this will be used to carry out comprehensive analyses of hazardous wastes like the fingerprint analysis and treatability studies to decide on the disposal path way as per the waste acceptance criteria.

2.5.2 Collection and transportation

Specially designed fleets shall be deployed for the collection of waste from industries, so that chance of spillage is minimized during transit. Articulated cranes and hook lifts mounted vehicles are used for carriage of containers. Vehicles proposed by project proponent shall be complying with the standards prescribed by CPCB, for collection and transportation of wastes which include a minimum of one each of hook loader, tripper, vibro roller, bucket loader, tractor with tanker. Type of vehicles used will be based on the relevant capacity (Crane mounted / containerized collection and loading vehicles /covered trucks / trucks having pneumatic loading / unloading arrangements). Further, the seven copy manifest system and TREM card system as per Hazardous and Other Waste (Management and Transboundary Movement) Rules 2016, shall be implemented as shown in **Table 2.7**.

Minimum SSC qualified experienced drivers are engaged for the purpose. They are trained in operating the manifest system and management of the TREM card system. As a practice a trained driver and helper are employed to accompany the truck to ensure that the manifest system and TREM card arrangement are properly maintained. Drivers and helpers are trained to take care of pollution arising out of emergency and first aid in case of injuries. Based on the need for the proposed facility, drivers and helpers would be employed.

Washing of tanker/ container and disposal of effluent: Each container of vehicle is thoroughly washed prior to being sent to the industry for collection of wastes. The collected water is treated and taken to the leachate treatment facility.

The manifest system contains information regarding:

- > Details of waste generator
- > Details of waste transporter
- > Quantitative and qualitative description of waste materials.
- Consistency of the waste

- > Waste category number and characteristics
- Precautionary measures for handling the wastes
- > Emergency procedures to be followed.

All records in respect of TSDF operations would be maintained as per the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

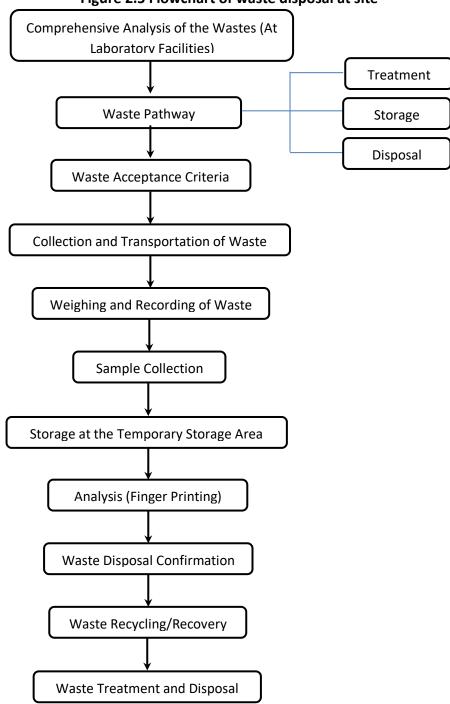


Figure 2.5 Flowchart of waste disposal at site

S.	Copy number	Purpose
No	with color code	
1	Copy 1 (White)	To be forwarded by the sender to the State Pollution Control
		Board after signing all the seven copies.
2	Copy 2 (Yellow)	To be retained by the sender after taking signature on it from
		the transporter and the rest of the five signed copies to be
		carried by the transporter.
3	Copy 3 (Pink)	To be retained by the receiver (actual user or treatment storage
		and disposal facility operator) after receiving the waste and the
		remaining four copies are to be duly signed by the receiver.
4	Copy 4 (Orange)	To be handed over to the transporter by the receiver after
		accepting waste.
5	Copy 5 (Green)	To be sent by the receiver to the State Pollution Control Board.
6	Copy 6 (Blue)	To be sent by the receiver to the sender
7	Copy 7 (Grey)	To be sent by the receiver to the State Pollution Control Board
		of the sender in case the sender is in another state

Table 2.7 Manifest system for hazardous waste as per HWM rules 2016

2.5.3 Storages

Temporary storage facilities will be provided primarily to store the wastes upon receipt at the facility until its pathway of waste disposal is determined. The temporary waste storage facility shall keep each shipment of wastes separately and ensure that wastes do not get mixed with each other. This is to ensure that incompatible wastes are kept segregated. Compatible wastes that can be mixed with others and those that can be stored in drums/containers are kept away from incompatible wastes. Incinerable wastes are stored separately in a shed following compatibility and labeling of the wastes. CPCB guidelines for the storage of incinerable wastes shall be followed.

Intractable Waste Storage Area: Waste coming to the TSDF that does not meet the criteria for landfill disposal or treatment or incineration would be referred to as intractable wastes. It is proposed to have a suitable storage area for these categories of waste until alternate viable treatment technologies are identified and become available.

- > Proper ventilation shall be provided to prevent accumulation of hazardous gases.
- The floor shall be a concrete slab or other impermeable, non-reactive material with a proper bund and graded towards one corner for the collection of accidental spillage and leakage.
- The storage area shall be built not less than 1 m above the 1:100 year flood level (nearest river) to avoid inundation.
- Bund and/or drains shall be provided around the storage area to avoid storm water entering into this area.

Fire control equipment shall be installed, appropriate to the characteristics of the waste and as the situation demands.

2.5.4 Waste disposal operations

2.5.4.1 Waste stabilization

It is proposed to establish a waste stabilization facility (with provision for immobilization, encapsulation, solidification) to treat up to 450 TPD of hazardous waste. Waste stabilization is designed to convert industrial wastes in the form of liquids, semi-solids or reactive solids into low leachable materials that can be deposited into a secured landfill. The stabilization operation will be carried out for all waste that requires this to minimize their contaminant leaching potential. This will change the nature of these wastes to a less hazardous category. Stabilization involves the immobilization of leachable materials by fixation as non-reactive solids. The treated wastes are assessed for compatibility with other wastes before being landfill and for compatibility with the HDPE and the pipe network. The term stabilization covers a number of mechanisms including:

- Immobilization / Chemical fixation the chemical binding of contaminants within a cementing structure to reduce the mobility or leachability of the waste.
- Encapsulation the occlusion or entrapment of contaminant particles within a solid matrix.
- Solidification the conversion of slurries that do not readily de-water, into solids by addition of adsorption agents.

Treatment facility utilizes a range of techniques and processes designed to change the physical, chemical or biological characteristics of the waste. This may include changing the composition so as to neutralize the waste, recover energy or natural resources from the waste, render the waste non-hazardous or less hazardous, safer to transport, store, dispose off or to reduce its volume. Typical reagents used, the infrastructure proposed and operations for waste stabilization units are presented in **Table 2.8**.

Typical reagents	Infrastructure	Typical operations		
Cement, lime, fly	 Storage facilities for regents 	 Receiving the waste 		
ash, bentonite clay,	 Tanks/Drums for storage of 	 Addition of reagents 		
saw dust, Sodium	reagents as required	 Mixing / Curing 		
silicate solution	 Stabilization bins for mixing the 	 Analysis of the stabilized 		
would be used as an	wastes	wastes		
additive binding	 Earth moving equipment for 	 Approval by laboratory for 		
agent wherever	movement of wastes and mixing.	disposal		
required	 Place for curing the treated waste 	 Transfer of waste materials 		
	 Trucks for hauling the wastes. 	to the truck		
		 Disposal in landfill 		

Table 2.8 Reagents, infrastructure and operations for waste stabilization unit

Application criteria: A study of the waste characteristics carried out as an integral part of the project indicates the following applicability to the process described below in **Table 2.9.**

Mechanism	Applicability		
Immobilization /	Heavy metal and metal plating sludge		
Chemical Fixation	Copper-chromium-arsenic wood preservative wastes		
	Mercury waste		
	Bag house dust		
	Tannery wastes		
	Spent catalysts		
	> Others		
Solidification	Effluent treatment plant sludge		
	Oil and paint sludge		
	Bitumen wastes		
	Textile industry sludge		
	Wool scouring slurries		
	> Others		
Encapsulation	Aluminum powder		
	Asbestos		
	➢ Filer aids		
	> Others		

Table 2.9 Stabilization mechanism based on waste characteristics

2.5.4.2 Secured landfill

Secured landfill has been proposed to dispose off up to 650 TPD (including upto 200 TPD direct land fillable waste and 450 TPD after stabilization/treatment). The landfill will be designed and constructed as a secure facility to contain the waste material and any leachate, which is formed by the entrapped moisture or by infiltration of rainfall. To meet these requirements the base of the landfill has been designed as an engineered liner constructed prior to the placement of waste and also an engineered capping over the surface after completion of filling to minimize the infiltration of rainfall.

The base liner of the landfill containment system is proposed to be a double composite liner with synthetic geo-membrane plus clay. Adequate leachate collection system shall be incorporated at the base to collect and remove the leachate. These shall incorporate HDPE pipes embedded in drainage layers of sand/ gravel and /or geonet/ geotextile. The composite liner (secondary liner) shall comprise of a 0.45 m thick clay compacted to a permeability less than 10⁻⁹ m/s and above this shall be a HDPE liner with permeability less than 10⁻¹⁴ m/s above which a complete drainage system shall be placed. Above the secondary base liner shall be placed a primary liner consisting of primarily clay layer and HDPE membrane which will prevent infiltration into the secondary layer. A leachate collection and removal system shall also be placed over the primary liner to collect and remove any leachate generated by infiltration of precipitation or by the moisture entrapped in the waste. This makes the secondary system to

serve as a leak detection system and an early warning of potential future liabilities to necessitate action for remediation. Above the drainage system of the primary liner shall be placed a geo-textile filter to act as a filter/ barrier between the waste and the drainage system. This entire system would make the base liner a double composite liner meeting the national laws.

Clay liner consists of a varying proportions of hydrated aluminum silicates (e.g. kaolnite, bentonite, illite and montmorillonite) which, when properly compacted, form a soil mass with a very low hydraulic conductivity. The clay material for use as the liner at this landfill shall be analyzed and permeability testing shall be carried out to ascertain its low permeability. Design permeability of the clay liner has been fixed at 10^{-09} m/s and with availability of clay liner; we will be able to achieve better results than the design values. Placement of clay liner shall be most critical in terms of its efficiency of functioning. Clay should be placed in layers not exceeding 200 mm and shall be compacted to attain the required permeability. Further to this, clay shall be kept moist to ensure that it does not dry up and cause cracks to the lining system. To ensure this we intend to keep the clay for the purpose at +4% wet of optimum moisture content.

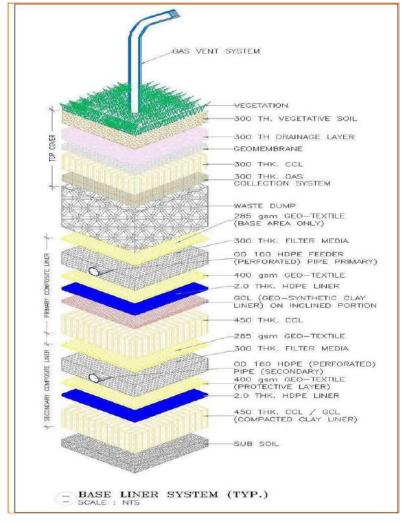
Synthetic liners consisting of various synthetic flexible membrane liners have been considered for use as the primary liner at the proposed landfill. Both Poly-Vinyl Chloride (PVC) and High – Density Polyethylene (HDPE) liners are generally suitable for this landfill. Tensile strength is a fundamental design consideration in order to assess the ability of the liner to resist uniaxial and biaxial strains, which occurs in the landfill. Another stress strain consideration is the coefficient of thermal expansion. Considering various membrane properties it is decided to use HDPE liner with appropriate thickness as primary liner for the base of the landfill. HDPE was selected for the following reasons:

- Adequate strength to withstand mechanical strength during construction, placement and operations.
- > Acceptable weathering performance.
- > Superior physical properties under chemical and environmental exposure to wastes
- > Capability to withstand the seaming process.

The hydraulic conductivity of HDPE is of the order of $0.5*10^{-16}$ m/sec, which is effectively impermeable. Construction of the seam welding process shall be subjected to strict QA/QC measures to ensure the integrity of the liner.

Secure landfill is the final placement area for land fillable hazardous wastes which are treated or wastes does not require treatment. Waste directly or after treatment will be disposed in the landfill as per the laboratory advice. Waste will be spread in the landfill using heavy earth machinery and then compacted using vibro compactor. At the end of the landfill operations 10 - 15 cm soil cover is placed as a daily cover.

During the rainy season a flexible geo-membrane cover shall be placed over the uncapped area of the landfill to minimize infiltration of rainfall into the landfill; the rain water shall be diverted to join the surface water drains. At the end of the total landfill operations the final capping shall be done using composite liner with clay and synthetic geo-membrane, with vegetative soil cover grass cover. The cross section of the landfill meeting MoEF&CC Guidelines is given in **Figure 2.6.**





Liner system specifications: Double composite liner as explained in landfill Section
Capping arrangement: Yes, section as defined in landfill Section
Monsoon capping: Yes, during monsoon the facility shall be under monsoon covers.
Primary collection system: 300 mm Drainage media with lateral and header pipes
Secondary collection system: 300 mm Drainage media with lateral & header pipes/Geo net

Secure landfill is the final placement area for land fillable hazardous wastes which are treated or wastes that do not require treatment. Waste directly or after treatment will be disposed in the landfill as per the suggestions of the laboratory personnel. Waste will be spread in the landfill using heavy earth machinery and then compacted using vibro compactor. At the end of the landfill operations, 10-15 cm soil is placed as a daily cover. During the rainy season, a flexible geo-membrane cover shall be placed over the uncapped area of the landfill to minimize infiltration of rainfall into the landfill and the rain water shall be diverted to join the surface water drains. At the end of the total landfill operations, final capping shall be done using composite liner with clay and synthetic geo-membrane along with vegetative soil cover and grass cover.

2.5.4.3 Leachate management

Leachate generated from the landfill is effectively collected and disposed without causing any adverse effect to the environment. Leachate generated is collected by a network of lateral and header pipes embedded in a drainage layer, all of which is eventually drained into a leachate collection sump. The collected leachate is transferred to a leachate collection pond/ solar evaporation pond where it is given a retention time of one to two days during which all the residue will be settled down. The decanted liquid is directly reused as sprayer on the landfill or pumped to the incinerator. The residue is disposed in the landfill. However, after the integrated facility is established, the leachate would be directed to the Effluent Treatment Plant (ETP) along with wastewater generated from other units. Some portion of the treated effluent will be recycled back to the waste stabilization unit.

2.5.4.4 Design of leachate collection system

The leachate collection system in an engineered landfill takes the form of an under-drain beneath the waste material it is required to ensure there is no more than a limited head of pressure above the base liner to cause leakage of liquid from the base of the landfill. The design maximum pressure head in the proposed landfill is limited to 300 mm.

Drainage is affected by a layer of about 300 mm thick of graded sand/gravel having a high permeability. Within this layer a network of HDPE pipes are placed to collect leachate and conduct it quickly to the collection sump for removal from landfill. The pipes are typically perforated only over the upper half to allow the leachate to enter the pipe and thereafter to be contained within the pipe network system. The layout of the pipe network generally includes sufficient redundancy to ensure that if a blockage occurs somewhere in the network the leachate simply backs-up a little then flows into the system a little further up-gradient. Two layers of the leachate collection system are provided one over the other. Slotting area of the pipe is done only on the top 120° portion of the pipe and to an extent of 100 sq. cm per running meter of the pipe.

The key design features of the leachate collection system to be installed at the proposed landfill comprise the following:

- A network of semi perforated HDPE pipes is laid out directly over the primary and secondary liners and graded towards the collection sump at no less than 1 and 2% slope, with a slotting area of 100 sq. cm per running meter of the pipe.
- A drainage layer 300 mm thick of graded sand/gravel placed over the entire base of the landfill, covering the pipe network.
- A geo-textile placed over the primary liner serving the purpose of a filter/ barrier between the waste and the drainage media.

The pipe shall have sufficient strength to withstand the load imposed by the overlying waste and the earth moving activities associated with the placement and the compaction of the waste (min 6 kg/ sq.cm). The main pipe (headers) feeding leachate to the sump should have the capability to be cleaned out in case of clogging. However, the design includes sufficient redundancy of pipe work to ensure alternative drainage paths that are available in the event of localized clogging of any part of the system. Leachate treatment plant design is discussed in the subsequent sections.

Quantity of leachate generated from landfill:

 $I = P - PC_{R/O} - AET + / - S$

Where,

I - Rate of infiltration
P - Precipitation
PC_{R/O} - Coefficient of runoff
AET - Actual evapo-transpiration
S - Soil moisture content retention capacity
Empirically,
For capped portion of landfill:
I = 0.01 P
For uncapped portion of landfill:
I = 0.07 P
Landfill with temporary cover:
I = 0.3 P

Drainage of surface run-off, its collection, treatment and disposal

Network of open channels have been designed and constructed around the landfill to intercept surface runoff of rainwater and divert it around the facility or collect it for use at the facility or for disposal. Storm water collected on the land fill site will be directed to a first flush retention pond which is designed for a sufficient capacity to cover a one in 100 years 10 minutes storm event.

Storm water drainage system

Storm water drainage is one of the main components of landfill facility. The arrangement is such that the storm water from the landfill facility has to be collected effectively in the drainage system and conveyed away from the facility quickly. Storm water drain is of trapezoidal shape / rectangular with concrete/pitching. The inside part of the drain has to be plastered with cement mortar.

First flush retention pond

Surface water runoff is a significant component in a landfill design and is clearly designed. The design includes a garland drainage system all around the landfill which is lined and is connected to a storm water collection pond. Water collected in the pond is tested for storm water quality parameters and if it meets the discharge standards it is discharged, otherwise the same is considered as leachate and sent to the leachate treatment plant.

2.5.5 Common incineration

A dual chambered incineration facility with a capacity of 2500 kg/hr (to handle up to 55 TPD) has been proposed. The incineration facility shall be established in compliance with CPCB Guidelines for Common Hazardous Waste Incineration (i.e. HAZWAMS/30/2005-06). Typical wastes that would need to be incinerated by the operator of TSDF may include - solvent wastes (spent solvents), waste oil, oil emulsions, oil mixtures, pesticide wastes, pharmaceutical wastes, refinery wastes, phenolic wastes, grease and wax wastes, organic wastes containing halogens, sulphur, phosphorus or nitrogen compounds, material contaminated with Oil, and other hazardous waste streams with calorific value >2500 Kcal/kg. As it is very difficult to estimate the quantities of different types of waste that would go for incineration, storage facility for incinerable waste shall be established in compliance with the CPCB Guidelines "Guidelines for Storage of Incinerable Hazardous Wastes by the Operators of Common Hazardous Waste Treatment, Storage and Disposal Facilities and Captive HW Incinerators"

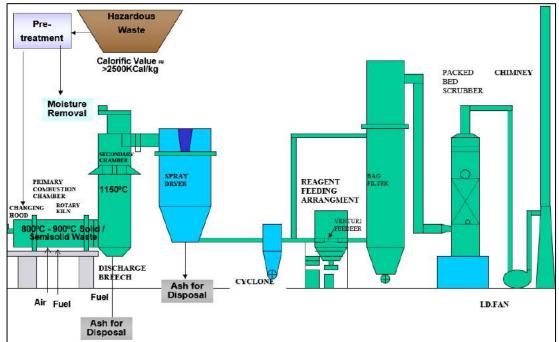
Incineration is an ultimate treatment process, applied to certain wastes that cannot be recycled, reused or safely deposited into a landfill. It is a high temperature, thermal destruction oxidation process in which hazardous wastes are converted in the presence of oxygen in air into gases and incombustible solid residue. The gases are vented into the atmosphere with cleaning as deemed necessary while the solid residue is sent to landfill for disposal. The proposed incinerator would cater for the disposal/ destruction of the following wastes:

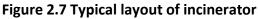
- Bio-medical wastes
- Spent solvents
- > Waste oils, oil emulsions and oil mixtures
- Pesticide wastes
- Refinery wastes
- Pharmaceutical wastes
- Phenolic wastes
- Grease and wax wastes
- > Organic wastes containing halogens, sulphur, phosphorus or nitrogen compounds
- Solid materials contaminated with oils.
- Organics with high calorific value
- E-waste

A typical incineration system consists of several distinct units. The first unit is the kiln or primary combustion chamber, into which waste is fed and in which initial volatilization and destruction of contaminants take place. Gases formed during incineration in the kiln include incombustible organics or combustion by-products, which are generally referred as Products of Incomplete Combustion (PIC). These PIC's are drawn to a secondary combustion chamber to inverse the efficiency of destruction of PIC's The off-gases from secondary chamber is routed through an air pollution control system in which gases are cooled, particulate matter is removed and final flue gases are emitted through a stack.

The incinerable wastes shall be pre-processed if necessary for making it to make its calorific value uniform. The norms of halogen concentrations are maintained to less than 1%. Waste fed through a cart dumper and ram feeder into the rotary kiln and the hot gases are sent to the secondary combustion chamber. Temperature at SCC will be min. 1100 °C for waste with a gas residence time of 2 seconds. The residence time and the desired temperatures are maintained at both primary and secondary combustion chambers for complete combustion as per guidelines for hazardous waste incineration. The gases after complete combustion shall be sent to spray dryer/evaporative cooler for cooling followed by gas cleaning equipment.

The gases are passed through multi cyclones for removal of particulates. Then dry lime and activated carbon are injected for neutralization of acidic gases and removal of organic constituents if any. The flue gases are then passed through bag filters for complete removal of particulates and then through wet alkaline scrubber for neutralization. The flue gases after complete cleaning in all respects shall be sent out through a 30 m stack.





2.6 Bio-medical waste treatment

It is proposed to establish a Bio- Medical Waste Treatment Facility to treat a total of about 12.5 TPD. Out of the total 12.5 TPD bio-medical waste, it is estimated that about 4 TPD (about 30% of the total waste) shall be recyclable waste. Accordingly, it is proposed to establish 4 TPD autoclave. The balance 8.5 TPD shall be disposed of in the Incinerator (common incinerator for both hazardous waste and bio-medical waste). Growth in population, industrialization and changing lifestyles and food habits have brought with it various health related issues. More and more people are suffering from ailments. Alongside this is the growing awareness towards utilizing proper medical facilities. This has created the need for a whole range of health care establishments, hospitals, clinics, laboratories which are generating "Bio-Medical Waste" that are incompatible with the environment. These wastes need professional attention for effective management as the infectious nature of the waste can cause irreparable damage to human health and the environment. It has become imperative to monitor and control the management and handling of these wastes.

The concern about disposal of infectious wastes generated by the hospitals is increasing rapidly due to the fear of the spread of viruses such as Acquired Immune Deficiency Syndrome (AIDS), COVID-19 and Hepatitis B. These wastes (bio-medical wastes generated from health care establishments) present a high risk of causing potential damage to the human health and the environment by way of spreading. To prevent the spread of such infectious wastes that finds its genesis in bio-medical wastes (from hospitals, clinics, laboratories, dispensaries etc.) a scientific approach is required. It is essential that professionally trained personnel should handle the wastes and that the wastes should be disposed scientifically.

To enable effective management and handling of the bio-medical wastes, MoEF&CC has issued regulations for the management and handling of these wastes. In response to these rules, Government and major private hospitals initiated their arrangements for treatment and disposal of bio-medical wastes. However, the smaller nursing homes, clinics and other similar institutions which do not have or can afford such facilities need alternate modalities and arrangements to dispose their wastes, in accordance with the latest amended waste handling and management rules.

In view of the difficulties faced by private hospitals, nursing homes and clinics that could not make their own arrangements due to the high cost involved in setting up treatment and disposal facilities, the need for a centralized system for treatment was felt. Consequently, in September 2003, the Central Pollution Control Board enunciated the "Guidelines for Common Bio-Medical Waste Treatment Facility" which in addition to providing common facilities discouraged the setup of individual incineration facilities by health care establishments.

2.6.1 Categories of BMW as per BMW rules, 2016 & 2018

According to the BMW Management Rules 2016, the waste is classified into four categories. A brief description of different categories of BMW, type and colour coding of bags/container along with treatment and disposal are given in **Table 2.10**.

Category	Type of waste	Type of	Treatment and disposal	Treatment
		bag or	options (as per bio-	and
		container	medical waste	disposal
		to be used	management rules, 2016	option
		N/ 11	and amendments)	
Yellow	()		Incineration or Plasma	Incineration
	Waste	coloured	Pyrolysis or deep burial	
	Human tissues, organs,			
	body parts and fetus below			
	the viability period (as per	•		
	the Medical Termination of	bags		
	Pregnancy Act 1971,			
	amended from time to			
	time).			
	(b) Animal Anatomical			Incineration
	Waste			
	Experimental animal			
	carcasses, body parts,			
	organs, tissues, including			
	the waste generated from			
	animals used in experiments			
	or testing in veterinary			
	hospitals or colleges or			
	animal houses.			
	(c) Soiled Waste		Incineration deep burial	Incineration
	Items contaminated with		or Plasma Pyrolysis or	
	blood, body fluids like		In absence of above	
	dressings, plaster casts,		facilities Autoclaving or	
	cotton swabs and bags		micro-waving/	
	containing residual or		hydroclaving followed by	
	discarded blood and blood		shredding or mutilation	
	components.		or combination of	
			sterilization and	
			shredding. Treated waste	
			to be sent for energy	

Table 2.10 Categories, types, colour coding and treatment options for Biomedical Waste

	[
(d) Expired or Discarded Medicines Pharmaceutical waste Like antibiotics, cytotoxic drugs including all items contaminated with cytotoxic drugs along with glass or plastic ampoules, vials etc	Yellow coloured non- chlorinated plastic bags or containers	recovery. Expired cytotoxic drugs and items contaminated with cytotoxic drugs to be returned back to the manufacturer or supplier for incineration at temperature>1200°C or to common bio-medical waste treatment facility or hazardous waste treatment, storage and disposal facility for incineration at >1200°C or Encapsulation or Plasma Pyrolysis at >1200°C. All other discarded medicines shall be either sent back to the manufacturer or disposed by incineration.	Incineration
(e) Chemical Waste Chemicals used in production of biological and used or discarded disinfectants.	Yellow coloured containers or non- chlorinated plastic bags	Disposed of by incineration or Plasma Pyrolysis or Encapsulation in hazardous waste treatment, storage and disposal facility.	Incineration
(f) Chemical Liquid Waste Liquid waste generated due to use of chemicals in production of biological and	Separate collection system leading to	After resource recovery, the chemical liquid waste shall be pre-treated before mixing with other	Not accepted at the CBWTF

	I		
used or discarded	effluent	wastewater. The	
disinfectants, Silver X-ray	treatment	combined discharge shall	
film developing liquid,	system	conform to the discharge	
discarded Formalin, infected		norms	
secretions, aspirated body			
fluids, liquid from			
laboratories and floor			
washings, cleaning, house-			
keeping and disinfecting			
activities etc.			
(g)Discarded linen,	Non-	Non- chlorinated	Incineration
mattresses, beddings	chlorinated	chemical disinfection	
contaminated with blood or	yellow	followed by incineration	
body fluid, routine mask and	plastic	or Plasma Pyrolysis or for	
gown.	bags or	energy recovery.	
	suitable	In absence of above	
	packing	facilities, shredding or	
	material	mutilation or	
		combination of	
		Sterilization and	
		shredding. Treated waste	
		to be sent for energy	
		recovery or incineration	
		or Plasma Pyrolysis.	
(h)Microbiology,	Autoclave	Pre-treat to sterilize with	Incineration
Biotechnology and other	or	non- chlorinated	
clinical laboratory waste:	Microwave	chemicals on-site as per	
Blood bags Laboratory	or	National AIDS Control	
cultures, stocks or	Hydroclave	Organisation guidelines	
specimens of micro-	safe plastic	on Safe management	
organisms, live or	U	of wastes from health	
attenuated vaccines, human		care activities and WHO	
and animal cell cultures		Blue Book, 2014 and	
used in research, industrial		thereafter sent for	
laboratories, production of		incineration.	
biological, residual toxins,			
dishes and devices used for			
cultures.			

Red	Contaminated Waste	Red	Autoclaving or micro-	Autoclave
	(Recyclable)	coloured	waving/ hydroclaving	
	(a) Wastes generated from	non-	followed by shredding or	
	disposable items such as		mutilation or	
	tubing, bottles, intravenous	plastic	combination of	
	tubes and sets, catheters,	bags or	sterilization and	
	urine bags, syringes	containers	shredding. Treated waste	
	(without needles and fixed		to be sent to registered	
	needle syringes) and		or authorized recyclers	
	vaccutainers with their		or for energy recovery or	
	needles cut) and gloves.		plastics to diesel or fuel	
			oil or for road making,	
			whichever is possible.	
			Plastic waste should not	
			be sent to landfill sites.	
White	Waste sharps including		Autoclaving or Dry Heat	Autoclave
(Transluc	Metals: Needles, syringes	•		
ent)	with fixed needles, needles	•	shredding or mutilation	
circy	from needle tip cutter or	-	or encapsulation in metal	
	burner, scalpels, blades, or	-	container or cement	
	any other contaminated	containers	concrete, combination of	
	sharp object that may cause		shredding cum	
	puncture and cuts. This		autoclaving, and sent for	
	includes both used,		final disposal to iron	
	discarded and		foundries (having	
	Contaminated metal sharps		consent to operate from the State Pollution	
			Control Boards or Pollution Control	
			Committees) or sanitary	
			landfill or designated	
			concrete waste sharp pit.	
Blue	(a)Glassware: Broken or	Puncture	Disinfection (by soaking	Autoclave
	discarded and contaminated			
	glass including medicine	•	0	
	vials and ampoules except			
	those contaminated with	containers	Hypochlorite treatment)	
	cytotoxic wastes.	with blue		
	,	colored	microwaving or	
		marking.	hydroclaving and then	
I		-	I	1

(b)Metallic Body Implants	Puncture	sent for recycling.
	proof and	
	leak proof	
	boxes or	
	containers	
	with blue	
	colored	
	marking.	

2.6.2 Collection and transportation

Collection and transportation shall be done in accordance with the BMW Management Rules 2016 and subsequent amendments. In brief, BMW shall be collected from each healthcare establishment on a regular basis. Before transportation, all HCUs should ensure that the wastes are segregated into the appropriate colour-coded bins/bags, labeled properly as waste type, site of generation and date of generation. The wastes thus segregated are placed at a secured designated point from where it will be collected. It is the duty of the operator of treatment facility to transport BMW from the premises of HCUs to any offsite treatment facility. Only the vehicles complying as per the existing rules shall carry secured load, clearly marked with the name and address of the waste carrier and biohazard sign. BMW shall be transported through designated route, with colour coded, covered and leak proof trolleys to avoid spillage on road.

2.6.3 Disinfection and destruction

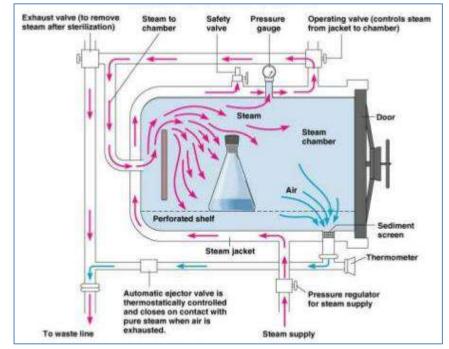
Upon receipt of the waste at the facility, wastes containers shall be unloaded. A mechanical shredder for shredding the bio-medical waste shall be installed with a capacity to handle about 100 kg of medical wastes per hour. Shredder motor capacity of 10 HP is used and 3 high speed blades shall be used. Further, the treatment or disposal options are decided on the basis of category/nature of the waste. All incinerable wastes shall be directly loaded into the incinerator, while autoclavable wastes shall be loaded into the autoclave for disinfection. Ash, residues from high temperature incineration and other materials from the process shall be collected into containers and disposed into a secured landfill.

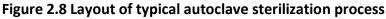
2.6.4 Autoclave

It is proposed to establish an autoclave of 4 TPD to treat bio-medical waste. The primary purpose of autoclave is to sterilize/disinfect the waste with steam. MoEF&CC has stipulated a temperature of 135°C with 35 psi pressure and 45 min duration. Under these conditions, microorganisms are completely destroyed and thus render the wastes infection free. The disinfected waste shall then be segregated into HDPE, PP, rubber, latex, glass and metal which will be further shredded completing the process of disinfection and ensuring non-recycling of the waste materials for medical/food grade purposes. All the process control conditions will be as per the applicable Bio-medical rules. A vacuum type (programmable) autoclave which can operate at all the specifications mentioned by MoEF&CC shall be proposed. Every batch shall be

monitored with a strip chart recorder and once in a month the spore validation test and/or spore monitoring shall be done. The key features of the proposed autoclave are shown in **Table 2.11** and the layout of typical autoclave sterilization process is given in **Figure 2.8**.

Туре	Vacuum Type, automatic with documentation
Temperature	121°C/135°C/ 149°C
Pressure	15 psi /35 psi/ 52 psi
Time	60 min/ 45 min/ 30 min
Automation	PLC with MMI (Man-Machine interface)
Documentation/ Recording	Computerized recording





2.6.5 Shredder

A mechanical shredder to make the waste unrecognizable as medical waste shall be installed with a capacity 200 kg/hr. The shredder shall be properly designed and covered to avoid spillage and dust generation. The hopper and cutting chamber of the shredder shall be designed to accommodate the waste bag full of bio-medical waste. The shredder blades are highly resistant and able to shred waste sharps, syringes, scalpels, glass vials, blades, plastics, catheters, broken ampoules, intravenous sets/ bottles, blood bags, gloves, bandages etc. The shredder blades shall be of non-corrosive and hardened steel.

The shredder shall be so designed and mounted so as not to generate high noise & vibration. If the hopper lid or door of the collection box is opened, the shredders shall stop automatically

for safety of the operator. In case of shock-loading (non-shreddable material in the hopper), there shall be a mechanism to automatically stop the shredder to avoid any emergency/accident. In case of overload or jamming, the shredders shall have a mechanism of reverse motion of shaft to avoid any emergency/accident.

The shredder shall have low rotational speed (maximum 50 rpm) to ensure better gripping and cutting of the bio-medical waste. The discharge height (from discharge point to ground level) shall be sufficient (minimum 3 feet) to accommodate the containers for collection of shredded material. This avoids spillage of shredded material.

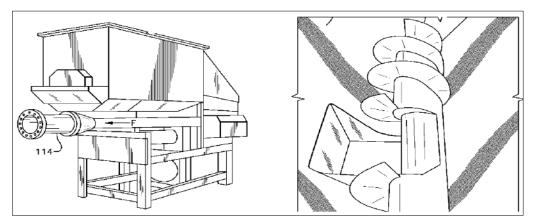


Figure 2.9 Shredder

2.7 E-Waste management

It is proposed to establish an E-waste recycling facility of 82 TPD. E-waste is a popular, informal name for electronic products nearing the end of their "useful life". E- waste is a term encompassing various forms of electrical and electronic equipment that may be old, might have reached the end of life and most importantly cease to be of any value to their owners.

Electronic Waste (E-Waste) comprises waste electronic goods which are not fit for their originally intended use. These range from household appliances such as refrigerator, air conditioner, cellular phone, personal stereos and consumer electronics to computers. The use of electronic devices for both business and personal use has increased dramatically in recent years. These electronic devices include computers (including printers and monitors), TVs, VCRs, DVD players, and cellular phones. At the same time, the life spans for these items are decreasing due to growing demand for enhanced features and performance. The ubiquitous presence of cellular phones and the advent of liquid crystal displays (LCDs), tablet PCs, and plasma TVs illustrate the rapid rate of change, since these devices were rare or unknown only a few years ago. Furthermore, many new technologies are on the horizon.

Environmental concerns with electronics are associated with the dramatic increase in the volume of E-waste – a waste stream estimated to be growing approximately three times as fast

as the rest of the municipal waste streams. The problem with E-waste is not just the volume of waste generated, but also the volume of hazardous chemicals associated with E-waste.

Most electronic devices contain a printed wiring board and battery, and these and other components may contain hazardous materials such as Lead, Mercury, Hexavalent chromium, arsenic, and Beryllium, Nickel, Zinc, Copper, Cadmium, and flame retardants. Each CRT (cathode ray tube) contains approximately 4 to 8 pounds of lead, which correlates to 300 million pounds of lead from the 50 million computers estimated to become obsolete each year.

Approximately 70 percent of the heavy metals in municipal solid waste landfills are estimated to come from electronics discards. Heavy metals such as lead and mercury are highly toxic substances that can cause adverse health effects, particularly to children and developing fetuses. Cutting down these processes also helps to reduce the levels of pollution caused by paper mills.

Sources of generation of E-Waste

In the past decade technological advances in electronic data management and communications have spurred economic growth and improved living standards of the people in many ways. However our growing dependence on electronic products both at home and work place has given rise to new environmental problem, electronic waste.

The following are the major sources of generation of electronic waste:

- 1. Large and small household appliances
- 2. IT & telecom equipment
- 3. Entertainment & consumer equipment
- 4. Lighting equipment
- 5. Electric & electronic tools
- 6. Sophisticated toys, sports equipment,
- 7. Medical devices,
- 8. Monitoring and control instruments etc.

Classification of electronic waste (E-Waste)

The electronic and electrical goods are broadly classified under three major heads.

- 1. White goods: Comprising household appliances like refrigerators, washing machines, and air conditioners.
- 2. Brown goods: This includes televisions, cameras etc.
- 3. Grey goods: This includes computers, scanners, printers, mobiles phones etc.

2.7.1 Process description

E-waste collected from various locations is manually sorted & segregated according to type of materials & contents at the take apart department & will go for refurbishing or dismantling process followed by the two major units of operations hammering and shredding with an objective of size reduction. The next process is of separation by Electromagnetic and eddy

current separation which utilizes properties of different elements like electrical conductivity, magnetic properties and density to separate ferrous, non-ferrous metal and plastic fractions. The next process is E-waste treatment, carried out mainly to recover ferrous, non-ferrous metals, plastics and other items of economic value. The major recovery operations are focused on non-ferrous and precious metal recovery at this facility.

There are two stages for Recycling the E- Waste:

- a. Mechanical process.
- b. Precious metal recovery

By using Mechanical recycling process, Electronic wastes such as Printed Circuit Boards, etc., separated into very clean fractions, with a great performance. Mechanical process flow chart of the proposed facility has been given in **Figure 2.10**.

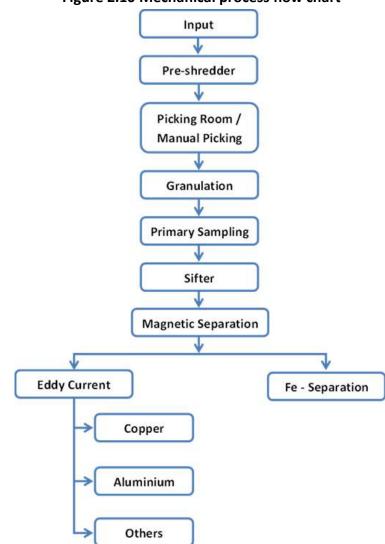


Figure 2.10 Mechanical process flow chart

The steps of the proposed process are described in following paragraphs and the process flow sheet is given in **Figure 2.11**. The flowchart for precious metal recovery is given in **Figure 2.12**.

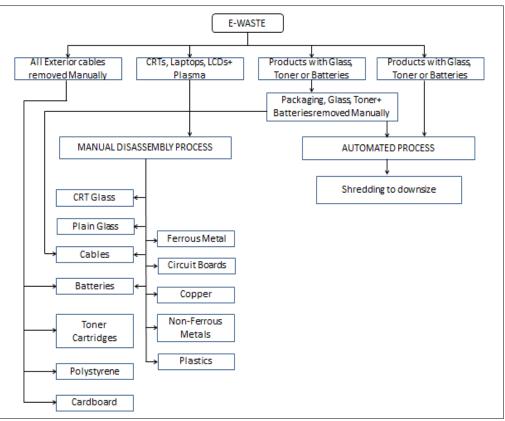
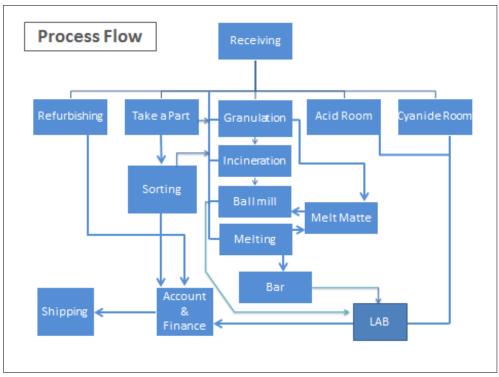


Figure 2.11 Proposed flowchart of E-waste processing

Figure 2.12 Proposed flow chart for precious metal recovery



- The e-waste received from the generator is stored at an earmarked covered shed having concrete floor and leak proof roof. Wooden or plastic pallets are provided to store the waste.
- Waste which may contain mainly electronic and electrical material and monitors of computer or TVs, shall be shifted to manual dismantling section in hand trolleys
- A set of 8 to 10 number of workstations are proposed with a suction hood for any dust particle coming out of the dismantling process. A team of experts in dismantling will be deputed for dismantling purposes with all the required tools and tackles. The tools and tackles shall be identified with the best available brand to ensure optimization in working and to avoid small accidents in the process. The employees at this section will be provided with all the required PPEs i.e. apron, safety shoes, gloves, dust mask etc. Fire extinguishers shall be provided in the working area.
- The team deputed shall dismantle all the waste articles Eg. Computer, CPU box, hard drive, CD ROM, cables, PCBs etc. and monitor into back cover and picture tube. The hard drive PCBs are further dismantled into components attached and naked PCBs.
- The dismantled PCBs will be sent for shredding followed by crushing and pulverizing. The product will be made into powder of PCB from which metal and non-metal parts will be segregated by physical process. Both the products shall be stored in bags for disposal for recovery (metal part) and for making toys and monuments (non-metal part). In case the non-metal part fails to be recycled, the same shall be disposed of into the incinerator as this consists of residue with high C.V.
- The dismantled picture tube shall be sent to Cathode Ray Tube (CRT) cutting m/c, which is a closed chamber attached with a hood connected to cyclone and bughouse.
- The CRT is put into the control panel connected automatic CRT cutting frame. The CRT will be cut into two pieces i.e. front glass and funnel glass.
- The glass which is free from all coating etc will be crushed further and stored in bags to be dispatched for recycling
- The components removed from PCBs will be segregated and stored in bags for further disposal and/or reuse.
- The ferrous material i.e. cabinet, body of monitor etc would be baled and disposed for recycling
- Plastic from cabinet, monitor will be shredded in the shredder and sold out for recycling to authorized recyclers
- The waste generated from the above process shall be stored at an earmarked area and not allowed to be exposed to the environment.

2.8 Recycling facilities

The recycling facilities proposed for the site are

- Spent solvent recycling
- Used oil recycling

- > Alternative fuel and raw material facility
- Waste plastic recycling
- Waste paper recycling
- Lead recycling

2.8.1 Spent solvent recycling

Solvent recovery facility

It is proposed to establish a Solvent recovery facility of about 27 KLD. A solvent recovery system is a process system that takes effluent and extracts useful solvents and raw materials back out of the process waste stream. The recovery of solvents from effluent can be achieved with a variety of technologies. A common recovery method is solvent distillation systems, but liquidliquid extraction, absorption systems, film evaporation, crystallization, and membrane separation can also be used, depending on the application.

Storage of spent solvents

- The waste solvents shall be received in drums (MS/Plastic) and stored in sheds which will be provided with garland drains, fire hydrant system, lined flooring etc.
- The drums shall be stacked as per the best practices. The leakages shall be avoided at any point of time.
- A separate storage shed is proposed adjacent to the facility to store the drums.
- The stacking of drums shall be in such a manner that mixing of solvent drums shall be avoided to a maximum extent.

Recovery of spent solvents

Fractional distillation process is the most suitable for the recovery of most of the spent solvents which can be either a batch or continuous operation. Some of the solvents proposed to be recovered include: Toluene, Xylene, Cyclohexane, Acetone, Methyl isobutyl ketone, Methanol, Isopropyl, alcohol, Methylene Dichloride, TetraHydroFuran, Ethyl Acetate, Iso Propyl Ether, Dimethyl formamide, Butyl acetate, Methyl Acetate, Butanol, Benzene, Ethanol, Methyl Ethyl Ketone etc.

Process description

Pre-treatment and filtration

The spent solvent is subjected for pre-treatment such as neutralization in a reactor followed by layer separation & filtration through leaf filter / micron filter for removal of any solids. Flow chart for Spent Solvent recovery is shown in **Figure 2.13**.

Distillation

The pre-treated solvent mixture is taken for distillation. This distillation can be a batch or continuous operation. The solvent mixture is heated indirectly by steam and the distillation column will be under total reflux for a specific period. Fractionation of solvent takes place with solvent / water as the case may be, separated initially under atmospheric pressure and later

under vacuum (if required). Distilled solvents are analyzed, stored and recycled, liquid effluent, mostly condensate, will be recycled back into the system and solid residue sent for landfill/ Incineration. Solvent recycling is accomplished by a distillation process that includes the following steps:

- 1. A distillation vessel processes waste solvent solution on either a batch or continuous basis.
- 2. A heated jacket injects heat into the waste solvent by conductive thermal transfer.
- 3. The vessel may be operated under vacuum, which lowers the boiling temperature of the solvent.
- 4. When the waste solvent reaches its boiling point, the solvent changes phase from liquid to a vapor.
- 5. Distillation column packed with structured packing is used to separate vapors of different volatility.
- 6. The clean solvent vapor is passed through a main condenser and any fugitive vapors will be handled by a vent condenser (5°C) containing both a condensing and a sub-cooling section. In the condenser, the solvent changes back to a liquid and is cooled back to ambient temperature.
- 7. The recovered product is passed through a product cooler supplied with chilled water (5^oC) to bring it to ambient temperature so as to minimize any evaporation losses.
- 8. The solid contaminants do not undergo a vapor phase, but stay behind to be discharged out of the drain port.

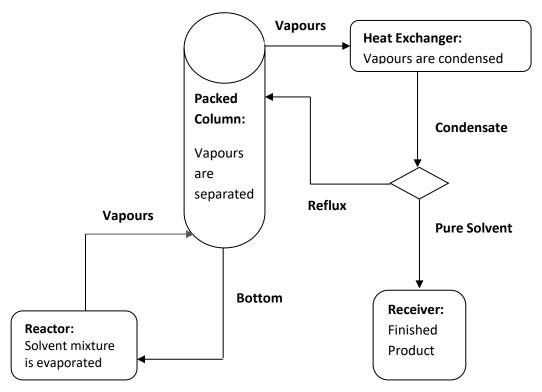


Figure 2.13 Process flow chart for solvent distillation

2.8.2 Used oil recycling

It is proposed to establish a used oil recycling facility of about 54 KLD. Used oil is termed as hazardous. Lube oil does not wear out with use, it only gets contaminated with water, carbon and fuel etc. that means used oil when it is ready for rejection can be re-used. The methods of disposal being followed are dumping, burning or reprocessing. The used/waste oil generated is not easily biologically degradable. Burning is not desirable for the following reasons:

- Waste fuel oil contains substantial quantities of water that will prevent proper burning of fuel and lead to generation of carbon monoxide.
- The used oil (used lubricants, transformer oils etc), may contain chemicals, metallic compounds, Polychlorinated Biphenyl (PCBs) etc which when burned will release gas to the atmosphere.
- Other option is reprocessing. But improper reprocessing methods can lead to generation of waste which is even more hazardous than used / waste oil.
- Therefore, reprocessing should be allowed only with approved methods. Reprocessing is not only a solution for disposal of waste but it will have tremendous economic advantage. The treatment scheme of the waste/ used oil recycling is shown in **Figure 2.14**.

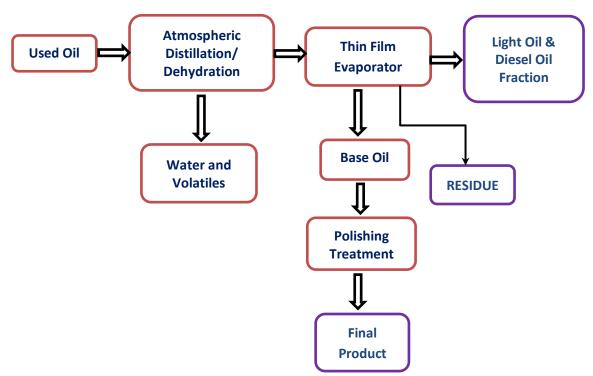


Figure 2.14 Treatment scheme for waste/used oil recycling

2.8.2.1 Process description

The proposed modular used oil recycling plant is a complete skid mounted facility ready for immediate installation. These proposed modular units are particularly advisable for small recycling capacities. They fulfill the requirement of environment friendly technology of short path thin evaporation as proposed by CPCB for granting consent to recyclers, re-refiners of used oil.

Agitated thin film evaporator, through the short path distillation unit is used to separate the heavy base oil without fouling of the process equipment with coke. The residue obtained after the fractionation is a brown carbon-free viscous oil that can be sold as a lubricant for the heavier applications such as heavy gear lubricant / sugar mill compounds / open gear lubricant or any other application where a heavy viscous lubricant would be required. Used oils are separated by a simple procedure of settling followed by dehydration, thin film evaporator and short path distillation. The fractioned base oils obtained from this process would be treated with activated clay to yield light colored base oil fit for re-use in lubricating oils. Proposed system is designed to obtain high quality base oil and use special entrapment separators for separation of carbon in oil from vaporized distill phase.

2.8.3 Alternative fuel and raw material facility

It is proposed to establish an Alternative fuel and raw material facility of about 55 TPD. Alternative fuel platforms will be developed as below:

'L' type alternative fuels area

'L' Type Alternative Fuels are basically liquid type incinerable waste which are more than 2500 Kcal.

- 1. Common neutralization tank to maintain pH level 7
- 2. 25 KL mixing tank with cooling coil and external jacket to control the heat for exothermic liquid waste
- 3. 25 KL mixing tank for the non-exothermic liquid waste
- 4. Agitator set up made by stainless steel
- 5. Pump

'S' type alternative fuels area:

'S' Type Alternative Fuels are basically solid type incinerable waste which are more than 2500 Kcal. Solid blend is prepared through mixing in an appropriate quantity of solid/ semi solid waste with binders. The first step of preparing a solid blend is to select the waste and segregate according to their pH and calorific value. Source materials for solid substitute fuel include paint sludge, oily filter cake, spent carbon, organic waste, tarry waste, biomass, resin, distillation residues, grease, ETP sludge, and alumina sludge etc. Assortment of waste is done according to blending norms. A general waste selection criteria for high calorific value fuel is low moisture content, high LOI & TOC, high calorific value, good compressibility, Less ash content, non-toxic, less pollutant, sustainable combustion.

2.8.4 Waste plastic recycling

It is proposed to establish a plastic recycling facility of about 10 TPD. A recycling plant uses seven steps to turn plastic trash into recycled plastic. The process flow sheet of waste plastic recycling is given in **Figure 2.15**.

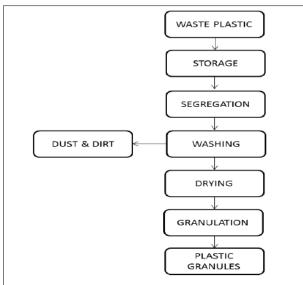


Figure 2.15 Process flow sheet of waste plastic recycling

Following is a brief explanation of recycling:

- **Segregation:** The plastic shall be segregated manually into two major components i.e. dirty plastic not suitable for granulation and plastic that can be used for granulation.
- **Mechanized Cleaning:** Mechanized cleaning is done with some cleaning agents to remove any types of hazardous substances in the drum. The cleaned drums can be reused or further processing can be done based on the requirement.
- **Chopping:** The washed drums are chopped into flakes for further processing.
- **Drying:** The plastic flakes are dried in a tumble dryer.
- **Melting:** The dried flakes are fed into an extruder, where heat and pressure melt the plastic. Different types of plastics melt at different temperatures.
- **Filtering:** The molten plastic is forced through a fine screen to remove any contaminants that slipped through the washing process. The molten plastic is then formed into strands
- **Pelletizing:** The strands are cooled in water and chopped into uniform pellets. Manufacturing companies buy them from recyclers to make new products.

2.8.5 Waste paper recycling

It is proposed to establish a paper recycling facility of about 10 TPD. Waste paper recycling is the process of recovering waste paper and remaking it into new paper products. There are three categories of paper that can be used as feedstock for making recycled paper:

- Mill broke: Paper trimmings and other paper scrap from the manufacture of paper, and is recycled internally in a paper mill.
- **Pre-consumer waste**: Material which left the paper mill but discarded before it was ready for consumer use.

• **Post-consumer waste**: Post-consumer waste are the material discarded after consumer use such as old magazines, old newspaper, office wastes, old telephone directories, residential mixed paper, industrial packaging, waste multi-wall cement paper bags.

2.8.5.1 Process of waste paper for recycling

Proposed project focuses on recovering waste paper and sending it to the paper manufacturing industry. It is proposed to carry out waste paper processing in the following steps:

- Waste Paper Collection: Collection of waste paper material shall be done through special color coded recycling bins (segregated directly at generator's premises). However, at some locations all kinds of papers may be collected in a single bin.
- **Manual Segregation**: The waste paper (newspaper, office stationery, packaging paper, card boards) collected is segregated according to variety/thickness of paper.
- **Compaction and Baling**: The waste paper is manually fed to the Baling press. It is equipment which utilizes hydraulic pressure on the loose paper in an enclosed chamber to compact them into bales. The bale weight can be varied from 40-60 kg, making them very convenient to handle manually.
- **Transportation**: Transportation of bales to paper mills and other paper related product manufacturing units.

2.8.6. Used lead acid battery recycling

It is proposed to establish a used lead acid battery recycling facility of 65 TPD. Lead is one of the most vital nonferrous metals having multiple uses like in lead acid batteries, cable covering, alloying elements in solders, nuclear shield etc. In terms of its chemical composition, it is used in glass, paint and as an important stabilizer in PVC as lead striate. Almost 70 to 80% of lead production comes from recycling and the balance 20 to 30% from virgin sources, that is lead concentrates. Demand for lead acid batteries is going up almost at the rate of 20 to 25% in India and China. The requirement of lead is also increasing alarmingly at the rate of 15 to 20% annually. Almost 70% of the lead goes in to the production of lead acid batteries. In India, only Hindustan Zinc Limited and two other producers in smaller quantities produce lead from lead concentrates. Rest of the lead production is either from recycling or imports. Since more and more scrap of lead acid batteries and other scrap of lead will be available, there is a good scope to recover lead in and environmentally friendly manner.

Recycling of used lead acid batteries

- Extraction of lead from used lead acid battery plates, lead scrap, lead dross and other lead bearing wastes is carried out by using Rotary Furnace and Reverberatory Furnace.
- Conventional methods of lead extraction from used lead acid battery plates, lead scrap, lead dross and other concentrate generate huge amounts of sludge which becomes very difficult for disposal in the landfill. However, the combination of Rotary furnace and Reverberatory furnace with high calorific furnace oil as fuel reduces the quantum of slag generation and improves the recovery of lead metal considerably. Furnace oil will be

used as fuel to melt the battery and other scrap. The schematic diagram of the lead recycling is shown in **Figure 2.16.**

Process description for lead recycling

The smelting process proposed in lead recycling unit is explained briefly below:

- The raw materials namely, the batteries are received at the unit. The battery casing is broken with the help of a cutting machine and sorted accordingly.
- The plastic containers, polypropylene wastes are processed in plastic grinding machines and the PVC separator waste is sold to the PVC recyclers.
- Initially, the lead scrap is fed into the rotary furnace and flux agents like charcoal, iron boring are added for ignition.
- The burner supplies the required heat for melting of scrap. After a sustained fire is established, the lead in the scrap (raw material) is melted gradually.
- The charging of charcoal and raw material is repeated and the molten metal is collected in a pot at the downstream side of the furnace.

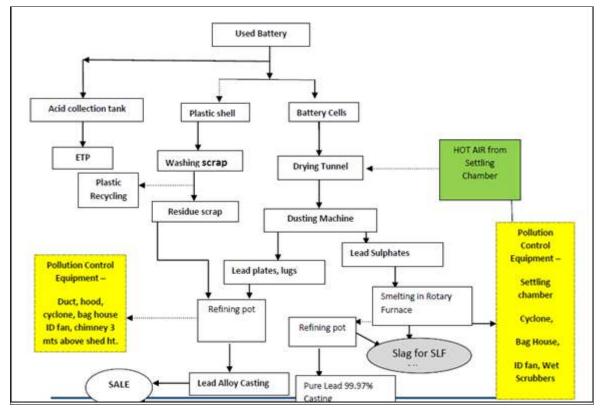


Figure 2.16 Schematic diagram of the lead recycling from used lead acid battery

2.8.7 MS (Mild Steel) drums recycling

It is proposed to establish a drum decontamination recycling facility of 10 TPD. Different types of used MS drums in various industries and commercial establishments after reaching their end life will be cleaned for any waste present and segregated as per the type of the material, cut

into small pieces and sent for further recycling process for making end use products. Recycling of various scrap materials helps in reducing the consumption of fresh raw materials and prevents excess consumption of power and energy.

Metal recovery process

- Collection of metal drums
- Cleaning of the drums
- Shredding
- Baling
- Storage of baled material
- > If the waste is opaque, the drums with waste shall be pyrolysed.
- Selling it for further processing

2.8.8 Aluminum dross reprocessing facility

It is proposed to establish an Aluminum Dross reprocessing facility of about 165 TPD. The dross residue is generated from separation of metal or cross reprocessing is categorized as Hazardous waste at S. No. 12 and 72 of Schedule II of HOWM Rules, 2016, due to the presence of nitrogen as nitrate and fluoride, which are required to be disposed in authorized disposal facility in accordance with authorization condition, when not utilized as resource recovery

Type of HW	Source of generation	Recovery/product		
Aluminium dross residues	Generated from separation	As a supplementary resource		
(Schedule II Category	of metal from aluminium	for manufacturing of Alum		
A12/A72 of HOWM Rules,	dross / aluminium dross			
2016)	reprocessing units.			

Table 2.12 Typical characteristics of the aluminum dross residues

Parameters	Results (%)
Alumina as Al ₂ O ₃	83.5
Heavy metals (As, Mn, Cu, Zn)	0.026
Calcium Oxide as CaO	0.62
Silicon Dioxide SiO ₂	1.40
Titanium Dioxide as TiO ₂	0.12
Magnesium Oxide as (as MgO)	0.81
Ferric Oxide as FeO ₃	1.12
Disodium Oxide as Na ₂ O	0.21
Sulphur Trioxide as SO ₃	0.30
Manganese Oxide as MnO	0.07
Chromium Trioxide (Cr ₂ O ₃)	0.02
Fluoride as F	ND
Nitrogen as N	3.0

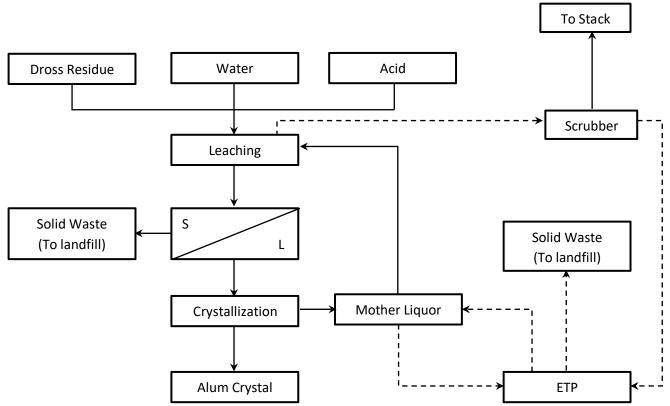
Process

The dross residues generated from separation of metal or dross reprocessing can be processed to produce alum. The production of alum by hydrometallurgical processing mainly includes unit operations like leaching, solid liquid separation, crystallization and centrifugation. The solid waste generated from the process may be washed with water prior to sending to landfill TSDF and washed water may be re-used in the process in case of further recovery of resources in the waste.

Product usage/ utilization

The aluminium dross residues will be utilized in the production of alum. Product (Alum) to be used only for treatment of industrial effluent or for industrial applications and will not be used for treating in case for drinking water use or in food/beverages applications, etc. The unit will label its product (i.e. alum) manufactured by utilizing aforesaid hazardous waste as "This Alum has been manufactured by utilizing aluminum dross residues generated from separation of metal from aluminum dross originated from primary aluminum production".

Figure 2.17 Process flow diagram/or utilization of hazardous waste i.e., aluminum dross residues.



2.8.9 Spent pot liner

Spent Pot Lining (SPL) is a waste generated in the primary aluminium smelting industries. Primary aluminium is produced by the electrolysis of alumina in Hall-Heroult electrolytic reduction pots at 960°C using carbon anode and a mixture of molten Cryolite (NaAIF₆) with 28% of dissolved alumina (Al₂O₃) and other additives. The reduction pot is provided with **electrically conductive carbon linings** for electrolyzing the molten electrolyte by passing an electric current between carbon anode dipped into the molten bath whereas the carbon lining acts as cathode. The outer pot-linings consist of **refractory material** enclosed in a steel pot-shell. Cells of this type have a typical life span of 3 to 6 years. During pot operation, carbon lining gradually deteriorates with slow penetration of molten melt. The lining gets deteriorated and the continued operation of the cells demands replacement of pot-lining.

The Spent Pot Lining (SPL) which is categorised as hazardous waste at S.No.11.2 of Schedule-I of HOWM Rules, 2016 has to be disposed in authorized disposal facility. Typical spent pot lining contains Carbon (60-75%), SiO₂ (1-2%), Al₂O₃ (7-8%), Fe₂O₃ (1-2%), Na (7-11%), Fluoride (4-7%) and Cyanide (100-250 ppm).

SPL consists of 2 parts: Carbon Portion and Non-Carbon (Refractory) Portion. The high calorific value carbon portion of SPL can be utilized and the low calorific value refractory portion of SPL needs to be safely disposed. It is proposed to establish facilities to handle both types of SPL: (a) SPL Carbon Portion Reprocessing Facility (for extracting carbon mineral fuel) – 165 TPD, and (b) SPL Refractory Portion Reprocessing and Disposal Facility – 165 TPD.

2.8.9.1. SPL carbon portion reprocessing facility

The utilization process involves crushing of SPL (of size 200 mm-500 mm received from generator) in the crusher followed by screening (30mm). The screened (-30mm) SPL is subjected to heat treatment in a rotary kiln at 430-460°C for cyanide destruction. The heat treated SPL is fed directly to the rotary hydro mist reactor along with lime and controlled water mist to convert the leachable fluoride into non-leachable CaF₂. Resultant mass from the reactor is collected and packed in bags as finished product termed as Carbon mineral fuel to be used in cement kiln.

Cyclone, Pulse Jet Bag Filter, and ID Fan etc. shall be utilized to treat the emissions from rotary kiln, crushing and screening. There shall be a common stack after the treatment. Emissions from the common stack shall comply with the following:

- Particulate Matter: 50 mg/Nm³
- Total Fluoride: 25 mg/Nm³
- Hydrogen Fluoride: 4 mg/Nm³
- Ammonia: 75 mg/Nm³
- Hydrogen Cyanide: 10 mg/Nm³

In addition, the unit shall maintain proper ventilation in the work zone and process areas. All personnel involved in the plant operations shall wear PPE including mask. **Figure 2.18** below presents the process flow diagram for producing carbon mineral from SPL carbon fraction.

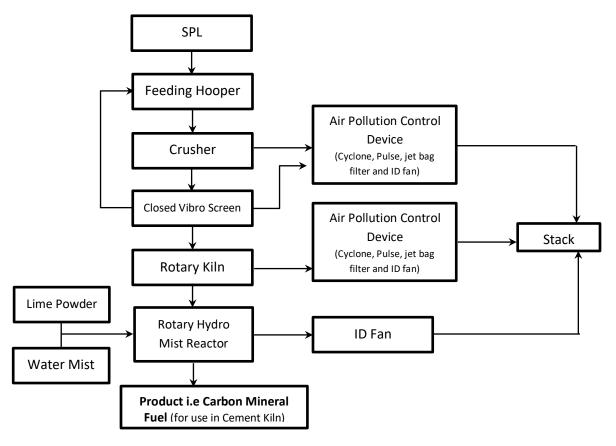
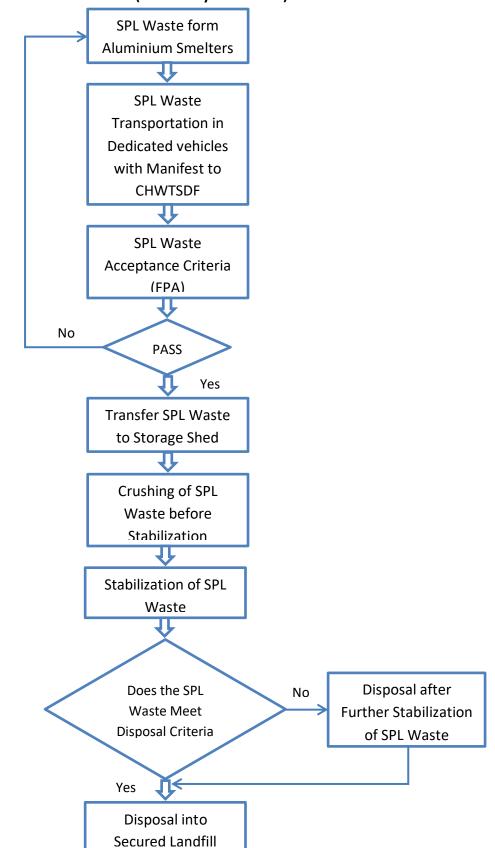


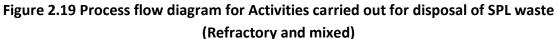
Figure 2.18 Process flow diagram for producing carbon mineral

2.8.9.2. SPL refractory portion reprocessing and disposal facility

Facilities required for reprocessing of SPL refractory portion include: (a) well-ventilated covered waste storage facility, (b) closed conveying system for transportation of SPL waste from storage shed to hopper of the crusher avoiding manual handling, (c) crushing of the SPL waste using Pulverizer along with pollution control equipment (i.e., dust suppression system with bag filters), and (c) stabilization facility for treatment of the SPL waste.

The waste shall be conveyed from the storage shed to hopper of the crushing unit (i.e., the Pulverizer attached with air pollution control equipment). Bag Filter/appropriate air pollution control equipment shall be attached to Pulverizer to meet the following emission standards - Particulate Matter – 50 mg/Nm³, Total Fluoride – 25 mg/Nm³, and Ammonia – 75 mg/Nm³. Once the size of the SPL waste is reduced to the desired size range, the waste material shall be conveyed to a concrete pit for stabilization (with water, lime, calcium hypochlorite etc.). The stabilized material, after compliance with all the parameters prescribed in CPCB guidelines with regard to "Criteria for Direct Disposal of Hazardous Waste into SLF". **Figure 2.19** below presents the process flow diagram for stabilization of SPL refractory portion and then disposal in Landfill.





2.9 Renewable energy

Renewable energy is energy that comes from natural resources such as sunlight, wind, rain, tides, waves and geothermal heat. In the proposed project it is intended to set up a 2 MW solar power project in the closed landfill after evaluating the recent developments in solar energy on closed landfill on following criteria.

- > Solar power system considerations with respect to landfill applications,
- > Landfill technical and engineering considerations, and Regulatory considerations.

The secured landfill after capping can no longer receive waste, and it must be maintained and monitored for a number of years. It is proposed to utilize the capped landfill space for power generation upto 2 MW through solar panels (PV). The power generated shall be utilized within the TSDF for running different facilities. As the landfill will be developed in a phase wise manner, the solar power panels will also be installed phase-wise, in line with the availability of capped landfill space. In addition to the capped landfill space, it is proposed to install solar panels on top of all the sheds/buildings, wherever possible, to maximize the power generation.

After solar panels are installed, they produce emission-free energy for about 20 years. Maintenance and disposal of batteries (Lithium ion/ lead acid batteries etc) is the only considerable environmental concern. Batteries, at their end of life shall be disposed off in compliance with Batteries (Management and Handling) Rules, 2001 and subsequent amendments.

At Ramky, we believe there are several important reasons for considering clean and renewable energy facilities on contaminated lands

- Contaminated lands offer hundreds of acres of open space in areas where solar Installations may be less likely to involve community concerns over aesthetic impacts.
- > Contaminated lands may have lower overall transaction costs than green field sites.
- Development of Brownfield's can assuage the stress placed on green fields to site clean and renewable energy facilities.
- Contaminated lands may have environmental conditions that are not well suited for commercial or residential zoning or otherwise have low demand for real estate development.
- Electricity generated from renewable energy projects on contaminated or remediated lands can then be used onsite or credited for offsite use.

2.10 Waste to energy

It is estimated that the Alternative Fuel and Raw Material Facility (AFRF) produces alternate fuel with calorific value of about 3,000 to 4,000 kcal/kg. It is proposed to utilize this alternate fuel (and similar high calorific value waste from other sources, if necessary) to produce electricity through the Waste to Energy Plant with generation capacity of up to 2 MW.

The proposed Waste to Energy plant involves combustion of waste leading to volume reduction (90-95%) and recovery of heat to produce steam that in turn produces power through steam turbines. Steps involved in this process can be broadly classified as under:

- Combustion Chamber
- Steam Generation and Power Production
- Flue Gas Treatment System
- Ash Handling System

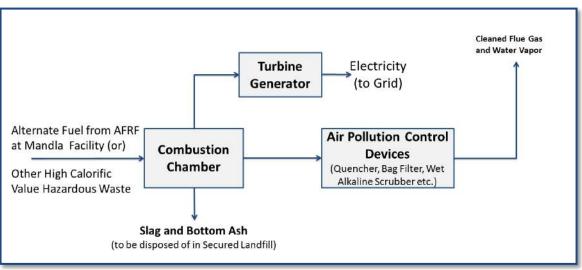


Figure 2.20 Flow chart presenting the waste to energy process

2.10.1 Combustion chamber

The combustion process shall be designed to utilize the heat value of the 'Alternate Fuel' from AFRF facility and other high calorific value waste with provision for steam generation at highest possible heat value to harness the energy potential. Various options for combustion include: (a) movable grate, (b) rotary kiln, and (c) fluidized bed type. Selection of appropriate technology and the detailed design of the combustion chamber shall be carried out by an expert team, with due consideration to waste characteristics such as average calorific value, chemical characteristics etc. Temperature in the combustion chamber shall be about 950°C.

It shall be ensured that 'flue gas recirculation' shall be an integral part of the furnace design. After passing through the dust filter, part of the flue gas shall be retained and recirculated through an insulated duct to the furnace. The recirculated flue gas shall be injected through separate nozzles in the furnace. The primary advantages of flue gas recirculation are the following: (a) Mono-nitrogen oxides (NOX) reduction is achieved because the supplied recirculated flue gases have lower oxygen concentration and, therefore, lower flue gas temperature, which leads to a decrease of the nitrogen oxide levels, and (b) It stabilises and improves the flow and turbulence conditions, particularly at partial load.

2.10.2 Steam generation and power production

The WTE project will have "One Boiler & One Turbo Generator Configuration". The boiler shall be designed by an expert team duly considering the super-heated steam parameters (temperature and pressure). Steam turbine is a rotating device, which converts heat energy from the superheated steam to mechanical energy. When a generator is coupled with the turbine, this mechanical energy is converted into electrical power. The steam generated from the boiler is expanded in the bleed cum condensing turbine, which generates power at 11kV level. The steam turbine shall be designed to operate with exhaust steam pressure below atmospheric pressure (vacuum pressure). Considering the present pollution norms, and to save water, it is envisaged to go for Air Cooled Condensor (ACC).

2.10.3 Flue gas treatment system

A combination of treatment units shall be installed for flue gas cleaning and removal of air pollutants, to comply with the standards. It is proposed to equip the plant with appropriate Air Pollution Control Devices (APCDs) along with a minimum stack height of 30 m to comply with the emission standards.

It is proposed to equip the plant with necessary air pollution control devices (APCDs) to meet the emission standards prescribed for Common Hazardous Waste Incinerator by MoEF Gazette vide GSR 481(E) dated June 26, 2008.

The following air pollution control devices are proposed:

- Rapid Quenching (or) Adsorption by Activated Carbon for control of Dioxins
- Bag Filters for control of particulate matter
- Wet Alkaline Scrubbers for removal of HCl, HF, and SO₂
- 'Flue Gas Recirculation' as an integral part of the furnace design to reduce NO_x

2.10.4 Ash handling system

From the combustion chamber, slag or bottom ash leaves through the ash chute. The furnace bottom ash, at high temperature, is cooled by quenching of the ash in slag extractor system. The ash from other outlets like economiser, bag filter will be at lower temperatures and hence directly fed into the screw or scrapper or belt conveyors. The ash thus collected shall be disposed of in the Secured Landfill (after treatment/stabilization, if necessary).

CHAPTER 3

DESCRIPTION OF THE ENVIRONMENT

Chapter 3

Description of the Environment

3.1 Introduction

Baseline environmental status in and around the proposed project site depicts the existing environmental conditions of Air, Noise, Water, Soil, Biological and Socio-economic environment. Considering the proposed project as the centre, a radial distance of 10 km is deemed as 'study area' for baseline data collection and environmental monitoring. Baseline data was collected for various environmental attributes so as to compute the impacts that are likely to arise due to the proposed project.

The main aim of the baseline study is to identify the critical environmental attributes which will be affected due to the proposed project and have adverse impacts on the surroundings. This study is carried out during the project planning stage itself, so that proper mitigation measures can be implemented in a technically, financially and environmentally sound manner for sustainability on a long term basis. The study depends mainly on two factors. One is the estimation of impact from proposed project on the environment and the second is assessment of the baseline environmental conditions. Both of these are key factors to arrive at the post project scenario. The scope of the baseline studies includes detailed characterization of the following environmental components, which are most likely to be influenced by setting up the proposed facility:

- Meteorological Conditions
- Ambient Air Quality
- Noise Levels
- Water Quality (Ground & Surface water)
- Soil Quality
- Biological Environment
- Land Environment and
- Socio-Economic Studies

a) Study period

The baseline data for the proposed project was carried out during October to December 2019 (post monsoon). The data is collected with respect to meteorological conditions, air pollution levels, noise levels, water quality, soil quality, land use and socio-economic conditions during the study period.

3.2 Micrometeorology

The study of micrometeorological conditions of a particular region is of utmost importance to understand the variations in ambient air quality status in that region. The prevailing micrometeorology at project site plays a crucial role in transport and dispersion of air pollutants released from the project site. The persistence of predominant wind direction and wind speed will decide the direction and extent of the air pollution impact zone. The principal variables which affect the micrometeorology are horizontal transport and dispersion (average wind speed and directions), convective transport and vertical mixing (atmospheric stability) and topography of the area towards local influences.

To understand the local micrometeorology, an automatic weather station (solar powered) was installed at the proposed site for collecting the data - Temperature, Relative Humidity, Wind Speed and Wind Direction. The weather station was programmed to record and automatically save the readings on an hourly basis. The primary data thus collected during the entire study period has been summarized and presented in **Table 3.1**.

Period	Tempe	rature (°C)	Relative Humidity (%)		Predominant
Period	Min.	Max.	Min.	Max.	Wind Direction
October, 2019	18.2	32.4	54	81	NE
November, 2019	13.5	29.2	48	75	NE
December, 2019	10.2	26.4	52	78	N

Table 3.1 Observed meteorological data onsite (October to December 2019)

From the primary data collected during the study period, the winds were predominantly recorded from NE to SW. This was closely followed by N, NNE and S directions. Calm conditions prevailed for 12.64% of the total time and the average wind speed for the season was 2.31 m/s. The frequency distribution table for the study period is given in **Table 3.2**.

Wind directions		Wind classes (m/s)							
	0.5 - 2.0	2.0 - 3.5	3.5 - 5.0	> 5.0					
Ν	5.53	1.45	2.26	1.22	10.46				
NNE	3.58	1.27	1.72	0.86	7.43				
NE	6.52	1.54	3.08	2.22	13.36				
ENE	2.40	0.68	1.49	0.50	5.07				
E	2.22	0.82	0.91	0.50	4.44				
ESE	2.22	0.54	0.91	0.59	4.26				
SE	2.17	0.86	0.72	0.72	4.48				
SSE	1.81	0.41	1.18	0.54	3.94				
S	3.40	0.77	1.95	0.95	7.07				
SSW	2.17	0.32	0.86	0.27	3.62				
SW	1.68	0.59	0.77	0.77	3.80				
WSW	2.17	0.68	0.72	0.32	3.89				
W	1.99	0.72	0.86	0.72	4.30				

Table 3.2 Frequency distribution table (October to December 2019)

Wind directions	Wind classes (m/s)						
	0.5 - 2.0	2.0 - 3.5	3.5 - 5.0	> 5.0			
WNW	1.68	0.77	0.72	0.32	3.49		
NW	2.04	0.68	0.45	0.72	3.89		
NNW	2.08	0.54	0.72	0.50	3.85		
Sub-Total	43.66	12.64	19.34	11.73	87.36		
Calms (<0.5 m/s)							
Total							
Note: 1. Average wind speed is 2.31 m/s							
2. All values are in percentages							

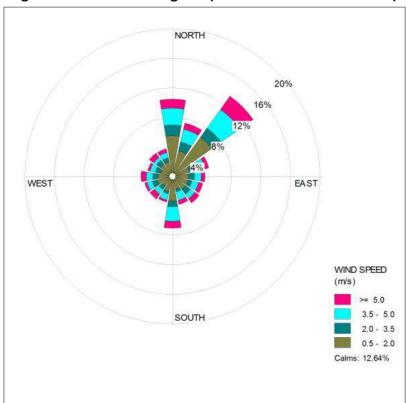


Figure 3.1 Wind rose diagram (October to December 2019)

For validation of the primary data (presented above), secondary meteorological data for the nearest IMD station, i.e., Jabalpur (distance from the proposed site is 30 km NW) was taken from the "Climatological Normals 1981-2010" issued by the Ministry of Earth sciences, Indian Meteorological Department. Secondary data from the IMD station is presented in **Table 3.3** below. A comparison between the observed meteorological data during the study period and that obtained from the secondary meteorological data of IMD Jabalpur (in terms of maximum and minimum temperature, predominant wind direction, wind speed, and relative humidity) revealed that the primary data collected is consistent.

IMD station– Jabalpur (MP), Lat: 23° 12' & Lon: 79° 57', 393 m above MSL, distance from proposed site 30 km NW											
	Ν	Nean temperature °C Humidity % Rainfall		Humidity % Rainfall		Humidity %		Rainfall		Mean wind	Predominant direction
Month	Min	Max	Highest	Lowest	8.30 hrs	17.30 hrs	Monthly mm	No of rainy days	speed m/s	1 st	
Jan	10.6	24.6	29.7	6.1	75	49	21.9	1.8	0.7	N	
Feb	13.2	27.8	33.0	8.3	66	37	24.6	1.6	1.0	N	
Mar	17.8	33.4	38.0	12.9	48	25	14.9	1.2	1.1	N	
Apr	22.9	38.5	42.0	17.5	35	19	4.8	0.5	1.2	W	
May	22.1	41.1	44.1	22.4	36	21	11.4	1.2	1.5	W	
Jun	26.8	37.7	43.2	22.6	61	47	168.0	7.4	1.8	W	
Jul	24.6	31.3	36.1	22.2	83	73	376.6	14.3	1.6	W	
Aug	24.0	29.8	33.4	22.3	88	79	401.9	14.9	1.4	W	
Sep	23.5	31.1	34.4	21.5	83	70	220.9	9.0	1.2	W	
Oct	20.0	31.7	34.5	15.4	72	53	30.2	2.0	0.8	NE	
Nov	14.5	28.9	32.0	10.1	68	51	10.1	0.7	0.7	NE	
Dec	10.8	25.7	29.2	6.9	72	51	6.0	0.6	0.6	N	
Source: (MSL – M		•	f Earth Sci	ences, IN	ID, Clim	atologica	l Normals:1	981-2010			

Table 3.3 IMD data of Jabalpur

3.3 Ambient air quality

The ambient air quality in the study area was monitored as per MoEF&CC guidelines. The prime objective of the baseline air quality study is to assess the existing ambient air quality of the area with reference to conventional air pollutants.

Methodology adopted for the study

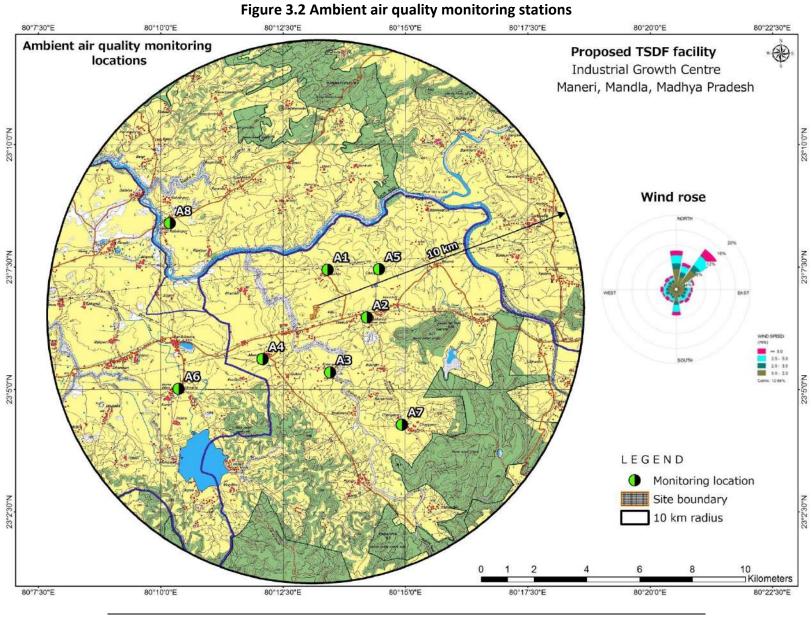
The baseline status of the ambient air quality has been assessed through a scientifically designed ambient air quality network. The design of monitoring network in the air quality surveillance programme has been made based on the following considerations:

- Topography of the study area.
- Representation of regional background.
- Populated and sensitive areas.
- Screening of maximum ground level concentrations and distances of their likely occurrences as per climatologically normal.
- Representation of valid cross sectional distribution in downwind direction.

Ambient Air Quality Monitoring (AAQM) stations were installed at 8 different locations with due consideration to the above mentioned points. AAQ locations were selected in downwind, cross wind and upwind direction of the proposed project location. The details of air quality monitoring stations are given in **Table 3.4.** The map showing ambient air quality monitoring locations is given in **Figure 3.2.**

	Name of locations	V	V.R.T. site			
Code		Wind type	Distance (km)	Direction	Latitude	Longitude
A1	Jhurkhi	Cross wind	1.4	Ν	23° 07' 26.6" N	80° 13' 24.6" E
A2	Maneri	Cross wind	1.7	Е	23° 06' 28.3" N	80° 14' 12.8" E
A3	Katangi	Cross wind	2.2	S	23° 05' 20.8" N	80° 13' 27.6" E
A4	Mendhi	Down wind	2.3	SW	23° 05' 37.3" N	80° 12' 05.1" E
A5	Chargaon	Up wind	2.5	NE	23° 07' 27.5" N	80° 14' 27.7" E
A6	Umaria	Down wind	5.3	SW	23° 05' 00.9" N	80° 10' 22.0" E
A7	Chargaon	Cross wind	5.3	SE	23° 04' 16.9" N	80° 14' 55.8" E
A8	Kalyanpur	Cross wind	6.1	NW	23° 08' 23.7" N	80° 10' 11.1" E

 Table 3.4 Details of ambient air quality monitoring stations



M/s. Ramky Enviro Services Private Limited

Ambient air quality monitoring stations were selected on the basis of surface influence, demographic influence and meteorological influence. During the study period, monitoring was carried out twice per week for 12 weeks at each sampling station for all the twelve parameters listed in the National Ambient Air Quality (NAAQ) Standards. Sulphur dioxide (SO₂), Oxides of Nitrogen (NO_x), Particulate Matter (PM<2.5 μ m, PM<10 μ m), Lead, Ammonia (NH₃), Benzene (C₆H₆), Benzo(a)Pyrene, Arsenic, and Nickel were sampled on 24 hourly basis. Carbon monoxide and Ozone (O₃) were sampled on 8 hourly basis. The ambient air quality results for all these pollutants, including comparison with the NAAQ standards, are presented in **Tables 3.5 to 3.9**.

Location		PN	/ ₁₀	PM _{2.5}		
LOCATION	Min	Max	98 th percentile	Min	Max	98 th percentile
Jhurkhi	47.5	54.5	54.5	26.4	30.9	30.9
Maneri	48.9	56.1	56.1	28.4	34.5	34.5
Katangi	46.5	55.6	55.6	27.3	32.7	32.7
Medhi	45.6	54.6	54.6	26.5	31.2	31.2
Chargaon (NE)	43.8	53.2	53.2	22.8	28.7	28.7
Umaria	45.8	55.1	55.1	24.8	33.2	33.2
Chargaon (SE)	44.8	53.8	53.8	25.8	31.3	31.3
Kalyanpur	46.1	54.3	54.3	23.8	30.2	30.2
98 th percentile	53.2 to 56.1			28.7 to 34.5		
NAAQ standards 2009 (24 hrs)		10	00			60

Table 3.5 Ambient air quality results for $PM_{10} \& PM_{2.5}$ concentrations ($\mu g/m^3$)

Table 3.6 Ambient air quality results for SO₂, NO_x concentrations (μ g/m³)

Location		S	0 ₂	NO _x		
LOCATION	Min.	Max.	98 th percentile	Min.	Max.	98 th percentile
Jhurkhi	Jhurkhi 9.3 11.6 11.6		21.1	23.8	23.8	
Maneri	11.1	14.8	14.8	22.2	25.1	25.1
Katangi	11.2	13.5	13.5	18.4	22.4	22.4
Medhi	10.2	12.5	12.5	19.3	21.8	21.8
Chargaon (NE)	8.3	10.5	10.5	18.6	20.5	20.5
Umaria	10.2	13.8	13.8	20.4	24.3	24.3
Chargaon (SE)	9.4	11.8	11.8	17.6	21.2	21.2
Kalyanpur	9.5	12.7	12.7	21.2	23.4	23.4
98 th percentile	10.5 to 14.8			20.5 to 25.1		
NAAQ standards 2009 (24 hrs)		8	0			80

Location		C)3	СО			
LOCATION	Min.	Max.	98 th percentile	Min.	Max.	98 th percentile	
Jhurkhi	urkhi <20 21.2 21.2		450	515	515		
Maneri	22.5	26.7	26.7	520	640	640	
Katangi	<20	22.5	22.5	458	530	530	
Medhi	<20	21.4	21.4	474	545	545	
Chargaon (NE)	<20	20.4	20.4	454	492	492	
Umaria	<20	23.4	23.4	480	610	610	
Chargaon (SE)	<20	20.8	20.8	468	520	520	
Kalyanpur	<20	22.1	22.1	475	570	570	
98 th percentile	20.4 to 26.7			492 to 640			
NAAQ standards 2009(8 hrs)	100			2000			

Table 3.7 Ambient air quality results for O_3 and CO concentrations ($\mu g/m^3$)

Table 3.8 Ambient air quality results for NH $_3$ and C₆H₆ concentrations (µg/m³)

		NH ₃		C ₆ H ₆			
Location	Min.	Max.	98 th percentile	Min.	Max.	98 th percentile	
Jhurkhi	16.2	18.7	18.7	0.45	0.59	0.59	
Maneri	18.2	21.4	21.4	0.65	0.75	0.75	
Katangi	14.5	18.2	18.2	0.52	0.68	0.68	
Medhi	15.4	17.7	17.7	0.48	0.58	0.58	
Chargaon (NE)	13.5	15.6	15.6	0.44	0.55	0.55	
Umaria	17.4	20.4	20.4	0.56	0.66	0.66	
Chargaon (SE)	16.5	17.8	17.8	0.54	0.65	0.65	
Kalyanpur	15.7	19.8	19.8	0.46	0.58	0.58	
98 th percentile	15.6 to 21.4			0.55 to 0.75			
NAAQ standards 2009	400(24 hrs)			5 (Annual)			

Table 3.9 Ambient air quality results for trace elements and benzo(a)pyrene concentrations

Parameters	Lead (µg/m³)	Arsenic (ng/m³)	Nickel (ng/m³)	Benzo(a)Pyrene (ng/m³)		
98 th Percentile	BDL	BDL	BDL	BDL		
Range	DDL	BDL	BDL			
BDL Value	< 1	< 1	< 0.5 µg/m ³	0.01		
NAAQ standards	1	6 20		1		
2009	24 hrs	Annual				

3.3.1 Ambient air quality scenario in the study area

a) Particulate matter <2.5µm and <10µm

Particulate Matter (PM) is the term used for a mixture of solid particles and liquid droplets suspended in the air. These particles originate from a variety of sources, such as power plants, industrial processes, and diesel trucks and they are formed in the atmosphere by transformation of gaseous emissions. Their chemical and physical compositions depend on location and time of year and composed of both coarse and fine particles.

Coarse particles (PM_{10}) have an aerodynamic diameter between 2.5µm and 10µm. They are formed by mechanical disruption (e.g. crushing, grinding, and abrasion of surfaces) evaporation of sprays, and suspension of dust. PM_{10} is composed of alumina silicate and other oxides of crustal elements, and major sources including fugitive dust from roads, industries, agriculture, construction & demolition and fly ash from fossil fuel combustion. The lifetime of PM_{10} is from minutes to hours and its travel distance varies from <1 km to 10 km.

Fine particles have an aerodynamic diameter less than $2.5\mu m$ (PM_{2.5}). They differ from PM₁₀ in origin and chemistry. These particles are formed from gas and condensation of high temperature vapors during combustion and they are composed of various combinations of Sulfate compounds, Nitrate compounds, Carbon compounds, Ammonium, Hydrogen ion, organic compounds, metals (Pb, Cd, V, Ni, Cu, Zn, Mn and Fe) and particle bound water. The major sources of PM_{2.5} are fossil fuel combustion, vegetation burning, the smelting and processing of metals. Their lifetime is from days to weeks and travel distance ranging from hundreds to thousands of kilometers.

The 98th percentile of Particulate Matter <10 μ m recorded within the study area were in the range of **53.2** - **56.1** μ g/m³. The 98th percentile of Particulate Matter <2.5 μ m recorded within the study area were in the range of **28.7** - **34.5** μ g/m³.

The values of PM 10 μ m (100 μ g/m³) and 2.5 μ m (60 μ g/m³) were compared with the national ambient air quality standards (NAAQS) and found that the PM values for all the samples in the study area were within the limits prescribed for residential and rural areas.

b) Sulfur dioxide

Sulfur dioxide gas is an inorganic gaseous pollutant. Sulfur dioxide emissions are expected to be emitted wherever combustion of any fuel containing sulfur takes place. The sulfur in the fuel will combine with oxygen to form sulfur dioxide. Sulfur trioxide and sulfuric acid mist are the other important pollutants in the sulfur group. In general some of the important sources of sulfur dioxide are power stations, sulfuric acid plants, oil refining, boilers in utilities in any industry and domestic use of coal. The following sources of Sulfur dioxide in the study area are identified:

- Emissions from domestic fuel (coal, diesel, etc.)
- Emissions from DG sets used by industries and local residents

Sulfur dioxide in atmosphere is significant because of its toxicity. Sulfur dioxide is capable of producing illness and lung injury. Further it can combine with water in the air to form toxic acid. Aerosols can corrode metal surfaces, fabrics and the leaves of plants. Sulfur dioxide is irritating to the eyes and respiratory system. Excessive exposure to sulfur dioxide causes bronchial asthma and other respiratory related diseases as it affects the lungs.

The 98^{th} percentile of SO₂ recorded within the study area was in the range of **10.5 - 14.8 µg/m³**.

The values of SO₂ were compared with the national ambient air quality standards and it was found that the recorded values for samples collected in sampling locations were much lower than the applicable limit of 80 μ g/m³ prescribed for residential and rural areas.

c) Oxides of nitrogen

Oxides of nitrogen are also inorganic gaseous pollutants like sulfur dioxide. Oxides of nitrogen are expected to be emitted wherever combustion at high temperatures takes place. Nitrous oxide and nitric acid mist are the other important pollutants in the inorganic nitrogen group. In general some of the important sources of oxides of nitrogen are boilers (utilities) in any industry and Auto exhaust. In a metropolitan town NO_x levels are predominantly due to automobile emissions. The following sources of oxides of nitrogen in the study area are identified:

- Emissions from industrial and domestic burning of coal.
- Emissions from automobiles.

Oxides of nitrogen have far greater significance in photochemical smog reaction than any of the other inorganic gaseous contaminants. NO_x in the presence of sunlight will undergo reactions with a number of organic compounds to produce all the effects associated with photochemical smog. NO_x has inherent ability to produce deleterious effects by themselves like toxicity. It acts as asphyxiate when in concentrations great enough to reduce the normal oxygen supply from the air. The 98th percentile of NO_x recorded within the study area was in the range of **20.5 - 25.1 µg/m³**.

The values of NO_x were compared with the national ambient air quality standards and it was found that the recorded values for samples collected in sampling locations were much lower than the applicable limit of 80 μ g/m³ prescribed for residential and rural areas.

d) Ammonia (NH₃)

Ammonia (NH_3) in the atmosphere results primarily from the decomposition and volatilization of animal wastes. As such it is in principle a natural trace gas. Other sources of

ammonia include direct volatilization from mineral fertilizers (particularly urea), agricultural crops and a wide range of non-agricultural sources including sewage, catalytic converters, wild animals, seabirds and industrial processes.

Atmospheric ammonia has impacts on both local and international (transboundary) scales. In the atmosphere, ammonia reacts with acid pollutants such as the products of SO₂ and NO_x emissions to produce fine ammonium (NH₄⁺) containing aerosol. While the lifetime of NH₃ is relatively short (<10-100 km), NH₄⁺ may be transferred to much longer distances (100 - >1000 km). In addition to the transboundary effects, NH₃ has substantial impacts at a local level: emissions occur at ground level in the rural environment and NH₃ is rapidly deposited). As a result some of the most acute problems of NH₃ deposition are for small relict nature reserves located in intensive agricultural landscapes. The 98th percentile of NH₃ recorded within the study area was in the range of **15.6 - 21.4 µg/m³**.

e) Ozone (O₃)

Ozone (O_3) or Trioxygen, is a triatomic molecule, consisting of three oxygen atoms. It is an allotrope of oxygen that is much less stable than the diatomic allotrope (O_2). Ozone in the lower atmosphere is an air pollutant with harmful effects on the respiratory systems of animals and will burn sensitive plants; however the ozone layer in the stratospheric layer is beneficial, preventing potentially damaging ultraviolet light rays from reaching the earth's surface. Ozone is present in low concentrations throughout the earth's atmosphere.

The 98th percentile of ozone recorded within the study area was in the range of **20.4 – 26.7 \mug/m³**. The values of ozone compared with the national ambient air quality standards revealed that the recorded values were within the applicable limits of residential and rural areas for all the locations in study area.

f) Carbon monoxide (CO)

It is a colorless, odorless and tasteless gas that is slightly less dense than air. It is toxic to humans and animals when encountered in higher concentrations, although it is also produced in normal animal metabolism in low quantities, and is thought to have some normal biological functions. In the atmosphere, it is spatially variable and short lived, having a role in the formation of ground-level ozone. Along with aldehydes it is part of series of reactions that forms photochemical smog. Carbon monoxide is present in small amounts in the atmosphere, chiefly as a product of volcanic activity but also from natural and manmade fires (such as forest and bush fires, burning of crop residues and sugarcane firecleaning). Carbon monoxide is a temporary atmospheric pollutant in some urban areas, mainly from the exhaust of internal combustion engines (including vehicles, portable and back-up generators, lawn mowers, power washers, etc.), but also from incomplete combustion of various other fuels (including wood, coal, charcoal, oil, paraffin, propane, natural gas, and trash).

The values of CO were compared with the national ambient air quality standards and it was found that all the sampling stations recorded values much lower than the applicable limit of 2000 μ g/m³ for residential and rural areas. The 98th percentile of CO recorded within the study area was in the range of **492 - 640 \mug/m³**.

g) Benzene (C₆H₆)

Benzene is a clear, colorless, highly flammable and volatile, liquid aromatic hydrocarbon with a gasoline-like odor. Benzene is found in crude oils and as a by-product of oil-refining process. Benzene is found in the air from emissions from burning coal and oil, gasoline service stations, and motor vehicle exhaust. Acute (short-term) inhalation exposure of humans to benzene may cause drowsiness, dizziness, headaches, as well as eye, skin and respiratory tract irritation. The 98^{th} percentile of Benzene recorded within the study area was in the range of **0.55 - 0.75 µg/m³**.

Other parameters such as lead, arsenic, nickel and benzo(a)pyrene are below detectable limits (BDL).

3.3.2 Air quality index

The air quality index (AQI) base level air quality is given in **Table 3.10a & 3.10b.** The AQI as per CPCB in the study area was in the range of **53 to 58**. AQI of all locations are falling in satisfactory (51-100) category (Minor breathing discomfort to sensitive people).

	Tabl	e 3.10a Air c	quality index bas	e level air qu	uality – 98 th perc	entile (µg/m	³)		
Pollutant	Jhurk	hi	Mane	ri	Katan	gi	Medhi		
Pollutant	Concentration	Sub Index	Concentration	Sub Index	Concentration	Sub Index	Concentration	Sub Index	
PM ₁₀	54.5	55	56.1	56	55.6	56	54.6	55	
PM _{2.5}	30.9	52	34.5	58	32.7	55	31.2	52	
SO ₂	11.6	15	14.8	19	13.5	17	12.5	16	
NO _x	23.8	30	25.1	31	22.4	28	21.8	27	
CO (mg/m ³)	0.51	26	0.64	32	0.53	27	0.54	27	
O ₃	21.2	21	26.7	27	22.5	23	21.4	21	
AQI	55		58		56		55		

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Table 3.10b Air quality index base level air quality – 98^{th} percentile ($\mu g/m^3$)

	Chargoan	(NE)	Umai	ria	Chargoar	n (SE)	Kalyan	pur	
Pollutant	Concentration	Sub Index	Concentration	Sub Index	Concentration	Sub Index	Concentration	Sub Index	
PM10	53.2	53	55.1	55	53.8	54	54.3	54	
PM _{2.5}	28.7	48	33.2	55	31.3	58	30.2	50	
SO ₂	10.5	13	13.8	17	11.8	15	12.7	16	
NOx	20.5	26	24.3	30	21.2	27	23.4	29	
CO (mg/m ³)	0.49	25	0.61	31	0.52	26	0.57	29	
O ₃	20.4	20	23.4	23	20.8	21	22.1	22	
AQI	53		55		58		54		

Category AQI:

Good (0–50) – Minimal Impact; **Satisfactory (51-100)** – Minor breathing discomfort to sensitive people; **Moderate (101-200)** – Breathing discomfort to the people with lung, heart disease, children and older adults; **Poor (201-300)** – Breathing discomfort to people on prolonged exposure; **Very Poor (301-400)** – Respiratory illness to the people on prolonged exposure; **Severe (>401)** – Respiratory effects even on healthy people.

3.4 Water quality

Surface water and ground water samples were collected from different sources within the study area and analyzed for some important physical and chemical parameters including heavy metals for depicting the baseline status of the study area.

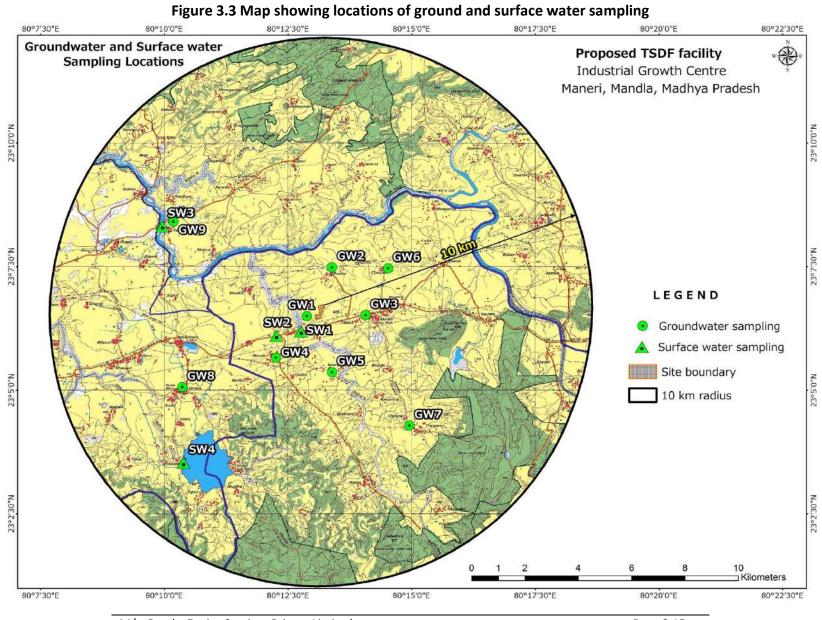
3.4.1 Water quality assessment

During the study period, total of 9 ground water samples and 4 surface water samples were collected from the study area in order to assess the water quality. Ground water samples were drawn from hand pumps and bore wells used by the villagers for their domestic needs. Surface water sampling was carried out from the river/lake in the study area. Details of the sampling locations are given in **Table 3.11** and **Figure 3.3**.

Water samples collected from the locations below were analyzed for important water quality parameters and the analytical results were compared with IS: 10500-2012 drinking water standards. The results are shown in **Table 3.12**. Surface water results were compared with CPCB water quality criteria as updated on 11th September, 2017 and shown in **Table 3.13**.

	Name of	Source	W.R.	Г. Site		
Code	the location	Туре	Distance (km)	Direction	Latitude	Longitude
			Grou	ndwater		
GW1	Site	Bore well	0.3	W	23° 06' 29.8" N	80° 12' 53.1" E
GW2	Jhurkhi		1.4	N	23° 07' 29.3" N	80° 13' 23.6" E
GW3	Maneri		1.5	E	23° 06' 31.0" N	80° 14' 04.2" E
GW4	Mendhi		2.1	SW	23° 05' 39.5" N	80° 12' 15.6" E
GW5	Katangi		2.2	SE	23° 05' 19.5" N	80° 13' 28.1" E
GW6	Chargaon	Hand pump	2.7	NE	23° 07' 27.9" N	80° 14' 32.1" E
GW7	Chargaon		5.1	SE	23° 04' 22.4" N	80° 14' 54.0" E
GW8	Umaria		5.4	SW	23° 05' 04.0" N	80° 10' 21.8" E
GW9	Kalyanpur		6.1	NW	23° 08' 24.5" N	80° 10' 11.2" E
			S	urface wate	r	
SW1	Jhamil	River	0.7	SW	23° 06' 11.3" N	80° 12' 45.1" E
SW2	Mendhi	Lake	1.5	SW	23° 06' 06.1" N	80° 12' 15.1" E
SW3	Gaur	River	6.2	NW	23° 08' 18.9" N	80° 09' 57.1" E
SW4	Mahgao	Lake	7.1	SW	23° 03' 32.1" N	80° 10' 22.5" E

 Table 3.11 Water sampling locations



Proposed ICHWTSDF & Recycling Facility at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh

					Ana	lysis resul	ts				Standard as per	
Parameter	Unit										IS -105	00:2012
Parameter	Unit	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	GW9	Acceptable	Permissible
											Limit	Limit
рН		7.4	7.8	6.9	7.6	7.9	7.2	7.5	7.7	7.6	6.5-8.5	No Relaxation
EC	μS/cm	486	822	345	524	854	534	560	534	480		
Dissolved Solids	mg/l	322	510	225	345	524	355	354	318	310	500	2000
TSS	mg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10		
Turbidity	NTU	0.2	0.5	0.3	0.2	1.5	0.1	0.8	0.1	0.2	1	5
Odor					A	greeable					Agre	eable
Alkalinity	mg/l	152	188	65	178	192	122	165	178	172	200	600
Chloride as Cl	mg/l	38	65	64	45	85	53	52	45	38	250	1000
Sulphate as SO ₄	mg/l	12.2	22.3	14.3	17.2	42.4	16.5	10.4	12.2	8.8	200	400
Nitrate as NO ₃	mg/l	3.6	20.4	3.4	5.5	12.8	4.2	5.5	3.4	6.4	45	No Relaxation
Phosphates	mg/l	0.5	2.5	0.8	1.5	3.5	0.5	1.5	0.5	0.5	-	-
Hardness as CaCO₃	mg/l	108	348	107	195	308	118	213	203	197	200	600
Calcium as Ca	mg/l	18	86	26	53	68	22	55	48	42	75	200
Magnesium as Mg	mg/l	15	32	10	15	33	15	18	20	22	30	100
Sodium as Na	mg/l	66	38	36	32	42	65	38	24	18		
Potassium as K	mg/l	5.5	8.5	6.8	5.5	8.8	8.5	6.8	5.2	5.2		
Fluoride as F	mg/l	1.0	1.12	<1.0	<1.0	1.15	<1.0	1.18	<1.0	<1.0	1.0	1.5

Table 3.12 Results of groundwater sample analysis

Proposed ICHWTSDF & Recycling Facility at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh

Iron as Fe	mg/l	0.24	0.28	0.21	0.24	0.25	0.26	0.26	0.22	0.22	0.3	
Lead as Pb	mg/l	<0.01	<0.01	< 0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	No
Cadmium as Cd	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.003	Relaxation
Total Chromium	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	
Copper as Cu	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	1.5
Zinc as Zn	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5	15
Boron as B	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	1

Table 3.13 Results of surface water sample analysis

Deventer	Linite	S)A/1	SW2	SW3	SW4	CPCB water	quality crite	ria as update	d on 11 th Sept	ember, 2017
Parameter	Units	SW1	3002	5005	5004	Α	В	С	D	E
рН		7.2	7.6	7.4	7.8	6.5-8.5	6.5-8.5	6.0-9.0	6.5- 8.5	6.5- 8.5
EC	μS/cm	265	305	270	322	-	-	-	-	2250
Odor			Unobjec	tionable		-	-	-	-	-
TSS	mg/l	<10	<10	<10	<10					
TDS	mg/l	168	182	178	210	-	-	-	-	-
Turbidity	NTU	0.1	<0.1	<0.1	0.5	-	-	-	-	-
Alkalinity as CaCO ₃	mg/l	102	110	108	118	-	-	-	-	-
Chloride as Cl	mg/l	18	23	14	22	-	-	-	-	-
Sulphate as SO ₄	mg/l	8.8	8.4	6.8	11.2	-	-	-	-	-
Nitrates as NO ₃	mg/l	2.1	2.3	1.8	3.2	-	-	-	-	-
Phosphate	mg/l	0.6	0.5	0.5	1.2					
Total Hardness	mg/l	104	120	108	125	-	-	-	-	-
Calcium as Ca	mg/l	25	28	20	30	-	-	-	-	-
Magnesium as Mg	mg/l	10	12	14	12	-	-	-	-	-
Sodium as Na	mg/l	15	10	15	18	-	-	-	-	-

Daramatar	Units	SW1	SW2	SW3	SW4	CPCB water	quality crite	ria as update	d on 11 th Sept	tember, 2017
Parameter	Units	2001	3002	3003	3004	Α	В	С	D	E
Potassium as K	mg/l	5	8	5	8	-	-	-	-	-
Fluoride as F	mg/l	<1	1.01	<1	1.12	-	-	-	-	-
Iron as Fe	mg/l	0.22	0.28	0.24	0.26	-	-	-	-	-
Lead as Pb	mg/l	<0.01	<0.01	<0.01	<0.01	-	-	-	-	_
Cadmium as Cd	mg/l	< 0.003	<0.003	<0.003	<0.003	-	-	_	_	_
Arsenic as As	mg/l	<0.05	<0.05	<0.05	<0.05	-	-	-	-	_
Copper as Cu	mg/l	<0.05	<0.05	<0.05	<0.05	-	-	-	-	_
Boron as B	mg/l	<0.1	<0.1	<0.1	<0.1	-	-	-	-	2
Chromium as Cr	mg/l	<0.05	<0.05	<0.05	<0.05	-	-	-	-	_
Zinc as Zn	mg/l	<0.5	<0.5	<0.5	< 0.5	-	-	-	-	_
DO	mg/l	6.6	5.9	6.6	5.6	6	5	4	4	-
COD	mg/l	8	22	8	32	-	-	-	-	-
BOD	mg/l	<4	8	<4	12	2	3	3	-	-
E. Coil	MPN/100ml	Absent	10	Absent	17	-	-	-	-	-
Total Coliform	MPN/100ml	58	94	47	110	50	500	5000	-	-

Proposed ICHWTSDF & Recycling Facility at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh

3.4.2 Regional scenario

Groundwater quality

- The pH limit fixed for drinking water samples as per IS: 10500-2012 Standards is 6.5 to 8.5. Beyond this range, water will affect the mucus membrane and water supply system. pH in the study area varied from **6.9 to 7.9**, showing that values are within the acceptable range.
- The acceptable limit for dissolved solids as per IS: 10500-2012 Standards is 500 mg/l whereas the permissible limits in absence of alternate source are 2000 mg/l. Beyond this, palatability decreases and may cause gastro intestinal irritation. In the ground water samples collected from the study area, the total dissolved solids varied from 225 mg/l to 524 mg/l. TDS of seven samples are within the acceptable limits and two samples are above the acceptable limit and below permissible limit.
- The acceptable limit for chloride is 250mg/l as per IS: 10500-2012 Standards whereas the permissible limit of the same is 1000 mg/l. Beyond this limit, taste, corrosion and palatability are affected. The chloride levels in the ground water samples collected in the study area ranged from 38 mg/l to a maximum of 85 mg/l, showing that all samples are within acceptable limits.
- The acceptable limit of hardness as CaCO₃ according to IS:10500-2012 Standards is 200 mg/l whereas the permissible limit for the same is 600 mg/l. Beyond this limit, encrustation in water supply structures and adverse effects on domestic use will be observed. The hardness values for the ground water samples collected from the study area varied from 107 mg/l to 348 mg/l. Five samples are within the acceptable limits and four samples are above acceptable limits and below permissible limits.
- Fluoride is another important parameter, which has an acceptable limit of 1 mg/l and permissible limit of 1.5 mg/l. However the optimum content of fluoride in the drinking water is <0.6 to 1.5 mg/l. If the fluoride content is less than 0.6 mg/l it causes dental carries, above 1.5 mg/l it causes staining of tooth enamel, higher concentration in range of 3 10 mg/l causes fluorosis. In the ground water samples of study area the fluoride value was in the range of <1 to 1.18 mg/l. Six samples are in acceptable limit and three samples are above the acceptable limit and below permissible limit.

Surface water quality

- pH of the surface water collected in the study area are varying from **7.2 to 7.8**.
- Total dissolved solids were in the range of 168 mg/l to 210 mg/l.
- Chlorides were in the range of **14 mg/l to 23 mg/l**.
- Hardness is varying between **104 mg/l to 125 mg/l**.
- BOD is varying between <4 mg/l to 12 mg/l.

The surface water quality is compared with the CPCB water quality criteria and it is found that the values are falling in 'D Category' (Propagation of Wild life and Fisheries). This is

because the surface water is highly susceptible to contamination due to discharge of sewage, animal bathing, agricultural run-off, recreational activities, etc.

3.5 Noise environment

Noise can be defined as any undesirable sound that interferes with speech and hearing and is intense enough to damage hearing or is otherwise annoying. Noise can also disturb natural wildlife and ecological systems. Noise impacts can be a major concern during the construction and the operational phases of the project. Noise should also be considered in relation to present and future land use zoning and policies.

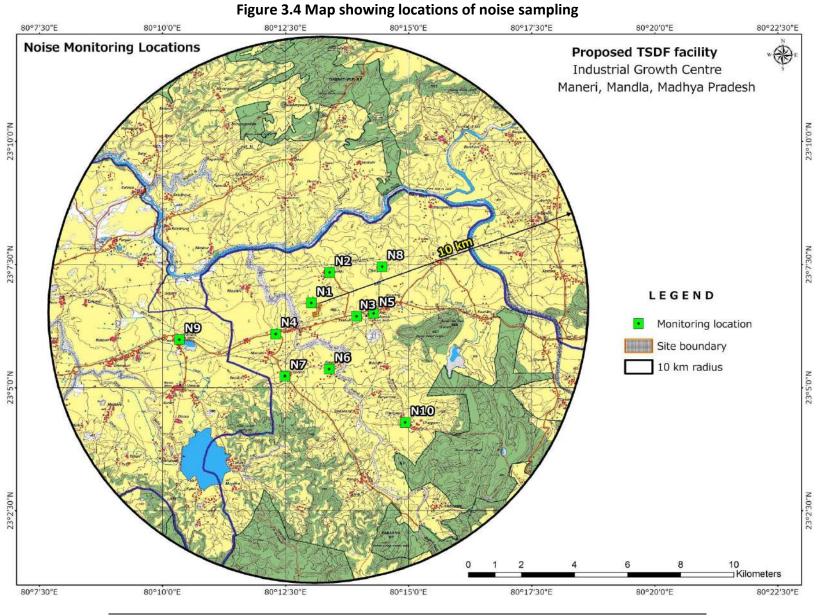
Construction noise can be a significant source of community noise. The impacts are felt on the people near the construction site, who are totally unrelated to construction activities (e.g. area residents, office workers, school children, staff, etc.). Factors which are important in determining noise levels that will potentially impact such populations include- distance from the noise source, natural or man-made barriers between the source and the impacted population, weather conditions which could potentially absorb, reflect or focus sound (such as wind speed, direction, temperature inversions), the scale and intensity of the particular construction phase (excavation, erection, or finishing). The Environment/ health impacts of noise can vary from Noise Induced Hearing Loss (NIHL) to annoyance depending on loudness of noise levels and tolerance levels of individuals.

3.5.1 Source of noise

The main sources of noise in the study area are domestic activities, industrial activities and vehicular traffic.

3.5.2 Noise levels in the study area

Noise levels were monitored at 10 locations within the study area, using a noise measurement device. Random noise level measurements at various locations were carried out for assessment of existing noise levels. Keeping in view the land use pattern, residential areas, schools, bus stands, etc., the day levels of noise have been monitored during 6 AM to 10 PM and the night levels during 10 PM to 6 AM. The noise monitoring locations are shown in **Figure 3.4** and **Table 3.14**. The results are presented in **Table 3.15**.



	Name of the	W.R.1	Г. Site			
Code	Locations	Distance (km)	Direction	Latitude	Longitude	Remarks
N1	Site	_	_	23° 06' 43.20" N	80° 13' 01.50" E	Site
N2	Jhurkhi	1.1	N	23° 07' 20.40" N	80° 13' 23.90" E	Near Market
N3	Takbeli	1.3	E	23° 06' 26.90" N	80° 13' 56.77" E	Near School
N4	Mendhi	1.5	SW	23° 06' 05.36" N	80° 12' 18.10" E	Village entrance
N5	Maneri	1.9	E	23° 06' 30.39" N	80° 14' 17.40" E	Near Temple
N6	Katangi	2.1	S	23° 05' 22.81" N	80° 13' 23.38" E	Near Junction
N7	Chikhli	2.4	SW	23° 05' 14.24" N	80° 12' 29.45" E	Village entrance
N8	Chargaon (NE)	2.5	NE	23° 07' 27.45" N	80° 14' 27.78″ E	Near Junction
N9	Paharikhera	4.8	W	23° 05' 58.53" N	80° 10' 20.77" E	Near Junction
N10	Chargaon (SE)	5.0	SE	23° 04' 17.60" N	80° 14' 56.10" E	Near Auto stand

Table 3.14 Noise monitoring locations

Table 3.15 Results of noise quality monitoring dB(A)

Code	Location	Da	iy 🗌	Ν	ight	L _{eq} d	B (A)				
Coue	Location	Min.	Max.	Min.	Max.	L _{day}	Lnight				
N1	Site	47.3	56.7	40.2	45.3	53.9	42.2				
N2	Jhurkhi	48.3	57.8	42.3	47.6	54.5	43.8				
N3	Takbeli	46.4	52.3	39.1	45.3	49.7	39.6				
N4	Mendhi	46.3	56.3	40.8	47.5	53.7	42.1				
N5	Maneri	44.5	52.4	38.7	45.6	49.8	39.9				
N6	Katangi	43.6	56.5	41.3	46.5	53.5	41.9				
N7	Chikhli	46.4	57.6	42.3	48.4	54.3	43.6				
N8	Chargaon (NE)	45.3	57.3	42.4	48.7	53.5	42.9				
N9	Paharikhera	47.6	57.1	41.4	48.9	53.7	43.8				
N10	Chargaon (SE)	48.3 57.9		41.2	47.6	53.8	43.1				
	Range 49.7 to 54.5 39.6 to 43.8										
	Note: 1. Day time is recorded in between 6 a.m. and 10 p.m., 2. Night time is recorded										

in between 10 p.m. to 6 a.m.

AAQ Standards in respect of Noise SO 123 (E) dt 14^{th} Feb 2000

Area code	Category of area	Limits in dB(A) Leq			
		Day time	Night time		
А	Industrial area	75	70		
В	Commercial area	65	55		
C	Residential area	55	45		
D	Silence zone	50	40		

3.5.2.1 Regional scenario

High noise levels observed in some of the rural areas are primarily because of vehicular traffic and other anthropogenic activities. In rural areas, wind blowing and chirping of birds would contribute to noise levels especially during nights. The day equivalents during the study period ranged between **49.7 to 54.5 dB (A)** whereas the night equivalents were in the range of **39.6 to 43.8 dB (A)**. The results are compared with AAQ standards in respect of Noise SO 123 (E) dt 14th Feb 2000 for Industrial, Residential and Commercial area. From the results it can be seen that the day equivalents and night equivalents were within the specified standards.

3.6 Traffic study

Traffic studies are required to assess the traffic density pattern of the region and to assist the proponent in planning vehicular movement during the project activity. The methodology adopted for carrying out the traffic study was to select the major roads around the project site and count the various categories of vehicles moving on these roads. The traffic survey was carried out on Maneri road at the project site, the details of which are given in **Table 3.16.** We observed that the highest peak was 435 PCU/hr during 10 to 11 AM. It was observed that the existing level of service of site access road is very good. This implies that traffic will not have a major impact due to the proposed project.

	Tw	Two wheeler		Three wheeler		Passenger cars &Pick-up vans		leavy Imercial les (HCV)	Total vehicles	
Hours	v/hr	PCU/hr(0.7 5)	v/hr	PCU/h r	v/hr	PCU/h r	v/hr	PCU/hr	Total	Total PCU/h r
6-7 am	28	21	12	24	2	2	16	59	58	106
7-8 am	48	36	16	32	8	8	32	118	104	194
8-9 am	78	59	28	56	12	12	42	155	160	282
9-10 am	97	73	43	86	22	22	56	207	218	388
10-11 am	105	79	54	108	26	26	60	222	245	435
11-12 pm	92	69	52	104	24	24	54	200	222	397
12-1 pm	83	62	45	90	22	22	55	204	205	378
1-2 pm	83	62	38	76	18	18	48	178	187	334
2-3 pm	74	56	32	64	15	15	42	155	163	290
3-4 pm	64	48	26	52	18	18	35	130	143	248
4-5 pm	58	44	23	46	23	23	48	178	152	290
5-6 pm	46	35	34	68	21	21	51	189	152	312
6-7 pm	36	27	26	52	14	14	56	207	132	300
7-8 pm	24	18	22	44	12	12	48	178	106	252

Table 3.16 Traffic survey at Maneri road

21	16	13	26	11	11	34	126	79	179			
17	13	11	22	8	8	24	89	60	132			
12	9	7	14	4	4	18	67	41	94			
t peak c	bserved is 435	PCU/h	r during 1	0 to 11	am							
n of the	Road in meters	s (Artei	rial Road)						7			
Carrying capacity of the road (the road is 2 lane 2 way road), As per IRC:106-1990 (PCU's per hour) 1 Existing V/C Batio												
Existing V/C Ratio												
of Servi	ce (Existing)								В			
for LOS												
١	//C			LC)S		Per	formand	e			
0.0) - 0.2			A	4		Ex	cellent				
0.2	2 - 0.4			E	3		Ve	ery good				
0.4	- 0.6			(2			Good				
0.6	5 - 0.8			[)		Fair	/Averag	е			
0.8	8 - 1.0			E	Ξ			Poor				
1.0 8	k above			F	=		Ve	ery poor				
	17 12 t peak of of the pacity of C Ratio of Servi for LOS 0.0 0.2 0.4 0.6 0.8	1713129t peak observed is 435of the Road in meterspacity of the road (the	1713111297t peak observed is 435 PCU/hof the Road in meters (Arterpacity of the road (the road isC Ratioof Service (Existing)for LOS V/C $0.0 - 0.2$ $0.2 - 0.4$ $0.4 - 0.6$ $0.6 - 0.8$ $0.8 - 1.0$	17 13 11 22 12 9 7 14 t peak observed is 435 PCU/hr during 1 14 14 t peak observed is 435 PCU/hr during 1 16 17 n of the Road in meters (Arterial Road) 17 14 n of the Road in meters (Arterial Road) 16 17 pacity of the road (the road is 2 lane 2 17 18 C Ratio 0 16 16 of Service (Existing) 17 17 17 for LOS 10 17 17 17 0.0 - 0.2 10 10 17 17 0.1 - 0.2 10 10 10 10 0.2 - 0.4 10 10 10 10	17 13 11 22 8 12 9 7 14 4 t peak observed is 435 PCU/hr during 10 to 11 of the Road in meters (Arterial Road) 10 to 11 n of the Road in meters (Arterial Road)	17 13 11 22 8 8 12 9 7 14 4 4 t peak observed is 435 PCU/hr during 10 to 11 am n of the Road in meters (Arterial Road) pacity of the road (the road is 2 lane 2 way road), As pear C Ratio of Service (Existing) for LOS V/C LOS 0.0 - 0.2 A 0.2 - 0.4 B 0.4 - 0.6 C 0.8 - 1.0 E	17 13 11 22 8 8 24 12 9 7 14 4 4 18 t peak observed is 435 PCU/hr during 10 to 11 am a a a a a a of the Road in meters (Arterial Road) a b a	17 13 11 22 8 8 24 89 12 9 7 14 4 4 18 67 t peak observed is 435 PCU/hr during 10 to 11 am of the Road in meters (Arterial Road) pacity of the road (the road is 2 lane 2 way road), As per IRC:106-1990 (PC C Ratio of Service (Existing) for LOS Per 0.0 - 0.2 A Ex 0.2 - 0.4 B V/e 0.4 - 0.6 C 0 0.8 - 1.0 E Image: state stat	17 13 11 22 8 8 24 89 60 12 9 7 14 4 4 18 67 41 t peak observed is 435 PCU/hr during 10 to 11 am 0 of the Road in meters (Arterial Road)			

3.7 Soil quality

The study on soil quality establishes the baseline characteristics in the study area surrounding the project site. The study has been addressed with the following objectives to determine.

- The base line characteristics.
- The soil characteristics of proposed project site.
- The impact of industrialization/ urbanization on soil characteristics.
- The impacts on soils from agricultural productivity point of view.

3.7.1 Criteria adopted for selection of sampling locations

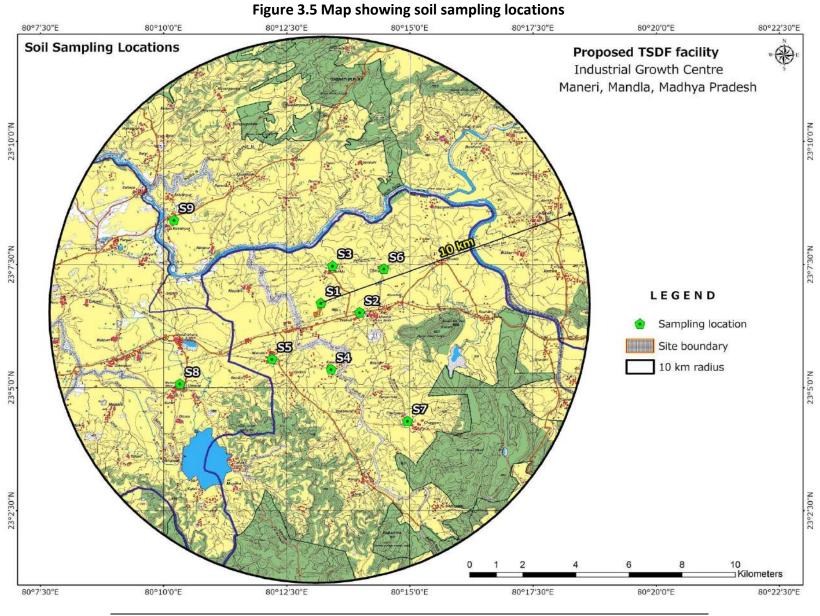
For studying the soil types and soil characteristics, 9 sampling locations were selected to assess the existing soil conditions representing various land use conditions and geological features. Homogenized soil samples collected at different locations were packed in a polyethylene plastic bag and sealed. The sealed samples were sent to the laboratory for analysis. Important physical and chemical parameters were determined for all samples.

3.7.2 Soil sampling locations

Details of the soil sampling locations are given in **Table 3.17** and the soil sampling location map is given in **Figure 3.5.** The analytical results of the soil samples collected during the study period are summarized in above **Table 3.18**.

S.No	Locations	Distance	Direction	Coordinates		Description
		(km)		Latitude	Longitude	
1	Site	_	_	23° 6' 43.2" N	80° 13' 11.7" E	
2	Maneri	1.3	E	23° 6' 31.9" N	80° 13' 58.8" E	
3	Jhurkhi	1.5	N	23° 7' 28.7" N	80° 13' 25.9" E	
4	Katangi	2.1	S	23° 5' 22.5" N	80° 13' 24.1" E	Agriculture
5	Mendhi	2.2	SW	23° 5' 35.1" N	80° 12' 12.3" E	land
6	Chargaon(NE)	2.6	NE	23° 7' 24.9" N	80° 14' 28.5" E	lanu
7	Chargaon(SE)	4.9	SE	23° 4' 19.6" N	80° 14' 57.2" E	
8	Umaria	5.4	SW	23° 5' 04.9" N	80° 10' 19.8" E	
9	Kalyanpur	6.1	NW	23° 8' 24.4" N	80° 10' 12.6" E	

Table 3.17 Soil sampling locations



Page 3.26

Parameters	Unit	S 1	S2	\$3	S 4	S5	S6	S7	S8	S9	Standard Soil Classification – (Indian Council of Agricultural Research, New Delhi
Texture	-	(L Clay loam			Silt loam			Clay Loar	<u> </u> n	-
Color	-	Brown	, Grey	Brown	Brown	Brown	Grey	Brown	, Grey	Brown	-
pH (1:5 Extraction)		7.5	7.6	7.5	7.4	7.4	7.4	7.2	7.5	7.5	Acidic<6.0, Normal to Saline 6.0-8.5, Tending to become Alkaline8.6 to 9.0, Alkaline above 9.
EC (1:5 Extraction)	μS/cm	178	188	210	172	224	165	180	158	145	Normal<1000, Critical for germination 1000-2000, Critical for growing 2000 - 4000, Injurious to most crops>4000
Organic Carbon	%	0.8	0.7	0.6	0.9	0.9	0.8	0.6	0.7	0.6	Low < 0.5 , Medium 0.5 – 0.75, High > 0.75
Bulk density	gr/cc	1.22	1.33	1.18	1.42	1.28	1.24	1.18	1.22	1.15	-
Calcium as Ca	mg/kg	2623	2534	2424	1978	2678	1854	1645	2856	3122	-
Magnesium as Mg	mg/kg	1234	1123	1345	1244	1312	1045	1004	1685	1765	-
Chloride as Cl	mg/kg	234	223	165	175	215	185	205	168	148	-
Available Nitrogen as N	kg/Ha	175	251	199	264	152	276	235	202	220	Low below 280, Medium 280-560, High above 560
Available Potassium as K	kg/Ha	152	170	217	206	161	188	213	175	195	Low below 110, Medium 110-280 High above 280
Available Phosphorus as P	kg/Ha	7.6	9.4	10.1	9.6	6.5	8.5	7.4	9.2	9.9	Low below 10, Medium 10-25,High above 25
Zinc as Zn	mg/kg	28.8	48.8	42.3	28.7	34.4	32.3	38.8	47.8	44.3	-
Copper as Cu	mg/kg	34.4	32.4	28.8	45.5	52.3	21.2	44.6	64.5	55.4	-
Manganese as Mn	mg/kg	67.6	76.5	57.8	87.5	48.8	112	103	145	164	-
Sulphur	%	1.13	0.67	1.34	0.43	0.28	0.56	0.43	0.51	0.35	
Boron as B	mg/kg	15.5	11.5	13.4	10.8	12.4	18.8	16.8	22.3	14.2	-

Table 3.18 Results of soil analysis

3.7.3 Regional scenario

The pH of soil is an important property as plants cannot grow in low and high pH soils. The pH of soils in the range 6.0 to 8.5 is called normal to saline soils. Most of the essential nutrients like N, P, K, Cl and SO₄ are available for plants at neutral pH, except for Fe, Mn and Al which are available at low pH range. Soils having pH below 7 are considered to be acidic from the practical standpoint, those with pH less than 5.5 and which respond to liming may be considered as acid soils. On the basis of pH measurements, the degree of soil acidity may be indicated. The pH values in the study area varied from **7.2 to 7.6**. The pH for all samples falls under normal to saline category.

Based on the electrical conductivity, the soils are classified into 4 groups (Normal, Critical for germination, Critical for growth of the sensitive crops, Injurious to most crops). The electrical conductivity in the study area varied from **145 to 224 \muS/cm** indicating that the soils fall under normal category.

The total organic carbon in the study area varied from **0.6 to 0.9 %** indicating that five samples are in medium level and all other samples are in high level.

Other important parameters for characterization of soil for irrigation are Nitrogen, Phosphorus and Potassium which are known as primary nutrients whereas Calcium, Magnesium and Sulphur are known as secondary nutrients. The primary and secondary nutrient elements are known as major elements. This classification is based on their relative abundance and not on their relative importance.

Nitrogen encourages the vegetative development of plants by imparting a healthy green colour to the leaves. It also controls, to some extent, the efficient utilization of phosphorus and potassium. Its deficiency retards growth and root development, turns the foliage yellowish or pale green, hastens maturity, causes the shriveling of grains and lowers crop yield. The older leaves are affected first. An excess of nitrogen produces leathery (and sometimes crinkled) dark green leaves and succulent growth. It also delays the maturation of plants, impairs the quality of crops like barley, potato, tobacco, sugarcane and fruits increases susceptibility to diseases and causes "lodging" of cereal crops by inducing an undue lengthening of the stem internodes. The available nitrogen as N in the study area varies from **152 to 276 kg/Ha** indicating that all samples are falling under low category.

Phosphorus influences the vigor of plants and improves the quality of crops. It encourages the formation of new cells, promotes root growth (particularly the development of fibrous roots) and hastens leaf development, the emergence of ears, the formation of grains and maturation of crops. It also increases resistance to disease and strengthens the stems of cereal plants, thus reducing their tendency to lodge. It offsets the harmful effects of excess nitrogen in the plant. When applied to leguminous crops it hastens and encourages the development of nitrogen fixing bacteria. If phosphorus is deficient in the soil, plants fail to

make a quick start, do not develop a satisfactory root-system, remain stunted, and sometimes develop a tendency to show a reddish or purplish discolouration of stem and foliage owing to an abnormal increase in the sugar content and the formation of anthocyanin. However the deficiency of this element is not so easily recognized as that of nitrogen. It has also been observed that cattle feeding on the produce of phosphorus deficient soils become dwarfed, develop stiff joints and lose the velvety feel of the skin. Such animals show an abnormal craving for eating bones and even soil itself. In the study area available phosphorus varies from **6.5 to 10.1 kg/Ha** indicating that all samples are falling under low category except one sample is falling under medium category.

Potassium enhances the ability of the plants to resist diseases, insect attacks, cold and other adverse conditions. It also plays an essential part in the formation of starch and production and translocation of sugars. It is of special value to carbohydrate rich crops e.g. sugarcane, potato and sugar beet.

The increased production of starch and sugar in legumes fertilized with potash benefits the symbiotic bacteria and thus enhances nitrogen fixation. It also improves the quality of tobacco, citrus etc. With an adequate supply of potash, cereals produce plump grains and strong straw. But excess of elements tends to delay maturity, though not to the same extent as nitrogen. Plants can take up and store potassium in much larger quantities than what is needed for optimum growth and this excess uptake is known as luxury consumption. With the maturity or death of plants, potassium is washed out from the plant readily.

Vegetables and legumes are particularly heavy consumers of potassium. The deficiency of potassium produces the characteristic ringing of alfalfa leaves with rows of small white spots, reddish brown discoloration of cotton leaves, drying, scorching and curbing of leaf margins of potato, intravenal chlorosis and flaring along the edges of maize leaves. The older leaves are affected first. The available potassium in the study area is varies between **152 to 217 kg/Ha** indicating that all samples are falling under medium category.

3.8 Biological environment

3.8.1 Introduction

The assessment of flora and fauna of the study area was carried out as per the MoEF&CC guidelines in post monsoon season. The assessment was carried out in between 14th to 16th October, 2019. The main objective behind gathering information about the ecology and biodiversity of the study area was to assess the existing baseline ecological conditions in the study area, correlate it with the data available with the forests department and develop mitigation measures for possible impacts of the project on the existing ecology.

3.8.2. Terrestrial Vegetation and Flora of the Core zone

The proposed project site is located inside the notified industrial area. The core zone is scrubland which is occupied by spiny, wild, grass species and common trees. Vegetation observed at site namely Coffee senna (*Senna occidentalis*), Lantana (*Lantana camara*), Century plant (*Agave Americana*), Congress grass (*Parthenium hysterophorus*), Crown flower (*Calotropis gigantea*) etc., Poaceae species like Bermuda grass (*Cynodon dactylon*), Indian crowfoot grass (*Eleusine indica*), Summer grass (*Alloteropsis cimicina*) etc., and common trees namely Neem (*Azadirachta indica*), Pongam tree (*Pongamia pinnata*), Wild date palm (*Phoenix sylvestris*) etc., List of Flora found in the Core zone is given in **Table 3.19**.

S. No	Scientific Name	Family Name	Common Name
1	Abutilon indicum	Malvaceae	Indian mallow
2	Agave Americana	Agavaceae	Century plant
3	Alloteropsis cimicina	Poaceae	Summer grass
4	Anisomeles indica	Lamiaceae	Indian catmint
5	Azadirachta indica	Meliaceae	Neem
6	Datura innoxia	Solanaceae	Datura
7	Calotropis gigantean	Apocynaceae	Crown flower
8	Cassia auriculata	Caesalpiniaceae	Tanner's cassia
9	Cynodon dactylon	Poaceae	Bermuda grass
10	Eleusine indica	Poaceae	Indian crowfoot grass
11	Lantana camara	Verbenaceae	Lantana
12	Leucaena leucocephala	Mimosaceae	Wild tamarind
13	Mimosa pudica	Mimosaceae	Sleepy plant
14	Parthenium hysterophorus	Asteraceae	Congress grass
15	Phoenix sylvestris	Arecaceae	Wild date palm
16	Pongamia pinnata	Fabaceae	Pongam tree
17	Ricinus communis	Euphorbiaceae	Castor oil plant
18	Senna occidentalis	Caesalpiniaceae	Coffee senna
19	Solanum virginianum	Solanaceae	Thorny nightshade
20	Tridax procumbens	Asteraceae	Tridax daisy
21	Waltheria indica	Sterculiaceae	Velvet leaf
Source:	Data collected during primary su	urvey	

Table 3.19 List of Flora found in the Core zone

3.8.3 Vegetation and Flora of the Buffer zone

Land use and land cover of the buffer zone reveals the absence of notified eco sensitive zones like National Parks or Wildlife Sanctuaries etc., within 10 km radius of the project site.

Forests falling within 10 km radius are namely Dasrathpur RF 4.5 km (NE), Parariya RF 4.7 km (SE), Bhaundi RF 6.7 km (S) and Gangai RF 9.0 km (NW). Buffer zone consists of, barren

rocky area, land with or without scrub area, forest area and agriculture fields etc., crops observed namely Paddy (*Oryza sativa*), Pigeon pea (*Cajanus cajan*) and Mustard (*Brassica compestris*) etc., vegetables like Brinjal (*Solanum melongena*), Tomato (*Lycopersicon esculentum*), Potato (*Solanum tuberosum*) etc., among the fruits like Guava (*Psidium guajava*), Mango (*Mangifera indica*) etc., were commonly grown in the study area.

There are open lands covered with vegetation viz. Gum arabic (*Acacia nilotica*), Cutch tree (*Acacia catechu*), Indian plum (*Ziziphus mauritiana*), Mesquite (*Prosopis juliflora*), Sal tree (*Shorea robusta*), Banyan tree (*Ficus benghalensis*), Peepal (*Ficus religiosa*), Forest red gum (*Eucalyptus tereticornis*), Wild tamarind (*Leucaena leucocephala*), Moringa (*Moringa oleifera*), Aloe vera (*Aloe vera*), White bark acacia (*Acacia leucophloea*), Crown flower (*Calotropis gigantea*), Rubber bush (*Calotropis procera*) etc.,. List of flora (trees, shrubs and perennial climbers) found in the buffer zone is given in **Table 3.20**.

S.No	Scientific Name	Family Name	Common/local name
1	Acacia catechu	Mimosaceae	Cutch tree
2	Acacia leucophloea	Mimosaceae	White bark acacia
3	Acacia nilotica	Mimosaceae	Gum arabic
4	Aegle marmelos	Rutaceae	Beli fruit
5	Agave Americana	Agavaceae	Century plant
6	Albizia lebbeck	Mimosaceae	Siris tree
7	Aloe vera	Asphodelaceae	Aloe vera
8	Annona squamosal	Annonaceae	Custard apple
9	Aristida adscensionis	Poaceae	Common needle grass
10	Azadirachta indica	Meliaceae	Neem
11	Bauhinia variegate	Caesalpiniaceae	Kachnar
12	Bauhinia purpurea	Caesalpiniaceae	Butterfly tree
13	Butea monosperma	Fabaceae	Flame of the forest
14	Caesalpinia pulcherrima	Caesalpiniaceae	Peacock flower
15	Carica papaya	Caricaceae	Рарауа
16	Calotropis gigantean	Apocynaceae	Crown flower
17	Calotropis procera	Apocynaceae	Rubber bush
18	Cassia fistula	Caesalpiniaceae	Amaltas
19	Cocos Nucifera	Arecaceae	Coconut tree
20	Dalbergia sissoo	Fabaceae	Shisham
21	Delonix regia	Caesalpiniaceae	Flame tree
22	Eucalyptus tereticornis	Myrtaceae	Forest red gum
23	Ficus benghalensis	Moraceae	Banyan tree
24	Ficus religiosa	Moraceae	Peepal

Table 3.20 List of Flora present in the buffer zone

S.No	Scientific Name	Family Name	Common/local name
25	Hibiscus rosa-sinensis	Malvaceae	China rose
26	Hardwickia binata	Caesalpiniaceae	Anjan
27	Holoptelea integrifolia	Ulmaceae	Indian Elm
28	Leucaena leucocephala	Mimosaceae	Wild tamarind
29	Mangifera indica	Anacardiaceae	Mango tree
30	Moringa oleifera	Moringaceae	Moringa
31	Musa paradisiaca	Musaceae	Banana
32	Opuntia elatior	Cactaceae	Prickly pear
33	Pithecellobium dulce	Mimosaceae	Sweet tamarind
34	Psidium guajava	Myrtaceae	Guava
35	Prosopis juliflora	Mimosaceae	Mesquite
36	Syzygium cumini	Myrtaceae	Java plum
37	Shorea robusta	Dipterocarpaceae	Sal tree
38	Tamarindus indica	Caesalpiniaceae	Tamarind
39	Tectona grandis	Verbenaceae	Teak
40	Thespesia populnea	Malvaceae	Indian tulip tree
41	Ziziphus mauritiana	Rhamnaceae	Indian plum
Sourc	e: Data collected during prima	ry survey	

3.8.4 Terrestrial fauna of the Core area and the Buffer zone

As the fauna species move from place to place in search of food, shelter, mate or other biological needs, separate list for core and buffer areas are not feasible. Primary survey carried out through physical observations, information gathered from surrounding villagers and nearby forest department. Among the Mammals only squirrels, mongoose, rats, bandicoots, monkeys were observed and during survey of reptiles only lizards, garden lizards were very common and the amphibians were also seen near the water bodies in the buffer zone. Avi fauna were observed during active period of early morning and evening hours. Among the bird's crows, asian koel, mynas, black drongo, crane, eagle and common babbler etc., were observed. The list of fauna observed during primary survey and based on secondary sources is given in **Table 3.21**.

S.No	Scientific name Common name		WPA, 1972			
Mammal	Mammals					
1	Sus scrofa	Wild pig	III			
2	Hystrix indica	Indian porcupine	IV			
3	Funambulus pennantii	Five-striped palm squirrel	IV			
4	Nesokia indica	Short-tailed mole rat	IV			
5	Macaca mulatta	Rhesus macaque	II(Part I)			

Table 3.21 List of Fauna in the Study Area

6	Lepus nigricollis	Indian hare	IV
7	Bandicota indica	Large bandicot rat	IV
8	Herpestes edwardsii	Common mongoose	II (Part I)
Reptiles	· (Venomous *)		·
1	Bungarus caeruleus	Common krait (*)	IV
2	Naja naja	Spectacled cobra (*)	II (Part II)
3	Chamaeleo zeylanicus	Indian chameleon	II (Part I)
4	Calotes versicolor	Garden lizard	IV
Amphibi	ans		
1	Bufo melanostictus	Common Indian toad	IV
2	Hoplobatrachus tigerinus	Fresh water frog	IV
Avian Sp	ecies		·
1	Ploceus philippinus	Baya weaver	IV
2	Orthotomus sutorius	Common tailorbird	IV
3	Alcedo atthis	Common kingfisher	IV
4	Vanellus malabaricus	Yellow-wattled lapwing	IV
5	Coracias benghalensis	Indian roller	IV
6	Pycnonotus cafer	Red-vented bulbul	IV
7	Dendrocitta vagabunda	Rufous treepie	IV
8	Lanius schach	Long-tailed shrike	IV
9	Ardeola grayii	Indian pond heron	IV
10	Merops orientalis	Green bee eater	IV
11	Milvus migrans	Black kite	IV
12	Centropus sinensis	Greater coucal	IV
13	Acridotheres tristis	Common myna	IV
14	Bubulcus ibis	Cattle egret	IV
15	Dicrurus macrocercus	Black drongo	IV
16	Egretta garzetta	Little egret	IV
17	Eudynamys scolopace	Asian koel	IV
18	Psittacula krameri	Rose ringed parakeet	IV
19	Saxicolodies fulicata	Indian robin	IV
20	Columba livia	Rock pigeon	IV
	Vanellus indicus	Red-wattled lapwing	IV

3.8.5 Aquatic flora and fauna

The Water bodies observed in the study area (10 km radius) are namely Jhamil nadi-0.6 km (W), Gaur nadi-2.1 km (N), Dundai Lake-5.5 km (SW). The observed water bodies were dry/semi dry in condition, hence aquatic fauna could not observed but few aquatic and

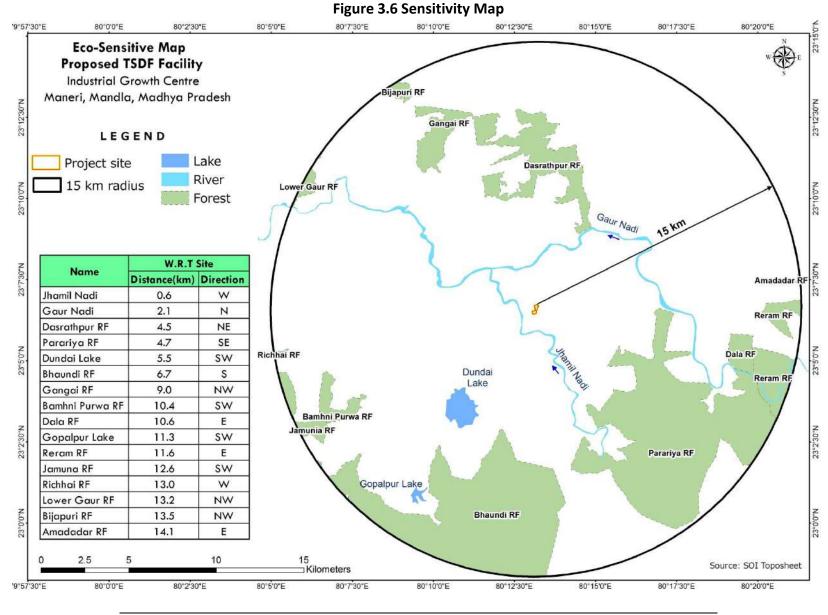
semiaquatic macrophytes could be seen in wet / moist areas. A list of aquatic macrophytes found near the water bodies is given in **Table 3.22**.

S.No	Latin name	Local / Common name	Family
1	Ipomoea aquatic	Water spinach	Convolvulaceae
2	Ipomoea carnea	Bush Morning Glory	Convolvulaceae
3	Oxalis corniculata	Creeping wood Sorrel	Oxalidaceae
4	Eichhornia crassipes	Common water hyacinth	Pontederiaceae
5	Echinochloa colona	Jungle rice	Poaceae
6	Alternanthera philoxeroides	Alligator weed	Amaranthaceae
7	Typha angustifolia	Cattail	Typhaceae
Source	: Data collected during primary s	urvey	

Table 3.22 List of aquatic / semi aquatic macrophytes observed in the water bodies

3.8.6 Details regarding the project boundary passing through any Eco-sensitive area and within 10 km from Eco-sensitive area.

As stated above, there are no notified ecologically sensitive areas such as the Wildlife Sanctuaries, National Parks etc., either in the project site or in the buffer zone except the above mentioned forests. Eco-sensitive map is shown in **Figure 3.6**.



3.9 Land use/ land cover details

The satellite based remote sensing is a sustainable global information system which has the potential to meet the needs and demands of the present and future. The synoptic coverage which provides capability for integration of real time information on regional and global scales is a unique characteristic of this information system. Its versatility lies in its inherent capability to conceptualize situation to give clear perceptions for defining short term and long term objectives. A very small activity could bring about changes in the land use and land cover in the vicinity. A data base on land use and land cover indicates ecosystems existing in and around the center of an economic activity, to safeguard and to allow comparison at a future date to draw conclusions on the nature. The study on land use and land cover is carried out within about 10 km radius of the proposed project.

3.9.1. Methodology for LULC mapping

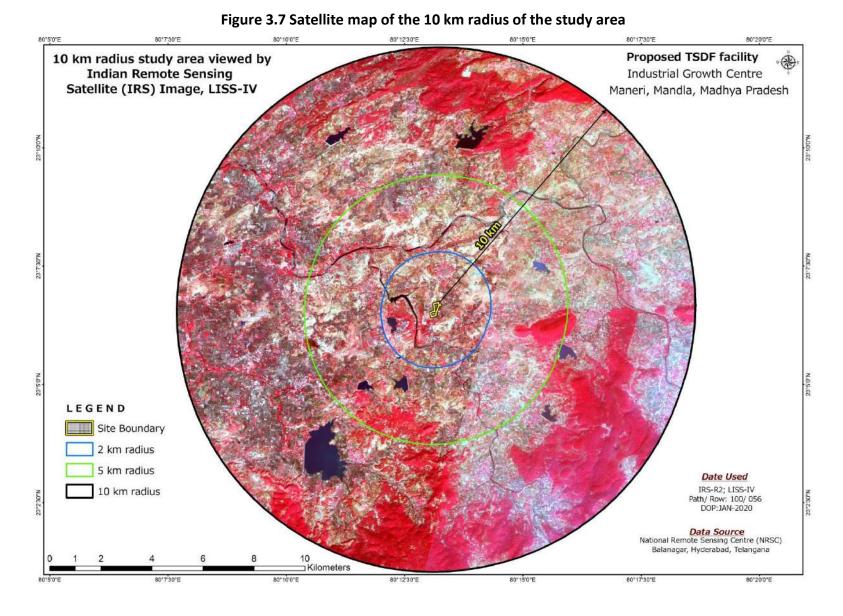
Land use/Land cover mapping involves primary and secondary data collection. High resolution satellite images IRS LISS-IV have been used to map the land use features. SOI Toposheets were used as secondary source for geographic reference of the study area and for geo-referencing the satellite images for one to one data matching. After the geometric correction of data, several image enhancement operations have been performed for betterment of image visibility for further discriminate of land use features.

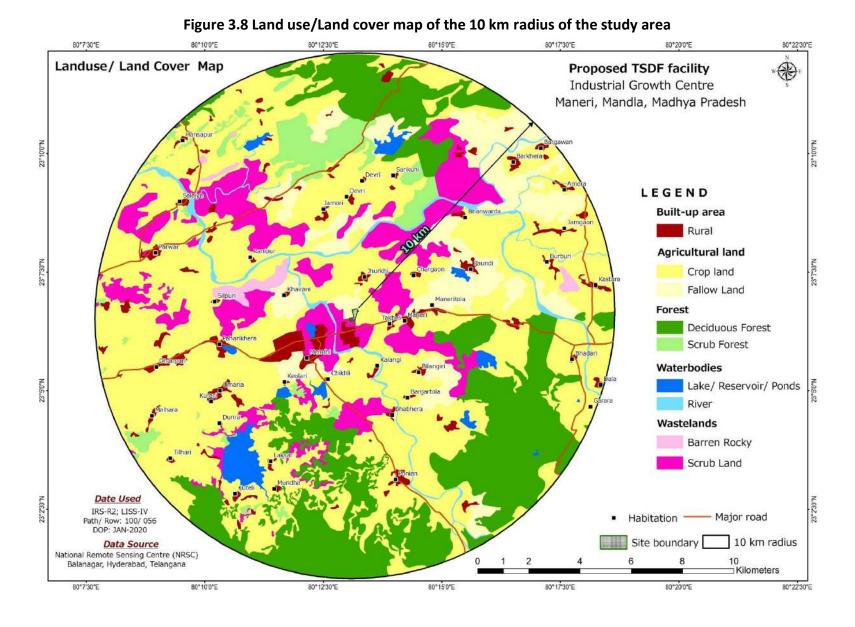
Land use features have been identified in LISS-IV image after doing several pre-processing operation and image enhancing image interpretation element and same has been digitized using ARC GIS-10 application tools, further it has been categorized as per standard NRSC Level-2 classification system to represent the into 1:50,000 scale level thematic map.

Ground truth forms an important and integral part of the interpretation methodology of remotely sensed data. After creation of draft LULC, the same has been verified by Remote Sensing expert on field for preparation of final LULC. This increases the interpretation accuracy as well as accuracy of LULC. This also enables to verify details which cannot be obtained from satellite imagery.

The base features information such as major roads, railways network and drainage networks were extracted from the available survey of India (SOI) Toposheet on 1:50,000 scale and vectorized using "ARC/INFO" (Geographic Information System) Software. The satellite map and land use & land cover of the study area (10 km radius of the project site) is provided in **Figure 3.7 and Figure 3.8**. The land utilization pattern in a radius of 10 km of the study area is given in **Table 3.23**.

According to 10 km radius lulc thematic map, it is observed that 62% of the study area is dominated by agricultural land and followed by other land uses likes forest land, wasteland, water bodies and some rural area randomly spread all along the study area.





	L1		L-2			
Class	Area (ha.)	% of area	Class	Area (ha.)	% of area	
Built-up	968	3	Rural	968	3	
Agricultural Land	18542	62	Crop Land	16029	54	
Agricultural Latiu	16542	02	Fallow Land	2513	8	
Forest	6599	21	Deciduous Forest	5872	19	
FOIESL			Scrub Forest	727	2	
Water bodies	905	3	Lake	468	2	
water boules	905	5	River	437	1	
Wastelands	3096	11	Barren Rocky	187	1	
vvasteldilus	5090	11	Scrub Land	2909	10	

 Table 3.23 Land utilization pattern in 10 km radius of the study area

3.10 Socio-economic environment

This section illustrates the prevailing socio-economic aspects of villages in the 10 km radius of proposed TSDF at industrial growth center at Maneri village, Mandla district of Madhya Pradesh. The following pages attempts to comprehend the social phenomenon so as to represent the demographic, occupational, gender and diversity among the project area villages, thereby postulate impactful developmental interventions.

3.10.1 Methodology adopted for the study

Afore mentioned, the socio-economic study covers villages in the 10 km radial distance from the periphery of the proposed project site at Maneri village in Mandla district of Madhya Pradesh. The Socio-Economic study further categorizes the villages in to 3 zones, namely core zone (0 to 2 km radius), buffer zone (2 km to 5 km) and other villages which are in 5 to 10 km distance from the proposed site. The socio-economic data is collected from 74 villages in 4 tehsils of Mandla and Jabalpur districts of Madhya Pradesh.

The study also adopts a two-fold methodology for data collection, namely, review of published secondary data and analysis of primary data. Secondary data was collected from district census statistics of 2011, which includes: demography, occupational structure, literacy profile and social structure etc.

Similarly, the primary data was collected through a range of research techniques and tools like: transact walk, structured questionnaire, Focus Group Discussions (FGDs), observations and key stakeholder interactions. The primary data was also collected through random survey covering a sample of 5% of households in the core project area villages.

The salient features of the demographic and socio-economic aspects in the core and buffer zone (hereafter referred as study area) has been described in the following sections. Similarly, village wise demographic data as per 2011 census is presented in **Table 3.29**.

3.10.2. Socio-Economic profile of the study area

3.10.2.1. Demographic aspects

Distribution of population

As per 2011 census the study area consists of 61,270 people and the distribution of population in the study area is given in **Table 3.24.**

C No	Deutieuleue	0.2 km	2.5 km	E 10 km	Total
S. No	Particulars	0-2 km	2-5 km	5-10 km	(0-10 km)
1	Number of households	1580	2799	9639	14018
2	Male population	3485	6276	21242	31003
3	Female population	3435	6393	20439	30267
4	Total population	6920	12669	41681	61270
5	SC population	1224	930	4383	6537
6	ST population	3702	9393	19398	32493
7	Total population (0-6 years)	927	1883	5566	8376
8	Average household size	4.4	4.5	4.3	4.4
9	% of males to the total population	50.4	49.5	51.0	50.6
10	% of females to the total population	49.6	50.5	49.0	49.4
11	Sex ratio (number of females per 1000 males)	985.7	1018.6	962.2	976.3
Source	District Primary Census statist	ics of Madhy	a Pradesh -2	011	

Table 3.24 Distribution of population in the stud	tudy area
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As illustrated in the above table, the gender diversity, as percentage of men and women constitute about 50.6% and 49.4% in the study area respectively.

Average household size

According to the Census data of 2011, study area had an average family size of 4.4 persons per household. This represents moderately high family size and also in similarity with other parts of the district.

Population density and projections

It is estimated that the average density of population of the study area is 160 persons per $\rm km^{2.}$

The population projections in the project area are as follows:

Percentage Decadal Variation in Mandla Dist (2001-11)	Year	Total population	Male	Female
	2011	61270	31003	30267
	2012	62343	31561	30782
	2013	63434	32129	31305
Decadal Population Growth Rate 17.9	2014	64544	32707	31837
Total Annual Percentage Growth Rate 1.7	2015	65674	33296	32378
Male Annual Percentage Growth Rate 1.8	2016	66824	33896	32929
Female Annual Percentage Growth Rate 1.7	2017	67994	34506	33488
	2018	69185	35127	34058
	2020	70396	35759	34637
	2021	71628	36403	35226
	2022	72882	37058	35824

Table 3.25 Annual population projections in the project area

Sex ratio

To reiterate; the male and female constitute 50.6% and 49.4% respectively and number of females per 1000 males is 976. The gap in sex ratio reveals certain sociological aspects with regards female birth rate in rural areas. This is a result of growing infant mortality among female children, single child family structure and also migration of industrial workers.

3.10.3 Social structure

The Socio-Economic study observed that 63.7% of people belong to scheduled category, in which 53% belongs to Scheduled Tribes (ST), and Scheduled Castes (SC) comprises 10.7% of total population. The distribution of population in the study area by social structure is illustrated in **Table 3.26**.

S. No	Particulars	0-2 km	2-5 km	5-10 km	0-10 km	
1	SC population	1224	930	4383	6537	
2	ST population	3702	9393	19398	32493	
3	% of SC to the total population	17.7	7.3	10.5	10.7	
4	% of ST to the total population	53.5	74.1	46.5	53.0	
5	Total SC & ST Population	4926	10323	23781	39030	
6	Percentage to the total population	71.2	81.5	57.1	63.7	
7	Total population	6920	12669	41681	61270	
Source: District primary census statistics of Madhya Pradesh – 2011						

Table 3.26 Distribution of population by social structure

3.10.4 Literacy levels

The analysis of the literacy levels in selected villages of study area, reveals that an average literacy rate of 57.9% as per 2011 census data. However, the male literacy of the study area

is 58.8%, whereas literacy rate among women, which is an important indicator for social change, is estimated to be 41.2%. The distribution of literates and literacy rates in the study area is illustrated in **Table 3.27**.

S. No	Particulars	0-2 km	2-5 km	5-10 km	0-10 km
1	Male population	3485	6276	21242	31003
2	Female population	3435	6393	20439	30267
3	Total population	6920	12669	41681	61270
4	Male literates	2308	3846	14713	20867
5	Female literates	1641	2701	10261	14603
6	Total literates	3949	6547	24974	35470
7	Male literacy rate (%)	58.4	58.7	58.9	58.8
8	Female literacy rate (%)	41.6	41.3	41.1	41.2
	% of Male literates to the male				
9	population	66.2	61.3	69.3	67.3
	% of Female literates to the female				
10	population	47.8	42.2	43.1	42.7
11	Total literacy rate (%)	57.1	51.7	59.9	57.9
Source: District Primary Census statistics of Madhya Pradesh -2011					

Table 3.27 Distribution of literate and literacy rates

3.10.5 Occupational structure

The occupational structure of project area is studied with reference three categories via., main workers, marginal workers and non-workers. According to Census Department of India, the main workers include 4 categories of workers - cultivators, agricultural laborers, those engaged in manufacturing, processing and repairs in household industry; and others including those engaged in household industry, construction, trade and commerce, transport and communication and all other services.

The marginal workers are those workers engaged in some work for a period of less than six months during the reference year prior to the census survey. The non-workers include those engaged in unpaid household duties, students, retired persons, dependents, beggars, vagrants etc.; institutional inmates or all other non-workers who do not fall under the above categories.

As per 2011 census, there are a total of 27.8% main workers in the study area. The marginal workers and non-workers constitute to 23.7% and 48.4% of the total population respectively. Therefore, non-workers are predominant in that of workers by occupation. The occupational structure of the study area is given in **Table 3.28**.

S. No.	Particulars	0-2 km	2-5 km	5-10 km	0-10 km
1	Total population	6920	12669	41681	61270
2	Total workers	3709	6725	21170	31604
	Work participation rate (%)				
3	(Total workers/Total population)*100	53.6	53.1	50.8	51.6
4	Main workers	2489	4306	10267	17062
	Percentage of main workers to total				
5	population	36.0	34.0	24.6	27.8
6	Marginal workers	1220	2419	10903	14542
	Percentage of marginal workers to				
7	total population	17.6	19.1	26.2	23.7
8	Non-workers	3211	5944	20511	29666
	Percentage of non-workers to total				
9	population	46.4	46.9	49.2	48.4
10	Dependency ratio	0.9	0.9	1.0	0.9
Source: District Primary Census statistics of Madhya Pradesh -2011					

Table 3.28 Occupational structure

3.10.6 Dependency ratio

Based on the occupational structure of the study area the dependency rate of non-workers on the workers category has been estimated at 0.9%. The study also noted that work participation rate is 51.6% in the project area. It is observed that majority of the educated youth are also part of the non-working population as they have limited employment opportunities in the area. Similarly, the prevalence of low industrialization and subsistence agriculture has affected the employability of local population therefore there is a need for income generation activities to strengthen the livelihoods of local population.

3.11 Primary data collection

Approach

In order to prepare a comprehensive report, few villages in the core zone were visited for conducting sample village survey containing questions about all socio-economic aspects, including questions on the aspirations and requirements of the people for a better living. The village schedule was filled in order to capture the overall condition of the village with respect to community land, major crops produced, sources of irrigation, availability of potential earning opportunities in the vicinity, community institutions (schools, Anganwadi centre, health sub-centre, community centre, places of worship, etc.), availability of electricity, provision of drainage and toilet facility etc.

Observed condition at proposed project site and its surroundings

At the project, in the core zone with a radius of nearly 0-2 km largely inhabited by backward communities. They are suffering from the lack of minimum facilities. For example lack of

roads, drinking water, dwellings, and education, medical and electricity facilities. They even lack employment opportunities.

The main occupation of the people in this area is agriculture and vegetable farming. The local population majorly works as either settled cultivators or agriculture labour. Some work as daily wage labourers in the nearby areas and as vegetable vendors at the local markets. Very few are employed in government and private sectors. Those who are not employed anywhere are involved in small trades and petty businesses. When we visited the local villages to conducted FGDs, many important facts have emerged.

Basically local population depends completely on agriculture and its allied activities. It's a major source of income but subsistence to extent of supports their family. Majority of these farmers are small and marginal land holders; they also work as agricultural labourers, industrial workers on daily basis and other services to earn income. Whereas income for men and women varies depending on the jobs assigned to them. In the agriculture sector both men and women are paid low compared to the other sectors. The production is low from the small and marginal landholders and self-sufficient for their families. Hence, local population are expecting assistance form the project authorities. Agriculture is partially mechanized at present.

Primary data collection & research instruments used

It was a descriptive type of research study. Three types of research instruments were used in this study.

- > Field Visit
- Village Survey Schedule
- Village meetings and Focused Group Discussion

The village visits, survey and discussions were carried out during the survey was carried out between 26th October to 30th October 2019. The relevant data has been collected through village level Focus Group Discussions. As part of the survey, six villages under different Panchayat's have been covered. The six villages covered fall in the rural areas of Niwas tehsil.

Socio-economic analysis of the villages was taken up as a part of the study. The data is based on the in depth collection of village level information in sampled villages through primary data to understand the social conditions, the needs and aspiration of the people etc. All the villages are at the distance of zero to three km from the project boundary and they are termed as the core areas as the impact of the proposed project are very significant.

Education

Each village has one primary school and on the other hand Jabalpur has technical institutes

and many degree collages both run by private and government. There are 8 Anganwadi's in the sample villages taken for the study. In the case of primary school, each village has one school. For secondary schooling children travel a distance of 8-10 km. In the case of technical education, vocational courses and higher secondary education, college education these children go to Jabalpur town.

Health

Health care facilities are lacking in the study area, among these six villages there only two villages have dispensaries or Primary Health Care Centres (PHCs). These villages have Primary Health sub-centers and mobile health camps are conducted twice in month. The studies reveal chronic diseases and some common diseases like malaria, typhoid, and seasonal fever prevalent in the study area. However, for getting medical facility, people have to go to main PHC is nearly distance of 2 to 5 km. In all six villages the ANM services are available in the weekly basis.

Infrastructure facilities in the surveyed villages

Post office: They are present in four villages and the rest of the villagers have to travel three to four km to post offices. At the block level they have post offices.

Drinking water facilities

Regarding water facility in the studied villages the main source of drinking water public taps, bore wells and private water cans, overhead tank (OHT), hand pump and wells as well.

Electricity

Electricity facilities are available in all the villages of project studied area

Tele communication

Telephone communication facilities are available in all the villages of project studied area. Most of them use mobile Phones.

Transport facilities

The study villages have inadequate and poor road and bus transport facilities. Some villages have Auto's facilities to communicate to the main road at the distance of 2km to get bus facilities.

Cremation ground

All communities in the villages have cremation ground.

Community Hall/Recreations: All have temple space as community halls (mandaps), where all sorts of meetings take place. Common play grounds are available.

Banks

Co-operative banks and commercial banks are available in the nearby Jabalpur towns and other blocks.

Agriculture

The District is known for its fertile soil and agricultural productivity. Agriculture is not only the tradition of People but also it is way of life for them, A variety of crops like paddy, Ground Nut, Sugar cane, Oil Seeds, Ragi, Mung, Biri etc. are grown in the district. Vegetable farming is also major cultivation in this area. Agricultural sector observes more than 75% of the labour force.

Cropping patterns in the studied area

The area has two main cropping season's viz. Kharif (June-September), and Rabi (October-March). The studied villages have a soil structure of Sandy loam, Loam, Clay Loam. Majority of the villages are small and marginal farmers depend on canal irrigation and monsoon rains. The farmers are using chemical fertilizers, insecticides and pesticides. They use meagre amount of natural manure.

Livestock details

The common diseases for the animals are Komari, Anthrox, foot and mouth diseases etc. The government veterinary hospitals are in Jabalpur and Sub centres in all villages doctors visit in all studied villages. On request, veterinary camps are organized in the villages.

Food pattern

In all the villages, generally they cook food two times, that is in the morning and evening and the food consists of mainly of rice. Regarding the fuel use pattern 1% of the people are using firewood, 10% of the people use kerosene and firewood and 89% of the people use the LPG.

Employment opportunities

Though agriculture is the main occupation, in the study area villages it has provided employment opportunities to only 10 to 15% of the families. The remaining population is depending on the other type of employment opportunities mainly as agricultural daily wise labourers.

Other observations

The socio-Economic study revealed that the youth in the project area are devoid of employment opportunities. They can be a potential source of workers with minimum handholding and vocational education skills. The youth have expressed their willingness to setting up of industries in the area as it provides them gainful employment opportunities. Similarly, this would also trigger many direct and indirect benefits for economic advancement and social development of project area.

CSR and developmental activities

The proposed TSDF would take a pivotal role in developing health, education, skill development, environmental management of the villages in the project area.

Suggestions for improvement of socio-economic status

The socio-economic status of the population in the project area shall be improved through CSR and focused community development interventions. Some of the salient activities are illustrated below:

- Youth empowerment programs through awareness creation about various government schemes, providing appropriate opportunities with relevance to their qualification and skills, conducting skills inculcating programs etc.,
- > Periodical health checkup camps, veterinary camps need to be conducted
- Sensitization and awareness programs on child and mother health, sanitation and personal hygiene, HIV/AIDS etc.
- > Strengthening the educational infrastructure in rural schools
- A number of women empowerment activities can be initiated in the project area villages on convergence mode whilst partnering with exiting Government schemes and financial support from developmental institutions like NABARD.
- > Environmental awareness campaigns in schools and villages

Impact and mitigation measures

The socio-economic impacts during the construction, operation and expansion phase of the proposed interventions would result in to inward migration of workers, establishment of worker camps, induced development etc. The impact of the proposed project on socio economic conditions of the study area is as follows:

- More employment opportunities to the local people and reduce the outward migration
- Increase of floating population.
- Increase in demand for services includes hotels, restaurants, public transport (including taxis), etc. which leads to overall economic up-liftment of the area.
- Raising of House rents and land prices and increase in Labour wages.
- Rapid growth of service sector will result in increase of household incomes in the area.
- Expansion of services like retail shops, banks, automobile workshops, school, health care facilities, etc.
- There will be structural changes in occupation and alternative employment opportunities would be developed due to growth of service sector

	-	Table 3.29 D	emograph	ic details i	n the stuc	ly area o	of 10 km	radius				
S. No	Name	No_HH	TOT_P	TOT_M	TOT_F	P_06	P_SC	P_ST	P_LIT	M_LIT	F_LIT	P_ILL
0-2 km												
1	Takweli	147	652	325	327	90	15	444	361	217	144	291
2	Maneri(Medhi)	528	2227	1152	1075	278	688	419	1529	889	640	698
3	Pondi (Bhanwarda)	226	1042	522	520	157	521	221	573	340	233	469
4	Chargaon (Bhanawarda)	153	724	354	370	94	0	596	428	244	184	296
5	Jhurki	260	1129	561	568	133	0	1080	567	335	232	562
6	Bilnagari Mal.	171	724	370	354	106	0	602	314	191	123	410
7	Bilnagari Ryt.	95	422	201	221	69	0	340	177	92	85	245
	Total	1580	6920	3485	3435	927	1224	3702	3949	2308	1641	2971
2-5 km												
8	Bhanwarda	189	743	362	381	113	0	417	354	205	149	389
9	Kohani	237	1183	592	591	185	5	968	586	333	253	597
10	Khairani Mal.	281	1149	554	595	173	3	1104	517	310	207	632
11	Mendhi (Medhi)	343	1393	703	690	203	841	80	812	466	346	581
12	Lahsar	140	631	291	340	92	0	624	296	177	119	335
13	Mohda	100	431	226	205	63	0	415	266	171	95	165
14	Bidri	69	329	163	166	46	0	299	188	114	74	141
15	Bhabhera Ryt.	86	421	223	198	63	0	236	172	105	67	249
16	Chikhali Mal.	184	747	383	364	103	19	248	343	205	138	404
17	Katangi (Bhabhera)	101	522	242	280	93	0	520	294	154	140	228
18	Bhabhera Mal.	139	591	305	286	111	0	406	322	201	121	269
19	Chargaon (Bilnagari)	222	1055	521	534	147	0	1024	490	288	202	565
20	Sankuhi	153	835	411	424	139	0	698	414	249	165	421
21	Jamodi	156	806	385	421	105	2	788	435	237	198	371
22	Jamgaon	295	1339	667	672	183	2	1159	739	441	298	600
23	Budbudi	104	494	248	246	64	58	407	319	190	129	175

Proposed ICHWTSDF & Recycling Facility at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh

	Total	2799	12669	6276	6393	1883	930	9393	6547	3846	2701	6122
5-10 km	า											
24	Pipariya	151	561	280	281	89	96	0	373	204	169	188
25	Partala	456	2049	1090	959	298	285	36	1338	829	509	711
26	Sehora	140	544	282	262	61	39	78	384	231	153	160
27	Lahagi	111	448	237	211	63	5	0	316	181	135	132
28	Bilgada	150	686	361	325	67	19	29	517	296	221	169
29	Pahadi Kheda	340	1478	746	732	177	60	56	1084	608	476	394
30	Padwar	558	2529	1346	1183	276	300	154	1914	1106	808	615
31	Silpuri	156	777	396	381	136	30	746	446	268	178	331
32	Salaiya	184	783	403	380	89	130	0	612	322	290	171
33	Gadarkheda	122	491	270	221	55	34	12	338	190	148	153
34	Bamhani	380	1748	933	815	222	424	475	1119	688	431	629
35	Dhanpuri	264	1182	625	557	140	153	131	846	511	335	336
36	Malara	201	910	475	435	125	64	0	589	360	229	321
37	Umariya	319	1411	720	691	168	156	119	1006	583	423	405
38	Dundai	255	1060	578	482	133	154	5	764	456	308	296
39	Kudari	330	1397	707	690	165	299	2	1002	552	450	395
40	Mahgaon	532	2163	1139	1024	266	299	968	1290	772	518	873
41	Gangdha	141	582	314	268	73	64	218	323	206	117	259
42	Khitola	49	262	126	136	35	0	256	172	97	75	90
43	Dugargawan	109	501	253	248	85	0	448	283	171	112	218
44	Batai	191	781	395	386	95	51	253	484	275	209	297
45	Kalyanpur	219	899	457	442	139	55	437	546	313	233	353
46	Khukkham (Khukhan)	88	408	211	197	53	16	320	298	164	134	110
47	Padariya	202	988	492	496	153	0	911	563	330	233	425
48	Doli	54	244	116	128	42	0	221	114	64	50	130
49	Deori Kalan	254	1181	581	600	183	236	709	612	368	244	569
50	Ranipur	90	388	208	180	45	179	93	268	168	100	120

Proposed ICHWTSDF & Recycling Facility at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh

M/s. Ramky Enviro Services Private Limited

	Grand Total	14018	61270	31003	30267	8376	6537	32493	35470	20867	14603	25800
	Total	9639	41681	21242	20439	5566	4383	19398	24974	14713	10261	16707
74	Harduli	93	293	147	146	37	0	266	147	89	58	146
73	Bhajiya	97	351	178	173	42	0	326	196	116	80	155
72	Gadra	284	1009	450	559	136	24	950	505	291	214	504
71	Dala	179	675	329	346	84	0	607	266	156	110	409
70	Bhadari	136	541	266	275	81	0	465	277	172	105	264
69	Jeora (Singhanpuri)	219	952	473	479	146	1	921	359	218	141	593
68	Singhanpuri(Jewra)	188	819	401	418	119	0	754	404	238	166	415
67	Padariya Mal.(Salhepani)	130	501	255	246	56	0	447	215	122	93	286
66	Dungariya Ryt.(Chhindgaon)	154	694	344	350	99	0	635	315	186	129	379
65	Salhepani (Padariya)	150	585	311	274	67	3	482	321	206	115	264
64	Pauniya Ryt.	12	60	30	30	6	0	60	27	15	12	33
63	Pauniya Mal.	301	1383	682	701	208	0	1202	568	376	192	815
62	Kurgawan	100	457	207	250	83	0	442	167	89	78	290
61	Rampuri Khurd	93	460	220	240	64	0	402	250	153	97	210
60	Chiraipani	105	491	250	241	87	5	473	258	147	111	233
59	Dargarh	122	477	229	248	55	0	474	306	181	125	171
58	Sakari	159	730	364	366	97	10	620	368	217	151	362
57	Kastara	174	814	417	397	96	6	773	495	313	182	319
56	Rampuri Kalan	177	837	417	420	140	16	783	355	223	132	482
55	Andhar	147	630	316	314	111	141	445	304	166	138	326
54	Amera	119	545	271	274	64	0	525	255	149	106	290
53	Badkhera	236	950	473	477	125	869	0	509	305	204	441
52	Kuhka	23	123	62	61	15	0	87	74	39	35	49
51	Dunda (Duda)	195	853	409	444	115	160	582	432	233	199	421

Proposed ICHWTSDF & Recycling Facility at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh

Source: District Primary Census statistics of Madhya Pradesh -2011

Resolution abbreviations

- No_HH: No. of House Holds
- TOT_P: Total Population
- TOT_M: Total Male
- TOT_F: Total Female
- P_06: Population below 6 years
- P SC: Population belongs to SC
- P_ST: Population belongs to ST
- P_LIT: Population Literate
- P_ILL: Population Illiterate
- TOT_WORK_P: Total Working Population
- MAINWORK_P: Main working population
- MAIN_CL_P: Main Cultivator Population
- MAIN_AL_P: Main Agriculture Labour Population
- MAIN_HH_P: Main Household Population
- MAIN_OT_P: Main Other Population
- NON_WORK_P: Number of Non-Working population

CHAPTER 4

ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

Chapter 4 Anticipated Environmental Impacts and Mitigation Measures

4.1 Objectives

The objective of this section is to:

- Identify project activities that could beneficially or adversely impact the environment
- Predict and assess the environmental impacts of the such activities
- Examine each environmental aspect-impact relationship in detail and identify its degree of significance
- Identify possible mitigation measures for these project activities and select the most appropriate mitigation measure based on the reduction in significance achieved and practicality in implementation

4.2 Identification of impacts

Any developmental activity in its wake will bring about some impacts associated with its origin, which can be broadly classified as reversible, irreversible, long and short-term impacts. In this chapter, an endeavor has been made to identify various environmental impacts associated with the operation of facilities and other activities wherein, there may be a chance of pollution. Based on the possible worst case emissions and waste generation from the proposed project and also taking into consideration the baseline environmental status at the proposed project site, the environmental factors that are likely to be affected (Impacts) are identified, quantified and assessed. Both instrumental (positive) and detrimental (negative) impacts are accounted for this purpose. The prediction of impacts helps in the preparation of a sound environmental management plan which has to be executed during the on-going activities for the proposed project to minimize the adverse impacts on the environmental quality.

4.3 Methodology

The potential impacts on the environment from the proposed project are identified based on the nature of various activities associated not only with the project implementation and operation, but also on the current status of the environmental quality at the project site.

4.4 Potential impacts

The potential significant environmental impacts associated with the project are grouped as:

- Air Environment: Impacts on ambient air quality and odor
- Water Environment: Impacts on surface and ground water quality; and aquatic life
- Land Environment: Impacts on land use, soil fertility and agriculture
- Socio Economics: Impacts on infrastructure and employment
- Indirect Impacts: Impacts on public health and safety; and aesthetics

4.5 Prediction of impacts

The impact assessment is carried out for the following phases and presented in the following paragraphs.

- Impacts during development phase
- Impacts during operation phase

4.5.1 Impacts during development phase

Construction phase works include site clearance, site preparation, civil works for secured landfill, machinery installation and commissioning activities like fabrication work, cutting, welding, lying of cables and pipelines etc. Other works include leveling of land, laying foundations, construction of buildings and other facilities, approach roads etc. However, the impacts due to construction activities are short term and are limited to the construction phase only. The impacts will be mainly on air quality, water quality, soil quality and socio-economic conditions.

4.5.2 Impact on air quality

The principal source of air quality impact arising from the construction of the proposed project is fugitive dust generation. The dust, measurable as Particulate Matter generated as a result of construction activities will be coarse and settle within a short distance close to the construction sites. Other sources include- loading and unloading of materials, top soil removal, vehicle movement on unpaved roads, civil constructions and provision of infrastructure, wind erosion etc.

Among all the construction activities, site preparation has the highest potential to cause nuisance to the nearby air sensitive locations. During the construction of the project, existing human settlements nearby may be exposed to the potential dust impacts. Exhaust emissions from vehicles and equipment deployed during the construction phase is also likely to result in marginal increase in the levels of SO₂, NO_x, PM, CO and un-burnt hydrocarbons. However, the impact of such activities would be temporary and restricted to the construction phase. Moreover the emissions from above activities are expected to result in temporary degradation of air quality, primarily in the working environment and negligible outside the plant boundaries.

4.5.2.1 Mitigation measures proposed – air quality

For the proposed project, site leveling and grading will be carried out, where ever possible to maintain natural elevations. Leveling will be carried out only for laying roads, sewage network, storm water system and infrastructure for administrative and plant shed erection. According to the engineering assessment; most of the excavated material shall be reused within the project boundary. The movement of cut and fill material will be limited.

Most of the dust generated from construction activities is due to the movement of vehicles carrying materials. Unloading of materials and removal of soil shall also act as a potential source for dust emission. Following are the control measures proposed:

Dust emission control

- Regular water sprinkling on haulage roads to deliver continuous moisture to suppress dust in dust prone areas.
- Regulate speed of vehicles in unpaved areas to reduce fugitive dust created and reduce dust to a large extent.
- The duration of stockpiling will be as short as possible as most of the material will be used as backfill material for the open cut trenches for road development.
- Care will be taken to keep all material storages adequately covered and contained so that they are not exposed to situations, where winds on site could lead to dust / particulate emissions. Fabrics and plastics for covering piles of soils and debris is an effective means to reduce fugitive dust from the material stores/ warehouses.
- Spills of dirt or dusty materials will be cleaned up promptly so that the spilled materials do not become a source of fugitive emission. Similarly, spilled concrete slurries or liquid wastes will be cleaned up immediately before they can infiltrate into the soil/ ground or runoff in nearby areas.
- Temporary tin sheets of sufficient height (3m) will be erected around the site of dust generation or all around the project site as barriers for dust control.
- Trees will be planted all around the project boundary and regularly watered to keep the area moist for most part of the day.

Gaseous emission control

- Regular maintenance of machinery and equipment will be carried out
- All the vehicles used for construction activity shall have valid "Pollution under control" Certification
- Ambient air quality monitoring will be carried out during the construction phase. If monitored parameters are above the prescribed limits, suitable control measures will be taken.

4.5.3 Impact on water quality

The proposed project will involve various construction activities. The following section summarizes the activities likely to be undertaken during the proposed development and describes the potential impacts on water quality from each activity.

i) Site preparation

During site preparation, along with other development activities, construction of temporary infrastructure such as drainage culverts may be required which may produce large quantities of run-off with high suspended solids loading in the absence of appropriate mitigation measures. This potential problem may be further aggravated during the rainy season.

ii) Construction of buildings

The construction of various civil structures and washing of various equipment results in site runoff especially during the rainy season, causing significant pollution in the receiving water bodies.

iii) Site workshop

The used engine oil and lubricants have the potential to create impacts if spillage occurs. Waste oil may infiltrate into the surface soil layers, or runoff into local water courses, increasing hydrocarbon levels. Proper precautionary measures should be taken to prevent any spillage of the above materials and their subsequent runoff into the water bodies.

iv) Domestic activities

During construction, impacts from domestic activities include waste and wastewater generated from canteen/cafeterias as well as sewage from temporary sanitary facilities. Sewage is mainly characterized by high levels of BOD, COD and E.Coli. Significant water quality impact will happen only if the sewage is discharged directly into the receiving waters without any prior treatment.

4.5.3.1 Mitigation measures – water quality

During site development, necessary precautions will be taken, so that the runoff water from the site gets collected to the working pit and if any, overflow will be diverted to nearby greenbelt/ plantation area. During construction activity, all the water resulting from the equipment washed will be diverted to the working pit in order to arrest the suspended solids. The settled water will be reused for construction purposes and for sprinkling on haul roads to control dust emissions. The domestic sewage generated will be treated in portable STP or sent to a septic tank/soak pit.

4.5.4 Impact of noise

Noise and vibrations generated during construction phase like foundation works, fabrication of structures as well as operation of construction equipment and machineries including pumps, motors, blowers, vehicular movement for transportation and inbound movement of vehicles etc will add to background noise levels, exposing nearby populace and on site worker's to high noise and associated disturbance. Typical mitigation measures for reducing noise levels will include the following:

4.5.4.1 Mitigation measures

- Low noise generating equipment will be selected to reduce noise levels.
- All noise generating equipment will be used during day time for a brief period of its requirement. Equipment will be provided with noise control measures such as acoustic insulation etc., to ensure noise abatement. Wherever possible, the equipment will be kept away from human habitation.
- Proper mounting of equipment and machinery on strong non-vibrating foundations will

be done.

- Regular maintenance of equipment and lubrication of machineries shall be carried out.
- Dense Greenbelt development around the noise source area and along the boundary of premises will be done.
- Personnel Protective Equipment (PPE) like ear plugs/muffs shall be given to all the workers at site and their usage is ensured during their work.
- Regulating the movement of vehicles to the site to maintain low noise levels.
- Sufficient engineering control during installation of equipment and machineries (like mufflers in DG sets) is to be ensured and all the openings like covers, partitions shall be acoustically sealed.

4.5.5 Impact due to solid waste generation

This category of waste generation in the proposed project is due to the use of different types of raw materials during construction stage which may comprise the following:

- Cement concrete
- Bricks, tiles,
- Cement plaster
- Steel (RCC, door/ window frames, roofing support, railings of staircase etc)
- Rubble, sand, stone (marble, granite, sand stone)
- Timber/wood
- Paints/varnishes

Besides the above, there are some other major and minor components viz., conduits, pipes, electrical fixtures, panels, etc. which will be segregated and stored in the proper storage area at the site.

4.5.5.1 Mitigation measures for solid waste

The solid waste generated during the construction phase is predominantly inert in nature. Hence maximum effort would be made to reuse and recycle them. All attempts shall be made to ensure the following:

- All construction waste shall be stored within the site itself. A proper screen will be provided so that the waste does not get scattered.
- Attempts will be made to keep the waste segregated into different heaps as far as possible so that their further gradation and reuse is facilitated.
- Materials which are to be sold or land filled will also be kept in separate heaps.
- Arrangements will be made from a local body or a private company to provide an appropriate number of skip containers/ trolleys on hire.

The use of the construction material basically depends on their separation and conditions of the separated material. A majority of these materials are durable and therefore, have a high potential for reuse. It would, however, be desirable to have quality standards for the recycled materials. Construction waste can be used in the following manner.

- Reuse of bricks, tiles, stone slabs, timber, piping railings etc. to the extent possible and depending upon their conditions.
- Sale/ auction of materials which cannot be used at the site due to design constraint
- Plastics, broken glass, scrap metals etc. will be stored and processed within the site.
- Rubble/ brickbats can be used for building activity, such as leveling, under coat of lanes where the traffic does not constitute heavy moving loads.
- Larger unusable pieces can be sent for filling low lying areas.
- Fine material such as sand and dust can be used as cover material
- The unearthed soil can be used for leveling as well as for lawn development
- The broken pieces of the flooring material can be used for leveling in the building or can be disposed off
- The unused or remaining paints/varnishes/wood can either be reused or can be disposed off

4.5.6 Impact on soil and land use

Major impacts on soil and land environment during the construction phase are as follows:

- The project will involve cut and fill activity, which will involve removal of vegetation cover and removal of top soil during earthworks prior to building construction resulting in accelerated soil erosion.
- Pollution of surrounding land due to soil, clay and silt that will be carried by runoff during the rainy season.
- Pollution caused by spilled oil/lubricants/fuel due to inadequate management and control of construction machinery, vehicles and allied equipment.
- Deterioration of surrounding lands due to improper disposal of packaging material, broken pieces of glass, tiles, municipal waste etc from construction activity.
- The development of the site may also result in increased surface runoff.

4.5.6.1 Mitigation measures

- The proponents have opted to take the maximum advantage of the existing terrain topography and as such, the possibility of severe soil erosion and land disturbance are ruled out. Before commencement of earth work, a retaining wall with garland drains will be built all along the lower contours of the site, to ensure trapping of soils in case occasional heavy rains.
- The land contours will be so developed that the flow of water is properly channelized and the drains out of site will have filter bunds made of Laterite stone and arrangement for polyelectrolyte dosing so as to ensure that any soil does not get washed out of the site and do not pollute nearby waters.
- The topsoil cover removed from the areas being dug and/or levelled will be stored separately and used for the development of green belt and gardens.
- Substratum removed during foundation, broken pieces of concrete, bricks will be used for leveling of plot.

- Separate areas will be earmarked for storage of solid and hazardous wastes generated.
- Wastes like broken glass, plastic drum/ bags / iron scrap etc will be sold to scrap dealers for recycle
- Robust native tree species present on the site will be, as far as possible, transplanted in the green belt in lieu of felling

4.5.7 Demographic and socio-economic

The impact of the proposed unit on demography and socio economic conditions of the study area would be as follows.

- Additional strain on civic amenities like road, transport, communication, drinking water, sanitation and other facilities to meet the workforce requirement.
- The project will result in giving business opportunities and increase in demand for services like hotels, lodges, public transport etc.
- Employment opportunities for labourers, skilled and unskilled workers etc., is anticipated.
- Economic up-liftment of the area.
- More work to the civil construction and transportation companies

4.5.8 Potential impact on biological environment

During the construction phase, there will be clearance of some natural vegetation in the form of trees, shrubs, ground vegetation and disturbance to natural habitats. However, most of the trees are local species and of low concern of conservation. While construction activity will temporarily affect flora and fauna in the surrounding area by settlement of dust on the leaves and blocking the stomatal openings, noise machinery will scare away the sensitive fauna. The impact of the proposed project on the local as well as regional ecology is not very significant. The site selected for study lacks reserve forest, protected forest, planted forest, national park, bird sanctuary etc. which bears ecological significance. The existing ecology in the study area comprises manmade habitat dominated by agricultural set up. The detailed ecological impact is summarized below.

4.5.9 Impacts on wildlife habitat in the non-forested area

The land use data presented earlier in the baseline shows that most of the study area comes under man made ecosystems. No designated wildlife habitat was reported during the site survey in the proposed project except for a few small mammals and common birds recorded during faunal study. However, the proposed construction activity, being a temporary activity, will not hamper the ecological balance of the area and will not cause permanent shifting of any birds or any faunal habitats. Uprooting of trees except shrubs and herbs will not be required during site preparation, so that impact on the vegetation will not be a major issue. Therefore the predicted impact due to proposed activity will be low.

4.6 Impact during operation phase

During the operation phase of the proposed project, there would be impacts on the air, water, land environment and socio-economic conditions.

4.6.1 Prediction of impacts on the air environment

Prediction of impacts from the proposed project on the air quality was carried out using air quality simulation models. The main sources of air pollution are as follows:

- 1. Area source emissions from landfill operations
- 2. Point source emissions from Incinerator, DG set.
- 3. Boilers for used oil and solvent recovery facility

The emissions from the DG sets are minimal since they will be operated only during power failures.

4.6.2 Atmospheric dispersion of stack emissions

In order to estimate the ground level concentrations due to the emissions from the proposed project, EPA approved American Meteorological Society/Environmental Protection Agency Regulatory Model - AERMOD 7.0.3 dispersion Model has been used. AERMOD dispersion Model provides an option to model emissions from a wide range of sources that are present at a typical industrial source complex. The model considers the sources and receptors in undulated terrain as well as plain terrain and the combination of both. The basis of the model is the straight line steady state Gaussian Plume Equation, with modifications to model simple point source emissions from stacks that experience the effect of aerodynamic downwash due to nearby buildings, isolated vents, multiple vents, storage piles etc.

AERMOD dispersion model with the following options has been used to predict the cumulative ground level concentrations due to the proposed emissions. Area being rural, the rural dispersion parameters are considered as below:

- Predictions have been carried out to estimate concentration values over radial distance of 10 km around the sources
- A combination of cartesian and polar receptor network has been considered
- Emission rates from the sources were considered as constant during the entire period
- The ground level concentrations computed were as is basis without any consideration of decay coefficient
- Calm winds recorded during the study period were also taken into consideration
- 24-hour mean meteorological data, extracted from the meteorological data collected during the study period as per guidelines of IMD/CPCB has been used to compute the mean ground level concentrations to study the impact of proposed activity.

4.6.3 Pollution sources

4.6.3.1 Area sources

Daily waste will be disposed by tipping at the working area on a landfill, within the area demarcated for the cell. Daily cover (weekly cover optional) is primarily used for prevention of windblown dust, litter and odours, deterrence to scavengers, birds, reduction of infiltration (during unseasonal rain) and in improving the site's visual appearance. Soil used as daily / weekly cover shall give a pleasing uniform appearance from the site boundary. To achieve this, thickness of about 150 mm is usually adequate and shall be adopted.

4.6.3.2 Point sources

The point source emissions considered for the proposed project are Incinerator, boilers (for used oil and spent solvent recycling) and DG sets. The DG set will be used only during emergency situations like power failure. Hence the impacts from DG sets will be less. The inputs used to run the model are details of emissions from stacks of incinerator, boilers and DG sets, the details which are given in **Table 4.1.** Twenty four hours mean meteorological data is given in **Table 4.2.**

In order to estimate the post project scenario which would prevail at the post operational phase, the predicted maximum Ground Level Concentration (GLC) of 24 hour average PM, SO₂ and NOx concentrations (considering the 24 hour mean meteorological data of study season) are superimposed on the maximum baseline concentrations obtained during the study period. The overall scenario with predicted concentrations over the maximum baseline concentrations is shown in **Table 4.3.** The isopleths are shown in **Figure 4.1 to 4.4**.

Facility	Incinerator	E-Waste Facility	ULAB
Capacity	2500 kg/hr	82 TPD	65 TPD
Stack details	Incinerator	Attached to crusher	-
Stack height, m	30	3 m above roof level	30
Stack diameter, m	0.85	0.3	0.5
Velocity, m/s	18	12	14
Volumetric flow rate, m ³ /s	10.2	0.85	2.75
Temperature, °C	110	45	140
PM Emissions, g/s	0.40	0.09	-
SO ₂ Emissions, g/s	1.58	0.15x10 ⁻³	-
NO _x Emissions, g/s	3.16	0.008	-
Lead Emissions, g/s	-	-	0.02
Parameters	Emi	ssion Standards (mg/Nm	l ³)
PM	50	115	-
SO ₂	200	0.2	-
NOx	400	10	-
xLead	-	-	10

Table 4.1a Details of stack emissions

Facility	DG Set	Used oil recycling	Spent solvent
Capacity	2 x 200 kVA	54 KLD	27 KLD
Stack details	DG sets	Boiler - 4 TPH	Boiler - 2 TPH
Stack height, m	7	30	30
Stack diameter, m	0.2	0.5	0.5
Velocity, m/s	15	14	12
Volumetric flow rate, m ³ /s	0.47	2.75	2.36
Temperature, °C	400	120	120
PM Emissions, g/s	0.009/each	0.185	0.09
SO ₂ Emissions, g/s	0.001/each	1.16	0.58
NO _x Emissions, g/s	0.18/each	0.76	0.38
APCD Efficiency %	-	99.5	

Note 1 - Incinerator: Emissions are calculated based on outlet emission standards.

Note 2 - Boiler and Heat Transfer Furnace: NOx is considered as 260 g/GJ - Pollution Prevention and Abatement Handbook (World Bank group – Industry sector guidelines).

- Stack height (H)= 14 Q^{0.3}, H- total stack height (m), Q- SO₂ emission rate in kg/hr. In no case the stack height shall be less than 11 m
- As per Indian coal standards- Ash content should be 40 %; Sulphur content 0.5% and ESP efficiency 99.5%.
- NO_x is considered as 260 g/GJ from pollution prevention and abatement handbook (World Bank group-industry sector guidelines).

Note 3- DG Sets

- Sulphur content in diesel 350 mg/kg, as per BS-III Standards
- NO_x & PM Limit 4 g/kW-h & 0.2 g/kW-h as per Gazette of India G.S.R .771(E) Environmental (Protection) Third amended rules dated 11th December 2013

	Temperature	Relative humidity	Wind direction	Wind speed	Stability
Hour	(°C)	(%)	(Degree)	(m/s)	class
1	18.9	72	20	1.92	6
2	17.8	74	45	2.15	6
3	16.7	76	135	2.13	6
4	14.5	77	360	2.34	6
5	13.5	78	45	2.56	6
6	15.4	76	20	2.34	6
7	18.8	75	45	2.25	5
8	20.5	73	360	2.12	4
9	22.3	70	45	2.21	4
10	24.5	68	45	2.41	3
11	26.8	60	45	2.62	2
12	28.7	58	45	3.12	1
13	29.3	56	45	3.43	1
14	29.1	50	45	3.05	1
15	27.6	54	45	2.45	1
16	26.5	59	360	2.43	2
17	25.3	61	45	2.34	3
18	25.1	63	110	2.55	4
19	24.3	65	60	2.43	5
20	23.8	66	360	2.54	5
21	23.4	67	20	2.45	6
22	22.6	69	180	2.44	6
23	21.5	70	45	2.26	6
24	20.1	72	60	2.21	6

 Table 4.2 24 Hours mean meteorological data for post monsoon season

Table 4.3 Post project scenario (µg/m³)

Particulars	Particulate Matter (PM)	Sulphur Dioxide (SO ₂)	Oxides of Nitrogen (NO _x)	Lead
Baseline scenario (Max)	56.1	14.8	25.1	-
Predicted GLC (Max)	0.61	2.9	3.6	0.03
Overall scenario (Worst case)	56.71	17.7	28.7	0.03
NAAQ standards 2009	100	80	80	1

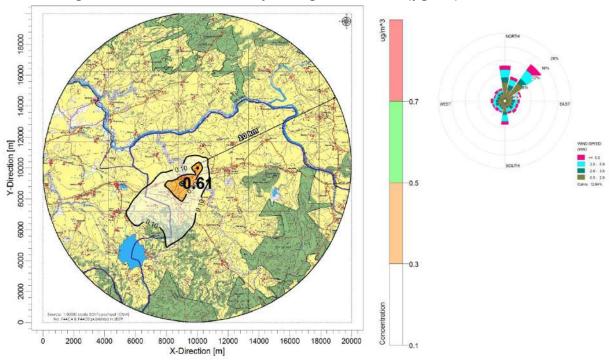


Figure 4.1 Predicted 24- hourly average GLCs of PM (μ g/m³) at 10 km radius

Max concentration of PM is 0.61 μ g/m³ (Distance – 0.9 km SW direction)

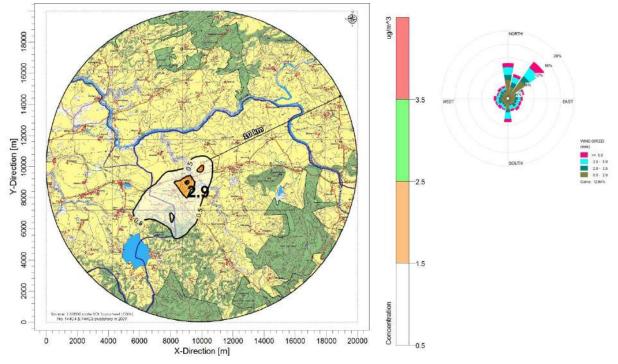


Figure 4.2 Predicted 24- hourly average GLCs of SO₂ (μ g/m³) at 10 km radius

Max concentration of SO₂ is $2.9 \,\mu g/m^3$ (Distance – 0.9 km SW direction)

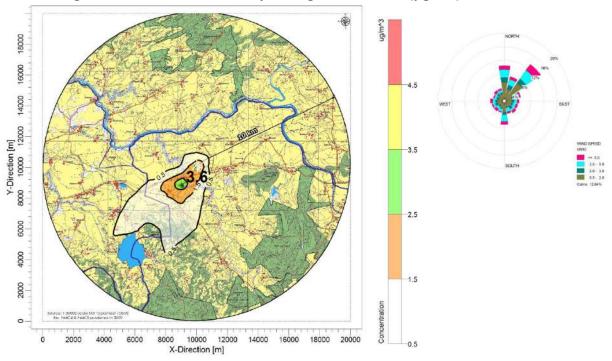


Figure 4.3 Predicted 24- hourly average GLCs of NO_x (μ g/m³) at 10 km radius

Max concentration of NO_x is 3.6 μ g/m³ (Distance – 0.9 km SW direction)

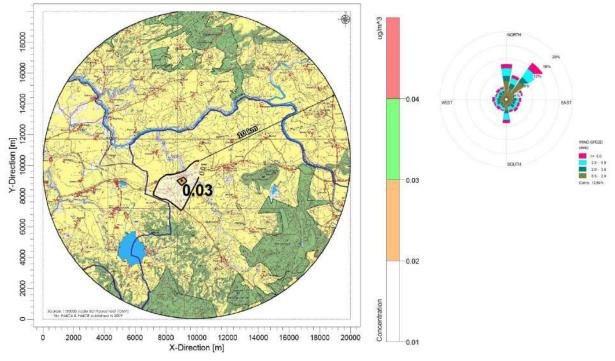


Figure 4.4 Predicted 24- hourly average GLCs of Lead Pb (μ g/m³) at 10 km radius

Max concentration of Lead is 0.03 μ g/m³ (Distance – 0.9 km SW direction)

4.6.4 Air pollution mitigation measures

4.6.4.1 Incinerator

Potential pollutants and respective pollution control devices are as listed below:

- The gases coming out of the incinerator stack are passed through scrubber, multi cyclone and bag filter for the removal of particulates. For proper dispersion of SO₂ and NOx emissions into the atmosphere, incinerator stack height meeting MoEF&CC/CPCB guidelines will be provided.
- Dry lime and activated carbon are injected for neutralization of acidic gases (HCl, HF and SO₂) and removal of organic constituents.
- Flue gases are passed through bag filters for the complete removal of particulates and further to wet alkaline scrubber for neutralization.
- To prevent the formation of dioxins, the flue gas temperature is rapidly lowered from 500 °C to less than 200 °C by adopting rapid quench / catalyst / adsorption by activated carbon.
- If the feeding waste contains mercury and its compounds, activated carbon treatment for control of these emissions will be carried out. (Ex. activated carbon, conversion into mercuric chloride and then to mercuric sulphide etc.)
- De-mister shall be provided to eliminate mist in the stack emissions.

4.6.4.2 Boiler

- Particulate Matter: ESP with efficiency of 99.5% will be installed to collect fly ash from the flue gas of the boiler. The collected fly ash and bottom ash will be sent to landfill.
- Gases: For proper dispersion of Sulphur dioxide & Oxides of Nitrogen emissions from the boiler, stack height meeting MoEF&CC/CPCB guidelines will be provided for proper dispersion into the atmosphere.
- To control fly ash generation at ash handling areas, fly ash evacuation from the ESP collecting hoppers would be done in closed pipelines by pneumatic means. The following pollution control measures would be installed for ash disposal.
 - > Closed trucks & containers would be used for this purpose, as far as possible.
 - It is proposed to cover the ash in the open trucks with tarpaulin to prevent flying of fine ash during transportation.

4.6.4.3 DG set

DG set will be used only in case of power failure. The DG set will be provided with acoustic enclosures and adequate height of stack, meeting MoEF&CC/CPCB guidelines. So impact due to D.G. Set will be temporary and for a short period.

4.6.4.4 Secured landfill

During operation, part of the secured landfill will be daily covered with soil/ash and during rainy period with temporary cover (HDPE/plastic sheets) to minimize the odor and gases generation.

4.7 Impact on water quality

The water demand of the project will be met through Audyogik Kendra Vikas Nigam (Jabalpur) Limited/tankers/ borewell. To minimize water consumption, water saving options will be planned.

- Improve energy efficiency of operations
- Installation of flow restrictors on water supply line
- Dry sweeping of all areas before mopping/washing
- Eliminate leaks of the pipelines
- Stormwater harvesting and rainwater holding tanks
- Recycling of water etc.,

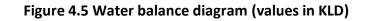
The total water requirement for the proposed project is estimated as 120 KLD out of which 60 KLD will be met through Audyogik Kendra Vikas Nigam (Jabalpur) Limited/tankers/borewell and remaining 60 KLD is treated water. The major part of the treated water is used for greenbelt (24 KLD), stabilization (16 KLD), incineration (16 KLD) followed by truck wheel wash, floor washings.

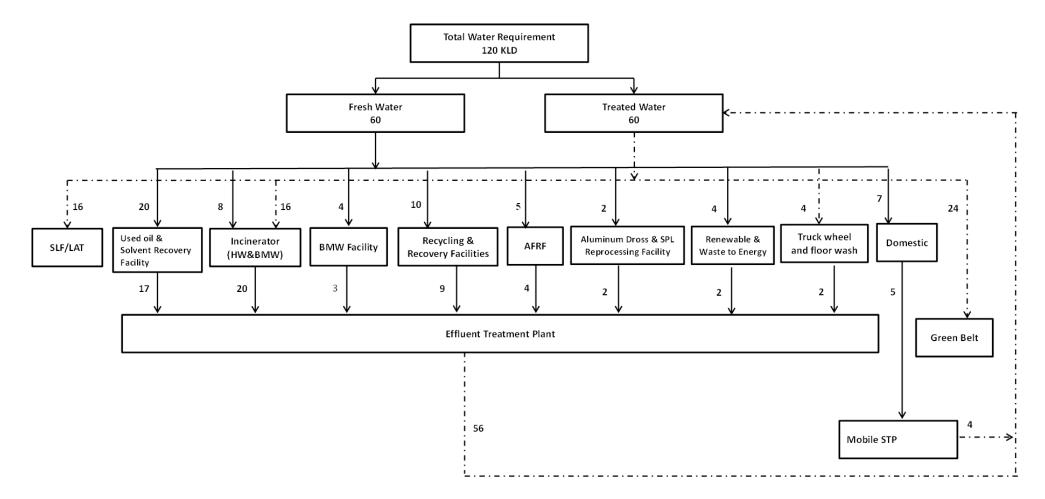
During rainy season the fresh water requirement will be 36 KLD only because the 24 KLD water consumed for greenbelt requirement will not be required, hence the water used for greenbelt during non rainy days will be adjusted for remaining requirements. The details of water requirement, wastewater generation and water balance are given in **Table 4.4** and the same is shown in **Figure 4.5**.

C No	Description	W	/ater requ	irement (I	KLD)	Remarks
S.No	Description	Fresh	Treated	Total	Effluent	
1	Secured Landfill and Stabilization	0	16	16	0	Leachate generated will be treated in LTP & reused for spraying on landfill or disposed through incinerator (spray dryer)
2	Incineration	8	16	24	20	
3	Biomedical Waste Treatment	4	0	4	3	
4	Alternative Fuel and Raw Material Facility (AFRF)	5	0	5	4	Spent to ETP for treatment
5	Recovery and Recovery Facilities like (E-Waste with PM, Drum Decontamination , Lead,	10	0	10	9	

Table 4.4 Details of water requirement, wastewater generation and water balance

	Description	W	/ater requ	irement (I	KLD)	Remarks	
S.No	Description Fresh Treated Total Effluent						
	Paper, Plastics)						
6	Boiler and cooling tower (Used oil and Solvent Recovery Facility)	20	0	20	17		
7	Aluminum Dross, SPL (Carbon Portion), SPL Refractory Portion Reprocessing Facilities	2	0	2	2		
8	Renewable Energy and Waste to Energy	4	0	4	2		
9	Truck Wheel Wash/Floor Wash etc.	0	4	4	2		
10	Domestic	7	0	7	5	Sent to soak pit/treated in STP	
11	Greenbelt	0	24	24	0		
	Total 60 60 120 64						
	Effective leachate generation the facility is operated at full of the facility is operated at facility		rculation to	the landfil	l is estimated	d to be approx. 30 KLD	





4.7.1 Leachate collection/ treatment and disposal

Leachate collection and removal is provided above the geo-membrane in two layers viz. the primary and the secondary liner. The primary liner serves as a leachate collection and removal system, while the secondary liner serves as a leak detection system and a signal of potential liabilities in terms of environmental pollution. Leachate is collected by a network of lateral and header pipes embedded in a drainage layer, all of which eventually drain into a leachate collection sump. The collected leachate is transferred to a leachate treatment system. Leachate, thus collected, is transferred to the forced evaporation system and the residue after decanting is subjected back to the land-filling process. The leachate collection system in an engineered landfill takes the form of an under-drain beneath the waste material. It is required to ensure there is no more than a limited head of pressure above the base liner to cause leakage of liquid from the base of the landfill. The design maximum pressure head in the landfill is limited to 300 mm. About 10% of the landfill capacity i.e. 65 KLD of leachate shall be collected and reused in the incinerator/ spray drier/ sprayed on landfill/evaporation system. Effective leachate generation after recirculation to the landfill etc., is estimated to be approx. 30 KLD when the facility is operated at full capacity.

Drainage is affected by a layer of about 300 mm thick graded sand / gravel having high permeability. Within this layer a network of HDPE pipes are placed to collect leachate and conduct it quickly to the collection sump for removal from landfill. The pipes are typically perforated only over the upper half to allow the leachate to enter the pipe and thereafter to be contained within the pipe network system. The layout of the pipe network generally includes sufficient redundancy to ensure that if a blockage occurs somewhere in the network the leachate simply backs-up a little then flows into the system a little further up-gradient. Two layers of the leachate collection system are provided one over the other. Slotting area of the pipe is done only on the top 120° portion of the pipe and to an extent of 100 sq. cm per running meter of the pipe. The pipe must have sufficient strength to withstand the load imposed by the overlying waste and the earth moving activities associated with the placement and the sump has the capability to be cleaned out in case of clogging. However, the design must include sufficient redundancy of pipe work to ensure alternative drainage paths are available in the event of localized clogging of any part of the system.

4.7.2 Leachate treatment plant

Collected leachate will be sent to the grid chamber thereafter sent to the oil & gas trap, from O&G it will be further processed at the collection pit then it will be treated through acid or alkaline or chemical precipitation. After the treatment it will be further sent to the primary settling tank then to an aeration chamber. At next level the leachate will be sent to the secondary settling tank and finally sent to the treated water holding tank. Treated leachate will be finally reused as sprayer on the landfill or sent for forced evaporation. Schematic diagram is given in **Figure 4.6**.

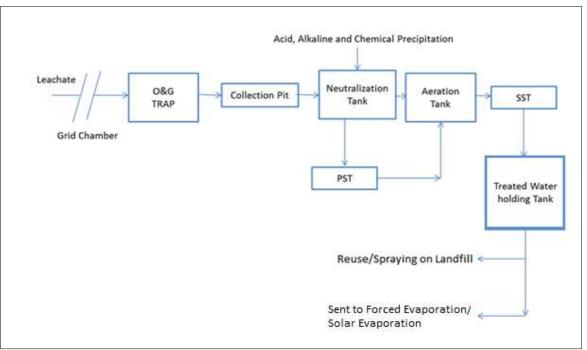
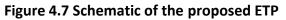
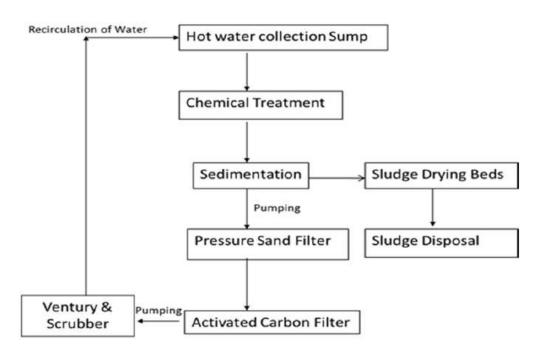


Figure 4.6 Leachate Treatment Plant

4.7.3 Effluent treatment plant

The wastewater generated from scrubbing, floor washings and other facilities will be treated in an ETP. The treated water shall be reused for circulation into the Incinerator scrubber/quencher, spray on landfill, and floor washing. However, the treatment system consists of a cooling tank, pressure sand filter and activated carbon filter assembly followed by neutralization before reuse.





4.7.4 Water impacts mitigation measures

Leachate collected from secured landfill shall be treated in the Leachate Treatment Plant and sent to a solar evaporation pond or sprayed on landfill. The domestic effluent generated will be treated in septic tank/treated in ETP/mobile STP. The effluent generated from floor washings, recycling activity, etc., will be collected in a collection sump, sent to chemical treatment, treated water sent to pressure sand filter and activated carbon filter then recycled to incinerator or circulated back to the system. The wastewater generated from boilers and cooling towers is used in ash quenching. There will not be any wastewater discharge to any nearby water body and adopts the zero wastewater discharge concept.

4.7.5 Storm water management

No artificial rainwater recharge structures are proposed within the facility (due to the nature of facility i.e., hazardous waste management) to eliminate the probability of groundwater contamination. However, it is proposed to make proper utilization of rainwater collected from within the facility. A HDPE lined rainwater holding pond has been designed to hold rainwater of first 30 minutes rainfall. The rainwater thus collected, after treatment as necessary, shall be used for various uses (dust suppression, floor washings, toiler flushing, greenbelt, etc.). The remaining rainwater will be diverted into proposed storm water drains (concrete) designed meeting the requirement and diverted into natural drains.

4.8 Noise environment

The major sources of noise during the operation phase will be from unloading of various types of wastes at respective facilities, during operation of incinerator and DG sets; and also during stabilization of hazardous waste.

4.8.1 Noise mitigation measures

Adequate measures for noise control, at the design stage shall be taken such as keeping high noise generating equipment like pumps, motors etc., on anti-vibration pads, closed rooms and regular maintenance as suggested by the manufacturer. The mitigation measures proposed are as follows:

- Noise level specification of various equipment as per the Occupational Safety and Health Association (OSHA) standards.
- Providing suitable enclosures (adequate insulation) to minimize the impact of high noise generating sources.
- Employees will be provided with PPE like ear plugs, helmets, safety shoes etc.
- Development of greenbelt all along the boundary and along the roads within the project.

4.9 Prediction of impacts on land environment

Environmental Impacts on land environment have been classified primarily into two broad aspects, i.e.

- Direct impacts on the soil and land in the study area: Land environment in the area has potential for contamination arising out of solid waste stored in the landfill area. The leachate generated from the land fill area is collected in the leachate holding tank and used back on to the landfill for dust suppression, mixing in stabilization process, etc. If any excess leachate is left over, it will be treated in a solar evaporation pond or spray dryer. As a result of this, there is no contamination of the soil due to the wastewater generated and hence the impacts due to the proposed facility on the land environment are negligible.
- Impacts on the flora and fauna: To address the impacts on flora and fauna, it has been observed that there are no endangered species in the project area and green belt will be developed along the boundary and adjacent to roads. Under CSR/CER activities adjacent open lands, parks, etc will be improved by plantation.

4.10 Predicted impacts of the landfill

The project has proposed secured landfill which shall be constructed and operated in line with the CPCB Guidelines (Criteria for Hazardous Waste Landfills - HAZWAMS/17/2000-01), with containment measures such as:

- Composite bottom liner to prevent leachate percolation
- Landfill gas management system
- Rodent control and dust control

There shall be no loss of carbon sequestration on account of the proposed activity since the area is almost barren. Development of a greenbelt all along the boundary of the site will more than compensate for the loss. As there are no rare or endangered or endemic or threatened (REET) species, the proposed project will not pose any problem to the species. Hence, the impact of the project on biota is negligible.

4.11 Impacts on the community

- **Public Safety:** A number of activities carried out in the facility might have significant impacts on the public safety. With the implementation of a strong environmental management plan, the communities residing near the project site are unlikely to be exposed to any long-term hazards.
- **Aesthetics:** The project site is located away from the settlements and proposed greenbelt around the site, as a part of the environmental management plan will help in improving the aesthetics of the environment.

4.12 Impact on ecology

There are no ecological and sensitive areas viz. wildlife sanctuaries, national parks, archeological important areas within 10 km radius of the project site. There are no known rare, endangered or ecologically significant animal and plant species. Except for a few wild species of plants and grasses and a few animals that are very commonly spotted in any rural environment,

the study area does not have any endangered or endemic species of animals. Due to the development of green belt at the project vicinity the impact on the ecology will be minimal.

4.13 Impact on socio-economics

The proposed facility is likely to provide direct and indirect employment and likely to increase the socio-economic status of the nearby villages in the study area. Due to proposed project the facilities for public transport, water supply, telecommunications, education, public health etc., are likely to improve.

4.14 Odour management

The goal for effective odour management is to eliminate objectionable odours by reducing the frequency, intensity, duration, and offensiveness of odours that people might experience. Following are some specific odour causing conditions that can arise during solid waste handling:

During waste transportation, odours from waste transportation can vary greatly depending on the type of waste and the method of transport. These odours are normally transient in nature and rarely the source of ongoing odour impacts. Typical odour causing compounds from waste transportation include volatile organic acids which can be prevented by containing the wastes as CPCB guidelines.

At the storage facility, the primary objective of storage is to store the waste temporarily before sending it to landfill. Some biological activity will occur in these storages, and the gases generated can be a source of odours. The potential for waste odours to be carried away by air movement will increase if the waste is left uncovered. It is important that putrescible waste be kept relatively cool in an enclosed container and be removed and disposed off quickly.

It is also important that the container be adequately cleaned after the waste is removed so that putrescible residues do not remain to decompose further and generate odour.

At the landfill, the most common odour-causing compounds at landfill cells are hydrogen sulphide, sulphur dioxide, ammonia etc.,

4.14.1 Odour control measures

Waste containers shall be covered with a solid lid or other covering to avoid emissions of any sort including spillage, dust, etc., and to minimise odour generation both at the point of loading as well as during the transportation.

In the landfill area, weekly cover shall be put in with layers of earth, clay or similar material. Weekly cover is primarily used for preventing windblown dust, litter and odours, deterrence to scavengers birds, reduction of infiltration (during unseasonal rain) and in improving the site's visual appearance. The soil used as weekly cover shall give a pleasing uniform appearance from the site boundary. To achieve this thickness of about 150 mm is usually adequate and shall be adopted.

- Spraying Ecosorb (organic and biodegradable chemical) around odor generation areas at regular intervals. Odour control system focus on minimizing the number of sources of odor generation
- Planting of selected species and planting them in proper pattern will help in dust control and odour control.
- Odour from sites shall be managed as per guidelines of CPCB issued from time to time.

4.15 Risk and Disaster impacts from TSDF sites

The proposed TSDF at Mandla handles various types of hazardous waste chemicals and also solvents with contamination during the process operations of industrial production. The concentration of the contaminated chemicals will be very marginal in the waste material; however the impact of the risk arising out of these waste materials without proper treatment will affect the surrounding environment of the TSDF facility. The risk and disaster expected during the landfill operations includes transportation of waste chemicals & materials from the industry to the TSDF site and subsequent step wise segregation for analysing the waste material to identify the suitable treatment method for alternate disposal. The SOP developed for handling of hazardous waste material at the site to reduce the exposure of risks to the persons handling those waste by following all PPEs and other safety norms. The transport vehicles will be regularly maintained for any damage to the parts and regular check-ups at designated workshops will minimize the impacts arising out of transportation vehicles.

The waste oil & contaminated solvents received at site mainly consist of low concentration of Butanol, Isopropyl Alcohol, Dichloro benzene, toluene etc., these contaminated solvents are recovered in solvent recovery plant and recovered solvents are sold to authorized dealers. The risk and impacts arising during the solvent recovery are very minimal as very low concentrated contaminates and processed at the recovery plant. However the final recovered solvents are stored in a designated tank farm area with all suitable precautionary measures to avoid any fire or explosion. The damage distance expected during any fire accident from these solvent chemicals varies in the range of 10 m to 26 m at different heat radiation levels. The treat zones identified due to storage of these chemicals are well equipped with fire-fighting form material for immediate control, thus minimal impacts area anticipated. The Acetylene cylinders are generally used in the TSDF sites were also observed for vapour cloud explosion scenario and found treat to damage distance between 14 m to 60 m only for Red and Yellow zones.

The hazards expected boiler steam processing are provided with high level thermal insulation to avoid any exposure to the people at the operations sites. A detailed risks and disaster expected and impacts from fire, electrical hazards, boiler hazards, etc., and necessary control measures provided are given in **Chapter 7**.

CHAPTER 5

ANALYSIS OF ALTERNATIVES (Technology & Site)

Chapter 5 Analysis of Alternatives (Technology & Site)

5.1. Introduction

The proposed facility is to manage the waste disposals / recycling or recovery or reprocessing facilities such as Hazardous waste treatment, biomedical waste treatment facility, Alternative Fuel Recovery e-Waste Recycling facility, Recycling and Reprocessing facilities, Waste to Energy, Renewable Energy facility etc. In addition to the above, there shall be temporary and long term storages for interim storage and for intractable/ in-compatible wastes respectively. The proposed site will be planned as per the rules provided by Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

5.1.1 Site selection

Environmental sound management of hazardous wastes would require common hazardous waste management facilities for industrial clusters spread all over the country, as it is not possible to have hazardous waste management facilities for each unit. Hence common facilities become more necessary in the wake of a large number of small, medium industries in our country, which either have no funds or space for development of hazardous waste management facilities. For establishing a common facility for treatment, storage, disposal and recycling facilities of hazardous waste CPCB has issued guidelines for site selection criteria (HAZWAMS/17/2000-2001 and HAZWAMS/25/2002-2003), under this criteria the following areas have to be excluded or rejected (knock out Criteria).

- Areas with unstable geological features like unstable or weak soils; organic soil, soft clay or clay-sand mixtures, soils that lose strength with compaction or with wetting, clays with a shrink-swell character, land subjected to subsidence and hydraulic influence.
- Subsidence: e.g. owing to subsurface mines, water, and oil or gas withdrawal or solution prone subsurface.
- Wetlands.
- Historical migration zones.
- Flood prone areas
- Area with 500 m from water supply zone and within 200 m from property line
- Natural depression and valleys where water contamination is likely
- Areas of ground water recharge and extremely high water table zone
- Unique habitation areas, close to national parks with scenic beauty and formerly used landfills.

- Areas with high population, unique archaeological, historical, paleontogical and religious interests,
- Agricultural and forests lands and existing dump sites
- Atmospheric conditions that would prevent safe disposal of an accidental release
- Major natural hazards, e.g. volcanic activity, seismic disturbance, etc
- Sensitive locations, e.g. storing flammable or explosive materials, airports
- An unfavorable local hydro-geological situation, e.g. springs or drinking water well within very close proximity to the chosen area
- Extremely bad access i.e. no existing access roads to the selected site which may involve long distance more than 5 km from main roads
- Great differences in altitude between the area of waste collection and the selected site

5.1.2 Compliance of the site with site selection criteria

Since the proposed project is located in the Industrial Growth Centre (IGC), Maneri, no alternate sites have been considered. However, the site is evaluated and selected based on the analysis of site selection criteria and knock-out criteria of MoEF&CC and site evaluation criteria as per CPCB guidelines HAZWAMS/17/2000-2001 and HAZWAMS/25/2002-2003. The Rejection and Knock-Out criteria given in **Table 5.1**, Location Criteria given in **Table 5.2**, and selected site evaluation is given in **Table 5.3**, based on the analysis of site evaluation criteria, the site got a weightage of 73 on a scale of 100 and it is falls under class Good.

Identif	ication of location of site	
S No	Criteria	Answer (Y / N)
1	Existing or planned drinking water protection and	N
	catchment areas	
2	High flood prone areas	Ν
3	Areas with unstable ground	Ν
4	Closer than 200 meters to populated areas	No, Jhurkhi village is located 0.9
		km N from the site.
5	Closer than 200 meters to river boundaries	No, Jhamil Nadi is located 0.6 km
		W and Gaur Nadi is located 2.1
		km N from the site.
6	Close to national parks, monuments, forests with	No, Dasrathpur RF is located 4.5
	large no. of flora and fauna, historical, religious and	km NE from the site.
	other important cultural places 500 m	
7	Existing use of site (Agricultural/Forest/Old dump site)	Industrial Land
Remar	ks	Comments
Site is	suitable for detailed EIA study (Y/N)	Y

Table 5.1 Knock Out Criteria

...

S.No	Parameter	Criteria	Observation
1	Lake or pond (Distance from SW body)	Should not be within 200 m	No lake or pond located within 200 m. Dundai Lake is located 5.5 km (SW) from the site.
2	River	Should not be within 100 m	No river located within 100 m. Jhamil Nadi is located 0.6 km (W) and Gaur Nadi is located 2.1 km (N) from the site.
3	Flood plain	Should not be within 100 year flood plain	Not in a flood plain area.
4	Highway – State or National	Should not be within 500 m	No highway located within 500 m. State Highway (SH)-22 (Kumdam- Jabalpur Rd) is located 12.2 km (N) and National Highway (NH)-30 (Mandla-Jabalpur Rd) is located 14.8 km (W) from the site.
5	Habitation – Notified habituated area	Should not be within 500 m	No habituated area located within 500 m. Jhurkhi village is located 0.9 km (N) from the site.
6	Public Parks	Should not be within 500 m	There are no public parks within 500 m.
7	Critical habitat area	Not suitable	The proposed site is not within critical habitat area.
8	Wetlands	Not suitable	The proposed site is not within wetlands.
9	AirPort	Should not be within a zone around the airport(s) as notified by the regulatory / aviation authority.	Jabalpur Airport is located 17 km (NW) from the site.
10	Water supply well	No water supply well within 500 m	No water supply well located within 500 m.
11	Coastal Regulation Area	Not suitable	The proposed site is not within the coastal regulation zone. CRZ is applicable only for the land area from High Tide Line (HTL) to 500 meters on the landward site along the seafront.
12	Ground Water Table level	GW table should be >2m from the base of the landfill	Pre monsoon (May-2012) groundwater levels are 4 to 8 m bgl and Post monsoon (November 2012) groundwater levels are less than 5 m bgl (as per CGWB 2013).
13	Presence of monuments / religious structures	Not suitable	The proposed site does not have monuments/ religious structures. A temple located at 0.6 km (N) from the site.

S. No	Criteria		Units	Relative values					Weightage	Overall
				5	4	3	2	1	С	Ranking
				100%	80%	60%	40%	20%		
				Excellent	Ideal	Good	Poor	Bad		
	General Informatio n (25% weightage)	Transportation Economy	km	0 to 5	5 to 10	10 to 20	20 to 40	>40	4.167	3.3336
		Slope (First Scale)	%	1.5	1.5 to 1.2	1.2 to 0.75	0.75 to 0.5	< 0.5	- 4.167	2.9169
		Slope (Second scale)	%	1.5	1.5 to 2.5	2.5 to 7.0	7.0 to 15	>15		
		Topography	Shape	Convex				Concave	4.167	2.9169
1		Flood proness							4.167	4.167
		Optimum wind direction (down stream village)	km	>1	1 to 0.5	0.5 to 0.2	0.2 to 0.1	< 0.1	4.166	4.166
		Infrastructure (Accessibility)		NH	SH	Local road		No road	2.083	1.2498
		Infrastructure (Power supply)							2.083	2.083
	Α								25	20.8332
2	Hydrology (12.5% weightage)	Distance from surface water body / drinking water	km	> 5	5 to 3	3 to 2	2 to 1	<1	6.25	1.25
		Annual rainfall	cm/year	<25	25 to 80	80 to 150	150 to 250	>250	6.25	3.75
	В								12.5	5
3	Hydrogeolo gy (12.5% weightage)	Groundwater depth Post Monsoon	m	>15	15 to 10	10 to 5	5 to 1	<1	3.125	1.5625
		Groundwater flow direction (distance to D/S village)	km	> 5	5 to 3	3 to 1	1 to 0.5	<0.5	3.125	1.875

Table 5.3 Site evaluation of the proposed site - (HAZWAMS/25/2002-2003)

		Groundwater quality		bad qlty				good qlty	3.125	1.875
		Groundwater gradient	m/km	<5	5 to 10	10 to 20	20 to 50	>50	3.125	2.5
	С								12.5	7.8125
	Geology	Subsidence		Settled soil				Filled up soil	4.167	3.3336
4	(12.5%	Depth of bedrock	m	>15	15 to 10	10 to 5	5 to 1	<1	4.167	2.9169
	weightage)	Seismic conditions	Intensit y	V	VI	VII	VIII	IX	4.167	2.5002
	D								12.5	8.7507
5	Geotechnic	Permeability	(1x10-6 cm/s)	<0.1	0.1 to 1	1 to 10	10 to 100	>100	6.25	4.375
5	al (12.5% weightage)	Engineering property (MA, Pl, Sheer)							6.25	5
	E								12.5	9.375
		Demography	km	>5	5 to 2.5	2.5 to 1.0	1.0 to 0.2	<0.2	6.25	3.75
6	Socio Economic /Ecological (25% weightage)	Land use Pattern		Waste land / saline	Grazing / fallow	Single crop / non irrigated	Double crop / irrigated	Plantation	6.25	6.25
0		Transportation impacts						passing populated areas	6.25	5
		Special ecological features							6.25	6.25
	F								25	21.25
	EXCELLENT: 90-100, IDEAL:80-90, GOOD:60-80, POOR:40-60,BAD:20-40								100	73

Proposed ICHWTSDF & Recycling Facility at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh

5.2. Technological aspects

The management of hazardous, bio-medical and e-waste etc. has become a major concern for many countries in the world in view of the environmental and public health issues which they pose. In the modern framework of hazardous waste management, a four pronged strategy has been adopted.

- 1. Minimizing the quantity of waste
- 2. Recycling
- 3. Treatment
- 4. Collection, transport, storage and disposal of waste in an environmentally sound manner

All these four approaches are very important. When dealing with a given hazardous waste problem, often there is a need to utilize a combination of the four general approaches outlined above.

5.2.1. Waste ainimization

The first priority in hazardous waste management is to reduce the quantity of waste generation to minimum. Three major waste reduction schemes which are often used are summarized as below:

Process Modification

Often the industrial process can be altered in such a way that the use of raw materials is optimized and the amount of hazardous waste is reduced to the barest minimum. For example, in zinc electroplating, the sulphate salt is substituted by the chloride compound with slight modification of the process; this can eliminate the cyanide problem. This activity is done at respective industry level.

Waste Concentration

The waste can be concentrated using evaporation, precipitation or decantation techniques which mean that the volume of waste can be considerably reduced using these methods. Incineration, viz., oxidation of inflammable-waste is often practiced in order to reduce the volume of waste to be handled. It is an excellent method of waste disposal, but the cost of operation usually exceeds the net gains.

Waste Segregation

Segregating the hazardous waste streams from non-hazardous streams decreases the volume of hazardous wastes, thus, making it easier to treat.

5.2.2. Waste recycling

Many substances in some wastes have value. They include glass, wood, fiber, paper products, metals, etc. Scientists have developed ways of recycling many wastes so they can be used again. The two broad ways of processing hazardous waste are waste reuse and waste

recycling. The brief details are given below

Reuse

In some cases waste material can be used as a raw material with very little processing. Transfer of the waste "as is" without reprocessing, to another facility is known as waste reuse or waste exchange. Unwanted materials of commence such as outdated chemicals or untested materials not meeting the high quality control requirements of the purchasing industry, can be reused without processing. Process wastes such as cardboard for making paper pulp, copper or other metal salt solutions for metal recovery, oils that can be used as fuels. This includes a variety of other materials that can be reused as industrial feed stocks.

Recycling

Recycling differs from reuse in that the waste must first be treated before it can be used in a manufacturing process. When a transfer of waste "as is" is not possible, reprocessing the waste for material recovery is known as recycling. For example, bag house dust from scrap steel processors, containing up to 25 per cent zinc oxide, can be combined with waste sulphuric acid to make galvaniser's pickle acid. The spent pickle liquor containing 8-10 percent zinc sulphate and some iron salts is then usable, as fertilizer in agricultural fields. Use of waste organic solvents is the best example of recycling waste.

5.2.3. Treatment of waste

After material recovery, the waste water containing hazardous waste chemicals should be detoxified and neutralized through treatment. There are many technologies available for treating hazardous wastes before they are ultimately disposed of. Their aim is to modify the physical and/or chemical properties of the wastes so that they are rendered harmless. Selection of a treatment process depends on many factors such as the nature of the waste, the desired characteristics of the output stream, and economic and energy considerations. The treatment technologies can be divided into the following groups, namely:

- Physical treatment
- Chemical treatment
- Biological treatment
- Solidification and Incineration

Physical treatment

Physical treatment is carried using various methods such as phase separation. Phase separation includes three steps, namely: lagooning, prolonged storage in tanks and sludge drying in beds. Lagooning and tank storage are collectively used to separate particulate impurities

Chemical treatment

This treatment is used to facilitate complete breakdown of hazardous wastes and more usually to modify the chemical properties of the wastes, e.g., to reduce water solubility or to

neutralize acidity or alkalinity. The techniques involve oxidation, chemical reduction, neutralization, heavy metal precipitation, oil/water separation and solvents/fuels recovery.

Biological treatment

The gross impurities obtained from treatment of sewage are collectively known as sludge, which is given biological treatment, before disposal. This is known as sludge processing which has become important since improvements in industrial waste water treatment. The typical technologies for sludge processing include conditioning, digestion, composting, thickening or dewatering and solidification.

- **Conditioning:** In this step the sludge is exposed to atmosphere for a stipulated period until a desired consistency is reached
- **Digestion:** In this process the sludge is treated with bacteria which break down the long chain compounds into simpler ones
- **Composting:** In this step the organic matter in the waste sludge is converted into a usable stable material

Solidification

Processes convert the liquid waste into insoluble, rock-hard material and are used as pretreatment prior to landfill disposal. This is usually done by mixing the waste with various reactants to produce a solid mass. The basic aim of the solidification process is to immobilize the hazardous constituents of the waste, so that these do not leach out at the landfill disposal site.

Incineration

Thermal oxidation through incinerator is one of the proven technologies for destruction of hazardous waste in all the forms i.e. solid / semi solid / liquid and gaseous, based on the feeding system, so as to render them innocuous in the form of non-toxic and non-hazardous residues.

5.2.4. Collection, transportation and disposal

Waste disposal is a multiphase activity, the different stages of which, i.e. collection, interim storage, transport; treatment and disposal are highly interdependent, both technically and organizationally. Safe collection and transport of hazardous waste form a critical link in the chain between its point of generation and its place of treatment and disposal. In many respects, the same precautions apply to hazardous waste in transit as apply to the carriage of dangerous goods; however, additional problems arise from the hazardous nature of certain wastes because:

- Waste in general has no perceptible economic value to the generator;
- The chemical and physical properties of a waste may not be precisely known because it is frequently a complex mixture from which all economically useful components have been extracted.

• Mixing of non-compatible wastes for convenience in transit could create an acute hazard, either immediately or on treatment and disposal (for example, a mixture of ether waste containing a sodium residue with an aqueous ether waste will explode)

Therefore, for a safe and secure disposal of hazardous waste, there should be a proper collection, transport and storage system. The non-compatible wastes should be segregated and transported separately.

5.3. Disposal of hazardous waste

The final disposal of the hazardous wastes also needs to be carefully planned. There are four different ways in which hazardous wastes can be finally disposed

- Landfill disposal
- Dumping at sea
- Underground disposal
- Incineration

5.3.1. Landfill disposal

The disposal of hazardous waste by landfilling is an important method of disposal in many countries. Landfilling means storing harmful substances under the ground. This involves hauling the refuse to an area allocated for this purpose. In India such areas range from open dumps to properly operated landfills. Open dumps are a poor method of waste disposal because they cause environmental problems. For example, they can ruin the appearance of all areas and provide a home for rats and other rodents who spread disease. If garbage is exposed, it rots and smells foul. Most dumps allow some burning, which fills the surroundings with smoke. In addition, rain water can drain through refuse and carry harmful substances to streams.

Properly operated landfills cause little damage to the environment. The area to be filled with waste must be lined with a nonporous substance such as clay, or high density polyethylene (HDPE)—plastic membrane to prevent the wastes from leaking to the surrounding areas. The wastes are packed and dumped at the site and covered with earth each day. Their cover of earth prevents insects and rodents from getting into refuse. Operators of these sites forbid burning. In time, landfill sites become filled up; many communities then cover the site for a final time and use the area for recreational purposes.

A typical landfill site consists of an artificial double liner at the bottom and a cover at the top. The above design of the landfill site does not have any provision for monitoring and repair of the site.

5.3.2. Dumping at Sea

Another method of disposal of hazardous wastes involves dumping wastes at deep sea, designed to prevent contamination of groundwater. Disposal at sea, of waste generated on land, is based on the misconceived notion that-the enormous volume of water available for dilution enables the seas to be used as a dump without permanent damage. However, this is an erroneous conviction. The decision to choose this method of disposal is generally based on financial considerations. The site of disposal is determined by the geographical location of the waste producer.

Disposal of waste at sea is controlled by international legislation and by the national legislation required for the ratification of the international legislation. To prevent pollution of the seas by the direct discharge of waste, the international legislation bans the dumping of extraordinarily hazardous wastes such as organic silicon compounds, halogenated organics, mercury and its compounds, cadmium, carcinogenic waste and plastics into the sea. The last of these can seriously disturb fishing and navigation.

5.3.3. Underground disposal

It maybe excessively expensive to dispose of certain hazardous wastes, such as radioactive nuclear wastes, in an environmentally acceptable manner at landfill still sites or incinerate them at thermal treatment plants. These wastes are generated in all operations associated with the use of nuclear energy for national defense or peaceful purposes such as mining of radioactive ore, production of nuclear fuel, laboratory experiments and medical treatment. Underground disposal may provide an environmentally and economically viable option in case of radioactive wastes. The underground disposal of hazardous waste is acceptable only in inactive or partially active mines that meet specific geological and technical criteria. Worldwide, only one deepmine disposal facility is currently in operation: a worked-out halite/potash salt mine at Herfa Neurode in the Federal Republic of Germany (now united Germany).

Salt mines are often used for radioactive waste disposal because the excellent properties of salt deposits prevent the interaction of wastes with other geological formations. The very existence of a salt deposit is a proof that the underground site has been unaffected by water for millions of years. Salt is impermeable to liquids and gases. Due to its hygroscopic nature, salt is capable of absorbing water entering the formation from outside and of repairing minor fractures by recrystallization, thus maintaining the original impermeability. This feature is frequently supplemented by impermeable upper strata consisting of wastes, usually rock, from mines or other industries.

The atmosphere in salt mines is extremely dry, so metal equipment and containers do not rust. There is no risk of methane explosions as in coal mines. Bursting of carbon dioxide gas inclusions in the salt mines may be observed during excavation of rocks but this does not pose a risk, particularly after mining operations have ceased. Thermal conductivity of salt is good. Salt is strong, permitting the excavation of spacious, stable galleries. In addition, salt has certain plasticity under pressure, allowing the dispersion of strain and increasing the overall stability.

Based on the several options present for safe treatment, storage, disposal & recycling of various wastes in the proposed projects the following options are considered which meet the national standards.

Hazardous wastes: Recycling, treatment stabilization, secured landfill, incineration
Bio medical wastes: Disinfection, shredding, autoclaving, incineration, secured landfill
E Wastes: Dismantling, cutting, disposal to authorized dealers, incineration
AFRF: Solid blending with binders

5.3.4. Incineration

Incineration burns waste products. This method is followed by many industries and large cities, if they do not have enough vacant areas for disposal sites nearby. Most hazardous wastes are detoxified in this process. This is also an excellent method of waste minimization, waste detoxification and disposal, but its cost of operation is very high, if the heat content of waste is not reutilized.

Advantages

Incineration is a process for the high-temperature oxidation of gaseous, liquid or solid wastes, converting them into gases and an incombustible residue. The flue gases are released to the atmosphere with or without recovery of heat and with or without cleaning; and any slag or ash produced is deposited in a landfill. In general, incineration may be considered as an alternative method of detoxifying some non-recoverable highly toxic wastes. It is an excellent method of reducing waste volume, and in addition offers the possibility for recovering the heat content of the waste. In some communities heat from municipal waste incineration is used to produce steam. This steam drives turbines that produce electric power. Recycling of heat thus reduces the cost of operation of incinerators.

Waste Input

Generally, the wastes having inflammable characteristics are incinerated. The following types of wastes are commonly treated in hazardous waste incinerators:

- Solvent waste and sludge
- Waste mineral oils
- Varnish and paint waste
- Plastics, rubber and latex waste
- Oils, emulsions and oil/water mixtures
- Phenolic wastes
- Mineral oil sludge
- Resin waste
- Grease and wax wastes

- Pesticide waste
- Acid tar and spent clay
- Organic waste containing halogen, sulfur or phosphorus compounds.

Waste having high chlorine, sulfur, nitrogen and phosphorus contents, polychlorinated biphenyls (PCB) and those containing heavy metals and carcinogenic substances need special incineration technologies and precautions. A large number of municipal incinerators lack adequate air pollution control devices. Burning in many of these devices may release gases and solid particles that may harm human health, damage property and kill plants. The flue gases from ordinary incinerators can be dangerous in the absence of pollution control devices.

5.4. Plasma gasification

Plasma gasification technology utilizes a plasma torch powered by an electric arc to convert organic matter into synthetic gas and solid waste (slag). The technology is presently being used for the gasification of biomass and solid hydrocarbons such as coal, oil sands and shale oil. The process can concomitantly generate electricity while reducing the volume of waste. In general, the feedstock for plasma gasification is most often municipal solid waste or organic waste, or both. Feedstock may sometimes include biomedical and hazardous waste. However there are a number of parameters like content and consistency of the waste which affect the performance of a plasma facility.

5.4.1. Pros and Cons of Plasma Gasification

Advantages

- Far less toxic emissions compared to landfills or other waste-to-energy facilities.
- Toxic waste can be safely processed, such as asbestos and medical wastes.
- Syngas is a byproduct of the process, hence it is as clean as or cleaner than natural gas and can be used to produce energy, such as biofuel.
- Metal is nearly 100 percent recoverable and can be used to make new steel.
- Low dioxin emissions.
- Waste is shrunk to one percent of its original size, one-tenth the size of byproducts of incineration.

Disadvantages

- Waste gasification and combustion ultimately releases carbon dioxide to the atmosphere instead of sequestering a large fraction of the carbon in a landfill.
- Large capital costs relative to current landfills.
- Requires large electrical energy input if the waste stream does not contain a large fraction of unoxidized hydrocarbons.
- The highly corrosive plasma flame may lead to frequent maintenance and component replacement with associated facility down time.
- The filters and gas treatment systems are themselves sources of toxic waste, some of which (e.g. acidified water) are poor candidates for plasma processing.

Though plasma gasification technology is commercially proven and viable, considering its demerits, the project management has decided to adopt a landfill system.

5.5. Benefits of the Proposed Project

It has been made mandatory by the government to dispose solid (Hazardous, Bio-medical, E-Waste, etc.,) waste in a systematic and scientific way and pollution control boards have been asked to ensure it. To achieve this, a Integrated common hazardous waste treatment storage and disposal facility (ICHWTSDF) becomes necessary where care has to be taken to avoid any negative effects on the environment. In the absence of this project, there are chances that industries would continue polluting the environment in all the ways possible.

The proposed integrated treatment facility would provide a 'one stop' solution for the treatment, storage and disposal of various kinds of wastes. The proposed facility would facilitate a clean environment by avoiding the threat posed by indiscriminate dumping of hazardous wastes by the industries and ensure the preservation of flora and fauna of the surrounding regions.

Benefits and Advantages of project

- Facilitating better management of solid wastes.
- Provides a one stop solution for the management of various types of wastes.
- Minimizes pollution load on the environment with an additional benefit of green and clean surroundings.
- Possibility for recovery of materials thereby conserving the natural resources
- Management of wastes is relatively easier and economically viable at a common facility
- Most viable option in the absence or availability of expertise.
- Reduced environmental liability due to captive storage of hazardous waste in the premises of industries
- Better occupational health and safety at individual industry level
- Prevention of natural resource contamination

The proposed project will not cause depletion of any natural resources or will have any significant impact on the environment. On the contrary, it will produce value added resources such as facilitating better management of the industrial wastes.

CHAPTER 6

ENVIRONMENTAL MONITORING PROGRAM

Chapter 6

Environmental Monitoring Program

6.1 Environmental monitoring program

Regular monitoring of environmental parameters is very important to assess the status of environment during project operations. With the knowledge of baseline conditions, the monitoring program will serve as an indicator for any deterioration in environmental conditions due to operation of the proposed project. This shall enable taking up timely measures to mitigate any adverse impacts on the environment. Based on the predicted and assessed impacts as well as the baseline environmental status of the project area, an environmental monitoring program is suggested for implementation during various stages of the project cycle.

All monitoring strategies and programs have reasons and justifications which are often designed to establish the current status of an environment or to establish trends in environmental parameters. In all cases, the results of monitoring will be reviewed, analyzed statistically and submitted to concerned authorities. The proposed project proponent shall implement the environment monitoring program in line with the planned schedule. The proponent shall ensure that necessary requisite facilities are made available and budgetary provision is made as and when required to ensure regular efficient environmental monitoring activities. The monitoring program will have three phases:

- Construction phase
- Operational phase
- Post operational phase

6.2 Construction phase

The proposed project is Integrated Common Hazardous Waste Treatment, Storage, Disposal & Recycling Facility at Industrial Growth Centre (IGC), Maneri village, Mandla district, Madhya Pradesh. The major construction activities involved in setting up the unit are construction of sheds for treatment units, stores, administrative blocks, canteen etc., major components in the industry are secured landfill, incinerator, autoclave, shredder, diesel generator, cathode ray tube cutter and other civil, mechanical and electrical equipment. The construction activities require clearing of vegetation, mobilization of construction material and equipment. The construction activities are expected to last for few months.

During construction phase of secured landfill at every stage quality of construction will be monitored viz. base preparation, liners quality, drainage layers, leachate collection system, storm water management system, gas vent systems, etc. The generic environmental measures that need to be undertaken during project construction stage are given in the following **Table 6.1**

S.	Potential	Detailed action to be	Parameters for	Frequency of
No	Impact	followed as per EMP	Monitoring	Monitoring
1.	Air Emissions	All equipments are operated within specified design parameters. Vehicle trips have to be minimized to the extent possible Any dry, dusty materials stored in sealed containers are prevented from blowing. Compaction of soil during	Random checks of equipment logs/ manuals Vehicle logs Stockpiles or open containers of dusty materials Construction logs	Once in a quarter/as per CTE issued by SPCB
		various construction activities DG set emissions have to meet stipulated standards Ambient air quality within the premises and adjacent villages of the proposed unit to be monitored covering upwind, downwind, nearest	Gaseous emissions (SO ₂ , HC, CO, NO _x) PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , and CO	At 3-4 locations in every quarter/as per CTE issued by SPCB
2.	Noise	habitation List of all noise generating machinery onsite has to be prepared.	Equipment logs, noise monitoring	Once in a month/as per CTE issued by SPCB
		Working during night has to be minimized. Generation of vehicular noise has to be minimized Implement good working practices (equipment selection and siting) to minimize noise and also reduce its impacts on human health (ear muffs, safe distances, and enclosures). Machinery should not be run when not required. Acoustic mufflers / enclosures to be provided for large equipment	Records of working hours Maintenance of records of vehicles Maintaining records of noise levels Mufflers/enclosures shall be in place.	Daily till the construction activities are completed/ as per CTE issued by SPCB

Table 6.1 Environmental measures during construction phase

S.	Potential	Detailed action to be	Parameters for	Frequency of
No	Impact	followed as per EMP	Monitoring	Monitoring
		Noise levels have to be monitored in ambient air within the plant premises. Noise levels shall not exceed the permissible limits both during day and night	Continuous recording of noise levels	
		All equipments shall be operated within specified design parameters. Vehicle trips to be minimized to the extent possible	Random checks of equipment logs/ manuals Vehicle logs	
3.	Soil Erosion	Minimize the area of site clearance by complying within the defined boundaries Protect topsoil stockpile	Site boundaries not extended / breached as per plan document. Effective cover in place.	
4.	Wastewater	No direct discharge of wastewater to be made into surface water, groundwater or soil. Take care of the disposal of wastewater generated such that soil and groundwater resources are protected.	No discharge hoses shall be in vicinity of watercourses. Discharge norms for effluents as given in permits	Once in a quarter/ as per CTE issued by SPCB
5.	Drainage and Effluent Management	Ensure drainage system and specific design measures are working effectively. They are designed to incorporate existing drainage pattern and avoid disturbing the same.	Visual inspection of drainage and records	
6.	Waste Management	ImplementwastemanagementplanthatidentifiesandcharacterizeseverywasteassociatedwiththeproposedactivitiesAlsotoidentifytheproceduresforcollection,handlinganddisposalofeachwastethatarises.	Comprehensive Waste management plan should be in place and available for inspection onsite. Compliance with Hazardous Wastes (Management and Handling Rules), 2016	•

S.	Potential	Detailed action to be	Parameters for	Frequency of	
No	Impact	followed as per EMP	Monitoring	Monitoring	
7.	Non-routine events and accidental releases	Plan will be drawn, considering the likely emergencies and steps required to prevent/limit consequences.	Mock drills and records of the same	Once in six months/ as per CTE issued by SPCB	
8.	Health	Health check-ups for employees and migrant labour	All relevant parameters of occupational health	Once in year /at the time of joining / as per CTE issued by SPCB/ as per Factories Act	

6.3 Operational phase

During operational phase air emissions from incinerator, boiler, DG set, gases from landfill, wastewater characteristics, ash generation quantity, etc., would be monitored by MoEF&CC/NABL approved third party or inhouse laboratory. The details are given in **Table 6.2**. The following attributes which are subjected to regular monitoring based on the environmental setting and nature of project activities are listed below:

- Point source emissions and ambient air quality in nearby villages (upwind, downwind, nearest habitation)
- Groundwater level and its quality (higher elevation and lower elevation surrounding areas/villages), piezometers around the landfill site.
- Water and wastewater, effluent and sewage quality etc.
- Solid and hazardous waste characterization (Incinerator ash, leachate etc.)
- Soil quality
- Noise levels (machinery, occupational exposures and ambient noise)
- Ecological preservation and afforestation.
- Noise levels (equipment and machinery noise levels, occupational exposures and ambient noise levels)

	Table 6.2 Environmental monitoring during operational phase				
S.No	Potential	Monitoring	Parameters for Monitoring	Frequency of	
	Impact			Monitoring	
1.	Air Emissions	Monitoring of Ambient Air	All the parameters listed in National Ambient Air Quality Standards (PM_{10} , $PM_{2.5}$, SO_2 , NO_x , O_3 , CO , NH_3 , C_6H_6 , Pb , Ni , As, Benzo(a)pyrene) Ambient air quality to be monitored at three locations at 120° angle around the TSDF (to be identified in consultation with SPCB).	Twice a week	
			Total Volatile Organic Compounds (VOCs), Polycyclic Aromatic Hydrocarbons (PAH) to be monitored – twice in an year (pre-monsoon and post- monsoon)	Twice in an year (pre- monsoon and post-monsoon)	
		Monitoring of Vent Gases attached with the capped SLF	Total VOCs and H ₂ S	Once in a month	
		Monitoring of Stack Gaseous Emission from Incinerator	 (a) Total Particulate Matter, CO, HCl, SO₂, NO_x, TOC, temperature and excess oxygen in stack emissions, (b) Pressure in combustion chambers, (c) temperature and excess oxygen in SCC. 	Continuous Online Monitoring	
		Incinerator Stack Monitoring and Waste to Energy Stack Monitoring	Mercury, Heavy Metals (Cd + Th + their compounds, Hg and its compounds, Sb + As + Pb + Co + Cr + Cu + Mn + Ni + V + their compounds), Dioxins and Furans. HF to be monitored at a frequency as directed by SPCB	Twice a year, under critical operating conditions	

S.No	Potential	Monitoring	Parameters for Monitoring	Frequency of
	Impact			Monitoring
		Stack monitoring of: Used Oil Recycling Plant	Particulate Matter, SO ₂ , NO _x , and hydrocarbon, Hydrogen sulphide, Halides/halogens.	Once in a month or as per the conditions stipulated in the
		Lead Recycling Unit	Particulate Matter, SO_2 , NO_x , CO_2 , CO , and Lead	EC and CFE/CFO, whichever is stringent.
		Solvent Recycling Plant	VOCs	
		Aluminum Dross Recycling Spent Pot Liner	Particulate Matter, SO ₂ , Acid Mist (H ₂ SO ₄) Particulate matter, Fluorides,	
		(Carbon Portion) Spent Pot Liner	Ammonia etc. Particulate Matter, Fluoride,	
	Crowndwatar	(Refractory Portion)	and Ammonia	Quertarlu
2.	Groundwater	Monitoring of Groundwater	Samples shall be collected	Quarterly
	Quality	Groundwater	from the four monitoring wells (piezometric) around the TSDF	
			i.e. one on up gradient of the	
			ground water flow and other	
			three on the down gradient	
			side of the ground water flow	
			and shall be analysed for the	
			following parameters: pH,	
			Colour, EC, Turbidity (NTU), SS,	
			TDS, TOC, COD, heavy metals	
			(such as Pb, Cd, Cu, Zn, Cr, Hg,	
			Ni), Fe, CN, F, As and Mn, Cl,	
			NO3, SO4, TKN, Total	
			Alkalinity, Total hardness and	
			Total Pesticides etc.	
3	Solid waste/	Monitoring of	Total Organic Carbon (TOC)	Monthly Once
	Haz. waste	Ash/Slag from the Incinerator	and Loss on Ignition (LOI)	
4	Soil quality	Composite	At least 2 composite samples	Once in a year
		samples upto a	for analysis of pH, EC, Colour,	(pre-monsoon)
		depth of 1 m	TDS, TOC, TSS, PAH, heavy	
		beneath the soil	metals (such as Pb, Cd, Cu, Zn,	
<u> </u>		surface	Cr, Hg, Ni), CN, F, As and Mn	
5	Greenbelt	Plantations of	To observe and record	Yearly Twice

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S.No	Potential Impact	Monitoring	Parameters for Monitoring	Frequency of Monitoring
	development	locally available sensitive plants to	periodically the health of each plant.	Montoning
		be made in all directions of the		
		TSDF and at different distances		
6	Noise	Noise generated from operation of Incinerators, boilers, cooling towers, etc to be monitored	Continuous noise level recording	Once in a month/ as per CFE /CTE/CTO conditions given by SPCB
7	Wastewater Treatment	All waste water shall be treated and reused, Treated water shall be monitored regularly	pH, TSS, TDS, BOD, COD, oil & grease (Heavy metals)	Daily at regular intervals/ as per CTO /CFE /CTE conditions given by SPCB
8	Health	Health check-ups for employees and migrant labour	All relevant parameters of occupational health	Once in six months/ as per CFE /CTE/CTO issued by SPCB/ as per Factories Act

6.4 Post operational phase

Post-closure monitoring of the landfill will be done primarily as a compliance requirement in addition to social responsibility. This provides an early warning towards possible adverse impacts on human health and the environment. The post-closure program of monitoring for water quality in the ground water and surface waters down the gradient of the landfill will be similar to that established for the operational stage of the facility. The frequency of monitoring may be varied from time to time depending on the circumstances.

There is no need for the post-closure monitoring of air quality, noise or visual effects during the post-closure period, however, these needs to be reviewed periodically. Any aspects warrant further monitoring will be included in the program. The details of post closure monitoring are given in **Table 6.3**.

6	Table 6.3 Environmental monitoring during post operational phase					
S.	Potential	Action to be	Parameters for Monitoring	Frequency of		
No	Impact	Followed		Monitoring		
1.	Air Emissions	Monitoring of vent gases attached with capped SLF	VOC, H ₂ S	Quarterly once		
		AAQ within the project premises and surroundings.	All the parameters listed in National Ambient Air Quality Standards (PM_{10} , $PM_{2.5}$, SO_2 , NO_x , O_3 , CO , NH_3 , C_6H_6 , Pb , Ni , As, Benzo(a) pyrene) Ambient air quality to be monitored at three locations at 120° angle around the TSDF (to be identified in consultation with SPCB).			
2.	Water quality	Samples from monitoring borewells	pH, TSS, TDS, BOD, COD & Oil & grease (Heavy metals) etc	Quarterly once from each monitoring borewell		
3.	Greenbelt development	Vegetation, green cover and greenbelt development	Survival of native plant species and maintenance of planted species	Once in a season/ as per CFE /CTE/CTO conditions given by SPCB		
4.	Soil quality	Checking and maintenance of soil quality in and around the project site	Physico-chemical parameters such as NPK, heavy metals etc.	Once in a quarter/ as per CFE /CTE/CTO conditions given by SPCB		
5.	Gas & leachate management system	Identification of broken pipes, leaking gas (if any) and damages/ clogged wells/ sumps	Corrective action shall be taken as necessary	Periodic inspection – two to four times a year		

Table 6.3 Environmental monitoring during post operational phase

6.5 Environmental laboratory equipment

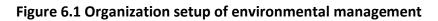
The proposed project will have an in-house environmental laboratory for the routine monitoring of air, water, soil, meteorology and noise. For all non-routine analysis, the plant will utilize the services of external recognized laboratories and facilities. The procedures given in IS standards or CPCB approved methods will be followed of analysis and sampling of various environmental parameters. The list of laboratory equipment need for the environmental monitoring is given in **Table 6.4**.

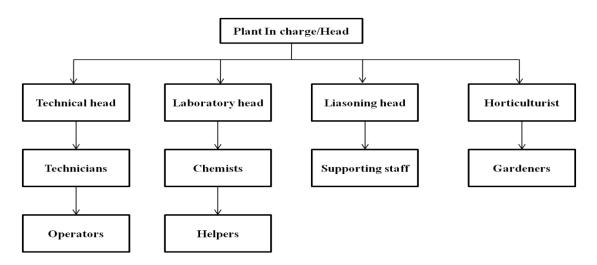
Name of the Equipment	No of Instruments for laboratory
Online monitoring for stack	1
Weather Station, which can record wind speed, wind direction	1
Temperature, relative humidity (automatic or manual)	
Respirable dust samplers	4
Fine dust samplers	4
Portable flue gas combustion analyzer	2
Portable noise level meter (dosimeter)	2
Portable wastewater analysis kit	2
BOD Incubator	1
COD digester with colorimeter	2
Electronic balance	1
Spectrophotometer	1
Hot air oven	1
Laboratory water distillation and demineralization unit	2
General glass ware and laboratory chemicals, etc.	As required

Table 6.4 Equipment needed for environmental monitoring

6.5.1 Environmental management cell

An efficient environmental management cell headed by a project in-charge/head having a minimum of 5 to 10 years of experience will be formed. The project in-charge/head will be supported by team of members (managers, operators, chemists, technicians, etc.) having minimum of 2 to 3 years of experience in their respective fields of work. The organizational setup of the environmental management cell is given below in **Figure 6.1**.





6.6 Pollution monitoring facilities

6.6.1 Reporting schedules of the monitoring data

It is proposed that voluntary reporting of environmental performance with reference to EMP should be undertaken. The environmental monitoring cell shall co-ordinate all monitoring program at site and data thus generated shall be regularly furnished to the State regulatory agencies. The frequency of reporting shall be twice a year (on a six monthly basis) submitted to the local state PCB officials and to Regional office of MoEF&CC or as per the existing guidelines of the regulatory authorities. The Environmental Audit reports shall be prepared for the entire year of operations and shall be submitted to the regulatory authorities.

6.6.2 Public health monitoring

The value of public health monitoring is of immense importance whether to establish a facility or not, based on the adverse health effects caused by the facility. In this situation, the results from a public health study may not fulfill the primary objectives of such a program. The objective has to detect health changes before the manifestation of adverse health effects. Therefore, a three-stage health monitoring program is proposed.

- Monitoring the health of workers within the project site to identify adverse health effects.
- Periodically obtain feedback from local doctors regarding any potential indicators of adverse health effects due to the proposed project in the surrounding communities, particularly down-stream of the landfill.
- By organizing health camps on a regular basis.

6.6.3 Budgetary provision for EMP

In order to comply with the environmental protection measures as suggested in the above sections, the project management has made budgetary provision for environmental protection and safety measures. Cost towards environmental mitigation measures are given in **Table 6.5**.

S.	Control	Description	Capital	Recurring
No	Measures	Description	Cost	Cost/Year
1	Air Pollution Control	Air pollution control devices attached to the incinerator, boiler etc., Fugitive dust emission control such as suction hoods, Sprinkling systems for dust control, Landfill gas management, Continuous online monitoring equipment (wherever required) etc.	150	12
2	Water Pollution Control	Water pollution control systems including packaged sewage treatment plant/septic tank and soak pit/effluent treatment plant(s)/leachate treatment system etc.	125	10
3	Noise Pollution Control	Provision of acoustic enclosures to DG sets and noise generating equipment rooms such as incinerator etc.	10	1
4	Solid waste management	Temporary storage of incineration ash and slag and ultimate disposal in secured landfill, after appropriate treatment if necessary.	10	2
5	Greenbelt development	Development and maintenance of greenbelt with native species, including sensitive & tolerant species	20	5
6	Environmental Monitoring	Periodic monitoring of ambient air, stack emissions, ground water, wastewater and leachate, noise, soil, and greenbelt etc. Provision of necessary equipment in the laboratory, for validation.	20	6
7	Miscellaneous	Environmental Audits, Safety Audits, Training Programs, Fire Safety System, Solar street lights, energy efficient appliances (5 star energy rating air conditioners etc.), usage of LED bulbs etc.	65	4
		Total	400	40

Table 6.5 Budget for implementation of environmental management plan (Rs. in lakhs)

CHAPTER 7

ADDITIONAL STUDIES

Chapter 7

Additional Studies

7.1 Risk assessment and disaster management plan

The principal objective of risk assessment is to identify and quantify the major hazards and risk associated with various operations of the proposed ICHWTSDF at Mandla, which may lead to emergency consequences (disasters) affecting the public health and safety. Based on this information, an emergency preparedness plan has to be prepared to mitigate the consequences. The approach involves hazards identification, hazards assessment, evaluation and developing a Disaster Management Plan (DMP).

7.1.1 Risk analysis

Risk analysis includes an estimate of the probability or likelihood that an event will occur. Estimation of random incidents totally uncorrected with plant activities may also be taken in to account. Risk can be characterized in qualitative terms as high, medium or low or in quantitative terms using numerical estimates and statistical calculations. Diminishing the likelihood of an accident or minimizing the consequences will reduce overall risk.

7.1.2 Evaluating hazards

The need for sophisticated techniques for evaluating hazards depends on the result of preliminary hazard analysis. Various techniques for evaluating hazards are as follows:

- Hazard and Operability Study (HAZOP)
- Accident Consequence Analysis
- Event Tree Analysis
- Fault Tree Analysis
- Failure Modes, Effects and Criticality Analysis.

In order to be in a state of readiness to face the adverse effects of accidents, an Emergency Preparedness Plan (EPP) has to be prepared. Such a plan must cover the possible hazardous situations in the locality and the causes, areas most likely to be affected, on-site and off-site emergency plans, establishment of Emergency Control Centre (ECC), location of emergency services and duties of officers/staff during an emergency.

The EPP protocol should be designed to provide measures to control the incident and minimizing the effects due to fire, explosives, release or escape of toxic gas, spillage of hazardous substances during storage, processing or transportation. The necessary preventive and protective steps required to be taken before, during and after an accident need to be worked out in operational terms and detailed in the document.

7.2 Risk assessment and hazard identification

The past disastrous events in India over a few decades have enlightened the need for a specific legislation covering major hazard activities. This has been enforced by Government of India in 1989 in conjunction with Environment Protection Act, 1986, amended in 2000. For the purpose of identifying major hazard installations, the rules employ certain criteria based on toxicity, flammability and explosive properties of chemicals which are outlined below.

7.2.1 Identification of toxic, flammable, explosive chemicals

Toxic Chemicals: Chemicals having acute toxicity values, owing to their physical and chemical properties are capable of producing major accidents. The details are given in **Table 7.1.**

S. No	Toxicity	Oral toxicity	Dermal toxicity	Inhalation toxicity
		LD ₅₀ (mg/kg)	LD ₅₀ (mg/kg)	LC₅₀ (mg/l)
1.	Extremely toxic	>5	<40	<0.5
2.	Highly toxic	>5-50	>40-200	<0.5-2.0
3.	Toxic	>50-200	>200-1000	>2-10

Table 7.1 Toxicity values of chemicals

Flammable Chemicals

Flammable gases: Gases which at 20°C and at standard pressure of 101.3 kPa are:-

- Ignitable when in a mixture of 13 % or less by volume with air, or
- Have a flammable range with air of at least 12 % points regardless of the lower flammable limits.

Flammable liquids: chemicals which have a flash point higher than 60°C but lower than 90°C.

Note: - The flammability shall be determined by tests or by calculation in accordance with methods adopted by International Standards Organization (ISO) Number 10156 of 1990 or by Bureau of Indian Standards ISI Number 1446 of 1985.

Explosives: Explosives means a solid or liquid or pyrotechnic substance (or a mixture of substances) or an article which is:

- In itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings;
- Designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as a result of non-detonative self-sustaining exothermic chemical reaction.

7.2.2 Storage of hazardous chemicals and nature of possible hazards

The details of storage facilities and capacities of hazardous chemicals proposed to be used in the project are given in **Table 7.2** and the nature of possible hazards is listed in **Table 7.3**.

Solvent	Storage Type	Listed in Schedule	Threshold Quantity (Tons) for		Quantity Stored at
			Application of	Rules	site
			4,5,7-9,13-15	10-12	
High Speed Diesel		Schedule 1(part I)	5000	50000	2 kL
(HSD)					
Isopropyl alcohol		Schedule 1(part III)	7000	7000	1 ton
Butanol	Tank	Schedule 1(part IV)	10000	10000	1 ton
Toluene	Tallk	Schedule 1(part III)	7000	7000	1 ton
N,N-dimethyl		Schedule 1(part V)	5000	50000	1 ton
formamide					
O-dichlorobenzene		Schedule 1(part V)	5000	50000	1.5 ton
Acetylene	Cylinder	Schedule 1(part II)	1000	5000	10 L

 Table 7.2 Details of chemicals and applicability of GoI rules

From the above table, it can be inferred that there would be no major hazardous chemicals stored at the proposed plant which would attract the GoI rules 4, 5, 7-9 and 13-15. Further, as the quantities likely to be stored at site lie below the stipulated threshold quantities major hazards are not anticipated.

Hazard	Area	Probable cause of the accident
Explosion	Boilers/transformers/receivers	Malfunctioning of the safety valve
	for the air compressors.	
	Flammable petroleum product	External fire causing pressure built up in
	storage tank/drum storage area	the tanks/barrels
Fire	HSD/fuel storage	Flammable vapor-air mixture and source of
	area/production area	ignition.
		External fire \rightarrow Built up of internal pressure
		ightarrowFailure of the top cover $ ightarrow$ Tank on fire
	Coal storage area	Fire, spontaneous combustion
Spillage	Acid/alkali storage area	Spillage of acid/alkali due to rupture of the
		pipeline, collapse of the storage tank

7.2.3 Maximum credible accident analysis (MCA) for fuel storage area

Identification of causes and types of hazards is the primary task for assessing risk. Hazards can happen because of the nature of chemicals handled and also the nature of processes involved. A pre-requisite for risk analysis is to identify and study the hazardous chemicals associated with risk.

Identification of hazardous chemicals is done in accordance with **Manufacture, Storage and Import of Hazardous Chemical (MSIHC) Amendment Rules, 2000.** Schedule 1, of the Rule provides a list of toxic and hazardous chemicals and the flammable chemicals. It defines flammable chemicals based on flash point and boiling point. **Table 7.4** shows the list of major chemicals which have been identified as hazardous, as per the MSIHC amendment rules 2000 and which are to be considered as MAH installations.

Chemical	Codes/	TLV	BP	FP	LEL	UEL
	Label	(mg/m³)	(°C)		%
High Speed Diesel (HSD)		800 ppm	215 - 376	55-65	0.6	6.0
Isopropyl alcohol		400	82.6	11	2	12.7
Butanol	Flammab	100	118	35	1.45	11.25
Toluene	le/ Toxic	100	111	6	1.1	7.1
N,N-dimethyl formamide		10 – 30	153	67	-	-
O-dichlorobenzene		50	180.5	66	2.2	9.2
Acetylene		-	-84	-17	2.5	100
TLV : Threshold Limit Value			BP :	Boiling I	Point	
MP : Melting Po		FP :	Flash Pc	oint		
UEL : Upper Exp		LEL :	Lower E	xplosive	e Limit	

Table 7.4 Physical properties of chemicals at site

Fire Explosive Toxicity Index (FETI) for HSD

The computations of FETI (Fire and Explosion, Toxicity Index) for HSD and other solvents handled at proposed TSDF is shown in **Table 7.5** and the subsequent F&EI categories are given in **Table 7.6**. The capacity of HSD Storage tank (2 KL) was considered for these studies. The Health (Nh), Flammability (Nf), Reactivity (Nr), and MF (Material Factor) under consideration was derived from NFPA (National Fire Protection Association) codes. The GPH (General Process Hazard Factor) and SPH (Specific Process Hazard Factor) was calculated accordingly. Based on F&EI (Fire and Explosion Index), HSD comes under "Low" category and nil toxicity.

NFP/	IFPA Classification		СРЦ	CDU	* - 0 - 1	Toxicity	F&EI	
Nh	Nf	Nr	MF			FQEI	Category	Category
1	2	0	10	1.8	2.8	50.4	Nil	Low
1	3	0	16	1.9	1.3	39.5	Nil	Low
1	3	0	16	1.9	1.3	39.5	Nil	Low
2	3	0	16	1.3	1.2	25.1	Moderate	Low
n	2	0	10	1 2	1	10	Moderate	Low
Z	Z	0	10	1.2	1	12		LOW
2	2	0	14	1.3	1.2	22.1	Moderate	Low
0	4	3	29	-	-	-	Nil	-
	Nh 1 1 2 2 2 2	Nh Nf 1 2 1 3 1 3 2 3 2 2 2 2 2 2	Nh Nf Nr 1 2 0 1 3 0 1 3 0 1 3 0 2 3 0 2 3 0 2 2 0 2 2 0	1 2 0 10 1 3 0 16 1 3 0 16 2 3 0 16 2 2 0 10 2 2 0 16 2 2 0 10 2 2 0 14	Nh Nf Mr MF GPH 1 2 0 10 1.8 1 3 0 16 1.9 1 3 0 16 1.9 1 3 0 16 1.9 2 3 0 16 1.3 2 2 0 16 1.3 2 2 0 10 1.2 2 2 0 14 1.3	Nh Nf Nr MF GPH SPH 1 2 0 10 1.8 2.8 1 3 0 16 1.9 1.3 1 3 0 16 1.9 1.3 1 3 0 16 1.9 1.3 2 3 0 16 1.9 1.3 2 3 0 16 1.9 1.3 2 3 0 16 1.9 1.2 2 2 0 16 1.3 1.2 2 2 0 10 1.2 1 2 2 0 14 1.3 1.2	Nh Nf Nr MF GPH SPH *F&EI 1 2 0 10 1.8 2.8 50.4 1 3 0 16 1.9 1.3 39.5 1 3 0 16 1.9 1.3 39.5 2 3 0 16 1.9 1.3 39.5 2 3 0 16 1.9 1.3 39.5 2 3 0 16 1.9 1.2 25.1 2 2 0 10 1.2 12 12 2 2 0 14 1.3 1.2 22.1	Nh Nf Nr MF GPH SPH *F&EI Category 1 2 0 10 1.8 2.8 50.4 Nil 1 3 0 16 1.9 1.3 39.5 Nil 2 3 0 16 1.9 1.2 25.1 Moderate 2 2 0 10 1.2 1 12 Moderate 2 2 0 14 1.3 1.2 22.1 Moderate

Table 7.5 F&EI of fuels used for the proposed project

*F&EI = MF *(GPH) * (SPH)

The F&EI values are ranked into following categories

S.No	F&EI	Category
1	1-60	Low
2	60-90	Medium
3	90 and above	Severe

Table 7.6 F&EI category

7.2.4 Nature of hazard from oil storage

Diesel is a flammable liquid having a flash point in the range of 55-65°C. However, its auto ignition temperature is 225°C. Its boiling point ranges between 215-376°C. Major hazards from oil storage can be fire and maximum credible accidents from oil storage tank can be

- a) Tank Fire and
- b) Pool / Dyke fire.

Similarly, for the solvents it can be seen as fire hazard to be a major cause and none of them are toxic to cause other accidental scenario.

a. Tank fire

A series of incidents could lead to tank fire. Oil is stored in a floating roof tank. Any leak in rim seal that leads to accumulation of vapour could be a source of fire. Further, this lighting can be a source of ignition and can cause tank fire. At times, overflow from tank leading to spillage may also cause vapour cloud formation which in turn catches fire. This can again flash back to the tank to cause tank fire.

b. Pool / Dyke fire

If there is outflow from the tank due to any leakage from tank or any failure of connecting pipes or valves, oil will flow outside and form a pool. When the tank is surrounded by a dyke, the pool of oil will be restricted within that dyke. After sometime, the vapour from the pool can catch fire and can cause pool or dyke fire.

7.2.5 Heat radiation and thermal damage criteria

The level of damage caused by heat radiation due to fire is a function of duration of exposure as well as heat flux (i.e. radiation energy onto the object of concern). This is true for both the effect on building and plant equipment and also for the effect on personnel. However the variation of likely exposure time is more marked with personnel, due to possibility of finding shelter coupled with protection of the skin (clothed or naked body). Further, it is assumed that everyone inside the area by the pool fire will be burned to death (100% lethality) or will asphyxiate.

The damage and fatality due to the exposure time is very important in determining the degree of fatality and corresponding effect distance. It is observed that the exposed persons normally find shelter or protection from the heat radiation (e.g. against a wall) within 10 seconds. However, exposure time of 30 seconds is normally assumed for pessimistic calculation which applies when people do not run away immediately or when

no protection is available. The effects on humans due to variations in heat flux and duration of exposure have been developed in the form of a model which gives following values for human fatality levels as shown in **Table 7.7**.

Incident Radiation Type of Damage Intensity (KW/m ²)			
37.5	Sufficient to cause damage to process equipment		
25	Minimum energy required to ignite nearby wood at infinitely long exposure (non-piloted)		
12.5	Minimum energy required for piloted ignition of wood, melting plastic tubing etc. 1 st degree burns for 10 seconds exposure.		
4.5	Sufficient to cause pain to personnel if unable to reach cover within 20 seconds; however blistering of skin (1 st degree burns) is likely.		
1.6 Will cause no discomfort to long exposure			

Table 3	7.7	Heat	radiation	and	fatality
TUNIC .		neut	radiation	una	racancy

Rupture of HSD tank with a damaged hole is considered as one of the major accidental scenarios in which large quantity of HSD will be leaked into the surrounding areas of the storage tank. If any ignition source is available near the accidental site, the leaked fuel will easily catch fire. It is assumed that the complete liquid leaks due to tank failure or ruptures and develops into a pool and gets ignited. Hazard distances have been arrived due to effect of pool fires. For computing the damage distance from the tank failure area, Areal Locations of Hazardous Atmospheres (ALOHA) software is used. Full tank storage capacity has been considered for the calculations. The effect of heat radiation and subsequent damage distances for HSD and 5 solvents are given in **Table 7.8 and 7.9**.

Table 7.8 Effect of heat radiation due to HSD storage tank (Pool fire)
---	---

Input Data		Results of computation		
Spilled quantity	2 kL	Flame length	7 m	
Circular opening diameter 2.5 cm		Max burn rate	21.8 kg/min	
Wind speed	2.2 m/s	Total amount burned	1292 Kg	
Heat Radiation at ground le	vel KW/m ²	Damage distances (m)		
12.5		<10		
4.5		11		
1.6		17		

The risk contour for HSD is given in Figure 7.1 & thermal radiation threat zone in Figure 7.2.

Butanol	Isopropyl	N,N-dimethyl	O-dichloro	Toluene
	alcohol	formamide	benzene	
		1		
		7.5		
		2.6		
13	12	11	14	17
188	258	181	226	211
793	771	932	1287	852
Thermal	radiation da	amage distances		
<10 m	<10 m	<10 m	<10 m	<10 m
14 m	14 m	12 m	10 m	14 m
24 m	23 m	21 m	20 m	26 m
	13 188 793 Thermal <10 m 14 m	alcohol 13 12 188 258 793 771 Thermal radiation data <10 m	alcohol formamide 1 1 7.5 2.6 13 12 11 188 258 181 793 771 932 Thermal radiation damage distances <10 m	alcohol formamide benzene 1 1 7.5 2.6 13 12 11 14 188 258 181 226 793 771 932 1287 Thermal radiation damage distances <10 m

 Table 7.9 Effect of heat radiation due to solvent leakage (Pool fire)

The **Table 7.9** shows the effect of heat radiation due to solvent leakage. It is observed that, for heat radiation of 25 KW/m² the damage distance is found to be less than 10 m from the accidental site, whereas for heat radiation of 12.5 KW/m², the impact distance is in the range of 10-14 m. For a heat radiation intensity of 4.5 KW/m², the damage distance is in the range of 20-26 m. The threat zone for the proposed solvents is given in **Figure 7.2**.

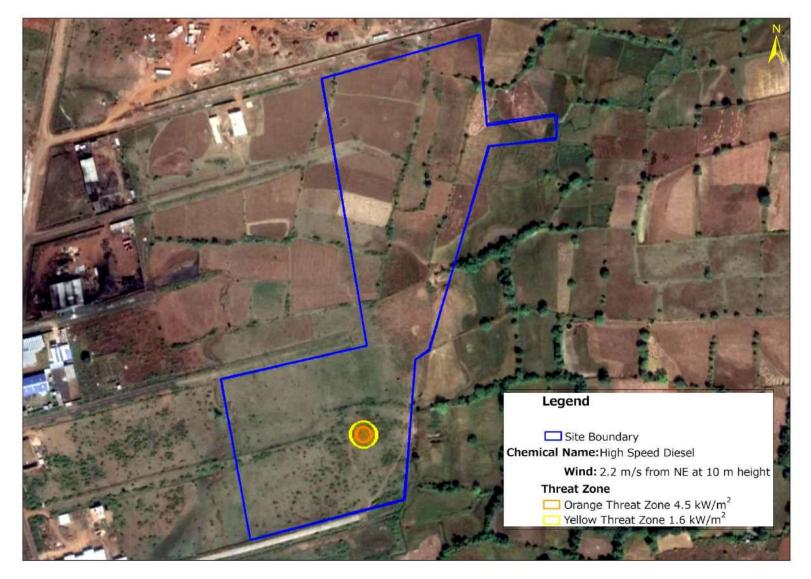


Figure 7.1 ALOHA source point on the layout

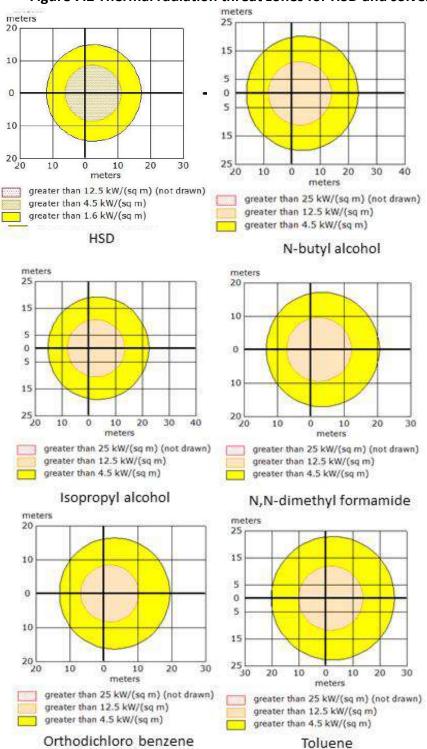


Figure 7.2 Thermal radiation threat zones for HSD and solvents

Acetylene

Cylinder with a damaged hole as cause for accident and two scenarios have been considered, one being flammable area vapor cloud and other being BLEVE (boiling liquid expanding vapor explosion). Acetylene when leaked into the atmosphere forms a mixture of air-acetylene because of its high reactivity resulting in a violent explosion. Cylinder of 10 liter volume is considered with diameter of 0.2m and length 1.4m. Aperture of 0.25 cm is considered and following results are obtained using ALOHA. The thermal radiation threat zone is given in **Figure 7.3**.

<u>Flammable Area Vapor Cloud</u> Threat Zone: Red : 14 meters --- (25000 ppm = LEL) Orange: 20 meters --- (15000 ppm = 60% LEL = Flame Pockets) Yellow: 60 meters --- (2500 ppm = 10% LEL)

<u>BLEVE</u>

Percentage of Tank Mass in Fireball: 100% Fireball Diameter: 17 meters Burn Duration: 2 seconds Threat Zone: Red: 20 meters --- (37 kW/(sq m)) Orange: 25 meters --- (24 kW/(sq m)) Yellow: 37 meters --- (12 kW/(sq m))

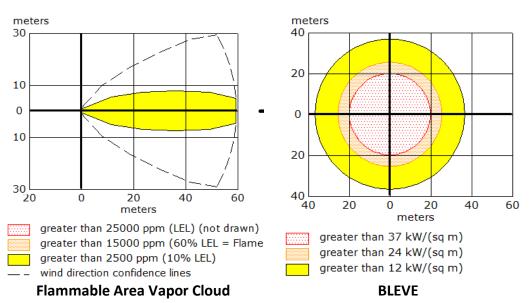


Figure 7.3 Thermal radiation threat zones for acetylene

7.3 Coal storage/ handling plant – dust explosion

Coal dust when dispersed in air and ignited would explode. Dust explosions may occur without any warnings with maximum explosion pressure up to 7.4 bars. Another dangerous characteristic of dust explosions is that it sets off secondary explosions after the occurrence of initial dust explosion. Many a times the secondary explosions are more damaging than the primary ones. The dust explosions are powerful enough to destroy structures, kill or injure people. To be explosive, the dust mixture should have:

- Particles dispersed in the air with minimum size
- Dust concentrations must be reasonably uniform; and
- Minimum explosive concentration for coal dust (33% volatiles) is 50 gm/m³

In order to mitigate these effects, the following preventive measures to be taken:

• The total quantity of coal shall be stored in separate stockpiles, with proper drains around to collect washouts during monsoon season

- Stockpile areas will be provided with automatic garden type sprinklers for dust suppression as well as to reduce spontaneous ignition of the coal stockpiles.
- The stock geometry shall be adopted to maintain minimum exposure of stock pile areas towards predominant wind direction
- Necessary water distribution network for drinking and service water with pumps, piping, tanks, valves etc. to be provided for distributing water at all transfer points, crusher house, control rooms etc.

7.4 Hazards occurring at site

The project authorities have to prepare detailed emergency control measures and give information such as the quantity of hazardous material stored, the location of storage, the approximate population living in the vicinity and the detail of the hazardous characteristic of the material to the employees, concerned government departments and the public living in the vicinity regularly to enable the government to prepare the on-site disaster management plan. Educate employees and the public living in the vicinity the safety measures required to be taken in the event of an accident taking place.

7.4.1 Fire

To increase the level of safety in the proposed project, installation of smoke alarms or automatic fire detection /alarm systems will be proposed at strategic locations as an early warning of fire to the occupants. To prevent fire mishaps and to manage the emergency situation during a fire in the proposed project the following activities and precautions are proposed.

- Emergency evacuation plan
- Regular mock drills to create awareness on procedures to be followed in times of emergency situation/evacuation
- It will be advised to keep oxygen cylinders, medical kits and masks to prevent smoke inhalation especially for those with respiratory disorders for who smoke inhalation can be very dangerous.
- Plant manager will be advised to ensure that the firefighting equipment are in good working conditions in sufficient numbers

7.4.2 Electrical accidents

Electrical hazards can cause burns, shocks, and electrocution which can lead to serious injury and even death.

Prevention of electrical accidents

- Flexible cords connected to appliance should be wired to conform to the international colour code.
- The appliance should preferably be tested and certified by a national or reputed standards testing authority
- All electrical wiring, rewiring or extension work must be carried out by licensed electrical contractors. On completion, the contractors should test before electricity supply is connected.

• To ensure electrical safety in the facility, a current-operated Earth Leakage Circuit Breaker (ELCB) or Residual Current Circuit Breaker (RCCB) set to operate at a very small leakage current is recommended. In case of dangerous electrical leakage to earth, it should automatically cut off the supply of electricity.

7.4.3 Boiler hazards

Irrespective of the type of fuel being fired, boiler explosion causes long outage and loss of generation resulting in loss of life and property. Evaluating the cause, documenting it for corrective and preventive action is essential. Various failures in the boiler are caused by the following:

- Operation of burners with insufficient air for perfect combustion
- Boiler fouling increases the deposits in the tubes and risk of corrosion **Precautionary measures**
- Major exposed portions of the boiler unit to be thermally insulated
- Regular inspection of safety valves for proper functioning
- Optimization of convective exchanger arrangement to prevent corrosion
- Avoid flue-gas preferential path, leading to temperature stratification and ineffective heat exchange
- Necessary measures and training to be given to the personnel operating near the boiler

Though the first response to a disaster is the job of the local government's emergency services, it is always advisable to develop teams within the organization for taking immediate rescue action if possible.

7.4.4 Major explosion of chemicals/fire and toxic gas release in landfill or stores

a. Control measures during planning

- Ensure that the material collected is analysed before taking the material inside the premises.
- Ensure that well-covered storage space is available for incinerable waste material and the storage area is well ventilated to prevent accumulation and concentration of gases below the explosive and flammable limit. Avoid electric fittings inflammable material storages and use flameproof materials if felt essential.
- Compartmentalize storage to limit the stock quantity and risk of fire spread. Locate incinerable waste storages away from heat source and hot furnace areas. Provide communication facility and an adequate number of security personnel for 24 hours of manual watching.
- Installation of smoke detection and warning and fire hydrant with foam monitors, sprinklers, mist sprays and CO₂ flooding system in incinerable waste storage will help a lot in early detection and automatic firefighting. Provide separate storage for reactive chemicals. Provide spark proof equipment to handle solvent waste containers.

- Ensure sufficient gap between storage sheds are maintained as per national building code to prevent fire spread and easy movement of fire vehicles around the storage during an emergency.
- Windsocks with wind speed indicators are installed on the site to see the wind direction from any location. Lightning arrestors are installed to cover the whole site. Employ only qualified and trained employees to supervise the storage activities.
- b. Control measures during operation
 - Ensure public liability insurance cover is in force for the site. Plan for the disposal of low flash point materials immediately on arrival and minimize inventory of these materials and flammable materials. Reactive materials shall be separated and stored away from the flammable materials store. Display No Smoking warning boards around the waste material storages. Do not allow any source of heat or spark in material storage.
 - Ensure static electricity is discharged from material containers by bonding the containers. Maintain sufficient gap between stack for inspection and also for better ventilation. Do not use mechanical handling equipment which produce sparks or static electricity.
 - Use spark-proof equipment while handling low flash point and waste containing solvents. Ensure good housekeeping is maintained in and around storage. Maintain a record of the quantity of material stock and the MSDS of material in each shed for giving the required information to disaster management team on arrival at the site. Install and maintain a sufficient number of appropriate first aid fire appliances and ensure the approach way is not blocked.
 - Train all the employees in first aid, fire-fighting and the procedures to be followed in case of an emergency. Replace leaky containers and clean spillage immediately. Remember inhaling gas generated due to a fire or explosion is dangerous. Use of Self-Contained Breathing Apparatus (SCBA) is mandatory for all rescue and firefighting work in case of an explosion or fire. Check the wind direction and inform everyone to stand on the upwind direction through the public address system or through phones. Advice evacuation of people at site and surrounding if found necessary.
 - Try and put off the fire with the help of available hand appliances, fire hydrant water using internal trained employees. Bring all available fire-fighting appliances and also get help from nearby industries in control and rescue operations only if they are trained and have the required PPE to carry out the work safely. Phone numbers of nearby industries.
 - Inform state fire and police department about the disaster through phone or through messenger. Inform company authorities through the phone. Inform nearby hospitals of the possible gas that can release from the incident for quick treatment.
 - Inform fire service and police personnel about the potential of the gas emanated due to the reaction promptly. Block the road traffic at least 5 km distance depending on

the toxicity of the gas and the wind speed to prevent exposure of more number of public.

- If felt necessary, inform public living near the affected area to evacuate through a
 public announcement and by using media like radio and TV the direction of an
 escape route and advise them to use a wet cloth to cover the nose while moving. Put
 off the fire using the fire hydrant water and foam compound or with the help of fire
 extinguisher.
- Provide first aid to burn injuries by pouring cool water before shifting the victim to hospital: Phone Number of Hospitals: Shift the gas affected victims to a well-ventilated area and provide breathing oxygen.
- Check the extent of damage to the liners if any and arrange for immediate repair based on the need. Prepare a report of the incident and investigate and find out the root cause of the accident.

7.4.5 Contamination of soil and water sources due to leakage of contaminants

a. Control measures

- Before commencing the operations, a collection of soil and water samples from the site have to be carried out to establish the baseline data. Ensure public liability insurance cover is taken for the site.
- Make sure that the preparation of landfill pits is done as per the laid out standard. Special care should be taken while laying the liners such as visual check for damage of liner material and proper welding of joints to ensure that the leakage of leachate from the liner is absolutely nil also by conducting leak proof tests ultrasonic or X-ray tests.
- Avoid damage of liners during landfill operation by the use of sharp-edged objects such as cutting knives, dropping of crowbars and by moving the heavy vehicle on the liners. Contamination of water and soil due to leakage of leachate from the liners / due to overflowing from leachate ponds especially during rainy season spillage while pumping or spillage during handling operation to be avoided.
- The flooring of material stores should not have cracks and should not allow seepage of material. The floor should be provided with the bund wall and collection pit.
- Periodic checking of soil and water samples and compare data with baseline data at least once a month. If any adverse increase in parameters noticed an increase in the frequency of tests. Prepare comparative analysis data if found more, than the baseline data inform the pollution board authorities.

b. After the incident

If the operation is continued, the condition is going to be disastrous after some time. Hence it is necessary to initiate corrective measures as per the advice of the pollution control board. Follow the corrective measures mentioned after an earthquake and flood.

7.4.6 Release of toxic gases from the incinerator

a. Control measures

- Ensure public liability insurance cover is taken for the site. Analyze the combination of waste material that is proposed to be burned and check the possibility of toxic gas generation and get the written report from the lab before starting to feed the waste material into the incinerator.
- Install windsocks and wind speed monitor at site visible from all points. Employ
 qualified and well-trained operators to operate the incinerator. Maintain the
 temperatures of gases at locations as per the incinerator operation instruction.
 Install instruments to detect and warn operators before the toxicity level reaches
 higher than the statutory limit.
- Monitor the toxic content levels at the chimney exhaust continuously during the operation. If any changes in parameters of gases noticed during the operation stop feeding the material and inform the lab manager immediately and take corrective measures. Re-analyze the sample and decide the combination of materials before the restart.
- Maintain the record of changes made for future reference. Inform the employees and the public living in the vicinity of the safety measures required to be taken in case of an accidental release.

b. After the incident

Evacuate everyone from the site and the vicinity to a safe place. Additional care has to be taken while evacuating, sick, old, infants and physically challenged persons. Detect the gas that is generated by analyzing the gas and its toxicity level. Provide first aid to victims by removing them to the safe and well-ventilated area. If necessary send the victim for treatment with information of the type of gas victim is exposed to.

7.4.7 Hazards due to combustibles

Hazards during storage and handling of combustible materials like plastics, paper and wood are very common. In the current expansion project, facilities for recycling of waste paper and plastic are proposed. Hence there are chances of hazards due to these combustible materials.

When the inflammable material is crushed, conveyed and stored, the risk of fire increases as these materials are usually dry and need only low ignition energy to ignite. The extent of damage due to fire in a waste recycling facility can occur due to several reasons like the oxygen content of the material, particle size and shape, moisture content, turbulence etc. A fire in these units can spread very quickly. Therefore, a fast-acting fire protection system or safety measures to mitigate the conditions is required.

Control measures

• A well-defined process for managing plastics and paper shall be in place not to let the waste build up and the waste shall be compacted to reduce its volume.

- The combustible materials shall be stored in containers made of non-combustible material. Generally, metal bins shall be used as they don't burn and won't add to the fire. A rubber lid shall be provided on the top of the containers to prevent fire.
- Where possible, access is restricted to the areas where waste is stored.
- Rubbish containers shall never be overfilled and always kept securely shut.
- Paper bales shall be arranged in an interlacing pattern rather than arranging directly on top of each other. This will reduce air-flow and fire intensity.
- Oxidant reduction can be accomplished by adding inert gas to enclosed processes in order to reduce the oxygen concentration to a level below that required for ignition to occur.

7.4.8 First aid and emergency procedures

Burns can cause due to acid spillage and leakage of electricity. Curative measures for any issues of burns and first aid procedures are given in **Table 7.10**.

	Burns covering small area		Burns covering extensive area
i.	Allow cold tap water to run	i.	Cover burned areas with a sterile dressing or clean
	gently over the area or		cloth and lightly bandage. If clothing is adhering, do
	immerse in cold water.		not disturb; leave the clothing alone.
ii.	It may be necessary to	ii.	Keep the person warm. If a person is not
	cover with gauze or a clean		nauseated, he may have sips of water.
	handkerchief, and bandage.	iii.	Arrange for immediate medical care.

Table 7.10 First aid for burns

7.5 Emergency preparedness

An emergency will be declared if an untoward event, i.e., fire, major fuel/inflammable material spillage or a major injury / accident occurs and requires the mobilization of all possible resources to handle the same. In view of the hazardous nature of products/process handled at the project site EPP is prepared. The plan is based on various probable scenarios like fire, explosion, natural calamities etc. The consequences arising out of such incidents are accurately predicted with the help of latest techniques available and mentioned in preceding sections.

The EPP is outlined in two sections. The first section explains the organizational set up, operational systems, actions on site, link with off-site emergency plan. The second section discusses the disaster management plan and mitigation measures after commissioning of work at site.

7.6 Organizational set up and infrastructure for emergency operations

The organizational set up for emergency operations is given in **Table 7.11** and the required infrastructure is summarized below.

Emergency Site	Incident	Emergency
	Controller	Administration
		Coordinator
Land fill, SEPs, Incinerable waste stores,	HOD	HOD (P&A)
waste storage sheds and stabilization unit	(Operations)	
Laboratory	HOD	HOD (P&A)
	(Laboratory)	
Material stores, workshop, D.G set, diesel	Store In	HOD (P&A)
stores, open stores, transformer area	charge	
Administrative, weighbridge, security, sampling	HOD (P&A)	EHS In charge
bay, canteen, overhead water tank area		

 Table 7.11 Organizational set up for emergency operations

Emergency Control Room- Emergency control room is to be set up and marked on the site plan. The control room will be the main focal point in case of an emergency, from where the operations to handle the emergency are directed and coordinated. It will control all the site activities and should be furnished with external and internal telephone connections, list of essential telephone numbers, list of key persons and their addresses.

Assembly Points- Assembly points are to be set up farthest from the location of likely hazardous events where pre-designated persons from the works, contractors and visitors would assemble in case of emergency. Up-to-date list of pre-designated employees of various departments (shift-wise) must be available at these points so that roll call could be taken. Pre-designated persons would take charge of these points and mark presence as the people come into it.

7.6.1 Roles and responsibilities of emergency personnel

The general roles and responsibilities of the emergency personnel involved are tabulated in **Table 7.12**.

Emergency Control Team		Roles and Responsibilities	
Members			
Emergency	Project	Assess the magnitude of the situation and decide	
Controller	Manager (Operations)	 if staff needs to be evacuated from their assembly points to identify safer places Exercise direct operational control over areas other than those affected Undertake a continuous review of possible developments and assess in consultation with key personnel Liaise with senior officials of police, fire brigade, 	
		Liaise with senior officials of police, fire brigade medical and factories inspectorate and provide	

Table 7.12 Roles and responsibilities of the emergency personnel

Emergency Control Team		Roles and Responsibilities
Members		
		 advice on possible effects on areas outside the factory premises Look after rehabilitation of affected persons on discontinuation of emergency.
Incident Controller	Respective HOD	 Assess the scale of emergency and send information to the emergency controller Direct to shut down of operations and try to minimize further aggravation of the incident Ensure that all key personnel and help from fire brigade is called for Communicate continually with emergency controller and inform all developments as appropriate Conduct search for causalities
Fire and Security Officer	EHS In-charge	 Co-ordinate closes down of operations as requested by the Incident Controller Advise fire and security staff in the factory of the incident zone and cancel the alarm Announce on Public Address System (PAS) or convey through telephones or messengers Arrange for additional extinguishers, fire water, pumps etc. from time to time
Emergency Administration Co-ordinator	HOD (P&A)	 Arrange head count of personnel at assembly point, main gate, as well as the personnel at emergency site Assist emergency controller in communicating about nature of assistance required from civic authorities Direct relief team to proceed to the emergency site under advice of the project head/EHS incharge.
Security Co-ordinator	Security In- charge	 Stop entry / exit of all vehicles other than fire brigade Arrange to park all loaded / partly loaded trucks in a safe place Keep control over the employees assembled near the gate and not allow them to go near the scene of incident

7.7 Operational systems during emergency

7.7.1 Communication system

There are different types of alarms to differentiate one type of an emergency from other such as - fire or gas, normal fire siren, emergency/evacuation and high-pitched wailing Siren. Apart from these alarms, an adequate number of external and internal telephone connections should be installed for passing the information effectively.

7.7.2 Warning system and control

Control Centres - The control centres should be located at an area of minimum risk or vulnerability in the premises concerned, taking into account the wind direction, areas which might be affected by fire/explosion, toxic releases, etc.

Emergency Services - Under this, each site should describe the facilities of fire-fighting, first-aid and rescue. Alternate sources of power supply for operating fire pumps, communication with local bodies, fire brigade, etc. should also be clearly indicated.

7.8 On-site emergency plan

An on-site emergency is caused by an accident that takes place in plant itself and the effects are confined to the premises involving only the people working in the project site. Therefore the onsite emergency plans deal with handling of emergency within the plant boundaries mainly with the help of proponent's own resources. The following steps will be followed in case of an emergency at the site:

- There is one long siren for the declaration of emergency and three intermittent sirens for the termination of emergency. On hearing the emergency siren, all the people will immediately stop their works and come to the assembly point. HOD (P&A) or his nominee will locate the emergency site and inform the same to the EHS In charge and Project Head. In case of failure of alarm system, information shall be conveyed to the telephone operator who will make announcement through PAS installed. If everything fails, a messenger could be used for sending the information.
- The project head, EHS in-charge and emergency control team will move to the incident site. The HOD P&A will select people gathered at the assembly point and direct them to the incident side depending on the necessity. Emergency Administrator will go to ECC and activates the emergency plan.
- The in-charge of general store/work shop will search for the emergency at store/workshop surroundings, starting from fuel storage, open stores, temporary stores etc.
- The landfill supervisor will look for emergency around landfill.
- The main gate security will sound the emergency siren under instructions of the Incident Controller, to declare emergency.
- The emergency administrator is informed about the incident with details of place, magnitude of mishap and follow instructions.
- The emergency administrator moves to emergency control centre, activates the emergency plan based on the feedback obtained from the Incident Controller or other reasonable sources

7.9 Off-site emergency plan

When the damage extends to the neighboring areas, affecting local population beyond plant boundaries, off-site emergency plan is put into action in which quick response and services of many agencies are involved. The off-site emergency plan is presented in **Table 7.13**.

S.No	Type of Emergency	Preventive and Control Measures
1	Spillage of waste during transport.	• Check and repair containers before sending to the generator's site.
		 Train the driver and cleaner to seal the container doors properly before lifting the container on the truck and on spill clean-up procedure. Ensure the spill kit and PPE is available in the truck for use in case of emergency.
2	Collision with other vehicle, pedestrians, trees or objects at the side of the road and injury to persons / damage to vehicle due to accident.	 Hire drivers who have valid license and well trained in hazardous waste transport. Ensure vehicle is well maintained and certified before it is sent out of the gate. Maintain phone numbers of authorized hospitals, specialist doctors, police station, and the fire station in the vehicle also paint the paint the phone no of the unit on the vehicle. Inform authorized hospital over phone. Report the matter to nearby police station and project authorities. Based on the seriousness the site in-charge will send the unit Personnel manager and the site transport in-charge to the accident site without delay. Take care of the injured without any delay and the unit personnel manager will follow up the requirement of further treatment. The transport in-charge and the personnel manager will deal with the police department for the release of driver and the vehicle.
3	Toppling of truck and spillage of waste.	 Hire only qualified drivers. Carry the MSDS issued by the waste generator Barricade the area till the resumption of normalcy. Contain and lean the spillage using the spill kit. Report to project official and inform pollution control board officials. Complete rescue work of the truck.
4	Fire on waste material during transport.	 Ensure fire extinguishers are available in the truck Ensure that the driver and cleaner are trained in the use of fire extinguishers. Inform the driver and cleaner, MSDS detail of the waste

Table 7.13 Off-site emergency plan

M/s Ramky Enviro Services Pvt. Ltd.

S.No	Type of Emergency	Preventive and Control Measures
		from the comprehensive analysis and the easy identification method before sending them for collection.
		• Park the vehicle at the side away from busy area.
		• Avoid inhaling the smoke or gases emanated due to the fire.
		• Stand on up wind direction.
		• Barricade the area and stop other vehicle movement if fire is uncontrolled.
		• Inform the nearest fire station and police the exact location where the vehicle is parked and the details of MSDS of the material on fire.
		• Maintain the phone numbers including mobile numbers of fire station, police station, waste generator and company emergency team members in the vehicle.
		• Give cool water bath as first aid to persons if at all there are burns and send for further treatment to the nearest hospital.

7.10 Disaster management plan

Natural disasters can neither be predicted nor prevented. Most disasters such as earthquakes, floods, hurricanes, etc., are natural and cannot be prevented. But we can learn to deal with the difficult situations that arise due to them. To minimize the extent of damage consequent to any disaster, restoration of normalcy is the main purpose of DMP. Though the first response to a disaster is the job of the local government's emergency services, it is always advisable to develop teams within the organization for taking immediate rescue action if possible. The project authorities have to prepare detailed disaster control measures.

7.11 Geology and hydrogeology

The project area is situated on a plain land and belongs to the plateau region, physiographically; and belongs to Mailkal hill range. The landform, in the study area within 10 km radius, consists of hills and undulating plains. The topographic elevation, in the study area within 5 km radius, is ranging from 430 to 650 m amsl (meters above means sea level), and average elevation within 5 km radius is 540 m amsl, the terrain is with slope of steep to very gentle land surface and is sloping towards northwest direction. And, at the project site area, the elevation is ranging from 453 to 461 m amsl; the terrain is with gentle undulating plain land surface and is sloping towards southwest direction, locally, at site. (reference, elevation data, Shuttle Radar [SRTM]). The contour map of the study area within 5 km radius is shown in **Figure 7.4**, and the contour map of the project site is shown in **Figure 7.5**.

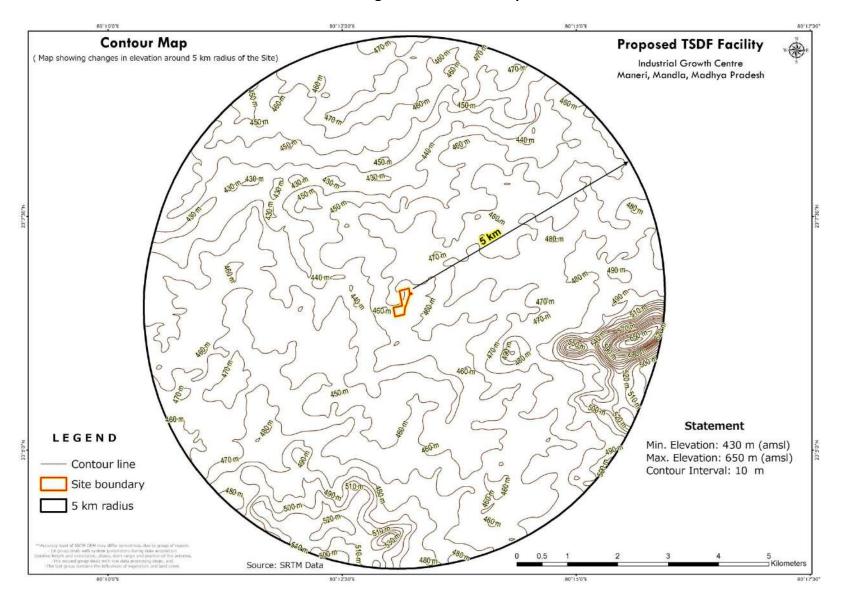


Figure 7.4: Contour map

M/s Ramky Enviro Services Pvt. Ltd.

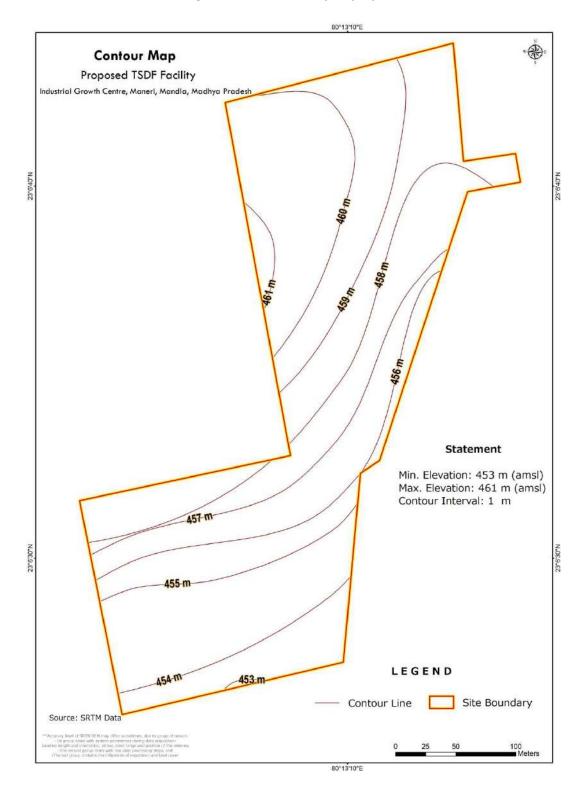


Figure 7.5: Contour map of project site area

The climate is tropical climate with hot wet and dry, as per Koppean climate classification, is covered in 'Aw' classed as 'tropical savanna climate'. The climate in general is hot and dry summer, wet and humid rainy season and dry cool winter. The seasons are, the winter from December to February, the summer from March to May, and the rainy season from June to December months are the regular occurring seasons.

The southwest and northeast monsoons are the rain occurring events in addition to the rains occurring due to natural and cyclonic depression.

The natural drainage consists of ponds and lakes, streams and rivers. The drainage system is showing a dendritic type of drainage pattern. Some streams originate at the uplands in the study area flowing towards major streams then to the river. The water flow in these water courses is of ephemeral nature, that is, flow during rains. Also, there are minor ponds and lakes which are sparsely spread and occupied the agricultural lands, and are multi-used mostly for irrigation, which also act for natural groundwater recharge. The flow of water in these water channels is governed by slope, geomorphology, land use and land cover, and the rains. The drainage basin falls in Narmada basin. The drainage map of the study area within 5 km radius is shown in **Figure 7.6**.

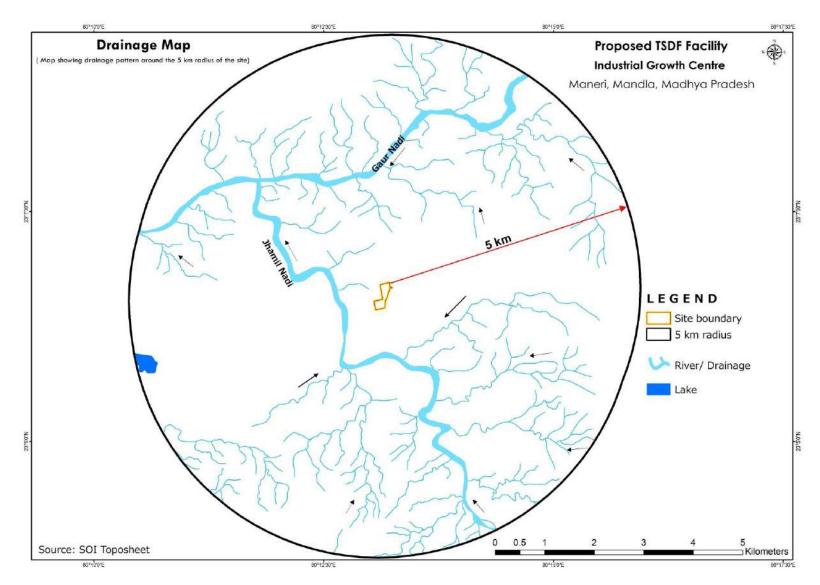


Figure 7.6 Drainage Map

Geology

The study area is underlined by various geological formations ranging in age from Archaean to recent. The major rock types observed in the study area are basalts of Cretaceous to Eocene age. Below the topsoil layer lies the hard rock formations consisting of basalts or Deccan traps. Deccan traps form the most important formation in the district. The basalts occur and spread as flows or beds. The basalt rocks are dark coloured, hard and compact. Their composition mainly consists of silica, feldspars and glass; and their rock texture varies from fine to medium grained. They are differentiated into a succession of basaltic flows as interflow zones of red/green below varying thickness. The 500 metre thick lava sequence of district has been divided into four formations on the basis of litho characters, type of flow and their long distance continuity. All the formations exhibit thickening in the center, thinning out in the marginal area. Below is the general (Mandla district) geo-stratigraphic succession.

Age	Formation/Group	Lithology
Quaternary	Alluvium	Top-soil, alluvium of unconsolidated sand, silt, clay and gravel.
Pleistocene	Laterite	Compact, ferruginous and weathered product of deccan traps
Cretaceous to Eocene	Deccan trap	Basaltic lava flows
Lower cretaceous	Lameta beds	Limestone and sandstone
Archean	Precambrian	Granite and gneiss

The rocks in this area have altered in the very past. The natural landforms such as plateau, mesa/butte, denudational and residual hill and valley are the physical land features present in the study area. The plateau has fairly level ground; slightly to moderately dissected and at some places it would be undissected. The mesa and buttes are isolated flat-topped hills or ridges having very steep slopes. The valleys are in small aerial extent occupied at topographic lows by streams and rivers mostly. A diagram of lithostratigraphy of Mandla area shown in **Figure 7.7**. There are no major geological lineaments present near the project site area (reference: geological and mineral map of Madhya Pradesh of Geological Survey of India).

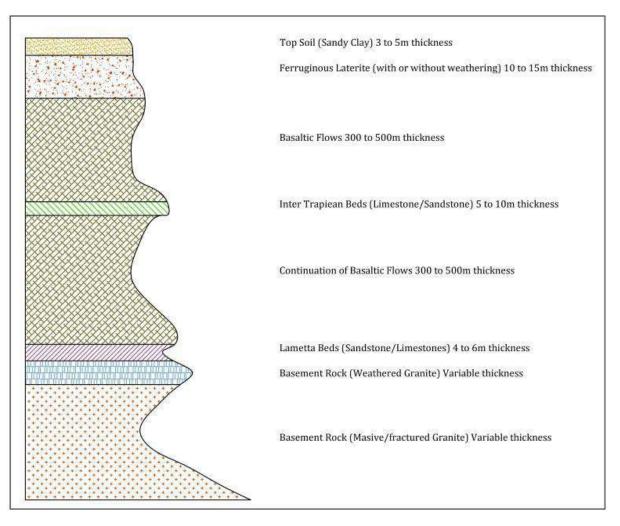


Figure 7.7 Litho-stratigraphy of Mandla area

Source: Central Ground Water Board of India district report

The soil in this area is spread mainly with black soil also known as black cotton soil which is derived from the surrounding basalt rocks. The color of this soil will be medium black to dark black. They are mostly fine varying with sandy, silty, clayey loam textures. Their thickness varies from place to place. And found are the alluvial soil in the major stream and minor river portion areas. They consist mostly of sand, silt and clay and are of narrow and limited aerial extent only. The soil is of residual nature consisting generally of sandy loam to clayey loam types; shallow to deep depth. Also, there are mixed soil types at places. These are mixed red and black soil types with red, brown and dark yellow color types. They are developed from granite gneiss and quartzite schist rocks. Their texture includes fine to coarse textural types.

Regarding mineral resource occurrences, the region is a source of minerals such as bauxite, dolomite, ochere, fuller's earth (Mandla district). And, at project site area, the site land is not located on any potentially mineable mineral deposit (reference: geological and mineral map of Madhya Pradesh published by Geological Survey of India, year 2005).

Hydrogeology Groundwater occurrence and scenario

Basaltic lava flow is the main water bearing formation of the study area. Basaltic flows show a lot of variation in lithological and structure features, which influence occurrence movement and recharge of groundwater in the study area. These laterally and vertically variation in characteristics in basaltic flow give rise to varying degrees of ground water productivity. Degree of weathering and topographic setting plays a major role in respect of productivity of wells. In the study area groundwater occurs in weathered and fractured basalts. These basalts show a vertical variability in permeability. The inter flow zone between two basaltic flows at depth act as conduits for groundwater flow. Groundwater in basalt occurs under confined to semi confined conditions.

The depth to water level, during the pre and post-monsoon season, would be ranging from 4 to 8 meters and 4 to 5 meters below ground level, respectively. The change in water levels is with both rise and fall. The seasonal period shows that, the water level changes with declining levels varying with 0.02 to 0.14 meter per year (reference: Central Ground Water Board of India report, Mandla district, Madhya Pradesh, 2013 year). Ground water majorly extracting by way of constructing bore wells and open wells.

Groundwater resource and classification as per Central Ground Water Authority (CGWA)

The dynamic groundwater resource potential was estimated as per the methodology given by the groundwater estimation committee. According to the revised methodology, the resource assessment is done based on the percentage of groundwater utilization. Regarding the dynamic ground water resources, the stage of development in the Bijadandi block of Mandla district is with percentage of categorized as 'safe' (reference: Central Ground Water Board [CGWB], Block wise Ground Water Resource Assessment-2017). As per the Water Resources Department of Madhya Pradesh state, the groundwater scenario map data of 2016 shows, the Mandla district is covered in the zone of 'safe' category (reference: Water Resources Information & Management System (WRIM), Water Resources Department, Government of Madhya Pradesh).

Water conservation and groundwater development

No artificial rainwater recharge structures are proposed within the facility (due to the nature of facility i.e., hazardous waste management) to eliminate the probability of groundwater contamination. However, it is proposed to make proper utilization of rainwater collected from within the facility. A HDPE lined rainwater holding pond has been designed to hold rainwater of first 30 minutes rainfall. The rainwater thus collected, after treatment as necessary, shall be used for various uses (dust suppression, floor washings, toiler flushing, greenbelt, etc.). The remaining rainwater will be diverted into proposed storm water drains (concrete) designed meeting the requirement and diverted into natural drains.

Geohazards

The hazards like: soil hazard, earthquake, also cyclonic storms are the natural occurring events which might occur and could cause a hazard threat in this area.

About the soil hazard, the facility stores and uses many types of materials which are in the form of solid and liquid; the liquid like oil and fuel, toxic and non-toxic materials, chemical, hazardous and non-hazardous substances or material would be stored in the project site area. The improper maintenance and accidental spillages of these on the top-soil will contaminate the soil horizons, thus deteriorate the quality and lead to soil pollution. These chemicals can also enter and/or infiltrate through soil horizons when mixed with water, especially rainwater, percolate into the ground and there contaminate the groundwater resources. During the rains the surface runoff from the contaminated surface soil areas spreads and further contaminates the nearby also far-off areas causing hazards on the surrounding soil and land environment also the surface water bodies such as lakes, streams, rivers also the groundwater resources.

Regarding the earthquakes, as per earthquake hazard map of Madhya Pradesh state, the project site area is covered in the seismic 'Zone-III' classed as 'Moderate damage risk zone (MSK-VII)' which is indicating a moderate vulnerability to this event (reference: Madhya Pradesh Earthquake Hazard Map of Vulnerability Atlas of India-2019, Building Materials & Technology Promotion Council [BMPTC] of Ministry of Housing & Urban Affairs of Government of India (map prepared as per seismic zones of India [Bureau of Indian Standards, IS 1893-Part-1: 2002)]. The earthquake hazard map of Madhya Pradesh state marked with and showing the tentative location of the project site is shown in **Figure 7.8** (map on left-side).

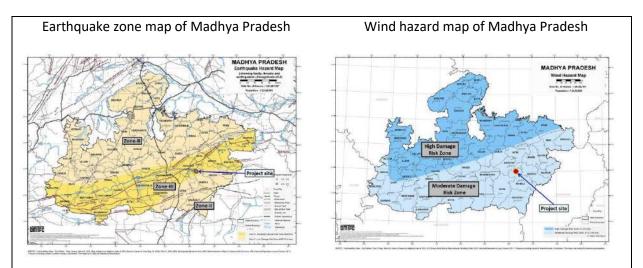


Figure 7.8 Natural hazard maps

Map source: Vulnerability Atlas of India, Building Materials & Technology Promotion Council (BMTPC) of Ministry of Housing & Urban Affairs of Government of India

And, as per the wind hazard map of Madhya Pradesh state, the project site is not covered in the zone of 'High Damage Risk Zone-B (Vb=47 m/s)'. The wind hazard map of Madhya

Pradesh state marked with and showing the tentative location of the project site is shown in **Figure 7.8** (map on right-side). The very high rainfall events are mostly caused by the cyclonic depressions in the Bay of Bengal sea which is very far away. As per flood hazard map of India, the project site is not covered in the zone of 'area liable to floods', so the project site area is not vulnerable to flood events. (reference: Vulnerability Atlas of India-2019, Building Materials & Technology Promotion Council (BMTPC) of Ministry of Housing & Urban Affairs of Government of India).

CHAPTER 8

PROJECT BENEFITS

Chapter 8

Project Benefits

8.1 Introduction

The Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, prevent the industries from dumping their solid wastes indiscriminately. At the same time, provisions have been made for the industries to dispose off their wastes in a systematic and scientific manner and the pollution control boards have been asked to ensure it. In view of this, the proposed project would minimize the risk involved in hazardous waste management by way of transportation and waste movement through manifest and regular monitoring of such facilities would be better and feasible as compared to individual captive facilities adopted by industries.

8.2 Benefits of the project

The main benefits of the proposed project are:

- Facilitating better management of hazardous wastes.
- Provides a one stop solution for the management of various types of wastes.
- Minimizes pollution load on the environment with an additional benefit of green and clean surroundings.
- Possibility for recovery of materials thereby conserving the natural resources.
- Management of wastes is relatively easier and economically viable at a common facility
- Most viable option in the absence or availability of expertise.
- Reduced environmental liability due to captive storage of hazardous waste in the premises of industries
- Better occupational health and safety at individual industry levels
- Prevention of natural resource contamination

8.3 Benefits of processing and resource recovery from E-waste

Almost all materials used for the manufacture of electronic equipment can be recovered to make new products. Metals, plastics, glass etc., can be turned into new materials and products. For example, electronic equipment contains a number of metals such as gold, silver, platinum, palladium, copper, tin, and zinc that could be recovered. These metals are used by various industries for making jewelry, plating, electronics, automotive and art foundries. Plastics recovered from the electronic equipment are recycled into plastic components for new electronic devices or other plastic products such as garden furniture, license plate frames, non-food containers and replacing automotive parts.

Recycling e-waste helps protect the environment in a number of ways. Recovering these materials avoids the need to mine and process new materials, which in turn, conserves our natural resources thereby avoiding air and water pollution as well as greenhouse gas emissions that are caused by manufacturing virgin materials.

8.4 Benefits of bio-medical waste treatment

Inappropriate treatment and disposal of bio-medical waste contributes to environmental pollution. Indiscriminate dumping of these wastes, uncontrolled burning/incineration causes air water and soil pollution. Thus, proper bio-medical waste management will help control nosocomial diseases (hospital acquired infections), reduce HIV/AIDS, sepsis, and hepatitis transmission from dirty needles and other improperly cleaned / disposed medical items, control zones (diseases passed to humans through insects, birds, rats and other animals), prevent illegal repacking and resale of contaminated needles, cut cycles of infection and avoid negative long-term health effects like cancer, from the environmental release of toxic substances such as dioxins, mercury and others.

8.5 Benefits of landfill

Following are the benefits offered from landfills:

- > Landfills minimize the impact of solid waste disposal on land.
- > Can produce energy by the conversion of landfill gas.
- The waste products of landfills can be used as direct fuel for combustion or indirectly they can be processed into another fuel.
- Up on completion, the landfill site can be reclaimed and used as parks /farming land / solar power parks.
- Control odors emanating from indiscriminate dumping of hazardous wastes in open areas.

8.6 Benefits from recycling facilities

Recycling is the process of making or manufacturing new products from a product that has originally served its purpose. If these used products are disposed off in an appropriate and environmental friendly way, the process of recycling has been set in motion. The recycling facilities proposed in the project and the benefits from these facilities are discussed below:

- Used oil
- Spent Solvents
- Waste paper
- Waste plastic
- AFRF
- Lead

8.6.1 Used oil recycling

To set an example, just one gallon of used oil can contaminate 1 million gallons of water. Thus, recycling used oil keeps it out of our rivers, lakes, streams and groundwater. To recycle used oil, processors and refiners are used which remove water insoluble dirt, heavy metals, nitrogen, chlorine and oxygenated compounds from the oil drained from automobiles or other machines. The resulting product called "refined" oil must meet the same stringent refining, compounding and performance standards as virgin oil for use in automotive, heavy duty diesel and other internal combustion engines. Extensive laboratory testing and field studies conclude that refined oil is equivalent to virgin oil if it passes all prescribed tests.

The same consumers and businesses that use regular oil also can use refined oil, since refining simply reconditions used oil into new, high-quality lubricating oil. Any vehicle maintenance facilities, automobile owners and other machinery maintenance operations that use oil also can use refined oil. The main benefits of used oil recycling are given below:

- Recycling used oil keeps it from polluting soil and water.
- Motor oil does not wear out. It just gets dirty. So recycling oil saves a valuable resource.
- Less energy is required to produce a gallon of redefined base stock than a base stock from crude oil.

8.6.2 Spent solvent recycling

Waste solvent recycling means reducing the amount of local, state and central toxic release inventory. Recycling waste solvents keeps excess contaminants from entering water systems and damaging the environment. Recovering solvents reduces emissions and cuts down raw material costs. Some of the benefits due to spent solvents recycling are as follows:

- Reduces environmental impact by reducing the volume of solvents destined for disposal at incineration facilities.
- Reduces the amount of hazardous waste generation
- Reduces the amount of virgin solvents for manufacturing
- Where waste is suitable for fuel blending a more cost effective solution will be provided.

8.6.3 Waste paper recycling

- Reduces pressure on trees
- Conserves energy
- Conserves water
- Reduces air and water pollution
- Reduces Greenhouse Gas Emissions

8.6.4 Waste plastic recycling

Plastics are becoming increasingly easy to recycle. Besides the invention of new plastic recycling technology, governments all over the world have plastic collection schemes in place.

- Recycling plastic conserves natural resources and energy that would be required to produce plastic from scratch.
- When plastic is recycled, less plastic is sent to landfill and thus less of this material takes up room in our environment for hundreds of years. In fact, recycling one ton of plastic can save 7.4 cubic yards of landfill space.

8.6.5 Benefits of alternate fuel raw material recovery facility

- Low calorific value non-hazardous waste and inorganic materials can be used as a blender. However, the homogeneity of the mixers parameter is vital for the end user.
- The cement Industry can play an important role in the urgent global need for destruction of hazardous wastes like Polychlorinated bi phenyls (PCB), Persistent Organic Pollutant (POP), and ensuring the Destruction and Removal Efficiency (DRE) of 99.9999 %.
- Investigation proved cement kiln had the Lowest Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/DFs) emission reduced to the extent of 99.3% using Hazardous Wastes.
- Methane is a particularly potent Greenhouse Gases (GHG), and is currently considered to have a Global Warming Potential (GWP) 25 times that of CO₂. Reduction of about 1.6 kilograms (kg) of CO₂ per kg of utilized Refuse Derived Fuel.
- A holistic approach to waste management has positive consequences of GHG emissions. Co-processing proved to be a viable method to dispose off hazardous wastes.

8.6.6 Lead recycling

Lead is a mineral that has been in use for at least 5000 years. Current statistics reveal Current statistics reveal approximately 88 % of the batteries were Starting, Lighting & Ignition (SLI) automotive batteries with a lifespan of about 4 years accompanied by 8% of motive power type with a lifespan of 6 years. Further, 4 percent were a stationary type with a lifespan of 10 years. Widely researched facts conclude that 97 percent of the lead recycled was from lead acid batteries. Until a couple of years ago, the lead recycled as a percentage of apparent lead supply, was estimated at 63% with a recycling efficiency of 95%. The rest was from other metal sources including castings, sheet, solders and miscellaneous fabrications. The main benefits are as follows.

 Recycled lead is cheaper to produce than virgin lead. Recycled lead takes less than 25% of the energy required to produce lead from ore extraction.

- 2. Recycling of lead has a smaller carbon footprint than mining, conserves ore reserves, and reduces the amount of waste associated with primary extraction
- 3. A high recycling rate means that there is less opportunity for lead to end up in the waste stream where it would pose a health risk to people.
- 4. In recent decades, the amount of lead from batteries ending up in landfills has dramatically decreased, and as a result, overall flow of lead to landfills has dropped markedly.
- 5. By keeping lead out of landfills, recycling helps conserve landfills, and reduce the need for investment in controls to eliminate airborne particulate from incineration.

The proposed renewable energy (solar based) plant aims at making the proposed integrated facility self-sustainable in terms of power requirement, over a period of time. Solar panels shall be installed over the capped landfill, on top of the storage sheds etc. It is proposed to utilize solar lighting systems for street lights etc.

The proposed waste to energy aims at utilizing the high calorific value hazardous waste (i.e., the heat generated from the waste) to make power. The power generated from this plant shall be utilized for in-house requirement (if required) and the rest shall be supplied to the State Electricity Board.

Facilities for handling of Spent Pot Liner: Spent Pot Liner, referred to as SPL, has high carbon content which can be separated out and refined for further alternate uses. The facilities provide alternate treatment/recovery/recycling options rather than simply landfilling the SPL waste.

8.7 Improvements in the physical infrastructure

Ramky Foundation is the Corporate Social Responsibility (CSR) arm of the Ramky Group that has been striving to realize the dream of a green and clean earth. Ramky Foundation is a non-profit organization founded in 2006, with a motto towards sustainable growth. Ramky Foundation is proactive in promoting public interest by encouraging community development, and voluntarily reducing practices that harm the public sphere. RF has four thrust areas - natural resource management, women empowerment, education and health. Ramky Foundation is a signatory to the United Nations Global Compact and a Member of the Global Compact Network India.

The proposed project would proactively promote the public interest through provision of basic amenities such as roads, transportation, electricity, education, sanitation and healthcare facilities. This would also encourage community growth, development and improved socio-economic conditions and quality of life of the people living in the project area. The company shall also continue to have among its objectives the promotion and growth of the national economy through increased productivity, effective utilization of

material, manpower resources and continued application of modern scientific and managerial techniques, in keeping with the national aspiration; and the company shall continue to be mindful of its social and moral responsibilities to consumers, employees, shareholders, society and the local community.

The following physical infrastructure facilities will be improved due to the proposed project.

- Roads
- Transport facilities
- Electricity
- Housing facilities
- Water supply and sanitation

8.8 Improvements in the social infrastructure

Since agriculture is the main source of income for the local people in this area, the proposed project will additionally lead to direct and indirect employment opportunities. Manpower will be required during construction and operational phases of the project for various activities and ancillary services. Employees will mostly comprise unskilled labour hired locally from nearby villages. These villagers are expected to engage themselves both in agriculture and project activities which will enhance their income and lead to overall economic growth of the area.

Following are the changes in socio-economic status with the proposed project:

- A positive impact by way of raising income through agriculture and project activities.
- The project will in the long run help in the development of facilities like education, banking, communication, health, recreation etc.
- Better standards of living and greater social awareness.
- Better hygienic conditions, as solid waste being dumped at several places will be brought to one place for further treatment and scientific disposal.

8.9 Employment potential

The main advantage of the proposed project is direct employment generation (i) absorbs rural labor and unskilled workers (in addition to semi-skilled and some skilled) (ii) provides opportunity for seasonal employment thereby supplementing workers income from farming; and (iii) permits participation of women workers both during construction and operation phase. The maximum benefit will be for local villagers as they are easily accessible. Additionally it is estimated that a good number of jobs will be created as indirect employment opportunities at local/regional level due to contractual, marketing and associated jobs directly with the project. The other related employment due to transportation requirements, supply of essential items and services to the project site and other community services will be plenty.

8.10 Other tangible benefits

- > Additional housing demand and demand for rental accommodation will increase
- > Cultural, recreation and aesthetic facilities will also improve.
- Improvement in communication, transport, education, community development and medical facilities.
- > Overall change in employment and income opportunity.

8.11 SWOT Analysis

SWOT Analysis is a useful technique for understanding the strengths & weaknesses of the proposed project and also for identifying both the available opportunities and the possible threats that could be encountered in future. What makes SWOT particularly powerful is that, with a little thought, it can help the company uncover opportunities that are well placed to exploit and by understanding the weaknesses of the business, measures could be taken to manage and eliminate threats that would otherwise cause unexpected damages/losses to the company in future.

More than this, by looking through the SWOT framework, we can start to craft a strategy that helps us distinguish ourselves from the competitors, so that we can compete successfully in the market.

It views all positive and negative factors inside and outside the firm that affect the success. A consistent study of the environment in which the firm operates helps in forecasting/predicting the changing trends and also helps in including them in the decision-making process of the organization.

8.11.1 SWOT Analysis of Integrated Waste Management Facility

Many cities are facing the problem of overburdened landfill because of limited land availability and open dumping sites, without proper sanitary systems such as soil cover, leachate collection, effluent and leachate treatment systems there by polluting the environment through CH₄ emission and leachate intrusion into ground and surface water.

India is still struggling to decide the best option to treat and dispose of waste, due to heavy load of population, crowning increase in industrialization, urbanization, non-availability of suitable, sufficient land and due to financial constraints. India is still evolving with low waste management literacy among the public, lack of cooperation between the public and private sector and limited availability of the trained and skilled personnel in the waste management sector as being the prime obstacles in the waste management sector.



Figure 8.1 SWOT analysis

It was found that community support on waste management work was not entirely satisfactory. It appears that the socio-economic status of a city is positively correlated with the technical competence of the waste administrators and may determine attitudes of the inhabitant such as the ability/willingness to recycle solid waste and knowledge on how or where to recycle.

In Integrated hazardous waste management SWOT analysis was performed to formulate strategic action plans for solid waste management. It has allowed the introduction of a participatory approach for better collaboration between the community and Municipal Corporation. With the SWOT analysis, efforts were made to explore the ways and means of converting the possible 'threats' into 'opportunities' and changing the 'weaknesses' into 'strengths' with respect to implementation of integrated hazardous waste management programs in the future.

8.11.2 Materials and methods

This study was carried out for the first time by data collection for focused analysis using the SWOT method. For completing SWOT analysis through this methodology, three stages were implemented including desk analysis and field survey. The stages included:

Stage 1

A field survey was conducted from landfills and interviews with residents of the area surrounding landfill site to evaluate the influence of the landfill on the people and with residents of four different strata: the upper-class, middle-class, lower-class and rural areas to evaluate resident perceptions of solid waste management and willingness to participate in the system.

Stage 2

The external and internal data of the solid waste management, the landfill site and the inhabitant perception was determined to support the decision with the SWOT analysis. The internal analysis was a comprehensive evaluation of the 'internal environments', i.e., strengths and weaknesses, while the external analysis included the opportunities and threats that might arise when changes occur in the external environments during the implementation and operation of the solid waste management program.

8.11.3 Landfill site condition

The factors investigated as the 'Strengths' of the proposed project are

- Closed landfill site has no effect on the environment which can be used as a public facility in future
- The quantity of waste which is dumped on various places in unscientific method will decrease
- Industrialists would have increased awareness of proposed facility and would get used to scientific and safe disposal of waste generated by them

The factors investigated as the 'Weakness' of the proposed project are

- > Chances of accidental leakage of leachate onto ground or water aquifer
- > Chances of industrial accidents due to unforeseen situations

The factors investigated as the 'Opportunities' of the proposed project are

- Recycled waste from used lead, used oil, spent solvent, paper and plastic could generate revenue and also minimize load of solid waste for treatment
- RDF obtained could find application in some industries like cement manufacturing industries as an alternate source of fuel and thus be beneficial.

The factors investigated as the 'Threats' of the landfill are

- > Leachate pollution to the environment
- > Influence of dumping in the site area can result in the odor diffusion
- The land cannot be used for any activity other than for developing playground, parks, etc.

8.11.4 Strategies derived from the SWOT profile of the proposed project

- > Proposing the technology to recover reusable, recyclable material from wastes.
- Authority of the project can coordinate with local persons to educate them for employment opportunities.
- Maintain the project site more properly to prevent the effect to the surrounding area and environment with using the sufficient equipment and facilities, and the technology such as daily cover and insect prevention.
- Constructing the leachate treatment facility properly to prevent the impact of leachate to the environment under accidental leakage.

8.12 Conclusion

Through SWOT analysis of the proposed project, the strategies have been identified and formulated in relation to identified strengths, weaknesses, opportunities and threats. The strategies that resulted from this analysis were focused on the inhabitant participation and environment consideration. As a part of this, educating the inhabitant, increasing the role of student and young people to involve in the system, increasing the awareness, increasing the effort to recycle and encourage the habitant to use the recycled material were identified as

most promising strategies for the benefit of the environment, government, public and the company.

The strategies for the environmental consideration were also focused in managing the landfill site more properly. The strategies were concerned to prevent the bad effects of the proposed project to the environment and surrounding area. They included encouraging proper and liberal development of the greenbelt that acts as a remedy to all kinds of pollution problems.

As the proposed project itself is an environmental friendly project which strives to minimize various risks and hazards associated with non-scientific ways of industrial, biomedical and other hazardous waste disposal and also equips itself with the most advanced and scientifically reliable ways of handling all types of wastes with proper preparedness to tackle accidents and unexpected incidents, the projects has been found more beneficial to society for present and future needs of waste management.

CHAPTER 9

ENVIRONMENTAL MANAGMENT PLAN

Chapter 9

Environmental Management Plan

9.1 Introduction

Preparation of environmental management plan is required for formulation, implementation and monitoring of environmental protection measures during and after commissioning of projects. The plan indicates the details of various measures which have been proposed to be followed including cost components. Cost of measures for environmental safeguard should be treated as an integral component of the project cost and environmental aspects should be taken into account at various stages of the project mentioned below:

- > **Conceptualization:** preliminary environmental assessment
- > Planning: detailed studies of environmental impacts and design of safeguards
- > Execution: implementation of environmental safety measures
- > **Operation:** monitoring of effectiveness of built-in safeguards

9.2 Environmental management during Construction

Impacts during construction phase on the environment would be temporary in nature and are expected to reduce gradually on completion of these activities.

9.2.1 Air quality mitigation measure

For the proposed project, site leveling and grading will be carried out if required and where ever possible natural elevations shall be maintained. Leveling activity will be carried out only for providing roads, sewage network, storm water system, construction of sheds and administrative buildings. According to the engineering assessment, most of the excavated mud generated during construction activities will be reused within the project site for leveling during road lying, bunds construction around the land fill site, etc.

During construction period most of the dust generated will be from the movement of construction vehicles on unpaved roads. Unloading and removal of soil material shall also act as a potential source for dust generation. Following are the control measures proposed to mitigate the impacts of air pollution caused by fugitive and gaseous emissions:

- Regular water sprinkling on haulage roads to deliver continuous moisture to suppress dust in dust prone areas.
- Regulate speed of vehicles in unpaved areas to reduce fugitive dust created and reduce dust to a large extent.
- The duration of stockpiling will be as short as possible as most of the material will be used as backfill material for the open cut trenches for road development.

- Care will be taken to keep all material storages adequately covered and contained so that they are not exposed to situations, where winds on site could lead to dust / particulate emissions. Fabrics and plastics for covering piles of soils and debris is an effective means to reduce fugitive dust from the material stores/ warehouses.
- Spills of dirt or dusty materials will be cleaned up promptly so that the spilled materials do not become a source of fugitive emission. Similarly, spilled concrete slurries or liquid wastes will be cleaned up immediately before they can infiltrate into the soil/ ground or runoff in nearby areas.
- Temporary tin sheets of sufficient height (3 m) will be erected around the site of dust generation or all around the project site as barrier for dust control.
- Trees will be planted all around the project boundary and regularly watered to keep the area moist for most part of the day.
- Regular maintenance of machinery and equipment will be carried out
- All the vehicles used for construction activity shall have valid "Pollution under control" Certification.
- Ambient air quality monitoring will be carried out during construction phase. If monitored parameters are above the prescribed limits, suitable additional control measures will be taken.

9.2.2 Water quality mitigation measure

During site development necessary precautions will be taken, so that the runoff water from the site gets collected to working pit and if there is any over flow, will be diverted to nearby greenbelt / plantation area. During construction activity, the washed water from all the equipments will be diverted to the working pit to arrest the suspended solids and the settled water will be reused for construction purposes and for sprinkling on roads to control the dust emission, etc.

The domestic wastewater generated from temporary toilets used by the work force will be diverted to septic tank followed by soak pit. Therefore, impact on water quality due to proposed unit would be insignificant.

9.2.3 Noise mitigation measures

The use of noise generating equipment will confined during day time. Proper enclosures will be used for reduction in noise levels and wherever possible the noise generating equipment will be kept away from the human habitation. Temporary tin sheets of sufficient height (3 m) will be erected around the noise generating activity or all around the project site as barrier for minimizing the noise travel to surrounding areas. Therefore, impact on noise environment due to the proposed project would be insignificant.

Furthermore, all vehicles entering into the project will be instructed to maintain speed limits, and not blow horns unless it is required. Personal protective equipment like earmuffs, helmets

covering ears would be provided to the workers working near noise generating equipment and would see that workers use the protective gadgets regularly.

9.2.4 Solid waste mitigation measures

The solid waste generated during construction period being predominantly inert in nature does not create any pollution. However maximum effort would be made to reuse and recycle the construction and demolition waste. Most of the solid waste material will be used for filling/ leveling low-lying areas or as road construction material. Excess material will be given to local contractors for lifting and dumping in low lying areas. All attempts would be made to stick to the following measures.

- 1. All construction waste shall be stored within the site itself. A proper screen will be provided so that the waste does not get scattered.
- 2. Attempts will be made to keep the waste segregated into different heaps as far as possible so that their further gradation and reuse is facilitated.
- 3. Materials, which can be reused for purpose of construction, leveling, making roads/ pavement will also be kept in separate heaps from those which are to be sold or land filled

A majority of these materials are durable and have a potential for reuse. Construction waste can be used in the following manner.

- Sale/ auction of materials which cannot be used at the site due to design constraint
- Plastics, broken glass, scrap metal, used cement bags, etc., can be sent for recycling in the industries
- Rubble/ brick bats can be used for building activity, such as leveling, under coat of lanes where the traffic does not constitute heavy moving loads.
- Larger unusable pieces can be sent for filing up low laying areas.
- Fine material such as sand, dust, etc., can be used as cover material
- The unearthed soil can be used for leveling as well as for lawn development
- The broken pieces of the flooring material can be used for leveling in the building or can be disposed off
- The unused or remaining paints/varnishes/wood can either be reused or can be disposed.

9.2.5 Ecological aspects

During construction period, there could be clearing of vegetation in order to prepare the site for construction, the top soil from the construction area will collected and will be stored separately and will be used for greenbelt development. A comprehensive green belt program will be planned to improve the ecological condition of the region.

9.2.6 Site security

Adequate security would be arranged to ensure that the local inhabitants and stray cattle are not exposed to the potential hazards of construction activities. Round the clock, the site will be under vigilance by the security personnel appointed, to restrict their entry. All the mitigation measures mentioned above are tabulated and presented in **Table 9.1**.

	Table 3.1 Miligation measures during construction period
Air Quality	Water sprinkling on haulage roads in the project area. This activity will be
Mitigation	carried out at least twice a day, if need arises frequency will be increased on
Measures	windy days, in this way around 50% reduction on the dust contribution from
	the exposed surface will be achieved.
	The duration of stockpiling of excavated mud will be kept as short as
	possible, as most of the material will be used as backfill material for the
	open cut trenches and for road development.
	Temporary tin sheets of sufficient height (3 m) will be erected around the
	site as barrier for dust control.
	Tree plantations around the project boundary will be initiated at the early
	stages by plantation of 2 to 3 years old saplings using drip irrigation or by
	regular watering so that the area will be moist for most part of the day.
	All vehicles carrying raw materials will be instructed to cover with tarpaulin /
	plastic sheet, unloading and loading activity will be stopped during windy
	period.
	To reduce the dust movement from civil construction site to the
	neighborhood, the external part of the construction activity will be covered
	by plastic sheets.
Water	The runoff water from the site is collected in working pit and the settled
Quality	water is reused for construction activities. Over flow if any, will be diverted
Mitigation	to nearby greenbelt / plantation area.
Measures	The washed water from all the equipments will be diverted to the working
	pit to arrest the suspended solids and the settled water will be reused for
	construction purposes and for sprinkling on roads to control the dust
	emission, etc.
	The domestic wastewater generated from washrooms used by the work
	force will be diverted to septic tank followed by soak pit.
Noise	Noise generating equipment will be limited to day time.
Mitigation	Proper enclosures will be used for reduction in noise levels. Wherever
Measures	possible, the noise generating equipment will be kept away from human
	habitation.
	Temporary tin sheets of sufficient height (3 m) will be erected around the
	noise generating activity or all around the project site as barrier for
<u>.</u>	

Table 9.1 Mitigation measures during construction period

minimizing the noise travel to surrounding areas.
All vehicles entering into the project will be informed to maintain speed
limits, and not blow horns unless it is required.
Personal protective equipment like earmuffs, helmets covering ears would
be provided to the workers working near noise generating equipment and
would see that workers use the protective gadgets regularly.
All construction waste shall be stored within the site itself. A proper screen
will be provided so that the waste does not get scattered.
Attempts will be made to keep the waste segregated into different heaps as
far as possible so that their further gradation and reuse is facilitated.
Materials, which can be reused for purpose of construction, levelling,
making roads/ pavement will also be kept in separate heaps from those
which are to be sold or land filled.
Adequate security would be arranged to ensure that the local inhabitants
and stray cattle are not exposed to the potential hazards of construction
activities. Fencing will be provided all along the boundary.
Round the clock, the site will be under vigilance by the security personnel to
restrict entry of unwanted people to the site.

9.3 Management during operation stage

Necessary control measures will be undertaken at the design stage to meet the statutory requirements and towards minimizing environmental impacts. During project implementation period, special emphasis will be made on minimizing leachate/effluent generation and dust control at source. The specific control measures related to air emissions, liquid effluent discharges, noise generation, solid waste disposal etc. are discussed below:

9.3.1 Air quality management

The main activities from the proposed project which cause air pollution are as follows:

- Emissions from incinerator, Boiler and DG sets
- Particulates due to movement of vehicles and sweeping of roads
- Dust, odour and gas generation from secured landfill

The following methods of abatement will be employed for the air pollution control.

- Incinerator will be provided with a stack height meeting MoEF&CC guidelines. Spray dryer, Multi cyclone, Bag house, and Wet scrubber shall be used to control other pollutants.
- Boiler will be provided with a stack height meeting MoEF&CC guidelines. ESP shall be used to control other pollutants
- DG set will be provided with a stack height meeting MoEF&CC guidelines for proper dispersion of sulfur dioxide and oxides of nitrogen.

- Internal roads will be paved to reduce dust emissions. Speed restriction will be followed within the project and speed breakers will be provided at entry and exit points
- Gas management system in secured landfill will be provided
- Greenbelt will be provided along the internal roads and plant boundary

9.3.2 Odor control

The odor management is one of the issues in TSDF. The main aim is to minimize the number of sources of odor generation which exist in the site. To undertake direct management of odor generating sources that give rise to odor problems.

The mitigation measures proposed to minimize and control odor are as follows.

- Dilution of odorant by odor counteraction or neutralized by spraying odor masking agents such as ecosorb around odor generation areas at regular intervals.
- Covering the landfill area under operation, weekly with layer of earth, clay or a similar material.
- Covering of trucks carrying waste while transportation.
- The waste after combustion in primary and secondary stages the off gas/flue gases shall be passed through spray dryer, cyclone separator, activated carbon dry lime and wet scrubber. The odour will be removed during the above gas cleaning operations especially the activated carbon shall adsorb any organics if so present in the flue gases. The odour free gases shall be released into the atmosphere from a stack of minimum 30 m height.

9.3.3 Gas management

Land fill gas is generated as a product of waste biodegradation. In land fill, organic waste is broken down by enzymes produced by bacteria in a manner. Considerable heat is generated by these reactions with methane, carbon dioxide, nitrogen, oxygen, hydrogen sulfide and other gases as by products. Methane and carbon dioxide are the principle gases produced with almost 50-50% share. When methane is present in the air in concentrations between 5 to 15%, it is explosive. Landfills generate gases with a pressure sufficient enough to damage the final cover and largely have the impact on vegetative cover. Also because only limited amount of oxygen is present in a land fill, when methane concentration reach this critical level, there is a little danger that the land fill will explode. To minimize the gas generation in the proposed project incinerator is proposed for the incineration of organic based (high calorific) waste, hence gas generation is anticipated to be less. To manage the gas generated a venting system with flaring arrangement is proposed. If the gas generation is more, it will be diverted to canteen.

9.3.4 Water quality mitigation measures

The main sources of wastewater generation in the proposed project are wastewater from domestic use, leachate generation from secured land fill area, effluent from various facilities

including that used in processes and floor washing, maintenance etc. The leachate collected will be sprayed back into landfill for dust suppression, stabilization of hazardous waste, etc. the excess if any will be disposed into spray drier of the incinerator or treated and sent to solar pond (during phase I). The domestic effluent generated will be sent to septic tank. The effluent generated from floor washings, recycling activity, etc will be collected in collection tank followed by settling tank and the settled water is reused. The effluent is treated in ETP and recycled to incinerator or circulation back to system. The waste water generated from boiler and cooling tower used in ash quenching. There will not be any wastewater discharge to any nearby water body and adopts the zero wastewater discharge concept.

9.3.5 Noise mitigation measures

The main source of noise generation is due to the movement of vehicles carrying waste. All vehicles (drivers) entering into the project site will be informed to maintain speed limits, and not blow horns unless it is required. Necessary speed controlling bumps will be placed near weighbridge and entrance of the site.

Other areas where noise generation is anticipated are- Incinerator section, power plant area, DG set room etc. Necessary PPE like earmuffs, helmets would be provided to the workers working near noise generating equipment and would see that workers use the protective gadgets regularly. Regular maintenance of the equipment will be carried out as per the schedule given by suppliers. The following mitigation measures are proposed for controlling noise pollution:

- Acoustic enclosures shall be provided for all high noise level equipments.
- Ensure that all the design/installation precautions as specified by the manufacturers with respect to noise control are strictly adhered to
- Major noise generating sources are insulated by providing suitable enclosures
- Other than the regular maintenance of various equipment, PPE are provided to the personnel working in noise generating units.
- All the opening like covers, partitions are designed properly

9.3.6 Solid waste mitigation measures

The ash coming from the incinerator will be used as a daily cover for landfill along with soil and mud. The mitigation measures proposed during operation period are given in **Table 9.2.**

Air Qua	ality	Incinerator and Boilers will be provided with APCD and a stack height	
Management		meeting MoEF&CC Guidelines	
		DG set will be provided with a stack height meeting MoEF&CC	
		Guidelines proper dispersion of sulfur dioxide and oxides of nitrogen.	
		Internal roads will be concreted / asphalted to reduce dust emissions	
		Speed restriction will be followed within the project and speed breakers	

Table 9.2 Mitigation measures proposed during operation period

	will be provided at entry and exit points
	Gas management system in secured landfill will be provided
	Green belt will be provided along the internal roads and plant boundary
Odour Control	Dilution of odourant by odour counteraction or neutralizing by spraying
	odor masking agents such as ecosorb spray around odour generation
	areas at regular intervals.
	Covering the landfill area under operation daily with layer of earth, clay
	or a similar material
Gas	To minimize the gas generation in the landfill, the organic based waste
Management	will be diverted to incineration to the maximum extent possible
	To manage the gas generated a venting system with flaring arrangement
	will be provided, if the gas generation is more it will be directed to
	canteen
Water Quality	The leachate generated from landfill will be collected into leachate
Mitigation	collection pond.
Measures	The leachate collected will be sprayed back into landfill for dust
	suppression, stabilization of hazardous waste, etc. the excess if any will
	be disposed into spray drier of the incinerator or treated and sent to
	solar pond (during phase I)
	The domestic wastewater will be collected and treated in septic
	tank/soak pit or portable STP and reused for greenbelt
	The effluent from floor washings, workshop etc., will be collected,
	treated in O&G trap, settling tank and recycle back for dust suppression,
	etc.,
	The waste water from bio-medical sections will collected, disinfected
	and after necessary treatment reused for dust suppression on landfill
	area
Noise Mitigation	Acoustic enclosures will be provided for all the high noise generating
Measures	equipments
	Major noise generating sources shall be insulated adequately by
	providing suitable enclosures
	Other than the regular maintenance of the various equipment, ear plugs
	are provided to the personnel close to the noise generating units;
	All the openings like covers, partitions are designed properly.
Solid Waste	The ash coming from incineration plant will be used as daily cover in
Mitigation	secured landfill
Measures	The sludge generated in the leachate pond/ solar evaporation pond will
	be sent to secured land fill.

Occupational	Periodic health checkups for workers would be facilitated for early
Health & Safety	detection and control of communicable Diseases
	Will provide preventive measures for potential fire hazards with
	requisite fire detection, firefighting facilities and adequate water
	storage, etc.
	Provide regular training for workers in their respective fields

9.4 Post operation of landfill

A final landfill cover is usually composed of several layers, each with a specific function. The surface cover system must enhance surface drainage, minimize infiltration, support vegetation and control the release of landfill gases. The landfill cover to be adopted will depend on the gas management system. As recommended by the MoEF&CC, the final cover system must consist of a vegetative layer supported by a drainage layer over barrier layer and gas vent layer. The details of the landfill cover are given below:

- A 60cm thick compacted clay
- A HDPE geo-membrane liner of thickness 1.5 mm
- Geo net and 285 gsm Geotextile, 7-8 mm drainage composite
- Top soil 45 cm and vegetative soil 15 cm followed by vegetation.

The mitigation measures proposed during post operation period are given in Table 9.3.

Post Operation	Phase
Landfill	After closure of the landfill, the integrity of the final cover will be
maintenance	maintained. If any repairs are required it will be rectified as necessary.
	After closure of the landfill, management as well as environmental
	monitoring shall be continued for leachate, landfill gas and surface water
	for a period of 30 years or until harmful leachate is not produced for 5
	continuous years.
	After few years of closure, the leachate is observed to meet all discharge
	standards, the same shall be discharged directly to lined drains.
	The landfill shall be abandoned after 30 years of closure if concentrations
	of contaminants in all liquid and gaseous emissions from the landfill are
	observed to be below prescribed limits.

Table 9.3 Mitigation measures proposed	d during post operation period
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9.5. Greenbelt Development

The greenbelt will be developed for the proposed project in an area of 26400 sq. m (33 %) of the site area (80000 sq. m). along the boundary 15 m wide greenbelt shall be developed. In open spaces, along the roads adequate greenery will be maintained and shrubs will be planted in between the trees. Proper measure will be taken to maintain the greenery. Tentative

greenbelt action plan is given in **Table.9.4.** However the design of greenbelt plan will be prepared by horticultural expert during the execution of the project.

Preference will be given to native species, pollution tolerant species and also pollution indicators species to minimize the environmental impacts of the site on its surroundings. A list of plants suggested for greenbelt and avenue plantation as per CPCB guidelines is given in **Table 9.5**.

Greenbelt development will be carried out prior to the commencement of construction activities within the site. Odour controlling species like *Acacia farnesiana (Mexican plant), Vetiver, Eucalyptus, Osimum sanctum, Curcuma longa* and *Chrysopogon zizanioides etc.* will be planted around the processing facilities. An amount of around Rs. 20 lakhs has been allocated as capital cost for greenbelt development in the EMP budget.

S. No	Description	
	Area allocated (Sq.m.)	
1	Periphery Greenbelt (15m)	20115
	Landscape/Open spaces	2970
	Along the Road	It is already included in green belt
		provided along the boundary and also
		landscaping
	No. of Plants to be planted	
2	Along the Boundary	Around 540 Trees
	Landscape/Open spaces & Roads	Around 510 Trees
		Shrubs will be planted in between the
		trees
	Plantation Schedule	
3	Construction Phase – Along the	540 Trees & Shrubs will be planted in
	Boundary	between the trees
	Operational Phase – Along the Road	510 Trees & Shrubs will be planted in
	and Open spaces	between the trees
4	Budget Allocated	
	Capital Cost	Rs. 20 lakhs
	Recurring Cost	Rs. 5 lakhs
5	Manpower Required	Horticulturist – 1
		Gardener – 2

Table 9.4 Greenbelt development action plan

S.No	Botanical Name	Family Name	Common Name	S/T	Habitat	Height (m)	Individual no. of tree species to be planted
1	Azadirachta indica	Meliaceae	Neem Tree	Т	Tree	20	80
2	Millingtonia hortensis	Bignoniaceae	Indian cork tree	S	Tree	12	80
3	Acacia farnesiana	Mimoseae	Fragrant acacia	Т	Tree	14	80
4	Bauhinia variegata	Caesalpinaceae	Orchid Tree	Т	Tree	10	75
5	Delonix regia	Caesalpinaceae	Gulmohar tree	Т	Tree	15	80
6	Eucalyptus citriodora	Myrtaceae	Lemon Scented Gum	Т	Tree	20	80
7	Mimusops elengi	Sapotaceae	Spanish cherry	Т	Tree	15	40
8	Syzygium cumini	Myrtaceae	Black Plum	Т	Tree	20	55
9	Cassia fistula	Caesalpinaceae	Golden Showers	Т	Tree	12	80
10	Alstonia scholaris	Apocynaceae	Devil tree	Т	Tree	15	80
11	Shorea robusta	Dipterocarpaceae	Sal Tree	Т	Tree	30	40
12	Tectona grandis	Verbenaceae	Teak	Т	Tree	20	50
13	Roystonea regia	Arecaace	Royal Palm tree	Т	Tree	15	60
14	Bambusa vulgaris	Poaceae	Bamboo/Bans	Т	Perennial grasses	15	80
15	Ficus religosa	Moraceae	Peepal Tree	Т	Tree	20	30
16	Polythia longifolia	Anonaceae	False Ashok	S	Tree	15	60
17	Chrysopogon zizanioides	Poaceae	Vetiver grass	Т	Shrub	2	
18	Bougainvillea spectabilis	Bischofiaceae	Great Bougainvillea	Т	Shrub	8	
19	Curcuma longa	Zingiberaceae	Turmeric	S	Shrub	2	
20	Osimum sanctum	Lamiaceae	Holy Basil	Т	Shrub	2	Shrubs will be planted in b/w
21	Nerium indicum	Apocynaceae	Pink Oleander	Т	Shrub	5	trees
22	Ixora coccinea	Rubiaceae	Jungle geranium	Т	Tree	6	
23	Tecoma stans	Bignoniaceae	Yellow bells	Т	Shrub	5	
24	Hibiscus rosa sinensis	Malvaceae	Chinese Hibiscus	Т	Shrub	5	
25	Citrus Limon	Rutaceae	Lime of India	Т	Shrub	5	

Table 9.5 List of plant species for greenbelt development

Note: *S/T= Sensitive/Tolerant (to air pollution) Source: Guidelines for developments of green belts, CPCB

9.6. Corporate Environment Responsibility (CER)

Corporate Environment Responsibility has become an integral, self-regulating mechanism through which business monitors and safeguards its active compliance with the law and environmental standards. CER aims to embrace responsibility for the company's actions and encourage a positive impact through its activities on the environment, stakeholders, communities and the larger public.

Since inception, REEL as a responsible citizen has been engaged in community development and creation of sustainable livelihoods for the targeted beneficiaries. It played an active role in developing health, education, skill development needs of people living in the villages of project area. The following are some of the activities which are currently implemented by the REEL at other TSDF sites.

- Health check-up programs for children, mother, pregnant women & old age persons.
- Providing Drinking Water through bore wells
- Awareness on immunization, nutrition, sanitation
- Need based support to strengthen educational infrastructure of schools and Anganwadi centers
- Encouraging rural sports
- Women Empowerment through self-employability initiatives
- Green rallies and plantation drive in local villages
- Scholarships for the merit

The proposed project would proactively promote the public interest through provision of basic amenities such as roads, transportation, electricity, education, sanitation and healthcare facilities. This would also encourage community growth and development and improved socioeconomic conditions, and quality of life of the people living in the project area. The Company shall also continue to have among its objectives the promotion and growth of the national economy through increased productivity, effective utilization of material, manpower resources and continued application of modern scientific and managerial techniques, in keeping with the national aspiration; and the company shall continue to be mindful of its social and moral responsibilities to consumers, employees, shareholders, society and the local community.

CER fund shall be allotted as per the MoEF&CC office memorandum F.No.22-65/2017-IA.III dated 1st May 2018.

"The fund allocation for CER shall be deliberated in the EAC or SEAC or DEAC as the many case may be with a due diligence subject to maximum percentage as prescribed below for the different cases"

S.	Capital Investment /Additional Capital	Greenfield Project	Brownfield Project
No	Investment (in Rs.)	- % of Capital	– % of Additional
		Investment	Capital Investment
1.	≤ 100 Crores	2.0%	1.0%
2.	> 100 Crores ≤ 500 Crores	1.5%	0.75%
З.	> 500 Crores ≤ 1000 Crores	1.0%	0.50%
4.	> From 1000 Crores to ≤ 10000 Crores	0.5%	0.25%
5.	> 10000 Crores	0.25%	0.125%

The CER budget allotted based on the capital cost of the proposed project shall be **Rs. 80 Lakhs** (2% of the project cost Rs. 40 Crores). The details break up and activities considered under CER activities are given in **Table 9.6** below. In addition to the above, once the operations commence, CSR activities shall be taken up every year as per the prevailing provisions of the Companies Act.

S. No	Activities	Details	Frequency/ timelines		rly Bud ation R Lakhs)	s. (in	Total Amount Rs. (in
NO			timeimes	1 st Year	2 nd Year	3 rd Year	Lakhs)
1	Health checkups	Health checkup for communities in the nearby villages and distribution of medicines to the needy	Once in a quarter in the core zone villages and needy villages in the other zones	4	4.5	4.5	13.0
2	Installation of Bore wells, Hand pumps	Bore wells, Hand pump in the nearby villages	Need based	3	3	3	9.0
3	Infrastructure Development of Schools	Donation of computers, note books, other need based education materials, provision of potable drinking water and improving sanitation in local schools	Need based	2	2.5	2.5	7.0

Table 9.6 Proposed CER activities and its budget

S. No	Activities	Details	timolinos	-	s. (in	Total Amount Rs. (in	
NU			timennes	1 st	2 nd	3 rd	Lakhs)
				Year	Year	Year	
4	Improving medical infrastructure	In PHCs and PHSCs	Need based	2.5	2.5	2.5	7.5
5	Plantation Drives	Avenue plantation, general plantation drives would be conducted on World Environment Day in the nearby villages	Once in an Year	3	3	4	10.0
6	Income Generation Training programs	For nearby villagers – Women empowerment initiative for SHGs	Half yearly	3	3.5	4	10.5
7	Skill Development Training	For local youth in the nearby villages	Half yearly	2	3	3	8.0
8	Installation of Solar Lights	For villages in the core project area	Need Based	5	5	5	15.0
		Grand Total		24.5	27	28.5	80

9.7 Occupational health management

Health of the employees would be regularly monitored as the workers are exposed to various operations. All the employees shall be required to undergo a medical checkup before joining the facility. Medical checkup will be conducted on regular basis and the health conditions will be monitored. First aid facilities required to attend immediately for meeting emergency situations shall be made available at the facility.

9.8 Fire protection system

The fire protection system will protect the entire site area from accidental fire hazards. The fire protection system comprises of a ground level water storage tank to store the necessary required water for emergency. One electric motor driven pump and one diesel high pressure pump will be provided to pump the water to a high pressure header from where the water is distributed to various high pressure hydrants provided at selected locations. Necessary fire hoses with spouts will be kept ready at each hydrant location to facilitate firefighting. The header also caters to a multi fire system to automatically sprinkle water through sprinklers provided.

9.9 Environmental management cell

The Environmental Cell will be headed by the Project Managers followed by other officers and technicians. The department is the nodal agency to co-ordinate and provide necessary services on environmental issues during operation of the project. This environmental group is responsible for implementation of environmental management plan, interaction with the environmental regulatory agencies, reviewing draft policy and planning. This department interacts with State Pollution Control Board and other environment regulatory agencies. The department also interacts with local people to understand their problems and to formulate appropriate community development plan. The major duties and responsibilities of Environmental Management Cell shall be as given below:

- > To implement the environmental management plan.
- > To assure regulatory compliance with all relevant rules and regulations.
- > To ensure regular operation and maintenance of pollution control devices.
- > To minimize environmental impacts of operations as by strict adherence to the EMP.
- > To initiate environmental monitoring as per approved schedule.
- > To review and interpret monitored results and corrective measures in case monitored results are above the specified limit.
- To maintain documentation of good environmental practices and applicable environmental laws as ready reference and ensure that they are followed and maintain environmental records.
- > Coordination with regulatory agencies, external consultants

9.9.1 Record keeping and reporting

Record keeping and reporting of performance is an important management tool for ensuring sustainable operation. Records should be maintained for regulatory, monitoring and operational issues. Typical record keeping requirements for the TSDF is summarized in **Table 9.7** below.

Parameter	Particulars		
Solid Waste Handling and	Daily quantity of waste received		
Disposal	 Daily quantity of waste sent to landfill 		
Waste water	 Daily quantities of waste water & treated effluent 		
	 Point of generation & usage of treated wastewater 		
	 Treated wastewater quality 		
Regulatory Licenses	 Environmental Permits / consents from SPCB 		
(Environmental)			
Monitoring and Survey	• Records of all monitoring carried out as per the		
	finalized monitoring protocol		
Accident reporting	Date and time of the accident		

Table 9.7 Record	keeping	particulars
	NCCPIIIS	purciculars

	 Sequence of events leading to accident & history of accidents Investigation reports of previous accidents Chemical datasheet assessing effect of accident on health and environment Emergency measures taken Corrective measures and steps taken to prevent recurrence of such events
Other	 Log book of compliance Employee environmental, health and safety records Equipment inspection and calibration records Vehicle maintenance and inspection records

9.10 E-Waste Management and Handling Rules 2016

The proposed E-waste management facility would comply with the E-Waste (Management) Rules, 2016 and subsequent amendments. The responsibilities of E-waste collection centers and dismantlers/recyclers to comply with E-Waste (Management) Rules, 2016 and subsequent amendments are summarized in **Table 9.8**.

Section	Applicable Rule	Compliance
Chapter II	Responsibilities of Collection Centers	
6.1	collect E-waste on behalf of producer	Shall comply with the rules
	or dismantler or recycler or refurbisher	
	including those arising from orphaned	
	products; provided the collection	
	centers established by producer can	
	also collect e-waste on behalf of	
	dismantler, refurbisher and recycler	
	including those arising from orphaned	
	products	
6.3	Ensure that the E-waste collected by	Shall comply with the rules
	them is stored in a secured manner till	
	it is sent to registered dismantler(s) or	
	recycler(s) as the case may be	
6.4	Ensure that no damage is caused to the	After receiving the request from the
	environment during storage and	client the project management will
	transportation of E-waste	arrange a suitable and secured
		transport to collect the material from
		client's premises and the collected

Table 9.8 Compliance as per E-Waste Management and Handling Rules, 2016

		material will be stored in secured
		place till it is processed further.
6.5	Maintain records of E-waste handled, in	Shall comply with the rules
0.5	Form-2 and make such records	Shall comply with the fulles
	available for scrutiny by the concerned SPCB	
Chantar II		
Chapter II	Responsibilities of Dismantler	
10.1	Ensure that the facility and dismantling	Shall be ensured
	process are in accordance with the	
	standards or guidelines published by	
10.2	the CPCB from time to time	
10.2	Obtain authorisation from the	Authorization and registration will be
	concerned State Pollution Control	obtained after obtaining EC
	Board in accordance with the	
	procedure under sub-rule (3) of rule 13	
10.3	Ensure that no damage is caused to the	It will be ensured that storage and
	environment during storage and	transportation of E-waste does not
	transportation of E-waste	damage the environment
10.4	Ensure that dismantling process do not	Necessary pollution control measures
	have any adverse effect on the health	shall be taken care of to preserve
	and the environment	health and environment.
10.5	Ensure that dismantled E-waste are	Shall comply with the rules
	segregated and sent to the registered	
	recycling facilities for recovery of	
10.0	materials	
10.6	Ensure that non-recyclable/non-	Non-recyclable/non-recoverable
	recoverable components are sent to	components are separated and sent
	authorized treatment storage and	to incineration or secured land fill for
107	disposal facilities	further disposal
10.7	Maintain record of e-waste collected,	Shall comply with the rules
	dismantled and sent to authorised	
	recycler in Form-2 and make such	
	record available for scrutiny by the	
	Central Pollution Control Board or the	
	concerned State Pollution Control Board	
10.8	File a return in Form- 3 to the SPCB on	Annual returns in Form-3 shall be
10.0	or before 30 th June following the	filed
	financial year to which that return	
	relates	

10.9	Not process any E-waste for recovery	Shall comply with the rules
	or refining of materials, unless he is	
	authorized with the concerned SPCB as	
	recycler for refining and recovery of	
	metals	

9.11 Action plan for complying performance evaluation and monitoring TSDF

The detailed action plans for complying performance evaluation and monitoring of TSDF facility as per HAZWAMS/..../2010-2011 are given in **Table 9.9**

Section	Condition	Compliance
4.1	Basic Information to be provided	The basic information as per the format given
	by the operator of the facility	in HAZWAMS//2010-2011 dated May 24,
		2010, Annexure-II will be provided to
		SPCB/CPCB before the commencement of
		operation of the facility. This would be done
		as one time exercise. In case there is any
		change in the activity of the proposed facility,
		information will be updated to SPCB/CPCB
4.2	Periodic information to be	Periodic information as per the format given
	prepared and submitted on	in HAZWAMS//2010-2011 dated May 24,
	quarterly basis by the operator	2010, Annexure-III will be provided to
	of the facility	SPCB/CPCB on quarterly basis within 15 days
		before the end of the quarter
5.2	Uniformity in monitoring of soil,	A monitoring protocol suggested in
	ground and surface water,	HAZWAMS//2010-2011 dated May 24,
	ambient air quality, gaseous	2010, Annexure-IV will be followed and will be
	emissions from vents provided	provided to SPCB/CPCB as per Consent
	to the already capped landfills, a	conditions
	monitoring protocol is to be	
	followed	
5.4	Storage of Incompatible wastes	While storing and mixing incompatible wastes
	in the TSDF	general criteria suggested as guideline in
		HAZWAMS//2010-2011 dated May 24, 2010
5.6	Online tracking system for	will be followed
0.0	Online tracking system for movement of hazardous waste	Measures will be taken to put in place online
		tracking system for movement of the
5.7	Strongthoning and ungrading	hazardous waste from generators to the TSDF
5.7	Strengthening and upgrading	A full-fledged laboratory having sufficient

Table 9.9 Action plan for monitoring TSDF

laboratories, Accreditation a	equipment for monitoring and analysis of all
per EPA, 1986, obtaining ISC	required parameters is in place. However,
17025 through NABL system	shall strive for accreditation as per EPA, 1986
	and to obtain ISO 17025 through NABL system

9.12 Compliance of Hazardous Waste Rules, 2016

Point wise compliance of the Hazardous Waste (Management and Transboundary Movement) Rules 2016 pertaining to authorization, collection, storage, transportation etc., are given in **Table 9.10.**

	Chapter II		
	PROCEDURE FOR MANAGEMENT OF HAZ	ZARDOUS AND OTHER WASTES	
II - 4	Responsibilities of the occupier for	Compliance	
	handling hazardous wastes		
4.2	The occupier shall be responsible for safe	No hazardous waste will be generated	
	and environmentally sound handling of	as the proposed project is Treatment,	
	hazardous wastes generated in his	Storage and Disposable Facility (TSDF)	
	establishment.		
4.3	The hazardous wastes generated in the	No hazardous waste will be generated	
	establishment of an occupier shall be	as the proposed project is Treatment,	
	sent or sold to a recycler or re-processor	Storage and Disposable Facility (TSDF)	
	or re-user registered or authorized under		
	these rules or shall be disposed of in an		
	authorized disposal facility.		
4.4	The hazardous wastes transported from	Transportation of hazardous waste shall	
	an occupier's establishment to a recycler	be done in accordance with the	
	for recycling or reuse or reprocessing or	provisions of these rules	
	to an authorized facility for disposal shall		
	be transported in accordance with the		
	provisions of these rules.		
4.5	The occupier or any other person acting	Management shall collect information	
	on his behalf who intends to get his	required as per State Pollution Control	
	hazardous wastes treated and disposed	Board from the respective industries	
	of by the operator of a TSDF shall give to	which send the hazardous waste for	
	the operator of a facility, such	treatment and disposal	
	information as may be needed for safe		
	storage and disposal		
4.6	The occupier shall take all adequate steps	All necessary preventive measures will	
	while handling hazardous wastes to:	be taken while handling the hazardous	

Table 9.10 Compliance of hazardous waste rules 2016

r		
	I. Contain contaminants and	wastes.
	prevent accidents and limit their	
	consequences on human beings	Personal protective gadgets will be
	and the environment; and	provided to workers and it will be seen
	II. Provide persons working on the	that they use while working
	site with the training, equipment	
	and the information necessary to	In case of accidents, necessary cleaning
	ensure their safety.	of the site will be taken up
II - 6	Grant of authorization for handling hazard	lous wastes.
6.1	Every person engaged in generation,	Application in Form 1 will be submitted
	processing, treatment, package, storage,	to the concerned State Pollution
	transportation, use, collection,	Control Board for authorization of
	destruction, conversion, offering for sale,	proposed TSDF after obtaining EC from
	transfer or the like of the hazardous	concern EAC
	waste or occupier of the facility shall	
	make an application in Form 1 to the	
	SPCB for authorization within a period of	
	sixty days from the date of	
	commencement of these rules: Provided	
	that any person authorized under the	
	provisions of the Hazardous	
	Waste(Management, Handling and	
	Transboundary Movement) Rules, 2008,	
	prior to the date of coming into force of	
	these rules, shall not require to make an	
	application for authorization till the	
	period of expiry of such authorization.	
6.2	On receipt of the application complete in	Accepting the condition
	all respects for the authorization, the	
	State Pollution Control Board may, after	
	such inquiry as it considers necessary and	
	on being satisfied that the applicant	
	possesses appropriate facilities, technical	
	capabilities and equipment to handle	
	hazardous waste safely, grant within a	
	period of one hundred and twenty days	
	an authorization in Form 2 to the	
	applicant, which shall be valid for a	
	period of five years subject to such	
	period of five years subject to such	

	conditions as may be laid down therein.	
6.2	An application for the renewal of an	Application for the renewal of
	authorization shall be made, before its	authorization shall be made before the
	expiry and the State Pollution Control	expiry to State Pollution Control Board
	Board may renew the authorization after	
	examining each case on merit subject to	
	the condition that there has been no	
	report of violation of the provisions of	
	the Act or the rules made there under or	
	conditions specified in the authorization.	
6.4	The State Pollution Control Board may	Condition acceptable
	after giving reasonable opportunity of	
	being heard to the applicant refuse to	
	grant any authorization.	
6.5	Every person authorized under these	Shall maintain the record of hazardous
	rules shall maintain the record of	wastes handled at the facility in Form 3
	hazardous wastes handled by him in	and prepare and submit to the State
	Form 3 and prepare and submit to the	Pollution Control Board, an annual
	State Pollution Control Board, an annual	return containing the details specified
	return containing the details specified in	in Form 4 on or before the 30th day of
	Form 4 on or before the 30th day of June	June following to the financial year.
	following to the financial year to which	
	that return relates.	
6.6	The State Pollution Control Board shall	Condition acceptable
	maintain a register containing particulars	
	of the conditions imposed under these	
	rules for management of hazardous	
	waste, and it shall be open for inspection	
	during office hours to any person	
	interested or affected or a person	
	authorized by him on his behalf.	
ll - 7	Power to suspend or cancel an authorizati	
7.1	The State Pollution Control Board, may, if	Condition acceptable
	in its opinion the holder of the	
	authorization has failed to comply with	
	any of the conditions of the authorization	
	or with any provisions of the Act or these	
	rules and after giving him a reasonable	
	opportunity of being heard and after	
	recording reasons thereof in writing	

	cancel or suspend the authorization	
	issued under rule-6 for such period as it	
	considers necessary in the public	
	interest.	
7.2	Upon suspension or cancellation of the	Directions given by State Pollution
	authorization the State Pollution Control	Control Board shall be followed
	Board may give directions to the person	
	whose authorization has been suspended	
	or cancelled for the safe storage of the	
	hazardous wastes, and such person shall	
	comply with such directions.	
II-8	Storage of Hazardous Waste	
8.1	The occupiers, recyclers, re-processors,	Condition acceptable
	re-users, and operators of facilities may	
	store the hazardous wastes for a period	
	not exceeding ninety days and shall	
	maintain a record of sale, transfer,	
	storage, recycling and reprocessing of	
	such wastes and Crake these records	
	available for inspection: Provided that	
	the State Pollution Control Board may	
	extend the said period in following cases,	
	namely:-	
	I. Small generators (up to ten	
	tonnes per annum) up to one	
	hundred and eighty days of their	
	annual capacity;	
	II. Actual users and disposal facility	
	operators up to one hundred and	
	eighty days of their annual	
	capacity,	
	III. Occupiers who do not have	
	I	
	access to any treatment, storage,	
	disposal facility in the concerned	
	State; or	
	IV. The waste which needs to be	
	specifically stored for	
	development of a process for its	

	recycling, recovery, pre-	
	processing, co-processing or	
	utilisation;	
	V. In any other case, on justifiable	
	grounds up to one hundred and	
	eighty days.	
	- 0 - 1 1 -	
	Chapter IV	1
TREA	TMENT, STORAGE AND DISPOSAL FACILITY	FOR HAZARDOUS AND OTHER WASTES
IV 16	Treatment, Storage and Disposal-Facility f	or hazardous wastes
16.1	The State Government, occupier,	Site meeting MoEF&CC guidelines has
	operator of a facility or any association of	been proposed for the proposed project
	occupiers shall individually or jointly or	
	severally be responsible for, and identify	
	sites for establishing the facility for	
	treatment, storage and disposal of the	
	hazardous wastes in the State.	
16.2	The operator of common facility or	The proposed facility shall be designed
	occupier of a captive facility, shall design	as per CPCB technical guidelines and
	and set up the treatment, storage and	necessary approval will be obtained
	disposal facility as per technical	from State Pollution Control Board for
	guidelines issued by the Central Pollution	design and Layout
	Control Board in this regard from time to	
	time and shall obtain approval from the	
	State Pollution Control Board for design	
	and layout in this regard.	
16.3	The State Pollution Control Board shall	Condition acceptable
	monitor the setting up and operation of	•
	the common or captive treatment,	
	storage and disposal facility, regularly	
16.4	The operator of common facility or	Management shall be responsible for
	occupier of a captive facility shall be	safe and environmentally sound
	responsible for safe and environmentally	operation of TSDF, closure and post
	sound operation of the facility and its	closure phase.
	closure and post closure phase, as per	
	guidelines or standard operating	
	procedures issued by the Central	
	Pollution Control Board from time to	
	time.	
	unic.	

10 5		We shall maintain research of the
16.5	The operator of common facility or	We shall maintain records of the
	occupier of a captive facility shall	hazardous wastes handled as per Form
	maintain records of hazardous and other	3
	wastes handled by him in Form 3.	
16.6	The operator of common facility or	Annual return will be filed in Form 4 to
	occupier of a captive facility shall file an	the State Pollution Control Board on or
	annual return in Form 4 to the State	before the 30 th day of June following
	Pollution Control Board on or before the	the financial year to which that return
	30 th day of June following the financial	relates.
	year to which that return relates.	
	Chapter V	,
P	ACKAGING, LABELLING AND TRANSPORT O	F HAZARDOUS AND OTHER WASTE
V - 17	Packaging and labeling	
17.1	The occupier handling hazardous or other	Packaging and labeling shall be done as
	wastes and operator of TSDF shall ensure	per Form 8 .
	that the hazardous and other wastes are	
	packaged in a manner suitable for safe	
	handling, storage and transport as per	
	the guidelines issued by the Central	
	Pollution Control Board from time to	
	time. The labelling shall be done as per	
	Form 8.	
17.2	The label shall be of non-washable	Packaging and labeling shall be done in
	material and packaging shall be easily	such a way that it is easily visible and
	visible and be able to withstand physical	withstands physical conditions and
	conditions and climatic factors.	climatic factors
V - 18	Transportation of Hazardous waste	
18.1	The transport of the hazardous wastes	Transportation of the hazardous wastes
	shall be in accordance with the provisions	shall be in accordance with the
	of these rules and the rules made by the	provisions of these rules and the rules
	Central Government under the Motor	made by the Central Government under
	Vehicles Act. 1988 and other guidelines	the Motor Vehicles Act.1988 and other
	issued from time to time in this regard.	guidelines issued from time to time.
18.2	The occupier shall provide the	Condition acceptable
	transporter with the relevant information	
	in Form 9 , regarding the hazardous	
	nature of the wastes and measures to be	
	taken in case of an emergency and shall	
	label the hazardous wastes containers as	

	per Form 8.	
18.3	In case of transportation of hazardous	Condition acceptable
	wastes for final disposal to a facility for	·
	treatment, storage and disposal existing	
	in a State other than the State where the	
	hazardous waste is generated, the	
	occupier shall obtain 'No Objection	
	Certificate' from the State Pollution	
	Control Board of both the States.	
18.6	In case of transportation of hazardous	Condition acceptable
10.0	and other wastes for recycling, utilisation	
	including co-processing or disposal	
	through a State other than the State of	
	origin or destination, the occupier shall	
	intimate the concerned State Pollution	
	Control Boards before he hands over the	
V -19	hazardous wastes to the transporter.	he used within the country only)
	Manifest system (Movement Document to	
19.1	The sender of waste shall prepare seven	Condition acceptable and 7 copies
	copies of the manifest in Form 10	manifest system shall be followed
	comprising of color code indicated below	
	and all 7 copies shall be signed by the	
10.0	transporter.	
19.2	The sender shall forward copy 1 (white)	Condition acceptable
	to the State Pollution Control Board, and	
	in case the hazardous wastes is likely to	
	be transported through any transit State,	
	the occupier shall prepare an additional	
	copy each for intimation to such State	
	and, forward the same to the concerned	
	State Pollution Control Board before he	
	hands over the hazardous wastes to the	
	transporter.	
19.3	No transporter shall accept hazardous	Condition acceptable
	wastes from an occupier for transport	
	unless it is accompanied by copies 3 to 7	
	of the manifest.	
19.4	The transporter shall submit copies 3 to 7	Condition acceptable
	of the manifest duly signed with date to	
1	the operator of the facility along with the	

	waste consignment.	
19.5	The operator after acceptance of the	Condition acceptable
	waste shall hand over copy 4 (orange) to	•
	the transporter and send copy 5 (green)	
	to his State Pollution Control Board and	
	send copy 6 (blue) to the sender and the	
	copy 3 (pink) shall be retained by the	
	receiver.	
19.6	The copy 7 (grey) shall only be sent to the	Condition acceptable
	State Pollution Control Board of the	
	sender, if the sender is in another State.	
	Chapter V	1
	Miscellaneo	us
VI -20	Records and returns	
20.1	The occupier handling hazardous wastes	Disposal of hazardous waste records
	and operator of the facility for disposal of	shall be maintained in Form 3
	hazardous waste shall maintain records	
	of such operations in Form 3.	
20.2	The occupier and operator of a facility	Annual returns shall be sent to the
	shall send annual returns to the State	State Pollution Control Board in Form 4.
	Pollution Control Board in Form 4.	
20.3	The State Pollution Control Board based	Not the responsibility of the facility
	on the annual returns received from the	
	occupiers and the operators of the	
	facilities for disposal of hazardous and	
	other wastes shall prepare an annual	
	inventory of the waste generated; waste	
	recycled, recovered, utilised including co-	
	processed; waste re-exported and waste	
	disposed and submit to the Central	
	Pollution Control Board by the 30 th day of	
	September every year.	
VI -21	Responsibility of Authorities	Not the responsibility of the facility
	The Authority specified in column 2 of	
	the Schedule VI shall perform the duties	
	as specified in column 3 of the Schedule	
10.00	subject to the provisions of these rules.	
VI -22	Accident reporting and follow-up	In case of accident report shall be sent
	Where an accident occurs at the facility	to the State Pollution Control Board in
	or on a hazardous or other waste site or	Form 11

	during transportation of the hazardous	
	waste, the occupier or operator of the	
	facility or the transporter, as the case	
	may be, shall report immediately to the	
	State Pollution Control Board about the	
	accident in Form11.	
VI- 23	Liability of occupier, importer or exporter	and operator of a disposal facility
23.1	The occupier, importer, transporter and	Condition acceptable
	operator of the facility shall be liable for	
	all damages caused to the environment	
	or third party due to improper handling	
	of the hazardous wastes or disposal of	
	the hazardous wastes.	
23.2	The occupier and the operator of the	Condition acceptable
	facility shall be liable to pay financial	
	penalties as levied for any violation of the	
	provisions under these rules by the State	
	Pollution Control Board with the prior	
	approval of the Central Pollution Control	
	Board.	
VI -24	Appeal	
24.1	Any person aggrieved by an order of	Condition acceptable
	suspension or cancellation or refusal of	
	authorization or its renewal passed by	
	the State Pollution Control Board, may,	
	within a period of thirty days from the	
	date on which the order is	
	communicated to him, prefer an appeal	
	in Form12 to the Appellate Authority	
	comprising of the Environment Secretary	
	of the State.	
24.2	The Appellate Authority may entertain	Condition acceptable
	the appeal after the expiry of the period	·
	of thirty days if it is satisfied that the	
	appellant was prevented by sufficient	
	cause from filing the appeal in time.	
24.3	Every appeal filed under this rule shall be	Condition acceptable
	disposed of within a period of sixty days	
	from the date of its filing.	
	nom the date of its filling.	

9.13 Compliance of Bio-Medical Waste Management Rules, 2016 and its subsequent amendments

Point wise compliance of the Bio-Medical Waste Management Rules, 2016 and its subsequent amendments, pertaining to collection, storage, transportation etc., is given in **Table 9.11**.

	Chapter III			
	STANDARDS FOR AUTOCLAVING OF BIO-MEDICAL W	/ASTE		
III - 1	When operating a gravity flow autoclave, medical waste			
	shall be subjected to:			
1.1	A temperature of not less than 121° C and pressure of 15	Condition on		
	pounds per square inch (psi) for an autoclave residence	maintenance of		
	time of not less than 60 minutes; or	temperature and		
1.2	A temperature of not less than 135° C and a pressure of 31	pressure is		
	psi for an autoclave residence time of not less than 45	acceptable		
	minutes; or			
1.3	A temperature of not less than 149° C and a pressure of 52			
	psi for an autoclave residence time of not less than 30			
	minutes	Canditian		
III - 2	When operating a vacuum autoclave, medical waste shall be subjected to a minimum of three pre-vacuum pulse to	Condition of		
	purge the autoclave of all air. The air removed during the	maintaining temperature,		
	pre-vacuum, cycle should be decontaminated by means of	pressure and		
	HEPA and activated carbon filtration, steam treatment, or	minimum residence		
	any other method to prevent release of pathogen. The	time is acceptable		
	waste shall be subjected to the following:			
2.1	A temperature of not less than 121°C and pressure of 15 psi			
	per an autoclave residence time of not less than 45			
	minutes; or			
2.2	A temperature of not less than 135°C and a pressure of 31			
	psi for an autoclave residence time of not less than 30			
	minutes;			
III - 3	Medical waste shall not be considered as properly treated	Condition acceptable		
	unless the time, temperature and pressure indicators			
	indicate that the required time, temperature and pressure			
	were reached during the autoclave process. If for any reasons, time temperature or pressure indicator indicates			
	that the required temperature, pressure or residence time			
	was not reached, the entire load of medical waste must be			
	autoclaved again until the proper temperature, pressure			
	and residence time were achieved			
III - 4	Recording of operational parameters: Each autoclave shall	Condition acceptable		
	have graphic or computer recording devices which will			
	automatically and continuously monitor and record dates,			
	time of day, load identification number and operating			

Table 9.11 Compliance of Bio-Medical Waste Management Rules, 2016

		Γ
	parameters throughout the entire length of the autoclave	
III - 5	cycle Validation test for autoclave: The validation test shall use four biological indicator strips, one shall be used as a control and left at room temperature, and three shall be	Condition acceptable
	placed in the approximate center of three containers with the waste. Personal protective equipment (gloves, face mask and coveralls) shall be used when opening containers for the purpose of placing the biological indicators. At least one of the containers with a biological indicator should be placed in the most difficult location for steam to penetrate, generally the bottom center of the waste pile. The occupier or operator shall conduct this test three consecutive times to define the minimum operating conditions. The temperature, pressure and residence time at which all biological indicator vials or strips for three consecutive tests show complete inactivation of the spores shall define the minimum operating conditions for the autoclave. After determining the minimum temperature, pressure and residence time, the occupier or operator of a common biomedical waste treatment facility shall conduct this test once in three months and records in this regard shall be maintained.	
III - 6	Routine Test: A chemical indicator strip or tape that changes colour when a certain temperature is reached can be used to verify that a specific temperature has been achieved. It may be necessary to use more than one strip over the waste package at different locations to ensure that the inner content of the package has been adequately autoclaved. The occupier or operator of a common bio medical waste treatment facility shall conduct this test during autoclaving of each batch and records in this regard shall be maintained.	Condition acceptable
III - 7	Spore testing: The autoclave should completely and consistently kill the approved biological indicator at the maximum design capacity of each autoclave unit. Biological indicator for autoclave shall be Geobacillusstearothermophilus spores using vials or spore Strips; with at least 1X106 spores. Under no circumstances will an autoclave have minimum operating parameters less than a residence time of 30 minutes, a temperature less than 121°C or a pressure less than 15 psi. The occupier or operator of a common bio medical waste treatment and disposal facility shall conduct this test at least once in every week and records in this regard shall be maintained	Condition acceptable

CHAPTER 10

SUMMARY & CONCLUSION

Chapter 10

Summary and Conclusion

10.1 Introduction

Ramky Enviro Engineers Limited (REEL) has the credit and distinction of experience in operating hazardous waste management facility in Madhya Pradesh. The group today is the leader in waste management in the state. The company offers high quality un-interrupted services at competitive prices. REEL is focused on industrial hazardous waste management as well as waste recycling. With this vast experience and expertise available, REEL is proposing to establish an ICHWTSDF and recycling facility at Industrial Growth Centre, Maneri village in compliance with the statutory guidelines. All the operational data and expertise of the established plants will be made available to the newly proposed facility.

EIA report has been prepared to comply with the Terms of Reference (ToR) received from MoEF&CC F. No.10-40/2019-IA.III dated December 05, 2019. As per EIA Notification S.O. No 1533 dated 14th September 2006 and its subsequent amendments, the project falls under Project / Activity 7 (d) Common Hazardous Waste Treatment, Storage and Disposal Facility (TSDFs), Category "A" (All integrated facilities having incineration & landfill or incineration alone) and requires environmental clearance from Expert Appraisal Committee (EAC), MoEF&CC, New Delhi.

10.2 Details of project capacity

It is proposed to establish an Integrated Common Hazardous Waste Treatment, Storage, Disposal & Recycling Facility in an area of 8 Ha, plot no. 11, 12, 13, 14, 18, 19, 20, 21, 27, 28, 29, 31, 32, 33, 34, 35, 36, 43 and 44, at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh. It shall be noted that MP Industrial Development Corporation Limited (Formerly Madhya Pradesh Audyogik Kendra Vikas Nigam, i.e., MP AKVN), while allotting the land, has clubbed all the above plot numbers to a single plot and named it as Plot No. 2, without any change in the land area. The details of the proposed project capacities are given below in **Table 10.1**.

S. No.	Facility	Capacity
1	Secured Landfill (Direct Landfill)	250 TPD
2	Landfill after Treatment	400 TPD
3	Common Incineration (hazardous waste, bio medical waste, E- waste	55 TPD
•	and other waste)	
4	Bio Medical Waste Treatment	12.5 TPD
5	Alternative Fuel and Raw Material Facility (AFRF)	55 TPD
6	E-Waste Recycling Facility (with Precious Metal Recovery)	82 TPD

Table 10.1 Proposed project details and capacities
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M/s Ramky Enviro Services Pvt. Ltd.

S. No.	Facility	Capacity
7	Drum Decontamination Recycling Plant	10 TPD
8	Used / Spent Oil Recycling Facility	54 KLD
9	Lead Recycling Facility	65 TPD
10	Paper Recycling Facility	10 TPD
11	Plastics Recycling Facility	10 TPD
12	Solvent Recovery Facility	27 KLD
13	Aluminium Dross Reprocessing Facility	165 TPD
14	Spent Pot Liner (Carbon Portion) Reprocessing Facility	165 TPD
15	Spent Pot Liner (Refractory Portion) Reprocessing and Disposal Facility	165 TPD
16	Renewable Energy	2 MW
17	Waste to Energy	2 MW

10.3 Project importance

There is a growing concern all over the country for the disposal of hazardous wastes generated from anthropogenic sources. The waste generators find it difficult to dispose their hazardous wastes without causing environmental disturbance, as very few appropriate disposal facilities are available. The Government of India has promulgated the Hazardous Waste (Management & Handling) Rules in 1989 through the Ministry of Environment, Forest and Climate Change (MoEF&CC) under the aegis of Environment (Protection) Act EPA Act 1986. Also in order to encourage the effective implementation of these rules, the MoEF&CC has further amended the rules several times with the emendation made in 2016. Further, the project will be designed to collect and treat the wastes on scientific basis in compliance with the following rules:

- The Hazardous Wastes (Management, Handling and Trans-boundary Movement) Rules, 2016.
- The Bio-Medical Waste Management Rules, 2016 and its subsequent amendments.
- The Plastic Waste (Management & Handling) Rules, 2016.
- E-Waste (Management) Rules, 2016 and subsequent amendments.
- Batteries (Management & Handling) Amendment Rules, 2010 and subsequent amendments.

10.4 Details of land area breakup

The project is proposed in an area of 8 Hectares, greenbelt will cover 33% of the total area. The details of land area breakup are presented in **Table 10.2**.

Description	Area (Ha)	Area (%)
Landfill	2.51	31.40
Facilities	1.80	22.49
Roads	1.01	12.66
Green belt	2.64	33.00
Parking	0.04	0.45
Total	8.00	100

Table 10.2 Land area breakup

10.5 Water requirement

The total water requirement for the proposed project is estimated as 120 KLD out of which 60 KLD will be met through Audyogik Kendra Vikas Nigam (Jabalpur) Limited/tankers/borewell and remaining 60 KLD is treated water. The major part of the treated water is used for greenbelt (24 KLD), stabilization (16 KLD), incineration (16 KLD) followed by truck wheel wash, floor washings.

During rainy season, the fresh water requirement will be 36 KLD only as the 24 KLD consumed for greenbelt will not be required. Hence the water used for greenbelt during non rainy days will be adjusted for remaining requirements. The water balance is given in **Table 10.3**.

S No	Description	V	/ater requ	irement (I	KLD)	Remarks
S.No	Description	Fresh	Treated	Total	Effluent	
1	Secured Landfill and Stabilization	0	16	16	0	Leachate generated will be treated in LTP & reused for spraying on landfill or disposed through incinerator (spray dryer)
2	Incineration	8	16	24	20	
3	Biomedical Waste Treatment	4	0	4	3	
4	Alternative Fuel and Raw Material Facility (AFRF)	5	0	5	4	Spent to ETP for
5	Recovery and Recovery Facilities like (E-Waste with PM, Drum Decontamination , Lead, Paper, Plastics)	10	0	10	9	treatment
6	Boiler and cooling tower (Used oil and	20	0	20	17	

Table 10.3 Water requirement

M/s Ramky Enviro Services Pvt. Ltd.

	Description	N	/ater requ	Remarks				
S.No	Description	Fresh	Treated	Total	Effluent			
	Solvent Recovery Facility)							
7	Aluminum Dross, SPL (Carbon Portion), SPL Refractory Portion Reprocessing Facilities	2	0	2	2			
8	Renewable Energy and Waste to Energy	4	0	4	2			
9	Truck Wheel Wash/Floor Wash etc.	0	4	4	2			
10	Domestic	7	0	7	5	Sent to soak pit/treated in STP		
11	Greenbelt	0	24	24	0			
	Total 60 60 120 64							
Note: Effective leachate generation after recirculation to the landfill is estimated to be approx. 30 KLD when the facility is operated at full capacity.								

10.6 Power and fuel requirement

The details of the power required for operation of the facility and fuel required for running DG sets for emergency use during power failure are given in **Table 10.4**.

Table 10.4 Power and the requirement							
Details	Requirement	Remarks					
Power	375 kVA	Madhya Pradesh State Electricity Board (MPSEB)					
DG set	2x 200 kVA	Used only for emergency power backup					
HSD Fuel for DG set/Incinerator	84 L/hr	Purchased from local dealers					
Coal Boiler	1x2 TPH	Coal shall be purchased from local dealers					
	1x4 TPH						

Table 10.4 Power and fuel requirement

10.7 Required manpower

The details of skilled and unskilled manpower required for the proposed project during construction and operational phase are given below in **Table 10.5**.

Table 10.5 Manpower details

S.No	Description	Direct	Remarks
1	Managerial staff	15	Indirect employment during operation will be
2	Skilled and semi- skilled	75	around 100 persons
	Total	90	

10.8 Baseline environmental status

The baseline monitoring studies have been carried out during October to December, 2019 (post monsoon). The predominant wind direction during study period was NE.

Air quality

The ambient air quality was monitored at 8 locations. The minimum and maximum 98th percentile values of pollutants are shown in **Table 10.6**. Lead, Nickel, Arsenic & Benzo(a)Pyrene) are found to be below detectable limits.

Details		PM ₁₀	PM _{2.5}	SO ₂	NOx	O ₃	СО	C_6H_6	NH ₃
Minimum	98 th	53.2	28.7	10.5	20.5	20.4	492	0.55	15.6
Percentile									
Maximum	98 th	56.1	34.5	14.8	25.1	26.7	640	0.75	21.4
Percentile									
NAAQ Stan	dards	100	60	80	80	100	2000	5	400
2009						(8 hourly)	(8 hourly)		

Table 10.6 Results of ambient air quality ($\mu g/m^3$)

Ground and surface water quality

Nine groundwater samples and four surface water samples were collected in the study area. The samples were analyzed for various physical and chemical characteristics, the results of which are given in **Table 10.7** and **Table 10.8** respectively.

Parameters	Units	Minimum	Maximum	-	ater Standards 500:2012
				Acceptable	Permissible
рН	-	6.9	7.9	6.5-8.5	No Relaxation
TDS	mg/l	225	524	500	2000
Chlorides	mg/l	38	85	250	1000
Hardness	mg/l	107	348	200	600
Fluorides	mg/l	<1	1.18	1.0	1.5

Table 10.7 Results of groundwater analysis

Parameters	Units	Min	CPCB water quality criteria as p Max September 2017			-	11 th	
				Α	В	С	D	E
рН	-	7.2	7.8	6.5-8.5		6-9	6.5-8.5	6-8.5
TDS	mg/l	168	210	-	-	-	-	-
Chlorides	mg/l	14	23	-	-	-	-	-
Hardness	mg/l	104	125	-	-	-	-	-
BOD	mg/l	<4	12	2	3	3	-	-

Table 10.8 Results of surface water analysis

Noise quality

Baseline noise levels have been monitored at ten locations within the study zone, using a continuous noise measurement device. The results are presented in **Table 10.9.** The day equivalents during the study period ranged between 49.7 to 54.5 dB (A) whereas the night equivalents were in the range of 39.6 to 43.8 dB(A). It was observed that the day

equivalents and the night equivalents were within the AAQ standards in respect of Noise SO 123 (E) dt 14th Feb 2000 for Industrial, Residential and Commercial area. From the results it can be seen that the day equivalents and night equivalents were within the specified standards.

Parameters	Minimum	Mavimum	AAQ Noise Standards			
Parameters	winninum	Maximum	Residential	Industrial	Commercial	
Day Equivalent (L _{Day})	49.7	54.5	55	75	65	
Night Equivalent (L _{Night})	39.6	43.8	45	70	55	

Table 10.9 Noise levels – dB (A)

Soil quality

To determine the impact of proposed activity on soil and agricultural productivity soil samples were collected at nine locations. The results are summarized in **Table 10.10**.

Parameters	Minimum	Maximum	Standard Soil Classification – (Indian Council of Agricultural Research, New Delhi
рН	7.2	7.6	Acidic<6.0, Normal to Saline 6.0-8.5, Tending to become Alkaline 8.6 to 9.0, Alkaline above 9.
EC (μS/cm)	145	224	Normal<1000, Critical for germination 1000- 2000, Critical for growing 2000 - 4000, Injurious to most crops>4000
Organic carbon (%)	0.6	0.9	Low < 0.5 , Medium 0.5 – 0.75, High > 0.75
Nitrogen (kg/Ha)	152	276	Low below 280, Medium 280-560, High above 560
Phosphorous (kg/Ha)	6.5	10.1	Low below 10, Medium 10-25, High above 25
Potassium (kg/Ha)	152	217	Low below 110, Medium 110-280 High above 280

Table 10.10 Soil quality in the study area

10.9 Anticipated impacts

Construction phase works include site clearance, site preparation, building works, infrastructure provision and activities. The impacts due to construction activities are short term and are limited to construction phase. The impacts will be mainly on air, water and soil quality, land use and socio-economics conditions. The major sources of air pollution are as follows:

- 1. Area source emissions from landfill operations
- 2. Point source emissions from Incinerator, DG set.
- 3. Boilers for used oil and solvent recovery facility

The area source emissions and line source emissions will be within the plant premises, whereas point source emissions expected from the proposed project and predicted GLCs are given in **Table 10.11**.

Particulars	Particulate Matter (PM)	Sulphur Dioxide (SO ₂)	Oxides of Nitrogen (NO _x)	Lead
Baseline Scenario (Max)	56.1	14.8	25.1	
Predicted GLC (Max)	0.61	2.9	3.6	0.03
Overall Scenario (Worst Case)	56.71	17.7	28.7	0.03
NAAQ Standards 2009	100	80	80	1

Table 10.11 Post project scenario (units in $\mu g/m^3$)

10.10 Environmental monitoring program

The main essence of environmental monitoring program is that there should not be much time lack between commencement of damage to environment and adoption of mitigation measures against various environmental parameters that are being affected. Environmental monitoring program has been prepared for assessing the efficiency of implementation of Environment Management Plan and details of the same are given in **Table 10.12**.

S.No	Potential	Monitoring	Parameters for Monitoring	Frequency of
	Impact			Monitoring
1.	Air Emissions	Monitoring of Ambient Air	All the parameters listed in National Ambient Air Quality Standards (PM_{10} , $PM_{2.5}$, SO_2 , NO_x , O_3 , CO , NH_3 , C_6H_6 , Pb , Ni , As, Benzo(a)pyrene) Ambient air quality to be monitored at three locations at 120° angle around the TSDF (to be identified in	Twice a week
			consultation with SPCB). Total Volatile Organic Compounds (VOCs), Polycyclic Aromatic Hydrocarbons (PAH) to be monitored – twice in an year (pre-monsoon and post- monsoon)	Twice in an year (pre- monsoon and post-monsoon)
		Monitoring of Vent Gases attached with the capped SLF Monitoring of	Total VOCs and H ₂ S (a) Total Particulate Matter,	Once in a month

Table 10.12 Environmental monitoring during operational phase

S.No	Potential	Monitoring	Parameters for Monitoring	Frequency of
	Impact			Monitoring
		Stack Gaseous Emission from Incinerator	CO, HCl, SO ₂ , NO _x , TOC, temperature and excess oxygen in stack emissions, (b) Pressure in combustion chambers, (c) temperature and excess oxygen in SCC.	Online Monitoring
		Incinerator Stack Monitoring and Waste to Energy Stack Monitoring	Mercury, Heavy Metals (Cd + Th + their compounds, Hg and its compounds, Sb + As + Pb + Co + Cr + Cu + Mn + Ni + V + their compounds), Dioxins and Furans. HF to be monitored at a frequency as directed by SPCB	Twice a year, under critical operating conditions
		Stack monitoring of: Used Oil Recycling Plant	Particulate Matter, SO ₂ , NO _x , and hydrocarbon, Hydrogen sulphide, Halides/halogens.	Once in a month or as per the conditions stipulated in the
		Lead Recycling Unit	Particulate Matter, SO ₂ , NO _x , CO ₂ , CO, and Lead	EC and CFE/CFO, whichever is stringent.
		Solvent Recycling Plant	VOCs	oungener
		Aluminum Dross Recycling	Particulate Matter, SO ₂ , Acid Mist (H ₂ SO ₄)	
		Spent Pot Liner (Carbon Portion) Spent Pot Liner	Particulate matter, Fluorides, Ammonia etc. Particulate Matter, Fluoride,	
		(Refractory Portion)	and Ammonia	
2.	Groundwater Quality	Monitoring of Groundwater	Samples shall be collected from the four monitoring wells (piezometric) around the TSDF i.e. one on up gradient of the ground water flow and other three on the down gradient side of the ground water flow and shall be analysed for the following parameters: pH,	Quarterly

S.No	Potential	Monitoring	Parameters for Monitoring	Frequency of
	Impact			Monitoring
			TDS, TOC, COD, heavy metals	
			(such as Pb, Cd, Cu, Zn, Cr, Hg,	
			Ni), Fe, CN, F, As and Mn, Cl,	
			NO3, SO4, TKN, Total	
			Alkalinity, Total hardness and	
			Total Pesticides etc.	
3	Solid waste/	Monitoring of	Total Organic Carbon (TOC)	Monthly Once
	Haz. waste	Ash/Slag from the	and Loss on Ignition (LOI)	
		Incinerator		
4	Soil quality	Composite	At least 2 composite samples	Once in a year
		samples upto a	for analysis of pH, EC, Colour,	(pre-monsoon)
		depth of 1 m	TDS, TOC, TSS, PAH, heavy	
		beneath the soil	metals (such as Pb, Cd, Cu, Zn,	
		surface	Cr, Hg, Ni), CN, F, As and Mn	
5	Greenbelt	Plantations of	To observe and record	Yearly Twice
	development	locally available	periodically the health of each	
		sensitive plants to	plant.	
		be made in all		
		directions of the		
		TSDF and at		
		different distances		
6	Noise	Noise generated	Continuous noise level	Once in a
		from operation of	recording	month/ as per
		Incinerators,		CFE /CTE/CTO
		boilers, cooling		conditions given
		towers, etc to be		by SPCB
		monitored		
7	Wastewater	Comply with	pH, TSS, TDS, BOD, COD, oil &	Daily at regular
	Discharge	wastewater	grease (Heavy metals)	intervals/ as per
	(leachate)	discharge		CTO /CFE /CTE
		standards as per		conditions given
		CPCB/SPCB		by SPCB
8	Health	Health check-ups	All relevant parameters of	Once in six
		for employees and	occupational health	months/ as per
		migrant labour		CFE /CTE/CTO
				issued by SPCB/
				as per Factories
				Act

10.11 Risk analysis

Risk assessment has been carried out to identify and quantify major hazards and the risk associated with various operations of the proposed project that may lead to an emergency (disaster) affecting public safety and health. A systematic analysis of the chemicals and their quantities of storage has been carried out to determine threshold quantities as notified by Manufacture, Storage and Import of Hazardous Chemical (MSIHC) Amendment Rules, 2000. The computations of FETI for HSD and other solvents at the proposed TSDF are carried out. Based on F&EI, these come under "Low" category and 'nil' to 'moderate' toxicity. The effects on humans due to variations in heat flux and duration of exposure have been developed. For computing the damage distance from the tank failure area, ALOHA software is used. All necessary measures to minimize the risk due to the proposed project will be taken during the design stage and also during operation period. In view of the hazardous nature of products/processes handled at the project site, proposed project shall prepare an emergency preparedness plan (on-site and off-site). The plan is based on various probable scenarios like fire, explosion, natural calamities etc., and has got good infrastructure and dedicated team to handle emergency situations

10.12 Project benefits

The main benefits of the proposed project are:

- Facilitating better management of hazardous wastes.
- Provides a one stop solution for the management of various types of wastes.
- Minimizes pollution load on environment with an additional benefit of green and clean surroundings.
- Possibility for recovery of materials thereby conserving the natural resources
- Management of wastes is relatively easier and economically viable at a common facility
- Most viable option in the absence or availability of expertise.
- Reduced environmental liability due to captive storage of hazardous waste in the premises of industries
- Better occupational health and safety at individual industry level
- Prevention of natural resource contamination

10.13 Environmental management plan

The Environmental Management Plan (EMP) is required to ensure sustainable development in the area of the proposed project site. The purpose of the EMP is to minimize the potential environmental impacts from the project and to mitigate the adverse impacts. Details of EMP are given in **Table 10.13**.

	10.13 Mitigation measures proposed during operation phase
Air Quality	Incinerator shall be provided with all necessary air pollution control
Management	devices (such as quencher/spray drier, venturi-scrubber, bag filter etc.)
	along with a stack height of minimum 30 m to ensure that the emissions
	be within the prescribed limits as per MoEF&CC Gazette vide GSR
	481(E) dated June 26, 2008. Boilers shall also be provided with air
	pollution control devices along with a stack of minimum 30 m height.
	DG set will be provided with a stack height meeting MoEF&CC
	Guidelines proper dispersion of sulfur dioxide and oxides of nitrogen.
	In the Used Oil Recycling plant, all the process vents are connected to
	scrubber with activated charcoal to control 99.9 % of emission form
	vents. In the Aluminum Dross Reprocessing Facility, Scrubbers shall be
	utilized to treat the flue gases.
	In the Spent Pot Liner (Carbon Portion) Reprocessing facility, APCDs such
	as Cyclone, Pulse Jet Bag Filter, and ID Fan etc. shall be utilized to treat
	the emissions from rotary kiln, crushing and screening. There shall be a
	common stack after the treatment. In the Spent Pot Liner (Refractory
	Portion) Reprocessing and Disposal Facility, Bag Filter to be attached to
	Pulverizer.
	The Waste to Energy Plant shall be provided with all necessary air
	pollution control devices (such as quencher/spray drier, venturi-
	scrubber, bag filter etc.) along with a stack height of minimum 30 m to
	ensure that the emissions be within the prescribed limits as per
	MoEF&CC Gazette vide GSR 481(E) dated June 26, 2008.
	Internal roads will be paved (concrete/asphalt) to reduce dust emissions
	Speed restriction will be followed within the project and speed breakers
	will be provided at entry and exit points.
	Gas management system in secured landfill shall be provided.
	Green belt will be provided along the internal roads and plant boundary.
Odour Control	In the landfill area, weekly cover shall be put in with layers of earth, clay
	or similar material. Weekly cover is primarily used for preventing
	windblown dust, litter and odours, deterrence to scavengers birds,
	reduction of infiltration (during unseasonal rain) and in improving the
	site's visual appearance. The soil used as weekly cover shall give a
	pleasing uniform appearance from the site boundary. To achieve this
	thickness of about 150 mm is usually adequate and shall be adopted.
	Spraying Ecosorb (organic and biodegradable chemical) around odor
	generation areas at regular intervals. Odour control system focus on
	minimizing the number of sources of odor generation.

Table 10.13 Mitigation measures proposed during operation phase

	Planting of selected species and planting them in proper pattern will help in dust control and odour control.
	Odour from sites shall be managed as per guidelines of CPCB issued from time to time.
Gas	To minimize the gas generation in the landfill, the organic based waste
Management	will be diverted to incineration to the maximum extent possible
	To manage the gas generated a venting system with flaring arrangement
	will be provided, if the gas generation is more it will be directed to
	canteen
Water Quality	The leachate generated from landfill will be collected into leachate
Mitigation	collection pond.
Measures	The leachate collected will be sprayed back into landfill for dust
	suppression, stabilization of hazardous waste, etc. the excess if any will
	be disposed into spray drier of the incinerator or treated and sent to
	solar pond (during phase I)
	The domestic wastewater will be collected and treated in septic
	tank/soak pit or portable STP and reused for greenbelt
	The effluent from floor washings, workshop etc., will be collected,
	treated in O&G trap, settling tank and recycle back for dust suppression,
	etc.,
	The waste water from bio-medical sections will collected, disinfected
	and after necessary treatment reused for dust suppression on landfill
	area
Noise Mitigation Measures	Acoustic enclosures will be provided for all the high noise generating equipments
	Major noise generating sources shall be insulated adequately by providing suitable enclosures
	Other than the regular maintenance of the various equipment, ear plugs
	are provided to the personnel close to the noise generating units;
	All the openings like covers, partitions are designed properly.
Solid Waste	The ash coming from incineration plant will be used as daily cover in
Mitigation	secured landfill
Measures	The sludge generated in the leachate pond/ solar evaporation pond will
	be sent to secured land fill.
Occupational	Periodic health checkups for workers would be facilitated for early
Health & Safety	detection and control of communicable Diseases
	Will provide preventive measures for potential fire hazards with
	requisite fire detection, firefighting facilities and adequate water
	storage, etc.
	Provide regular training for workers in their respective fields

10.14 Project cost estimate and means of finance

Project costing

The costing for each of the plant has been done with respective civil structures, buildings, plant and machineries.

- A. Civil costing includes costing of the following required activities:
 - Earthwork
 - Bush clearance
 - Construction of Shed for storage area
 - Buildings of each Recycling facility with
 - RCC framed structure
 - Brick walls plastering
 - AC sheet roofing
 - Painting
 - Development of Effluent Convergence system
 - Storm water drains
 - Improvement of roads
- B. Plant and machineries:
 - Execution of Land fill
 - Design, supply, installation and commissioning of process plant and machineries based on budgetary quotations with suppliers for each of the recycling plant
 - Equipment for pollution control measures.
 - Safety and fire hydrant equipment
 - Supply, erection and commissioning of common utilities equipment
 - Development of greenbelt
 - Electricals
 - Supply, fabrication, erection and testing of MCC panels, cabling and lighting.

10.15 Cost estimate of the project

The total cost of the project is **Rs. 40 crores.** The capital cost for environmental management plan is Rs. 4 crores with a recurring cost of Rs. 40 lakhs per annum. The CER budget allotted based on the capital cost of the proposed project is around Rs. 80 Lakhs (2% of the project cost).

CHAPTER 11

DISCLOSURE OF CONSULTANTS

Chapter 11 Disclosure of Consultants Engaged

11.1 About the company

Ramky group, founded in the year 1994 and developed into a specialist multi-disciplinary organization focused in areas of Civil, Environment & Waste Management Infrastructure with specific emphasis on 'Public Private Partnership' Projects. The corporate office of the group is located in Hyderabad and the regional offices are located all over the country i.e., in Delhi, Mumbai, Bangalore, Chennai, Bhopal, Bhubaneswar, Jaipur and Kolkata. Some of the major companies of the group are:

- 1. Ramky Enviro Services Pvt. Ltd. (RESPL)
- 2. Ramky Enviro Engineers Ltd (REEL)
- 3. Ramky Estates & Farms Pvt. Ltd. (REFL)
- 4. Ramky Infrastructure Ltd (RIL)

11.2 Accredited consultant organization

The Ramky group has over 2000 employees in various sectors of which over 600 employees are post graduates and about 15 employees are having Ph.Ds. The consultancy group of RESPL has a strength of around 40 scientific and technical persons with a background of Civil, Chemical & Mechanical engineering as well as Environmental Science & Energy Management experts including Microbiology & Biotechnology experts. The field sample analysis is carried out in the laboratory of Hyderabad Waste Management Project (HWMP), a subsidiary company under Ramky Enviro Engineers Ltd., which is a NABL accredited laboratory and as well as recognized as Environmental Laboratory by MoEF under the Environment (Protection) Act 1986.

RESPL is accredited with 13 sectors under NABET Scheme with all 12 FAEs (Category A) are available as in-house experts and self-sufficient in handling EIA /EMP projects. RESPL consultancy group also provide training and course work for obtaining M.Sc. / M. Tech project works for students under various institutions and universities. The consultancy group also collaborate with research institutions and reputed educational institutions for carrying out Research & Development activities. The group is also empanelled with reputed government organizations like TSPCB, HPCL, OSPCB, TSIIC, APIIC, EPCO & NTPC. The services offered by the RESPL are mentioned below.

11.2.1 Consultancy services

- Facilitating Environmental Clearances from MoEF&CC, New Delhi and SEAC/SEIAA from different states.
- Obtaining Consent for Establishment and Consent for Operation from State Pollution Control Boards for industries.

- Preparing of Environmental Impact Assessment & Environmental Management Plan reports.
- Preparation of ESIA & ESMP reports for World Bank sponsored projects.
- Environmental audits to help industries to recycle and reuse resources and plan for low polluting technologies.
- Risk assessment studies for hazardous chemical storage & processes in order to prepare onsite and offsite disaster and emergency plans.
- Identification and evaluation of hazardous waste disposal sites.
- Environmental Management Systems Standards.
- Characterization and quantification of biomedical waste, municipal solid waste and design of treatment and disposal facilities.
- Effluent treatment plant & sewage treatment plant designs.
- Post project monitoring network design
- Consultancy services for setting up environmental laboratories
- Design of waste treatment plants
- Health and socio- economic surveys
- Resettlement and rehabilitation plans

11.2.2 Laboratory services

- Analysis of air samples for ambient air quality and from industrial sources for both routine and industry specific pollutants
- Water and waste water analysis for all parameters as per standard methods, including pesticides and poly hydro carbons
- Solid and hazardous waste analysis including TCPL tests
- Monitoring of noise levels at source and in ambient air
- Development of new methods and quality assurances of results obtained
- Design and settings of analytical laboratories

11.2.3 Training services

- Monitoring of environmental parameters –air, water, noise, soil etc.
- Environmental Impact Assessment and Environmental Management Plans
- Effluent treatment plant operations and maintenance
- Sewage treatment plant operations and maintenance
- ISO 9001: 2015 awareness, documentations, internal auditors
- Establishment environmental laboratories
- Pollution control in industries

11.2.4 Field services

- Site selection and suitability studies for setting up of Industries
- Ambient Air Quality monitoring for all gaseous pollutants
- Noise Level Monitoring & Traffic management studies

- Meteorological data collection as per CPCB norms
- Stack Emission monitoring for all pollutants and assessment of efficiency of control equipment
- Water, Wastewater and Soil Sample Collection
- Assessment of efficiency of ETP and analyzing critical parameters.
- Flora and Fauna assessment through sectorial studies and damage assessment due to development projects
- Damage Assessment studies in case of oil well blowouts, major industrial accidents

11.2.5 Solid waste management services

RESPL will prepare DPRs based on the field/engineering data for the following:

- Industrial Waste Management
- Hazardous Waste Management
- Municipal Solid Waste Management
- Biomedical Solid Waste Management
- E-waste Management & Recycling waste

ANNEXURES

ANNEXURE 1

PROTOCOL FOR PERFORMANCE EVALUATION OF COMMON HAZARDOUS WASTE TSDF AND COMMON HAZARDOUS WASTE INCINERATOR

Protocol for Performance Evaluation of Common Hazardous Waste TSDF and Common Hazardous Waste Incinerator

<u>Part A:</u> Basic information to be provided by the operator of the TSDF (Prior to the commissioning of the facility or whenever there is any change in the information provided earlier or the existing facility).

l.	General Information						
(1)	Name and Address of HWTSDF	:	Integrated Common Hazardous Waste Treatment, Storage, Disposal & Recycling Facility, Plot no. 11, 12, 13, 14, 18, 19, 20, 21, 27, 28, 29, 31, 32, 33, 34, 35, 36, 43 and 44, at Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh by Ramky Enviro Engineers Limited. It shall be noted that MP Industrial Development Corporation Limited (Formerly MP AKVN), while allotting the land, has clubbed all the above plot numbers to a single plot and named it as Plot No. 2, without any change in the land area.				
(2)	Contact Person Telephone No.	:	Mr. Mr. Sanjiv Kur	nar			
	Mobile No.		(M): 9810265282				
	Fax		Email: sksanjiv@ra	amky.com			
	Email						
(3)	Month and Year of Establishment	:	New Project	New Project			
(4)	HWTSDF Established by	:	M/s. Ramky Enviro	M/s. Ramky Enviro Engineers Ltd.			
(5)	HWTSDF Presently Operated by	:	New project	New project			
(6)	Total Area of TSDF	:	8 Hectares				
			Description	Area (Ha)	Area (%)		
			Landfill	2.51	31.40		
			Facilities	1.80	22.49		
			Roads	1.01	12.66		
			Green belt	2.64	33.00		
			Parking	0.04	0.45		
			Total	8.00	100		
(7)	Location of TSDF Delineated Area for TSDF if any (pl.	:	Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh by Ramky Enviro Engineers Limited. Location Map is attached as Attachment 1				
	enclose map of the delineated area)						
(8)	Industries or Industrial Estates nearby TSDF (indicate type of industries)	:	Industrial Growth Centre (IGC), Maneri (V), Mandla (D), Madhya Pradesh				
	i) Total Number of Member Industries (pl. attach map of the	•	Not Applicable, New Project				

		industrial estates)		
	ii)	Whether TSDF is located in Industrial Estate or Not	:	Yes
	iii)	Total HW Generation by the Member Industries as per Authorization. (FY 17-18)	:	Not Applicable
	v)	Total HW proposed to be disposed of by the member units. (FY 17- 18)		Not Applicable
(9)	Tota Rup	I Cost of the facility (in Lacs of ees)	:	4000 lakhs
	(i)	Financing Pattern	:	Nil
	(ii)	Subsidy, if any (Central Govt., State Govt,) in Rs.	:	Nil
(10)		e of Notification of the site by the eGovernment	:	Nil
(11)		l of Ground Water in and around disposal facility (below ground)	:	
	i)	Direction of ground water flow in the TSDF site	:	North West
	ii)	Depth of GWT in m during Monsoon period	:	4 to 5 m bgl
	iii)	Depth of GWT in m during Non Monsoon Period	:	4 to 8 m bgl
(12)	Win (enc	d pattern details (average) losed wind rose diagram)	:	Average wind speed is 2.31 m/s and predominant wind direction in the study period is NE, wind rose diagram is enclosed as Attachment 2
(13)	Land Use around the disposal facility up to radius of 5 km (indicate the forest or monuments or sensitive zones)		:	Proposed facility is in Industrial Growth Centre (IGC), Maneri. Dasarathpur RF- 4.5 km (NE), Parariya RF- 4.7 km (SE)
(14)	Rivers/canals/lakes, if any in and around the TSDF with approximate distance from TSDF.		:	Jhamil Nadi- 0.6 km (W), Gaur Nadi- 2.1 km (N), Dundai lake- 5.5 km (SW), Gopalpur lake – 11.3 km (SW)
(15)	Tota	l Rainfall (annual average in cms)	:	4.95 cm
(16)	Geohydrological features of the site		:	Site is situated on plateau of Maikal range. Terrain, in study area within 5 km radius is steep to very gentle with elevation 430 to 650 meters above means sea level sloping towards northwest, at site it is undulating gentle plain elevation ranging from 453 to 461 m amsl. Natural drainage is of dendritic type pattern, ephemeral flow nature, falls in Narmada basin; the Jhamil Nadi flowing at distance 600 m west.

(17)	Sources of water i	ntake	:	Major rock type is basalt; covered with landforms plateau, mesa/butte, denudational and residual hill and valley; spread with black cotton and mixed red black soil types. The geo-hydrological terrain is deccan trap basalt as main aquifer, groundwater occurring as confined to semi confined aquifer condition, and depth to water level during pre- and post-monsoon seasons ranging from 4 to 8 and 4 to 5 metres below ground level respectively. The total water requirement shall be sourced from Audyogik Kendra Vikas Nigam
				(Jabalpur) limited/ tankers/borewell.
(18)	Electrical Resistivi	ty data around SLF	:	Proposed project is green field project.
(19)	Reduced level of T	SDF w.r.t MSL	:	Site elevation is ranging from 453 - 461 m above MSL and reduced level of TSDF is 2 m below w.r.t. to site elevation.
(20)	Maximum Flood Reservoir if any	Level of River, Lakes,	:	There is no major river located in 5 km radius from project site. However Jhamil Nadi (minor river) is 600 m West.
(21)	Details of Consent to Establishment/ Operation issued under Water & Air Acts (please enclose copy of Consents issued by PCB).		:	Nil
	,	I Date of issue of ler Water Act and its	•	Nil
	,	l Date of issue of der Air Act and its	••	Nil
(22)		tails (please enclose ion issued by PCB)	:	Nil
	1	of Authorization	:	Nil
	ii) Validity of Au		:	Nil
(23)	(please enclose co		:	Nil
	i) Date of Issue	e of EC	:	Nil
	ii) EC issued by		:	Nil
	iii) EC issued fo Incinerator/S	r operation of TSDF , SLF	:	Nil
	iv) EIA prepared	l by	:	Nil
II. C	esign Details of Sto	orage, Treatment and D	isp	osal Facility
(1)	respect of Transp	e with the TSDF in portation, Laboratory, atment (chemical	:	Layout Attached as Attachment 3

	stabilization/solidification, incineration)						
		F and any other (pl. attach layout)					
(2)		sportation					
	i)	No. of vehicles	:	About 10 to 25 vehicles shall be utilized,			
) <i>'</i>	(Existing/Proposed) (own/hired)		depending on the waste quantities.			
	ii)	Type of vehicles with capacity	:	Different types of vehicles to be utilized			
				include: Tipper, Hyva Trucks, 10 PLT, 15 PLT,			
				Utility of TATA 207 Model – Approx. 5 MT.			
				10 MT Trucks, 15 MT Trucks, 20 MT Trucks,			
				20 MT Tankers etc.			
(3)	Labo	ratory					
	i)	No. of persons engaged in the	:	6 Nos			
		analysis with qualification and					
		experience					
	ii)	Lab Accreditation/recognition, if	:	Accreditation/recognition of the lab shall be			
	;::\	any Instruments available in the	_	procured once the project starts operation			
	iii)	Instruments available in the laboratory (enclose list of	:	List of instruments for proposed laboratories is given in Attachment 4			
		equipment/instruments)		is given in Attaciment 4			
	iv)	Comprehensive capabilities of	:	Attached as Attachment 5			
	,	analysis of parameters including					
	detailed analysis and fingerprint						
	(enclose list of parameters)						
	v)	Waste Acceptance criteria	:	Waste acceptance criterion is attached as			
		followed (enclose copy)		Attachment 6			
	vi)	Time (in hrs) required for	:	Approx. 2.0 to 3.0 Hrs.			
		fingerprint analysis parameters					
	vii)	Time (in hrs) required for	:	Approx. 6 to 7 working days.			
		comprehensive analysis of					
(4)	Ctore	relevant parameters					
(4)		age Area Temporary storage area for landfillab		wastos during Monsoon			
	i)	Temporary storage area for landiniat	:	940 sq. m			
	'/	sq. meters	•	5 10 54.111			
	ii)	Leachate collection and	:	Leachate generated from the landfill is			
		transportation provision made at	-	effectively collected and disposed without			
		the temporary storage area		causing any adverse effect to the			
				environment. The leachate generated is			
				collected by a network of lateral and header			
				pipes embedded in a drainage layer, all of			
				which is eventually drained into a leachate			
				collection sump.			
				Bunding/drains are provided around the			
				storage area to avoid storm water entering			
	:::)	Safaty provisions made at the		into this area.			
	iii)	Safety provisions made at the	•	Fire control equipment are shall be installed			

	1		1
	temporary storage area		in accordance with the characteristics of waste and as the situation demands. Fire Extinguishers along with Safety Shower and Fire Hydrant System are provided at the storage area.
iv)	Spillage collection and transportation provision made	:	The floor at temporary waste storage area are constructed with concrete slab, non- reactive material, properly bunded and graded towards one corner for the collection of accidental spillage and leakage. The storage area is built not less than 1 m above the 1:100 year flood level (nearest river) to avoid inundation. Bunding/drains are provided around the storage area to avoid storm water entering into this area.
b) I	ncinerable HW (Organics) Storage A	rea	:
i)	Number of sheds	:	01
ii)	Area of each shed in sq. meters	:	940 sq. m
iii)	Distance between sheds in meters	:	Nil
iv)	Proposed quantities to be stored in each shed (in metric tons)	:	1500 MT
v)	Arrangement of stacking of drums	:	The stacking of drums shall be in the manner that mixing of solvent drums shall be avoided at maximum extent.
vi)	Compatibility criteria followed for storage	:	Yes. Wastes containing ignitable, reactive and no compatible characteristics will be stored separately. Wastes containing volatile solvents or other low vapor pressure chemicals will be adequately protected from direct exposure to sunlight.
vii)	Arrangement made for smoke and fire detection	:	To increase the level of safety, sprinklers shall be installed along with smoke detector in incinerable waste storage shed
viii)	Arrangement for remedial action in case of fire	:	The proposed safety systems like fire/foam hydrants, warning systems and control centers, fire pumps etc are available for existing facility and the same will be provided for various emergency situations for proposed facility
ix)	Arrangement for spillage/run off collection		The floor at incinerable waste storage area shall be constructed with concrete slab, non-reactive material, properly bunded and graded towards one corner for the collection of accidental spillage and leakage.
x)	Arrangement made for control of fire accidents	:	Fire control equipment like Fire Extinguishers along with safety showers and

				Fire Hydrant System will be provided.			
(5)	Pre-t	reatment Facilities					
(0)	i)	Facilities provided/proposed for	:	Stabilization pits are proposed for Pre-			
	'	pre-treatment		treatment			
	ii)	List of Chemicals/stabilizing	:	Cement, lime, fly ash, bentonite clay, saw			
		agents proposed to be used in		dust etc. Sodium silicate solution would be			
		the treatment processes		used as an additive binding agent wherever			
				required			
	iii)	Arrangements for storage of	•••	A separate chemical / reagent storage Room			
		chemicals/stabilizing agents		is available.			
(6)	Incin	eration including other thermal treat	me	ent technology:			
	i)	Total Installed Incineration	:	55 TPD			
		Capacity in Tons per hour and in					
		energy units					
	ii)	Expected incineration operating	:	Approx.450 to 600 Hrs			
		hours in a month					
	iii)	Make and Supplier of incinerator/	:	To be decided at the time of execution,			
		any other technology		based on techno-commercial advantages.			
				Tentative selection:			
				Aake: Mojj Engineering			
				Supplier: Mojj Engineering Systems Limited, Pune			
	iv)	Pollution Control Systems	•	Attached as Attachment 7 .			
		attached with the incinerator	•				
		(enclose details along with a flow					
		diagram)					
	v)	Arrangements made for mixing of	:	Arrangements are made as per the finger			
		incinerable wastes before feeding		print analysis report. Before feeding the			
				wastes in to the incinerator, the wastes are			
				pre-processed for making it homogenous in			
				calorific value. The wastes are mixed based			
				on compatibility with other wastes received			
				and calorific value.			
	vi)	Safety measures adopted at the	:	Fire extinguishers along with fire buckets			
		waste feed mixing area		and Fire hydrant system are provided at			
				waste feed mixing area			
	vii)	Criteria followed for waste feed	:	The details are enclosed as Attachment 8			
(7)	Sec.	mixing (enclose details)					
(7)		red Landfilling		Wasta Accontance criterion is Attached as			
	i)	Criteria followed for disposal of	:	Waste Acceptance criterion is Attached as Attachment 6			
		wastes in SLF (please attach details)					
	ii)	Proposed Secured Landfill	:	650 TPD			
	'')	Capacity (in Tons)	•				
	iii)	Proposed no. of Cells and	:	The proposed 2 cells with approx. 1,00,000			
	,	capacity of each cell	•	MT/ cell capacities (tentative).			
<u> </u>	1						

Annexure - 1

	iv)	Construction details of the cell (provide a sketch)	:	SLF Drawing Attached as Attachment 9.
	v)	Proposed liner system components and their specifications	:	2 mm HDPE Liner (Double Liner System) is used
	vi)	No. of vents proposed/provided with the capped cells	:	30 Nos.
	vii)	No. of leachate collection wells proposed in each cell	:	2 Sumps.
	viii)	Design details of secured landfill with sketch including the proposed capping of completed Cells (provide a copy of the sketch giving information on each layer with reduceds levels (RL) as approved by the PCB)	:	SLF Drawing Attached as Attachment 9.
	ix)	Designed life span of the SLF in years (total as well as cell-wise details)	:	50 Years (30 Years for Operation & 20 Years Post Closure Monitoring).
	x)	Expected leachate generation in KL per annum	:	Approx. 2000 KL per annum from all cells.
	xi)	Operational plan of the landfill	:	Varies as per intake of waste.
	xii)	No. of proposed/existing monitoring wells around TSDF (attach layout with GW flow direction)	:	4 number of peizometric wells are proposed.
(8)	Leach	ate Treatment Details		
	i)	Proposed leachate treatment (by Multiple Effect Evaporator (MEE)/Solar evaporator/steam stripping followed by Incinerator spray drier or any other means)	:	Reused on SLF and Incineration/ sent to SEP
	ii)	Final mode of treatment and disposal of leachate other than above	:	NA.
III. F	Procedu	ire for waste acceptance, characteri	zat	ion, mode of treatment and disposal
(1)		er information proposed to be ed from the member industrial	:	(Indicate Yes/No)
	i)	Products Manufactured	:	NA
	ii)	Stepwise process chemical reactions	:	NA
		Quantity of wastes generated as per the stoichiometric requirements	:	Yes
I T	iv)	Characteristics of the waste	:	Yes

		(physical)		
	v)	Chemical characteristics of the	:	Yes
	v)		•	res
		waste (finger print as well as		
	-	detailed analysis)		
	Vi)	Category of the wastes (as per	:	Yes
		Schedule 1 or 2 of the HW		
		(M, H & TM) Rules)		
	vii)	Any pre-treatment given, if so,	:	NA.
	,	type of treatment given by the		
		generator		
(2)	What	her TSDF accepting the waste from	:	Yes
(2)			•	165
(2)		rator having the manifest		
(3)		es of the manifest sent to SPCB/PCC	:	Yes
	and	the generator of the waste, after		
	treat	ment and disposal		
(4)	Facili	ties provided for cleaning the	:	Yes
		portation vehicles		
(5)		ment and disposal provision made	•	Yes
		liquid wastes generated from	•	
		ing of vehicles		<u> </u>
(6)		k for any other relevant information	:	Yes
		respect of waste acceptance		
	proce	edures including packing and		
	labeli	ng		
IV.	Monit	oring Data – Base Line		
(1)	Amb	vient air quality (date of sampling,	:	Report attached as Attachment 10.
		perature, wind speed, wind		
		ction and monitoring results for		
		dard air quality parameters to be		
(2)	-	osed)		
(2)		quality (up to 1m depth) (date of	:	Report attached as Attachment 10.
		pling, depth of sampling and the		
	soil	characteristics for standard soil		
	para	meters including heavy metals to		
	be e	nclosed)		
(3)		ace /Ground water characteristics	:	Report attached as Attachment 10.
(-)		e of sampling, depth of ground		
	-	er table and direction of flow/depth		
		· · ·		
		surface water at which samples		
		n, characteristics for drinking water		
	para	meter to be indicated)		
(4)	Nois	e Levels in decibels (parameters to	:	Report attached as Attachment 10.
	be	monitored and indicated as per		
	norr	· · · · ·		
(5)	-	posed permanent Ambient Air	:	Minimum 2-3 AAQ stations will be
(3)		lity Monitoring Stations around the	•	considered for monitoring. However, the
				-
1	1 1201	- (enclose location map with wind		conditions provided in EC and CFE will also

Annexure - 1

	rose diagram of the area)		be followed.
	Proposed Record Keeping & Maintenance vana Disposal	vit	h regard to the Waste Acceptance, Treatment
(1)	Maintenance of records w.r.t the waste receipt manifest from the member units	:	Yes. Will be maintained
(2)	System of record keeping w.r.t the finger print analysis and detailed analysis of the wastes of the member units	:	Yes. Will be maintained
(3)	System of decision making for deciding the requirement of pre-treatment of wastes/treatment by incineration/ disposal into SLF.	:	Based on comprehensive and finger print analysis report
(4)	Record keeping with respect to the Wastes treated and disposed within TSDF upon receipt of wastes from the member units.	•	Yes. Will be maintained
(5)	Arrangement made for collection and handling of spillages	:	Spill control kits shall be provided to handle the spillages.
(6)	System of record keeping with regard to the leachate generation in KL per annum and its treatment and final mode of disposal.	:	Log Book shall be maintained, leachate will be disposed through SLF, SEP and incineration.
VI. I	Miscellaneous		
(1)	Provisions made for post-closure monitoring and maintenance (enclose copy of the escrow agreement)		The proposed project is green field project, provision shall be made for post closure monitoring and maintenance and same shall be submitted.
(2)	Emergency preparedness plan		Onsite and Offsite emergency preparedness details are attached as Attachment 11.
(3)	Details of Insurance policies, premiums, sum assured, including Insurances under Public Liability Insurance (PLI) Act etc.		Details enclosed as Attachment 12.
(4)	Occupational Health, Facility safety systems, Risk management procedures		Environmental aspects/Occupational Hazards of the organization's activities, products & services are collected from individual HODs and by direct survey in the facility by EHS officer / HOD's. A set of data is preserved for reference in the 'SHE Register' file. As an ongoing process, data on environmental aspect/occupational hazards is regularly collected from various sources

		such as employees / contract people / equipments etc. Safety systems shall be provided in the areas wherever there is a chance of risk and procedures are followed according to the emergency preparedness plans.
(5)	Report on Health Status of the public living within 5 km radius (pl. attach copy obtained from the State Health Department) and workers appointed by the facility operator (pl. attach list of workers and their health status at the time of appointment)	Not Applicable, as proposed project in greenfield project
(6)	Certificate obtained from Department of Explosives/Directorate of Industrial Safety and Health for Fire Safety and Storage	NA
(7)	Fire fighting systems descriptions	Fire Hydrant System, Fire Extinguishers, Fire buckets, Smoke detection system etc. are proposed
(8)	Personal protective equipment	Safety helmets, Gum boots, Shoes, Goggles, Dust mask, ear plugs, reflecting Jackets, Gloves are made available to the personnel

Declaration

This is to certify that the details furnished above are true to the best of my knowledge and as per records available with us

barjiv kumar

Signature of Operator of a Facility

Name Address	: Sanjiv Kumar : 13 th Floor, Ramky Grandiose, Ramky Towers Complex, Gachibowli, Telangana – 500 032
Telephone no	: 04023015000
Mobile no	: 9810265282

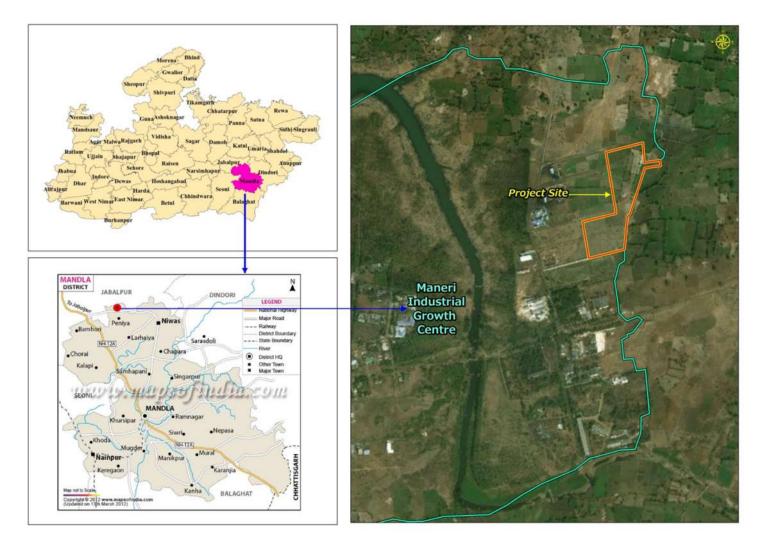
E-Mail : <u>sksanjiv@ramky.com</u>

Station: Hyderabad

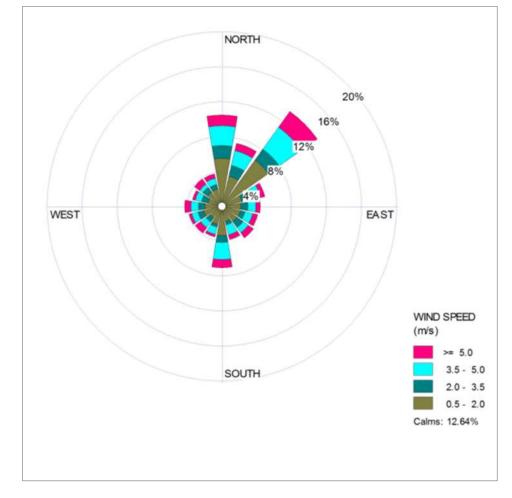
Date: 09.01.2020

Attachment 1

Location Map

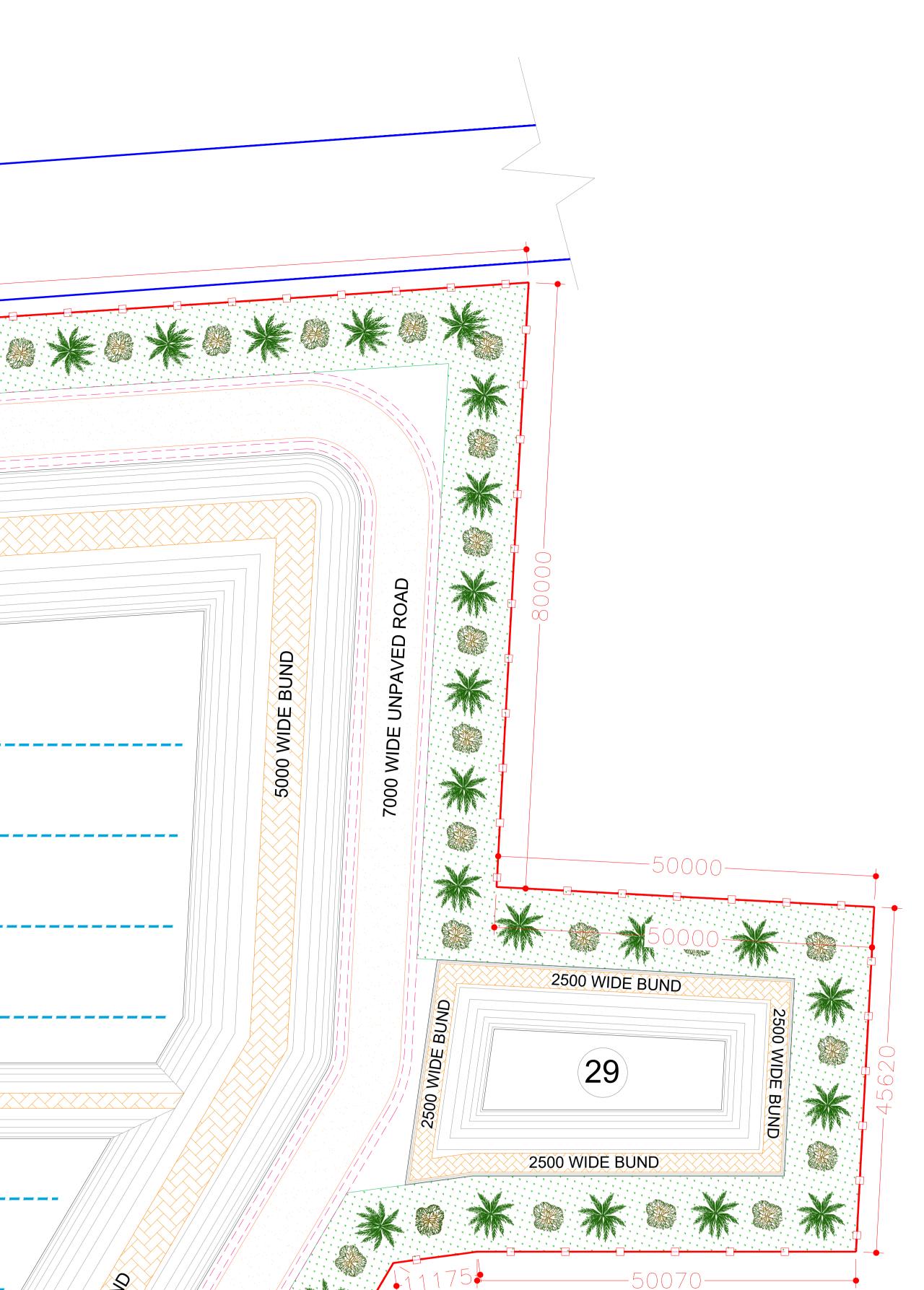


Attachment 2

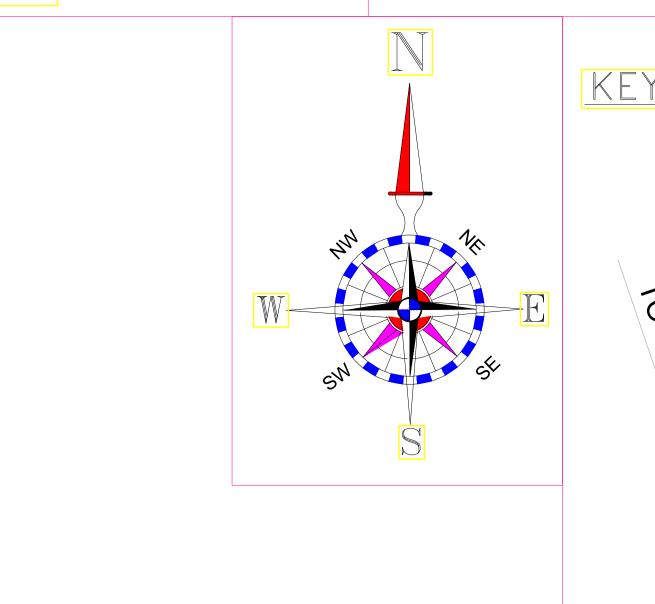


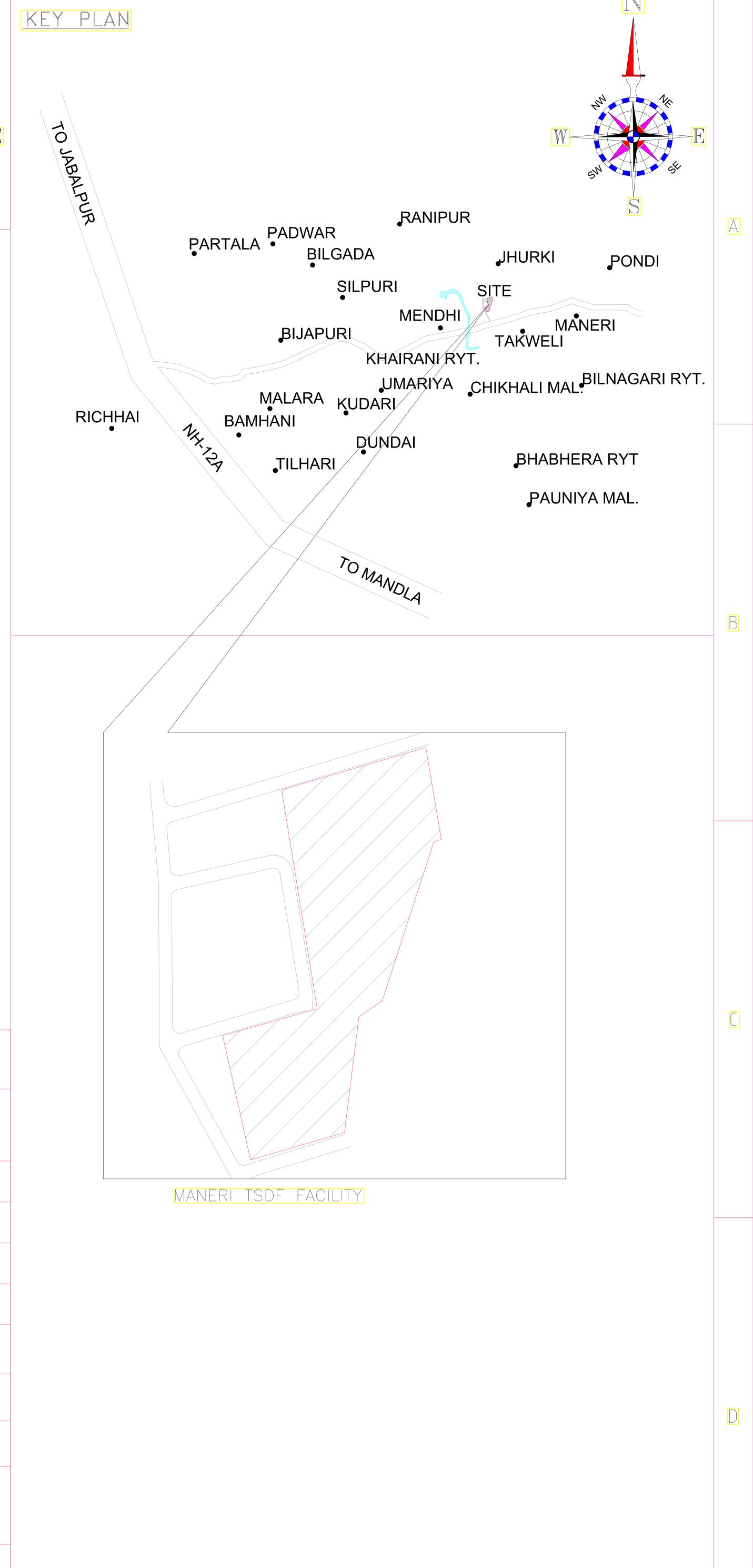
Wind rose diagram (Study Period - October to December 2019)





►						
SU	PPORTING INF	RASTRUCTURE				
TAG NO.	DESCRIPTION	NOF UNIT		SIZE	QTY,	MoC
1	SECURITY ROOM		3.46 x	3.46m	1	RCC
2	UNDER GROUND S	UMP	3.00 x	3.00m	1	RCC
3	WEIGH BRIDGE &		3.46 x	3.46m	1	RCC
4	ADMINISTRATION C	UM LAB BUILDING	13.90 x	19.00m		RCC
5	CANTEEN		10.46 x	8.46m	1	RCC
6	ELECTRICAL PANEL RO	OM & D.G PLATFORM	6.23 x	5.23m	1	RCC
	RAIN WATER COLL	ECTION POND	660.00	Sqm	1	
8	SPL REPROCESSIN (CARBON PORTION		30.00 x	25.00m	1	PEB
9	SPL REPROCESSING (REFRACTORY POR	G & DISPOSAL FACIL TION)	ITY 30.00 x	25.00m	1	PEB
10	VEHICLE TYRE WAS	SH	24.00	x 6.66 m	1	
1 1	AFRF SHED		24.90 x	13.00m	1	PEB
12	MECHANISED WAST Shed, temporary		42.92 x	21.90m	1	PEB
13	SOLVENT RECOVER RECYCLING FACILIT	Y/USED OIL Y	31.00 x	10.00m	1	RCC
14	TANKFARM FOR ING	CINERATOR PLANT	12.00 x	6.00m	1	RCC
15	PCC/MCC/PLC RO	OM	15.92 x	5.46m	1	RCC
16	INCINERATOR PLAN	Τ	35.00 x	10.00m	1	PEB
1 7	BMW PROCESSING S	HED	42.90 x	14.50 m		
17A	AREA FOR ETP		10.93	x 3.65 m		
18	WORKERS RESTROC	MS & WASHROOMS	11.43 x	3.50m	1	RCC
19	BOILER & COAL ST	FORAGE SHED	8.20 x	23.70m	1	RCC
20	LTP AREA		131	.20 Sq.m	1	
21	TANK FARM FOR S RECOVERY/USED (
	FACILITY		11.00 x	18.50m	1	RCC
22	GENERAL STORES		26.66 x	12.46m	1	PEB
23	VEHICLE MAINTENA	NCE SHED REPROCESSING FACIL	ITY2500 x	20.00m	1	RCC
	SAMPLE COLLECTI			1.76m	1	RCC
24	LEAD RECYCLING			× 20.26m	1	PEB
26	VEHICLE WASH &	PARKING		Sqm	1	RCC
27		PLASTIC & METAL		< 45.64m		PEB
	DRUM PROCESSING	G SHED		770		
28	LANDFILL LEACHATE COLLEC	TIANI DANN		37 Sqm	1	
29	AREA FOR WTE			18 Sqm 35 Sqm	1	
30 AREA	STATEMENT:					
REF.	NOTATION	DESCRIPTION		PERIMTR		
<u>NO</u> .		FACILITY/PLOT AREA (19.76 ACRES)	in 'sqm' 80,000.00	in 'rmt' 1,622.29		
2		ROAD		1446.56		
3		GREEN BELT	26,400.00			
4		TRANSFORMER YARD	50.00			
5		TRUCK PARKING	360.00	76.00		
	9		10			





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GENERAL NOTES:

work.

1. ALL DIMENSIONS IN MILLIMETERS, LEVELS & COORDINATES IN METERS UNLESS OTHERWISE STATED. 2. THE COORDINATES INDICATED IN THE DRAWING IS TO BE VERIFIED PROPERLY BEFORE EXECUTION. 3. DO NOT SCALE DRAWING. ONLY WRITTEN DIMENSIONS SHALL BE 5. DO NOT SCALE DRAWING. UNLY WRITTEN DIMENSIONS SHALL BE FOLLOWED.
4. ANY DISCREPANCIES NOTED SHALL BE BROUGHT TO THE NOTICE OF THE ARCHITECT PRIOR TO EXECUTION.
5. ROAD WIDTH SHOWN ARE INCLUSIVE OF BERMS & STORM WATER DRAINS SHALL BE EXECUTED AS PER SITE GRADING.
6. THESE DRAWINGS ARE ONLY FOR APPROVAL, DEVELOPED FOR PRELIMINARY STAGE DESIGN.

B The responsibility of control, check and verification of accuracy, correctness, completeness, integration and full compliance of contract provisions in respect of design analysis and drawings rests with the design consultants and the contractor.

REV:	DESCRIPTIO	ON	BY:	DATE
CLIENT:				
	MADHYA PRADESH II	NDUSTRIAL DEVELOP	MENT CORP	ORATION
CONTRACT				
	RAN	AKY ENVIRO EN	NCINEERS	
	Floor	13, Ramky Grandios		
		s		1
RA	Opp. GACH	Rolling Hills, Anjaiah		
RAN Towards su	GROUP GACH		500032.	
lowards su	Opp.GROUPGROUPGACHstainable growthTel :	Rolling Hills, Anjaiah HBOWLI, HYDERABAD-	500032.	
Towards su	Opp.GROUPGROUPGACHstainable growthTel :	Rolling Hills, Anjaiah HBOWLI, HYDERABAD– +91 040 2301 500 E TREATMENT STORA	500032.	POSAL FACII
Towards su	Opp. GROUP GACH stainable growth TITLE:	Rolling Hills, Anjaiah HBOWLI, HYDERABAD— +91 040 2301 500	500032.	POSAL FACII
PROJECT COMMO	Opp. GACHstainable growthTITLE:N HAZARDOUS WAST	Rolling Hills, Anjaiah HBOWLI, HYDERABAD– +91 040 2301 500 E TREATMENT STORA	500032.	POSAL FACI
PROJECT COMMO	Opp. GACHstainable growthTITLE:N HAZARDOUS WAST	Rolling Hills, Anjaiah HBOWLI, HYDERABAD– +91 040 2301 500 E TREATMENT STORA	500032.	POSAL FACI
PROJECT COMMO	Opp. GACH stainable growth TITLE: N HAZARDOUS WAST TITLE:	Rolling Hills, Anjaiah HBOWLI, HYDERABAD- +91 040 2301 500 (CHWTSDF)	500032.)0.	POSAL FACI
PROJECT COMMO	Opp. GACH stainable growth TITLE: N HAZARDOUS WAST TITLE:	Rolling Hills, Anjaiah HBOWLI, HYDERABAD– +91 040 2301 500 E TREATMENT STORA	500032.)0.	POSAL FACI
PROJECT COMMO DRAWING	Opp. GACH stainable growth TITLE: N HAZARDOUS WAST TITLE: TITLE: TITLE: TITLE: TITLE:	Rolling Hills, Anjaiah HBOWLI, HYDERABAD- +91 040 2301 500 (CHWTSDF)	500032.)0.	POSAL FACI
PROJECT COMMO DRAWING	Opp. GACH Itel : TITLE: N HAZARDOUS WAST TITLE: TITLE:	Rolling Hills, Anjaiah HBOWLI, HYDERABAD- +91 040 2301 500 (CHWTSDF)	500032. O.	POSAL FACI
PROJECT COMMO DRAWING	Opp. GACH Itel : TITLE: N HAZARDOUS WAST TITLE: TITLE:	Rolling Hills, Anjaiah HBOWLI, HYDERABAD +91 040 2301 500 (CHWTSDF)	500032. DO. AGE & DISP YOUT GA/100	
PROJECT COMMO DRAWING	Opp. GACH stainable growth TITLE: N HAZARDOUS WAST TITLE: TITLE: TENTAT NO : REEL/CHW	Rolling Hills, Anjaiah IBOWLI, HYDERABAD– +91 040 2301 500 (CHWTSDF) TIVE MASTER LA	500032. O. AGE & DISP YOUT GA/100	REV:
lowards su PROJECT	Opp. GACH stainable growth TITLE: N HAZARDOUS WAST TITLE: TITLE: TENTAT NO : REEL/CHW	Rolling Hills, Anjaiah IBOWLI, HYDERABAD– +91 040 2301 500 (CHWTSDF)	500032. O. AGE & DISP YOUT GA/100	REV:

Attachment 4

List of Instruments for Proposed Laboratories

S.No	Name of the Equipment
1.	High Temp Muffle furnace
2.	Oven Universal
3.	BOD Incubator
4.	Deep Freezer Vertical
5.	Hot Plate
6.	Laboratory High Vaccum Pump
7.	Karl Fisher titration Apparatus
8.	COD digestion Unit
9.	Water Bath
10.	Soxhlet Extraction Hot Plate
11.	Magnetic Stirrer with Hot Plate
12.	Rotary Shaker
13.	Water distillation Unit
14.	pH Meter
15.	EC TDS Analyzer
16.	Flame Photometer
17.	UV Vis Spectrophotometer
18.	BOMB calorimeter
19.	TCLP Agitator
20.	Zero Head Space Extractor
21.	Electronic Analytical Balance
22.	Top Loading balance
23.	Flame Hood & Wall Storage Cup
24.	Weather Monitoring Station
25.	Flash Point Tester
26.	Air Compressor
27.	Pellet Press
28.	Sound Level Meter
29.	Stack Monitoring Sampler
30.	Breathing Apparatus
31.	CHNS – Cl analyzer
32.	Respirable Dust Sampler (RDS) – 3nos
33.	Heating mantle – 5 liters
34.	Heating mantle – 2 liters
35.	Weight Box (2mg to 100 mg)
36.	VOC detector
37.	Glass Thermometer - 2nos

Report No.

Date

TEST REPORT

Parameter	Unit	Method	Result	CPCB:HAZWAMS/ /2009-2010
PFLT (Paint Filter Liquid Test)	-	SW 846 9095 A		Passes
Specific Gravity	g/cm	ASTM-D 5057-90		Not Specified
Calorific Value	cal/g	IS:1350 Part II - 1970		<2500 cal/g
Flash Point	٥C	SW 846 1020 A		>65.0
Moisture Content	%	KF Titration		Not Specified
LOD @ 105ºC	%	APHA 2540		Not Specified
LOI @ 550°C	%	APHA 2540		< 20 %
Ash Content @ 900 ⁰ C	%	APHA 2540		Not Specified
Viscosity @ 40°C/70°C/100°C	cSt	IS:1448 P-25		Not Specified
pH (At Room Temperature)	-	SW 846 9045 C		> 4 To < 12
TDS (Total Dissolved Solids) @ 180 °C	%	APHA 2540		Not Specified
TVS (Total Volatile Solids) @ 550 ^o C	%	APHA 2540		Not Specified
WSI (Water Soluble In organics)	%	APHA 2540-C		Not Specified
Silica	mg/L	APHA 4500 SiO ₂ - C		Not Specified
C.O.D. (Chemical Oxygen Demand)	mg/L	APHA 5220		Not Specified
Hexane Extractable Organics	%	SW 846 3540 C & 9071 A		<4.0

Parameter	Unit	Method	Result	Hazardous Waste (Management, Handling & Transboundary Movement) Rules 2008 Schedule II
Ammonia as NH ₃ -N	mg/Kg	APHA 4500 NH ₃ - C		>20000
Nitrate as NO ₃ ⁻	mg/kg	APHA 4500 NO ₃ ⁻ - B		>20000
Nitrite as NO ₂ ⁻	mg/kg	APHA 4500 NO ₂ ⁻ - B		Class B >5000, Class C >20000
Phosphate as $PO_4^{}$	mg/kg	APHA 4500 P - D		>20000

Priyanka Dixit Assistant Manager Laboratory

Report No.		Date	
Sulphate as SO ₄	mg/kg	APHA 4500 SO4 - E	Not Specified
Chlorides as Cl ⁻	mg/kg	APHA 4500 Cl ⁻ - B	Not Specified
Fluorides as F ⁻	mg/kg	APHA 4500 F⁻ - D	Not Specified
Organic Halogens	mg/kg	SW 846 5050 & 9253	Not Specified
Total Phenols	mg/kg	APHA 5530-D	>5000
Reactive Cyanides	mg/kg	SW 846 9010 B &	Refer Class E4
Reactive Sulphides	mg/kg	SW 846 9030 B &	>20000
% Carbon	%	CHNS-O Analyzer	Not Specified
% Hydrogen	%	CHNS-O Analyzer	Not Specified
% Nitrogen	%	CHNS-O Analyzer	Not Specified
% Sulphur	%	CHNS-O Analyzer	Not Specified
Total Sulphur	mg/kg	CHNS-O Analyzer	>50000
Aluminium as Al	mg/kg	SW 846 7020	Not Specified
Antimony as Sb	mg/kg	SW 846 7040	>50
Arsenic as As	mg/kg	SW 846 7061 A	>50
Barium as Ba	mg/kg	SW 846 7080 A	>20000
Cadmium as Cd	mg/kg	SW 846 7130	>50
Total Chromium as Cr	mg/kg	SW 846 7190	Not Specified
Chromium as Cr 3 ⁺	mg/kg	SW 846 7190	>5000
Chromium as Cr 6 ⁺	mg/kg	SW 846 7196A	>50
Cobalt as Co	mg/kg	SW 846 7200	>5000
Copper as Cu	mg/kg	SW 846 7210	>5000
Iron as Fe	mg/kg	SW 846 7380	Not Specified
Lead as Pb	mg/kg	SW 846 7420	>5000
Manganese as Mn	mg/kg	SW 846 7460	Not Specified
Mercury as Hg	mg/kg	SW 846 7470 A & 7471 A	>50
Molybdenum as Mo	mg/kg	SW 846 7480	>5000
Nickel as Ni	mg/kg	SW 846 7520	>5000
Selenium as Se	mg/kg	APHA 3500- Se	>50
Titanium as Ti	mg/kg	APHA 3500-Ti	Not Specified
Tin as Sn	mg/kg	SW 846 7870	>5000
Vanadium as V	mg/kg	SW 846 7910	>5000
Zinc as Zn	mg/kg	SW 846 7950	>20000

Report No.

Date

Parameters	Unit	Method	Result	TCLP Limits as per CPCB / HAZWAMS/ / 2009-2010
(TCLP) Toxicity Characteristics Leaching Procedure	-	SW 846 1311 & 1330	-	-
Total Phenols	mg/L	APHA 5530		<100
Fluoride	mg/L	APHA 4500 F⁻		<50
Ammonia	mg/L	APHA 4500 NH ₃ - C		<1000
Cyanide	mg/L	SW 846 9014		<2.0
Nitrate	mg/L	APHA 4500 NO3 ⁻ - B		<30
Aluminium as Al	mg/L	SW 846 7020		Not Specified *
Antimony as Sb	mg/L	SW 846 7040		Not Specified *
Arsenic as As	mg/L	SW 846 7061 A		<1.0
Cadmium as Cd	mg/L	SW 846 7130		<0.2
Total Chromium as Cr	mg/L	SW 846 7190		Not Specified *
Chromium as Cr ⁶⁺	mg/L	SW 846 7196A		<0.5
Cobalt as Co	mg/L	SW 846 7200		Not Specified *
Copper as Cu	mg/L	SW 846 7210		<10
Iron as Fe	mg/L	SW 846 7380		<30
Lead as Pb	mg/L	SW 846 7420		<2.0
Manganese as Mn	mg/L	SW 846 7460		Not Specified *
Mercury as Hg	mg/L	SW 846 7470 A & 7471 A		<0.1
Molybdenum as Mo	mg/L	SW 846 7480		Not Specified *
Nickel as Ni	mg/L	SW 846 7520		<3.0
Zinc as Zn	mg/L	SW 846 7950		<10

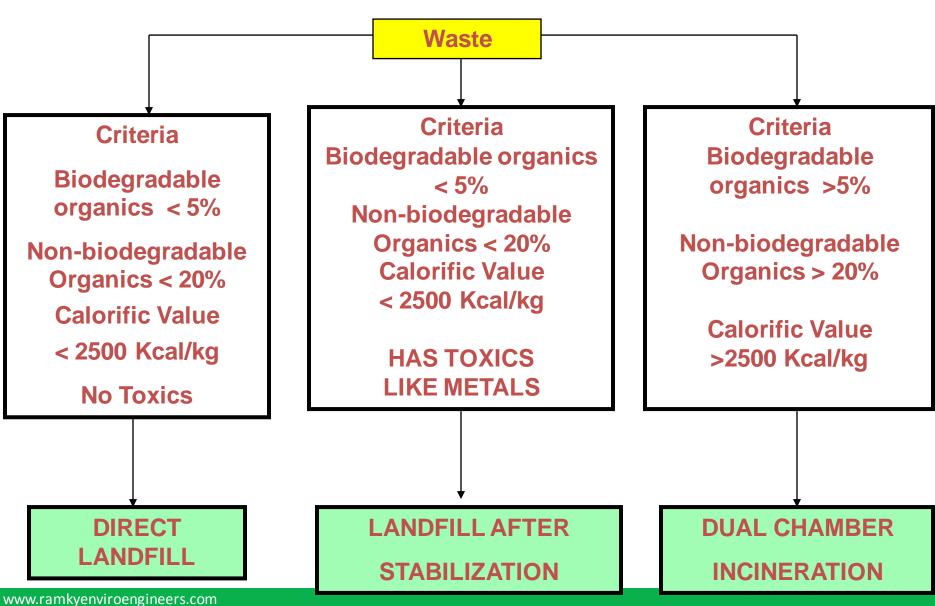
PARAMETER	Unit	Method	Result	Std. for Secure Landfill Disposal
Chloroform	mg/Kg	GC-MS		6.0 mg/L (TCLP)
Carbon tetra chloride	mg/Kg	GC-MS		0.5 mg/L (TCLP)
Benzene	mg/Kg	GC-MS		0.5 mg/L (TCLP)
Chloro Benzene	mg/Kg	GC-MS		100.0 mg/L (TCLP)

Priyanka Dixit Assistant Manager Laboratory

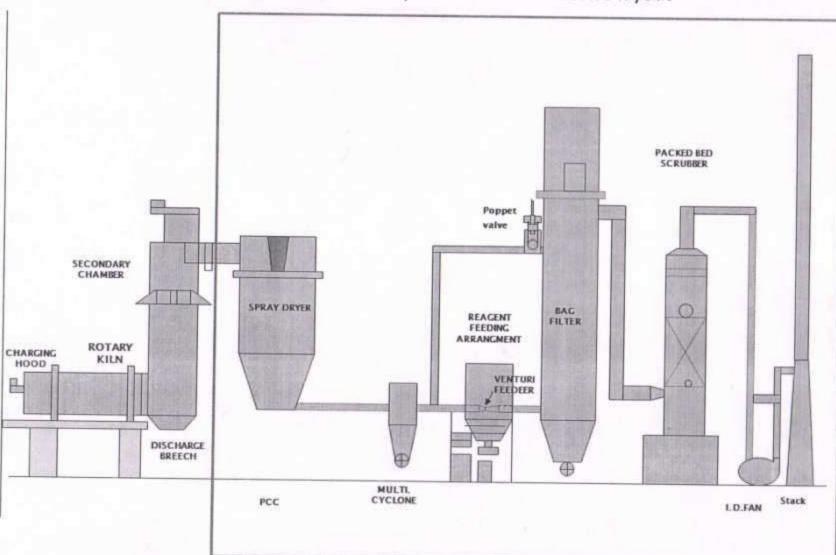
Report No.		Date		
Cresols	mg/Kg	GC-MS		200.0 mg/L (TCLP)
1,4- Dichloro Benzene	mg/Kg	GC-MS		7.5 mg/L (TCLP)
PARAMETER	Unit	Method	Result	Std. for Secure Landfill Disposal
1,2- Dichloro Ethane	mg/Kg	GC-MS		0.5 mg/L (TCLP)
Pyridine	mg/Kg	GC-MS		5.0 mg/L (TCLP)
Ethyl Methyl Ketone	mg/Kg	GC-MS		200.0 mg/L (TCLP)
Nitro Benzene	mg/Kg	GC-MS		2.0 mg/L (TCLP)
Tetrachloro Ethylene	mg/Kg	GC-MS		0.7 mg/L (TCLP)
Trichloro Ethylene	mg/Kg	GC-MS		0.5 mg/L (TCLP)
1,1- Dichloroethylene	mg/Kg	GC-MS		0.7 mg/L (TCLP)
2,4- Dinitrotoluene	mg/Kg	GC-MS		0.1 mg/L (TCLP)
Endrin	mg/Kg	GC-MS		0.02 mg/L (TCLP)
Heptachlor(and its epaoxide)	mg/Kg	GC-MS		0.008 mg/L (TCLP)
Hexachlorobenzene	mg/Kg	GC-MS		0.13 mg/L (TCLP)
Hexachlorobutadiene	mg/Kg	GC-MS		0.5 mg/L (TCLP)
Hexachloroethane	mg/Kg	GC-MS		3.0 mg/L (TCLP)
Lindane	mg/Kg	GC-MS		0.4 mg/L (TCLP)
Methoxychlor	mg/Kg	GC-MS		10.0 mg/L (TCLP)
Pentachlorphenol	mg/Kg	GC-MS		100.0 mg/L (TCLP)
Toxaphene	mg/Kg	GC-MS		0.5 mg/L (TCLP)
2,4,5- Tri Chlorophenol	mg/Kg	GC-MS		400.0 mg/L (TCLP)
2,4,6- Trichlorophenol	mg/Kg	GC-MS		2.0 mg/L (TCLP)
2,4,5- TP (Silvex)	mg/Kg	GC-MS		1.0 mg/L (TCLP)
Vinyl Chloride	mg/Kg	GC-MS		0.2 mg/L (TCLP)
2,4- D	mg/Kg	GC-MS		10.0 mg/L (TCLP)
Chlordane	mg/Kg	GC-MS		0.03 mg/L (TCLP)

END OF REPORT





Attachment 7



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Air pollution control devise layout

Doc. No.	:	SOP – INC.	STANDARD OPERATING	Revision No.	:	00/23.04.2018
Issued by	:	Incineration In charge		Pages	:	1 of 1
TITLE	:		Common Waste Storage, Feed Preparation, and Feeding Practices in Hazardous-Waste Incineration Facility			

*** PURPOSE:**

To describe the Common Waste Storage, Feed Preparation, and Feeding Practices in Hazardous-Waste Incineration Facility.

*** SCOPE:**

Applicable to the Incineration for Common Waste Storage, Feed Preparation, and Feeding Practices in Hazardous-Waste.

*** RESPONSIBILITY:**

Technical Supervisor	:	Waste Storage, Feed Preparation of Hazardous Waste.
Incineration In charge	:	Review of activity
Operation In charge	:	Implementation and compliance of SOP.

*** PROCEDURE:**

WASTE FEEDING MECHANISMS

- a. Maintaining designed heat capacity of the combustion chambers under varying feed calorific values demands skill. In absence of proper hands on training and adequate knowledge, the minimum negative pressure could not be maintained at all the times leading to diffused emissions / sudden puffing of emissions into the secondary combustion chambers constraining the retention time resulting in poor efficiency. Besides, these temperature fluctuations will have negative bearing on refractory and insulation material.
- b. Therefore, continuous feeding of homogeneous waste having same / similar calorific value to the combustion chambers is the desired choice. However, often maintaining homogeneous feed of waste is not feasible due to incompatibility of different wastes for mixing. Conventionally, hazardous wastes in solid form are fed through a hydraulic system, which will have automatic two gates i.e. once the outside plate is closed, inner side plate is opened and solid waste mass is hydraulically pushed inside the Kiln and once the inner side plate is closed, outer plate is opened for next batch of solid waste. This system, besides negative pressure in the combustion chambers is required to ensure safety and to prevent workmen exposure to thermal radiation.
- c. Thus, waste-feeding mechanism plays an important role to achieve desired combustion efficiencies. For example, the variety of wastes received from the member industries can be classified into following for better control of combustion:

Doc. No.	:	SOP – INC.	STANDARD OPERATING	Revision No.	:	00/23.04.2018
Issued by	:	Incineration In charge		Pages	:	2 of 1
TITLE	:		Common Waste Storage, Feed Preparation, and Feeding Practices in Hazardous-Waste Incineration Facility			

Waste in solid form

Property	Options				
High calorific value containing waste (organic residues)	Quantity of solid mass feeding may be reduced in each charging to contain temperature shoot-ups. Besides, following are used in specific cases: Low calorific value liquid waste may be parallelly injected; and/or				
	Steam may be parallelly injected				
Reactive waste, which can not be	Sealed drums, as such, may be charged into the kilns.				
mixed with others	Depending on calorific value, size of the drum / container may be specified to the member industry for such waste.				
Other mixable solid waste having moderate calorific value	May be homogenized to the extent possible and charged to the kilns at desired quantity of packets and frequency.				
Specific materials which melts on heating	Here, the possibility would be to ask the member industry to store in required capacity of the container, which can be directly injected with out heating; or to provide a system by which such drums can be heated-up and can be charged through closed-loop pressurized nitrogen.				

Waste in semi solid form

Property	Options
Very high solids	Fully shelled (to prevent diffused emissions) screw pumps
concentration	may be a choice
Relatively low conc.	Pumps similar to the one used for cement concrete charging
of solids / low	may be used.
viscosity	

Waste in semi solid form

Property	Options		
Highly reactive /	May be directly injected into combustion chambers without		
inflammable liquids	quids mixing with other wastes. The charging from the container		
	may be through closed loop nitrogen pressure purging.		

Doc. No.	:	SOP – INC.	STANDARD OPERATING	Revision No.	:	00/23.04.2018					
Issued by	:	Incineration In charge	PROCEDURES MANUAL	Pages	:	3 of 1					
TITLE	:		Common Waste Storage, Feed Preparation, and Feeding Practices in Hazardous-Waste Incineration Facility								

Liquids having high calorific value (ex.	Can replace auxiliary fuel requirement, once the combustion chambers reaches to its designed temperatures.				
contaminated					
solvents)					
Liquids having	Once it is established, these liquids can be used for raising the				
properties similar to	initial temperature of the combustion chambers. However,				
that of auxiliary fuel	specific tests in support of such claims be produced by a				
	recognized credible third party.				
Liquids having low	These may be injected in to kilns to suppress the temperature				
calorific values	shoot-ups due to high calorific solid/ other special liquid				
	waste feeds.				

- d. Depending on type of wastes received, the scheme shall be established by the common incineration facility and the member industry shall place the corresponding code number/ sticker and it is to be verified by analytical laboratory of common incineration facility to ensure appropriate feeding by operator of the facility.
- e. While charging the liquid hazardous waste, filtering the liquids may be required to avoid chocking of pumps.
- f. Non-easily pumpable wastes (ex. High viscous, having high solids content etc.) may require pressurized nitrogen purging for charging the liquid to the combustion chambers.
- g. Incase of emptying liquid waste containing drums by inserting suction pumps & induced draft (hoods and ducts), set-up above such drum emptying area for collection of volatile organic compounds (VOCs) must be ensured. These collected diffused emissions must be controlled / routed to the combustion chambers.
- h. Feeding pipeline and equipment are to be cleaned before a new type of waste is fed to the combustion system to avoid undesired reactions.

Doc. No.	:	SOP – INC.	STANDARD OPERATING	Revision No.	:	00/23.04.2018				
Issued by	:	Incineration In charge	PROCEDURES MANUAL	Pages	:	4 of 1				
TITLE	:		Common Waste Storage, Feed Preparation, and Feeding Practices in Hazardous-Waste Incineration Facility							

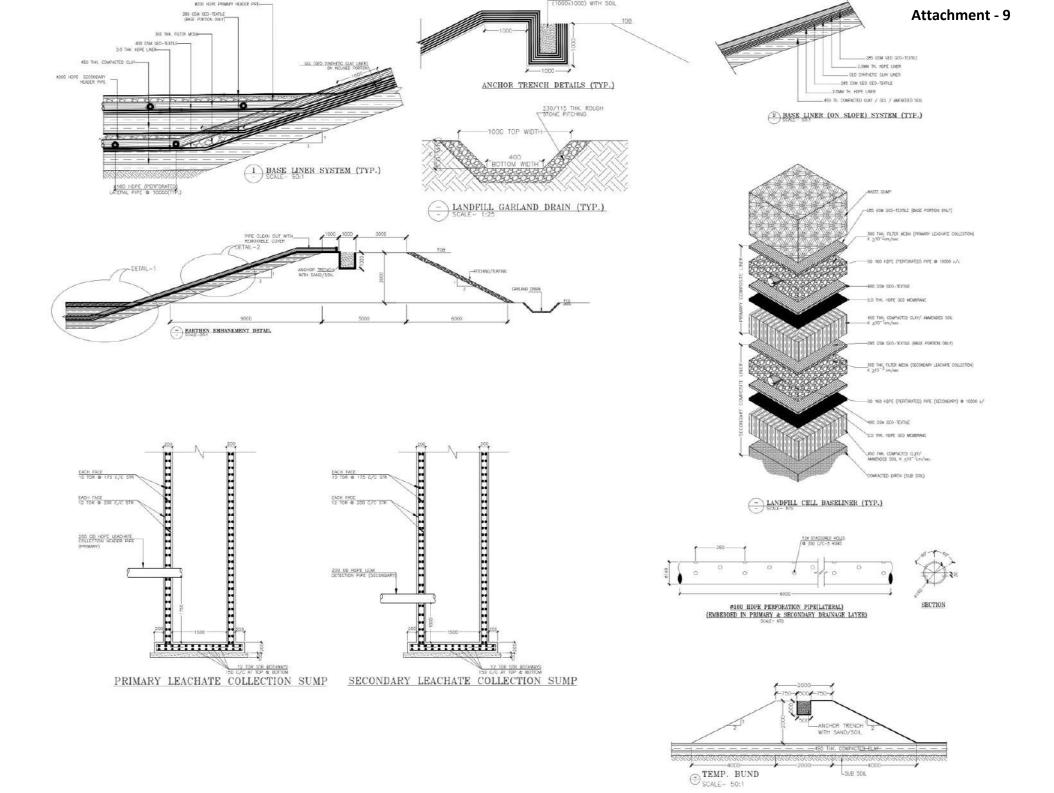
There are many variations in the methods of waste feeding in small or old waste incineration facilities. Follow the Table:

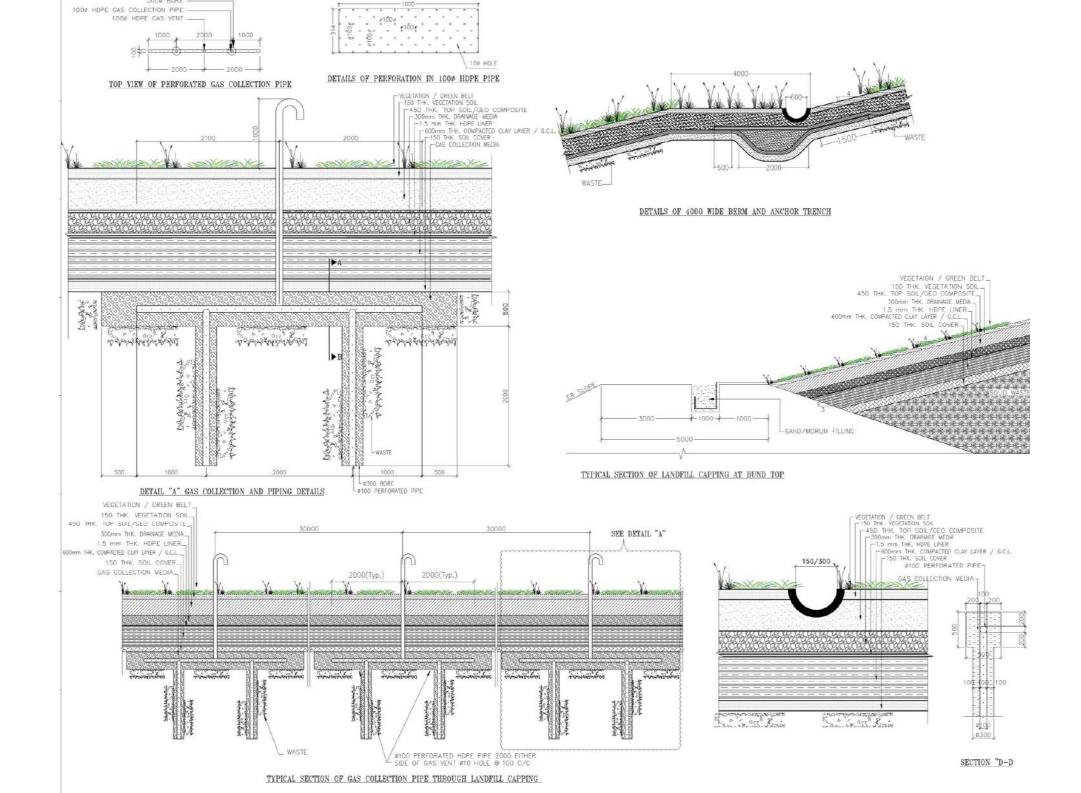
TABLE -1: Common Waste Storage, Feed Preparation, and Feeding Practices in Hazardous-Waste Incineration Facilities

Waste Type	Storage/Staging	Feed Preparation	Feeding to Incinerator
Hazardous Waste—Solids	Tarped roll off binDrums	 Screening for debris removal Shredding Decanting liquids from drums 	 Drop shaft with double- gate airlock Ram feeder
Hazardous Waste— Liquids	 Tanks, segregated by chemical compatibility Drums 	 Aqueous/organic phase separation Blending of compatibles Preheating to reduce viscosity Solids filtration, usually in- line 	• Pump to burner or atomizing nozzle

*** REFERENCE:**

• Guidelines For Common Hazardous Waste Incineration.





Baseline Monitoring Date

(October to December 2019)

Table 1 Observed meteorological data onsite

Period	Tempe	erature (°C)	Relative H	Predominant Wind	
Period	Min.	Max.	Min. Max.		Direction
October, 2019	18.2	32.4	54	81	NE
November, 2019	13.5	29.2	48	75	NE
December, 2019	10.2	26.4	52	78	N

Table 2 Frequency distribution table (October to December 2019)

Wind directions		Total			
	0.5 - 2.0	2.0 - 3.5	3.5 - 5.0	> 5.0	
Ν	5.53	1.45	2.26	1.22	10.46
NNE	3.58	1.27	1.72	0.86	7.43
NE	6.52	1.54	3.08	2.22	13.36
ENE	2.40	0.68	1.49	0.50	5.07
E	2.22	0.82	0.91	0.50	4.44
ESE	2.22	0.54	0.91	0.59	4.26
SE	2.17	0.86	0.72	0.72	4.48
SSE	1.81	0.41	1.18	0.54	3.94
S	3.40	0.77	1.95	0.95	7.07
SSW	2.17	0.32	0.86	0.27	3.62
SW	1.68	0.59	0.77	0.77	3.80
WSW	2.17	0.68	0.72	0.32	3.89
W	1.99	0.72	0.86	0.72	4.30
WNW	1.68	0.77	0.72	0.32	3.49
NW	2.04	0.68	0.45	0.72	3.89
NNW	2.08	0.54	0.72	0.50	3.85
Sub-Total	43.66	12.64	19.34	11.73	87.36
Calms (<0.5 m/s)	12.64				
Total	100				
Note: 1. Average wind	l speed is 2.31 m	/s			
2. All values are	in percentages				

Location		PN	/ ₁₀		PM _{2.5}			
Location	Min	Max	98 th percentile	Min	Max	98 th percentile		
Jhurkhi	47.5	54.5	54.5	26.4	30.9	30.9		
Maneri	48.9	56.1	56.1	28.4	34.5	34.5		
Katangi	46.5	55.6	55.6	27.3	32.7	32.7		
Medhi	45.6	54.6	54.6	26.5	31.2	31.2		
Chargaon (NE)	43.8	53.2	53.2	22.8	28.7	28.7		
Umaria	45.8	55.1	55.1	24.8	33.2	33.2		
Chargaon (SE)	44.8	53.8	53.8	25.8	31.3	31.3		
Kalyanpur	46.1	54.3	54.3	23.8	30.2	30.2		
98 th percentile	53.2 to 56.1 28.7				to 34.5			
NAAQ standards 2009 (24 hrs)	100 60			60				

Table 3 Ambient air quality results for PM_{10} & $PM_{2.5}$ concentrations ($\mu g/m^3$)

Table 4 Ambient air quality results for SO_2 , NO_x concentrations ($\mu g/m^3$)

Location		S	0 ₂	NO _x		
Location	Min.	Max.	98 th percentile	Min.	Max.	98 th percentile
Jhurkhi	9.3	11.6	11.6	21.1	23.8	23.8
Maneri	11.1	14.8	14.8	22.2	25.1	25.1
Katangi	11.2	13.5	13.5	18.4	22.4	22.4
Medhi	10.2	12.5	12.5	19.3	21.8	21.8
Chargaon (NE)	8.3	10.5	10.5	18.6	20.5	20.5
Umaria	10.2	13.8	13.8	20.4	24.3	24.3
Chargaon (SE)	9.4	11.8	11.8	17.6	21.2	21.2
Kalyanpur	9.5	12.7	12.7	21.2	23.4	23.4
98 th percentile	10.5 to 14.8 20.5 to 25.1				to 25.1	
NAAQ standards 2009 (24 hrs)	80 80				80	

Table 5 Ambient air quality results for O_3 and CO concentrations ($\mu g/m^3$)

Location		C	D ₃		СО			
LOCATION	Min.	Max.	98 th percentile	Min.	Max.	98 th percentile		
Jhurkhi	<20	21.2	21.2	450	515	515		
Maneri	22.5	26.7	26.7	520	640	640		
Katangi	<20	22.5	22.5	458	530	530		
Medhi	<20	21.4	21.4	474	545	545		
Chargaon (NE)	<20	20.4	20.4	454 492		492		
Umaria	<20	23.4	23.4	480	610	610		
Chargaon (SE)	<20	20.8	20.8	468	520	520		
Kalyanpur	<20	22.1	22.1	475	570	570		
98 th percentile		20.4 to 26.7 492 to 640				to 640		
NAAQ standards 2009(8 hrs)		1	00	2000				

		NH₃		C ₆ H ₆			
Location	Min.	Max.	98 th percentile	Min.	Max.	98 th percentile	
Jhurkhi	16.2	18.7	18.7	0.45	0.59	0.59	
Maneri	18.2	21.4	21.4	0.65	0.75	0.75	
Katangi	14.5	18.2	18.2	0.52	0.68	0.68	
Medhi	15.4	17.7	17.7	0.48	0.58	0.58	
Chargaon (NE)	13.5	15.6	15.6	0.44	0.55	0.55	
Umaria	17.4	20.4	20.4	0.56	0.66	0.66	
Chargaon (SE)	16.5	17.8	17.8	0.54	0.65	0.65	
Kalyanpur	15.7	19.8	19.8	0.46	0.58	0.58	
98 th percentile	15.6 to 21.4 0.55 to 0.75				75		
NAAQ standards 2009	400(24 hrs) 5 (Annual)					1)	

Table 6 Ambient air quality results for NH_3 and C_6H_6 concentrations ($\mu g/m^3)$

Table 7 Ambient air quality results for trace elements and benzo(a)pyrene concentrations

Parameters	Lead (µg/m³)	Arsenic (ng/m³)	Nickel (ng/m³)	Benzo(a)Pyrene (ng/m³)				
98 th Percentile Range	BDL	BDL	BDL	BDL				
BDL Value	< 1	< 1	< 0.5 µg/m³	0.01				
NAAQ standards	1	6 20		1				
2009	24 hrs	Annual						

				Standard as per								
Parameter	Unit										IS -10500:2012	
		GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	GW9	Acceptable	Permissible
											Limit	Limit
рН		7.4	7.8	6.9	7.6	7.9	7.2	7.5	7.7	7.6	6.5-8.5	No Relaxation
Ele Conductivity	μS/cm	486	822	345	524	854	534	560	534	480		
Dissolved Solids	mg/l	322	510	225	345	524	355	354	318	310	500	2000
TSS	mg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10		
Turbidity	NTU	0.2	0.5	0.3	0.2	1.5	0.1	0.8	0.1	0.2	1	5
Odor						Agreeable					Agre	eable
Alkalinity	mg/l	152	188	65	178	192	122	165	178	172	200	600
Chloride as Cl	mg/l	38	65	64	45	85	53	52	45	38	250	1000
Sulphate as SO ₄	mg/l	12.2	22.3	14.3	17.2	42.4	16.5	10.4	12.2	8.8	200	400
Nitrate as NO ₃	mg/l	3.6	20.4	3.4	5.5	12.8	4.2	5.5	3.4	6.4	45	No Relaxation
Phosphates	mg/l	0.5	2.5	0.8	1.5	3.5	0.5	1.5	0.5	0.5	-	-
Hardness as CaCO ₃	mg/l	108	348	107	195	308	118	213	203	197	200	600
Calcium as Ca	mg/l	18	86	26	53	68	22	55	48	42	75	200
Magnesium as Mg	mg/l	15	32	10	15	33	15	18	20	22	30	100
Sodium as Na	mg/l	66	38	36	32	42	65	38	24	18		
Potassium as K	mg/l	5.5	8.5	6.8	5.5	8.8	8.5	6.8	5.2	5.2		
Fluoride as F	mg/l	1.0	1.12	<1.0	<1.0	1.15	<1.0	1.18	<1.0	<1.0	1.0	1.5
Iron as Fe	mg/l	0.24	0.28	0.21	0.24	0.25	0.26	0.26	0.22	0.22	0.3	
Lead as Pb	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	No
Cadmium as Cd	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.003	Relaxation
Total Chromium	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	
Copper as Cu	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	1.5
Zinc as Zn	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5	15
Boron as B	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	1

Table 8 Results of ground water sample analysis

Parameter	Units	SW1	SW2	SW3	SW4	CPCB water quality criteria as updated on 11 th September, 2017						
	Units	3001				Α	В	С	D	E		
рН		7.2	7.6	7.4	7.8	6.5-8.5	6.5-8.5	6.0-9.0	6.5- 8.5	6.5- 8.5		
EC	μS/cm	265	305	270	322	-	-	-	-	2250		
Odor			Unobjec	tionable		-	-	-	-	-		
TSS	mg/l	<10	<10	<10	<10							
TDS	mg/l	168	182	178	210	-	-	-	-	-		
Turbidity	NTU	0.1	<0.1	<0.1	0.5	-	-	-	-	-		
Alkalinity as CaCO ₃	mg/l	102	110	108	118	-	-	-	-	-		
Chloride as Cl	mg/l	18	23	14	22	-	-	-	-	-		
Sulphate as SO ₄	mg/l	8.8	8.4	6.8	11.2	-	-	-	-	-		
Nitrates as NO ₃	mg/l	2.1	2.3	1.8	3.2	-	-	-	-	-		
Phosphate	mg/l	0.6	0.5	0.5	1.2							
Total Hardness	mg/l	104	120	108	125	-	-	-	-	-		
Calcium as Ca	mg/l	25	28	20	30	-	-	-	-	-		
Magnesium as Mg	mg/l	10	12	14	12	-	-	-	-	-		
Sodium as Na	mg/l	15	10	15	18	-	-	-	-	-		
Potassium as K	mg/l	5	8	5	8	-	-	-	-	-		
Fluoride as F	mg/l	<1	1.01	<1	1.12	-	-	-	-	-		
Iron as Fe	mg/l	0.22	0.28	0.24	0.26	-	-	-	-	-		
Lead as Pb	mg/l	<0.01	<0.01	<0.01	<0.01	-	-	-	-	_		
Cadmium as Cd	mg/l	<0.003	<0.003	<0.003	<0.003	-	-	_	_	_		
Arsenic as As	mg/l	<0.05	<0.05	<0.05	<0.05	-	-	-	-	_		
Copper as Cu	mg/l	<0.05	<0.05	<0.05	<0.05	-	-	-	-	_		
Boron as B	mg/l	<0.1	<0.1	<0.1	<0.1	-	-	-	-	2		
Chromium as Cr	mg/l	<0.05	<0.05	<0.05	<0.05	-	-	-	-	_		
Zinc as Zn	mg/l	<0.5	<0.5	<0.5	< 0.5	-	-	-	-	_		
DO	mg/l	6.6	5.9	6.6	5.6	6	5	4	4	-		
COD	mg/l	8	22	8	32	-	-	-	-	-		
BOD	mg/l	<4	8	<4	12	2	3	3	-	-		
E. Coil	MPN/100ml	Absent	10	Absent	17	-	-	-	-	-		
Total Coliform	MPN/100ml	58	94	47	110	50	500	5000	-	-		

Table 9 Results of surface water sample analysis

Code	Location	Da	iy	N	ight	L _{eq} dB (A)			
Coue	Location	Min.	Max.	Min.	Max.	L _{day}	L _{night}		
N1	Site	47.3	56.7	40.2	45.3	53.9	42.2		
N2	Jhurkhi	48.3	57.8	42.3	47.6	54.5	43.8		
N3	Takbeli	46.4	52.3	39.1	45.3	49.7	39.6		
N4	Mendhi	46.3	56.3	40.8	47.5	53.7	42.1		
N5	Maneri	44.5	52.4	38.7	45.6	49.8	39.9		
N6	Katangi	43.6	56.5	41.3	46.5	53.5	41.9		
N7	Chikhli	46.4	57.6	42.3	48.4	54.3	43.6		
N8	Chargaon (NE)	45.3	57.3	42.4	48.7	53.5	42.9		
N9	Paharikhera	47.6	57.1	41.4	48.9	53.7	43.8		
N10	Chargaon (SE)	48.3	57.9	41.2	47.6	53.8	43.1		
Range 49.7 to 54.5 39.6 to 43.8									
Note: 1. Day time is recorded in between 6 a.m. and 10 p.m., 2. Night time is recorded in between 10									
p.m. to 6 a.m.									

Table 10 Results of noise quality monitoring dB(A)

Parameters	Unit	S 1	52	\$3	S 4	\$5	S6	57	S8	S9	andard Soil Classification – (Indian Council of Agricultural Research, New Delhi
Texture	-		Clay loam	1		Silt loam			Clay Loam		-
Color	-	Brown	Grey	Brown	Brown	Brown	Grey	Brown	Grey	Brown	-
pH (1:5 Extraction)		7.5	7.6	7.5	7.4	7.4	7.4	7.2	7.5	7.5	Acidic<6.0, Normal to Saline 6.0-8.5, Tending to become Alkaline8.6 to 9.0, Alkaline above 9.
EC (1:5 Extraction)	μS/cm	178	188	210	172	224	165	180	158	145	Normal<1000, Critical for germination 1000- 2000, Critical for growing 2000 - 4000, Injurious to most crops>4000
Organic Carbon	%	0.8	0.7	0.6	0.9	0.9	0.8	0.6	0.7	0.6	Low < 0.5 , Medium 0.5 – 0.75, High > 0.75
Bulk density	gr/cc	1.22	1.33	1.18	1.42	1.28	1.24	1.18	1.22	1.15	-
Calcium as Ca	mg/kg	2623	2534	2424	1978	2678	1854	1645	2856	3122	-
Magnesium as Mg	mg/kg	1234	1123	1345	1244	1312	1045	1004	1685	1765	-
Chloride as Cl	mg/kg	234	223	165	175	215	185	205	168	148	-
Available Nitrogen as N	kg/Ha	175	251	199	264	152	276	235	202	220	Low below 280, Medium 280-560, High above 560
Available Potassium as K	kg/Ha	152	170	217	206	161	188	213	175	195	Low below 110, Medium 110-280 High above 280
Available Phosphorus as P	kg/Ha	7.6	9.4	10.1	9.6	6.5	8.5	7.4	9.2	9.9	Low below 10, Medium 10-25, High above 25
Zinc as Zn	mg/kg	28.8	48.8	42.3	28.7	34.4	32.3	38.8	47.8	44.3	-
Copper as Cu	mg/kg	34.4	32.4	28.8	45.5	52.3	21.2	44.6	64.5	55.4	-
Manganese as Mn	mg/kg	67.6	76.5	57.8	87.5	48.8	112	103	145	164	-
Sulphur	%	1.13	0.67	1.34	0.43	0.28	0.56	0.43	0.51	0.35	
Boron as B	mg/kg	15.5	11.5	13.4	10.8	12.4	18.8	16.8	22.3	14.2	-

Table 11 Results of soil analysis

On-site emergency plan

An on-site emergency is caused by an accident that takes place in plant itself and the effects are confined to the premises involving only the people working in the project site. Therefore the onsite emergency plans deal with handling of emergency within the plant boundaries mainly with the help of proponent's own resources. The following steps will be followed in case of an emergency at the site:

- There is one long siren for the declaration of emergency and three intermittent sirens for the termination of emergency. On hearing the emergency siren, all the people will immediately stop their works and come to the assembly point. HOD (P&A) or his nominee will locate the emergency site and inform the same to the EHS In charge and Project Head. In case of failure of alarm system, information shall be conveyed to the telephone operator who will make announcement through PAS installed. If everything fails, a messenger could be used for sending the information.
- The project head, EHS in-charge and emergency control team will move to the incident site. The HOD P&A will select people gathered at the assembly point and direct them to the incident side depending on the necessity. Emergency Administrator will go to ECC and activates the emergency plan.
- The in-charge of general store/work shop will search for the emergency at store/workshop surroundings, starting from fuel storage, open stores, temporary stores etc.
- The landfill supervisor will look for emergency around landfill.
- The main gate security will sound the emergency siren under instructions of the Incident Controller, to declare emergency.
- The emergency administrator is informed about the incident with details of place, magnitude of mishap and follow instructions.
- The emergency administrator moves to emergency control centre, activates the emergency plan based on the feedback obtained from the Incident Controller or other reasonable sources

Off-site emergency plan

When the damage extends to the neighboring areas, affecting local population beyond plant boundaries, off-site emergency plan is put into action in which quick response and services of many agencies are involved. The off-site emergency plan is presented in below table.

S.No	Type of Emergency	Preventive and Control Measures
1	Spillage of waste during transport.	• Check and repair containers before sending to the generator's site.
		 Train the driver and cleaner to seal the container doors properly before lifting the container on the truck and on spill clean-up procedure. Ensure the spill kit and PPE is available in the truck for use in case of emergency.
2	Collision with other vehicle, pedestrians, trees or objects at the side of the road and injury to persons / damage to vehicle due to accident.	 Hire drivers who have valid license and well trained in hazardous waste transport. Ensure vehicle is well maintained and certified before it is sent out of the gate. Maintain phone numbers of authorized hospitals, specialist doctors, police station, and the fire station in the vehicle also paint the paint the phone no of the unit on the vehicle. Inform authorized hospital over phone. Report the matter to nearby police station and project authorities. Based on the seriousness the site in-charge will send the unit Personnel manager and the site transport in-charge to the accident site without delay. Take care of the injured without any delay and the unit personnel manager will follow up the requirement of further treatment. The transport in-charge and the personnel manager will deal with the police department for the release of driver and the vehicle.
3	Toppling of truck and spillage of waste.	 Hire only qualified drivers. Carry the MSDS issued by the waste generator Barricade the area till the resumption of normalcy. Contain and lean the spillage using the spill kit. Report to project official and inform pollution control board officials. Complete rescue work of the truck.
4	Fire on waste material during transport.	 Ensure fire extinguishers are available in the truck Ensure that the driver and cleaner are trained in the use of fire extinguishers. Inform the driver and cleaner, MSDS detail of the waste from the

Off-site emergency plan

S.No	Type of Emergency	Preventive and Control Measures			
		comprehensive analysis and the easy identification method before sending them for collection.			
		• Park the vehicle at the side away from busy area.			
		• Avoid inhaling the smoke or gases emanated due to the fire.			
		Stand on up wind direction.			
		• Barricade the area and stop other vehicle movement if fire is uncontrolled.			
		• Inform the nearest fire station and police the exact location where the vehicle is parked and the details of MSDS of the material on fire.			
		• Maintain the phone numbers including mobile numbers of fire station, police station, waste generator and company emergency team members in the vehicle.			
		• Give cool water bath as first aid to persons if at all there are burns and send for further treatment to the nearest hospital.			

THE NEW INDIA ASSURANCE CO. LTD. (Government of India Undertaking)

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POLICY SCHEDULE FOR PUBLIC LIABILITY (Act Only) INSURANCE

Insured's Name	:	: RAMKY ENVIRO ENGINEERS LIMITED & ITS SUBSIDIARIES Insured's Details Insured's Details								
-	In	sured's Details								
Customer ID	PO71938791	Office Code	:	BALANAGAR DO (613800)						
Address		RAMKY ENVIRO ENGINEERS LIMITED AND ITS SUBSIDIARIES, JOINT VENTURES AND ASSOCIATES, 13TH FLOOR, RAMKY GRANDIOSE, RAMKY TOWERS COMPLEX,GACHIBOWLI Hyderabad, TELANGANA, 500032	Address	:	AL-AMEEN PLAZA, PLOT NO. 21, D NO 6-3-134/1, II FLOOR, BALANAGAR X ROADS, BALANAGAR ,500037					
Phone No		///////////////////////////////////////	Phone No	:	04023774483					
E-mail/Fax		bhargavaraman.t@ramky.com, /	E-mail/Fax	:	nia 613800@newindia.co.in /					
PAN No	-		S.Tax Regn. No	:	AAACN4165CST178					
GSTIN/UIN	-	36AAACR9626A2ZJ / NA	GSTIN	:	36AAACN4165C3ZQ					
	:		SAC	:	997139 (Other non-life insurance services excl RI)					

		Pol	icy Details		
Policy Number	:	6138003619330000003	Business Source Code		
Period of Insurance	:	From: 20/08/2019 10:00 00 AM To: 19/08/2020 11:59:59 PM	Dev.Off. level/Broker/Corp. Agent/Web Aggregator	:	DIRECT BUSINESS - (1D4316397)
Date of Proposal	:	20-Aug-19	Agent/Bancassurance/ Specified Person	:	
Prev. Policy no.	:		Phone No	;	NA / NA
Client Type	:	Corporate	E-mail/Fax	:	111

Premium(₹)	ERF Premium(₹)	GST(₹)	Total (₹)	Total (₹ in words)	Receipt No. & Date
17929	17928	3228	39085	RUPEES THIRTY-NINE THOUSAND EIGHTY-FIVE ONLY	6138008119000000383 3 - 20/08/19

Details of Risks Covered Under Policy:

Risk Covered	Jurisdiction	Territory/Address of Business Premises	AOA	AOY/Total Sum Insured	Turnover	Deductibles
Public Liability -Act Only	India	54 Locations as per the schedule attached, which forms part of this policy	50000000	150000000	391294064 3	0

Extensions under the Policy

Name of the Extension		Sub Limit of the Extension	Deductibles of the Extension
Special Conditions	All other	Terms, Conditions and Exclusions as	per Public Liability Act Only Policy
Special Exclusions	NA		
Special Excess/Deductible	0		
Retroactive Dates		Date	
Policy Retroactive	Date		20/08/2019

The policy shall be subject to the rules framed under the Public Liability Act 1991 and subsequent amendments from time to time.

The Policy shall be subject to PUBLIC LIABILITY (Act Only) INSURANCE Policy clauses attached herewith.

Clause	S	Descrip	tion	
Premium and GS	I Det संबंधित बीमा पॉलिसी स्टाम्प के लिए	Descrip	uon	
Premium	निक्त दिलक भुगतान कर	Rate of Tax	Amount In INR ₹ 35857.00	2000
Schinature valid Digitally scores by Summer Valid Scores Date 209 08 20 11 13 M IST	CONSOLIDATED STAMP DUTY FAID IN RESPECT OF INSURANCE FULICY STAMPS	9	1614	1 () () () () () () () () () (
	Policy No : 6138003610330000000 D			2013 100 000

Policy No. : 6138003619330000003 Document generated by 34322 at 20/08/2019 11:13:10 Hours. Regd. & Head Office: New India Assurance Bidg., 87 M.G. Road, Fort, Mumbai - 400 001. TOLL FREE No. 1 800 209 1415.



		100000
	9	1614
CGST	0	0
IGST		

In witness whereof the undersigned being duly authorised by the Insurers and on behalf of the Insurers has (have) hereunder set his (their) hand(s) on this 20th day of August, 2019.

For and on behalf of The New India Assurance Company Limited

Duly Constituted Attorney(s)

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Surance

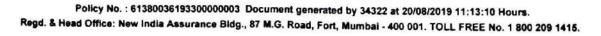
Date of Issue: 20/08/2019

Stamp Duty under the Policy is ₹1

strayide receipt consolidated Stamp Fees Paid by Pay Order Number_ Mudrank_ Dt. dt. Balainger D number____

Tax Invoice No : 61380019P0004951

IRDA Registration Number: 190



Schedule forming part of the Policy No. 6138003619330000003 - Public Liability-Act Only Policy - RAMKY ENVIRO ENGINEERS LIMITED ITS SUBSIDIARIES

5 No	Company	Segment	Project	Address	Turnover-2019-20
1	Mumbai Waste Mangement limited	IWM	Mumbai Waste Management Project - IWM	Plot No. P-32, Behind Galaxy Surfactants, MIDC, Taloja, Taluka Panvel, Dist: Raigad. Pin - 410 208.	44352679
2	Ramky Enviro Engineers limited	IWM	Hyderabad Waste Management Project	HWMP, Survey No: 684 / 1, Dundigal Village, Qutbullapur Mandal, RR Dist. 500 043, Telangana.	182789566
3	Ramky Enviro Engineers limited	IWM	Coastal Waste Management Project	CWMP, Jawaharlal Nehru Pharmacity, E - Bonangi Village, Parawada Manadal, Visakhapatnam Dist - 531 021.	14862527
4	West Bengal Waste Management Limited	IWM	West Bengal Waste Management Ltd - IWM	JL-103, PurbaSrikrishnapur,P.S: Sutahata, Haldia, Dist.: Purba Medinipur Haldia Pin - 721 635,	74467212
5	TamilNadu Waste Management Limited	IWM	TamilNadu Waste Management Project - IWM	Plot No : 5-15 & 28-33,EPIP, SIPCOT Industrial Estate, Gummidipoondi – 601201, Thiruvallur Dist., Tamil Nadu	36738408
6	Ramky Enviro Engineers limited	IWM	Madhya Pradesh Waste Management Project	Plot No. 104, Industrial Area No II, Pithampur, Dhar (Dist.), MP Pin – 454775,	81859116
7	Ramky Enviro Engineers limited	юм	Orissa Waste Management Project	Plot No: 420/648/1, Khata No-61, Kanchichuan(V), Sukinda(T), Jajpur (D) Oiddsha	30746971
8	TamilNadu Waste Management Limited	IWM	TNWML-MADHURAI-TSDF Project	S.no. 136, 137, undudurumikkidakulam, Aruppukottai taluk, Virudunagar Dist, T.N 626129	36738408
9	Ramky Enviro Engineers limited	IWM	Punjab Waste Management Project	Village- Nimbua, PO-Rampur Sanian Teh-Derabassi, DistMohali (Punjab) – 140507	37673670
10	Ramky Enviro Engineers limited	IWM	Uttar Pradesh Waste Management Project	A Div. of Ramky Enviro Engineers Ltd. Plot No.672, On NH-2, Sikandra Road, Village- Kumbhi, Tehsil- Akbarpur, Kanpur Dist. Dehat - 209101(U.P.)	39406540
11	Ramky Enviro Engineers limited	IWM	Rajasthan Waste Management Project	S.no: 1018/13,Udaibagh road, Viillage Gudli,Zinc Smelter Chouraha,Debari,Udaipur-313024	40905068
12	Ramky Enviro Engineers limited	IWM	Balotra Waste Management Project	Kher, Tehsil Pachpadra, District Balotra, Rajasthan	39049517
13	Ramky Enviro Engineers limited	IWM	Karnataka Waste Management Project	NH 207, Kiadb industrial Area, Nelemangala taluk,Dobbaspet Karnataka-562114.	20897116
14	Adityapur Waste Management Private Limited	IWM	Adityapur Waste Management Private Ltd	43, Khata No. 529, Mauza - Dungi, Dist - Saraikela Kharsawan, Jharkhand	6777744
15	Mumbai Waste Mangement limited	ww	Costal Waste Management Project - IMW II	Sy No: 20/2P1, Raviguntapalli Village, Bojjanapalli Panchayati, Rapur, Rapur, Sri Potti Sriramulu NelloreDistrict, Andhra Pradesh	27005826
16	Hyderabad Intergrated Muncipal sc	msw	HIMSW P&D	Hyderabad MSW energy solutions pvt ltd, Ramky group, Survey no-173, Jawahar nagar village, CRPF road, Near army dental college, Kapra mandal, medchal dist-50007, Hyderabad, Telangana.	436074941
17	Delhi MSW Solutions Limited	MSW	Delhi P&D	Delhi MSW Solutions ltd, Pocket: N-1; Sector-5, Bawana industrial area, Behind pragathi power plant, Bwana, Delhi-110039.	436974841
18	Ramky Enviro Engineers limited	MSW	Koyambedu Integrated	SY.NO.90/2, NERKUNDRAM ROAD,	105162337
19	Dehradun MSW Limited	мsw	Dehradun P&D	KOYAMBEDU, CHENNAI 600 107 Dehradun waste management pvtitd, Seeshambada, Sherpur, Dehradun-248197.	18083846
20	Ramky Enviro Engineers limited	MSW	Belgaum P&D	REEL-Belgaum MSW project, Turmuir village,Vengurla road, Belgaum, Karnataka.	15101625
21	Ramky Enviro Engineers limited	MSW	Shimoga P&D	REEL Shimoga project, SY no-290-293, purdall	10940955

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22	Delhi MSW Solutions Limited	MSW	Bilaspur P&D	MS Delhi MSW solutions ltd, Survey no-1359, Amtara road, Sendri, Kchhar village, Bilaspur,	
23	Katni MSW Management Limited	MSW	Katni P&D	Chattisgarh 495009. Katni MSW Management pvt ltd, Khasra no.527,	41365212
	and an angement entried	11.51	Natili PQD	Padarwara village, Ameerganj, Katni-483501	18719120
24	Ramky Enviro Engineers limited	IES	UNIDO Part A & B	Unodo Project, NSPCL Road, Purane, beside darubatti, sirsa gate Bhilai-3	10/19/20
		-		Additional Works Management Did Ltd CETD	51300000
25	Adityapur Waste Management Priva	IES	Adityapur Waste Management Pvt Ltd-CETP	Adityapur Waste Management Pvt Ltd-CETP, Industrial Area, Gamaria, jhamshedpur, Jharkhand, India.	2978000
26	Delhi MSW Solutions Limited	WTE	WTE - Delhi	Pocket N-1,Sector-5, Behind Pragati Power Plant, Bawana Industrial Area, New Delhi - 110039	
-				CWMD Jawaharlal Nobru Pharmacitu	209355902
27	Ramky Enviro Engineers limited	Recycling	Reel-Cwmp Recycling	CWMP, Jawaharlal Nehru Pharmacity, E - Bonangi Village, Parawada Manadal, Visakhapatnam Dist - 531 021.	
28	Ramky Enviro Engineers limited	Recycling	REEL - Mumbai Ewaste	Plot No. P-32, Behind Galaxy Surfactants, MIDC, Taloja, Taluka Panvel, Dist: Raigad. Pin - 410 208.	
29	Ramky Enviro Engineers limited	Recycling	REEL-ARM Recycling	25/A, Hardware Park, Near International Airport, Srisailam Highway Road Kurmaguda, Hyderabad, Telangana 500005	
30	West Bengal Waste Management L	i Recycling	Wbwml-Recycling	West Bengal Waste Management Ltd. J.L No-103, PO-Sutahata, Purba Medinipur Mouza-Purba-Srikrishnapur, Haldia West Bengal - 721635	
31	Hyderabad Intergrated Muncipal so	Recycling	Plastics Hyderabad - Recycling	Survey No-173, Jawahar Nagar, Kapra Mandal,	
32	Ramky Reclamation and Recycling	LiRecycling	RRRL-Tamil Nadu	Medchal Dist - 500087 Plot No : 5-15 & 28-33, EPIP, SIPCOT Industrial Estate, Gummidiacondi - 601001	
33	Ramky Enviro Engineers limited	Recycling	Adityapur-Oil Recyling	Gummidipoondi – 601201, Adityapur Waste Management Pvt Ltd-CETP, Industrial Area, Gamaria, jhamshedpur, Ibackhand, Iadia	
34	Pro Enviro Recycling Limied	Recycling	Pro Envrio C&D-Vijayawada	Jharkhand, India. Near water tank, pipes road , vijayawada	
35	Pro Enviro Recycling Limied	Recycling	Pro Envrio C&D-Vizag	Marikavalasa ,Madhuravada post,vizag	
36	Vishaka Solvents Limited	Recycling	Vishaka solvents	CWMP, Jawaharlal Nehru Pharmacity, E - Bonangi Village, Parawada Manadal, Visakhapatnam Dist - 531 021.	
37	Vishaka Solvents Limited	Recycling	Pro Enviro Recycling	Thirupathi	
38	Mumbai Waste Mangement limite	d BMW	Mumbai Waste Management Project - BMW	Mumbai Waste Management Project - BMW Plot No. P-32, Behind Galaxy Surfactants, MIDC, Taloja, Taluka Panvel, Dist: Raigad, Pin - 410 208.	21630426
39	Tamilnadu waste Management Lin	ni BMW	TamilNadu Waste Management Project - BMW	TamiNadu Waste Management Ltd. S.No. 29/3, 29/2, KK Pudur Road, Kinar Village, Madhuranthagam Taluk, Kanchepuram District - 603303 Tel - +91 - 44 - 43443650	17842960
40	West Bengal Waste Management l	ir BMW	West Bengal Waste Management Ltd - BMW	West Bengal Waste Management Ltd. J.L No-103, PO-Sutahata, Purba Medinipur Mouza-Purba-Srikrishnapur, Haldia West Bengal - 721635 Tel : +91 - 03224 - 278238	24214259
41	Medicare Environmental Mangeme	BMW	Hyderabad-BMW	Medicare Environmental Management Pvt. Ltd. Pashyamayalaram Indl. Area Isnapur Village, Patencheru Modal	13116946



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42	Medicare Environmental Mangemer	BMW	Banglore-BMW	Medicare Environmental Management Pvt. Ltd. Plot no. 39, KIADB Industrial Area, Dabaspet, Nelamangala(TQ), Bangalore (Rural District) Tel : +91 - 9845089462	30141136
43	Medicare Environmental Mangemer	BMW	Ludhiana	Medicare Environmental Management Pvt. Ltd. Opp. Central Jail, Tajpur Road, Jamalpur Village, Ludhiana (Punjab) - 141001 Tel : +91 - 161 - 5070054	20925747
44	Medicare Environmental Mangemer	BMW	Ahmedabad	Medicare Environmental Management Pvt. Ltd. 28, Ashwamegh Industrial Estate, Changodar, Tulak: Sanand, District-Ahmedabad (Gujrat) Tel : +91 - 2717 – 251806	11778066
45	Medicare Environmental Mangemer	BMW	Ghaziabad	Medicare Environmental Management Pvt. Ltd. C-21, UPSIDC Industrial Area, Masuri Gulawathi Road, Ghaziabad Uttar Pradesh - 201001 Tel : +91 - 120 - 2678917 / 3250674	13202040
46	Medicare Environmental Mangemer	BMW	Howrah	Medicare Environmental Management Pvt. Ltd. Site-41,"F" Road, Belgachia, Near HMC Dump Site Howrah, West Bengal - 711 105 Tel : +91 - 33 - 26513890	24214259
47	Medicare Environmental Mangeme	BMW	Kalyani	Medicare Environmental Management Pvt. Ltd. K-26, Phase-III, Growth Centre, Kalyani Kalyani, Nadia (W.B.) - 741 235 Tel : +91 - 33 - 25022937	22950523
48	Medicare Environmental Mangeme	BMW	Durgapur	Medicare Environmental Management Pvt. Ltd. Mouza Mangalpur, JL No.22, P.S.Raniganj, Durgapur, Distt- Burdwan (W.B.) - 713 347 Tel : +91 - 341 - 3260412	18029136
49	Medicare Environmental Mangemer	BMW	Muzafarpur	Medicare Environmental Management Pvt. Ltd. A-19, Phase - II, Bela Ind. Area Bela, Muzaffarpur Bihar - 843 116 Tel : +91 - 621 - 6590142	21133394
50	Medicare Environmental Mangemei	BMW	Lohadaga	Medicare Environmental Management Pvt. Ltd. Plot No. 82-90, RIADA, PS - Lohardaga PS - Lohardaga, Jharkhand - 835 302	2077415
51	Ramky Energy and Enviroment Limit	BMW	Salem	Ramky Energy & Environment Ltd. No.10, Thangayur Village, Konameri Bus Stop Edappadi TK, Salem, Tamilnadu - 637102	16052034
52	Ramky Energy and Enviroment Limi(BMW	Madhurai	Kamky Energy & Environment Ltd. Survey No.136-137, Undurumikkidakulam Village A Mukkulam, Tiruchuli Taluk, Virudhunagar District Tamilnadu - 630611	10868336
53	Ramky Energy and Enviroment Limit	BMW	Manglore	Ramky Energy & Environment Ltd. Plot No: 47/B, Karnad Industrial Area KIADB, Mulki Mangalore, Mangalore, Karnataka - 574154	4549245



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54	Bio medical waste treatement Plant BMW	Patankot	Bio medical waste treatement Plant Private Limited Villege PANGOLI.The.Dist., PATHANKOT 145001 Correspondance Address:- Deffence Road, Saini Eye Hospital, Opp Old SBI Bank, Dhangu Road, The.Dist., PATHANKOT 145001 Tel. No. 0186 2227801	8201709
	Total			2,44,29,40,643
	All Recycling projects Turnover			1470000000
	Total Turnover of all Projects			3,91,29,40,643

Jyoth:



ANNEXURE 2

LAND DOCUMENTS



M P INDUSTRIAL DEVELOPMENT CORPORATION LIMITED.

(Formely M. P. AUDYOGIK KENDRA VIKAS NIGAM (J) LTD, JABALPUR) (Government of Madhya Pradesh Undertaking) **REGIONAL OFFICE** "UDYOG BHAWAN", Katanga, Jabalpur (M.P.) - 482 001 Phone: 0761-4004207, 4004209, 2970199 Fax: 0761-2970180 E-mail : akvnjbp@gmail.com, ed.rojbp@mpidc.co.in Website : www.invest.mp.gov.in

क्रमांक-एमपीआईडी-ज/विकास/2019/ 3986 प्रति,

जबलपुर, दिनांक 14/08/19

M/s Ramky Enviro Engineers Ltd. 14th floor, Ramky Grandiose, Ramky Tower, Gachibowli, Hydrabad, 500032

विषय :--अग्रिम प्रब्याजी सहित भूमि आवंटन आवेदन प्रस्तुत करने बाबत

संदर्भ :--एमपीआईडीसी का पत्र क्र. एमपीआईडीसी / भू.प्र.क. / 2019 / 3654, दिनांक 29.07.2019

महोदय,

उक्त विषयांतगर्त लेख है कि औद्योगिक विकास केन्द्र मनेरी, जिला मण्डला के अतिप्रदूषणकारी एवं खतरनाक श्रेणी के उद्योगों हेतु चिन्हित जोन में "Hazardous waste treatment, Storage and disposal facility" हेतु 80000 व.मी. भूमि आवंटन हेतु आपके आवेदन दिनांक 06.07.2019 के परिपेक्ष्य में एमपीआईडीसी भोपाल के संदर्भित पत्र द्वारा क्षेत्रीय कार्यालय जबलपुर को अनुमति प्रदान की गई है।

अतः उक्तानुसार भूमि आवंटन हेतु 25 प्रतिशत अग्रिम प्रब्याजी रू. 22,00,000 / - सहित आवेदन करने का कष्ट करें, ताकि आपके भूमि आवंटन प्रकरण में आवश्यक कार्यवाही की जा सकें। धन्यवाद

Lunner कार्यकारी संचालक

जबलपुर, दिनांक

पु. क्रमांक-एमपीआईडी-ज/विकास/2019/ प्रबंध संचालक (भूमि प्रबंधन कक्ष), एमपी इण्डस्ट्रियल डेव्हलपमेंट कार्पोरेशन लि., उद्यमिता भवन, द्वितीय तल, ए–16, अरेरा हिल्स, भोपाल की ओर संदर्भित पत्र के परिपेक्ष्य में सचनार्थ ।

कार्यकारी संचालक

CORPORATE OFFICE :

M P INDUSTRIAL DEVELOPMENT CORPORATION LIMITED SECRETARIAT FOR SINGLE WINDOW SYSTEM CIN : U51102MP1977SGC001392 "CEDMAP BHAWAN", 16-A, Arera Hills, Bhopal-462011 (India) Tel. : (91) 755-2559978, 2575773 Fax : (91) 755-2559973 E-mail : facilitation@mptrifac.org Website : www.invest.mp.gov.in (Formely Madhya Pradesh Trade and Investment Facilitation Corporation Limited)

ANNEXURE 3

ACTION PLAN FOR EXCESSIVE LEACHATE GENERATION DURING MONSOON PERIOD

Annexure 3

Landfill Protection Measures for Monsoon period

Landfill Closure

The following activities must be planned and completed before the commencement of the monsoon rains. As many as possible of these activities should be completed at the earliest opportunity (i.e., do not wait until the last days – plan to have them completed as early as you can – any task that you can complete now saves you needing to worry about it later when there could well be other problems requiring your attention).

- Timely completion of waste covering and landfill cell sealing-off. The waste mass in the landfill must be completely covered on all sides with well compacted soil cover. This soil cover layer must be smoothly finished so that there are no depressions to trap water and will track rolled with the bulldozer or excavator to provide a firm surface.
- Provide watershed protection and leachate exclusion measures for all waste deposits. Once the waste mass has been securely covered with soil and smoothed off then rolled, you must then place loose un-welded sheets of HDPE material over the waste mass so that rainfall is prevented from collecting on or washing away the soil cover. These HDPE sheets must be overlapped so that no areas are left exposed and so that water runs off each sheet onto the top of the adjoining sheet (not under it) and so on progressively, until the water has been shed completely off the waste mass.
- Install commission and test all leachate / storm water pumps and lines. Must complete these activities before rain commences. The leachate sumps pumps must be either electric submersible units with floatation switches fitted, or alternatively borehole style pumps with positive mechanical action. Whichever style pump is selected, it should be understood that this will not be a permanent installation because the leachate will severely corrode all leachate handling equipment. Suction style pumps have been proved to be unsatisfactory in this application due to the difficulties continuously experienced in priming these (foot valves quickly corrode or suffer lack of sealing due to encrustation buildup. And manually priming these require considerable time and large quantities of water). For best results, transfer of leachate from sump to containment is best managed through properly installed permanent pipelines.
- Check and repair where necessary, all site access roads, surface storm water drains and any other storm water management structures. General landfill and other site infrastructure should be made ready for the onset of monsoon rain. Surface water drains and culverts must be cleaned out and made ready to carry the surface water flow. Critical areas of the site must be inspected and assessed for surface water flow performance and where necessary bunds and drains should be provided before rain commences. Roads should have potholes patched and grades adjusted where necessary

so that water is shed from the surface (there should be no water puddles on the road surface).

During closure maintenance procedures

During the period that the monsoon rains are falling, regular inspection and maintenance of the site infrastructure and equipment is essential and can be managed in the following format

Daily inspection of	Landfill cover	
	Storm water watershed and containment	
	Leachate management equipment	
	Site roads	
	Solar evaporation ponds	

> Weekly running and testing of automatic storm water / leachate pumping equipment.

Collection and transport activities during Monsoon season

Collection and transport of waste during the monsoon season should be conducted under the following guidelines

- Containers should all be covered to prevent them collecting rainwater. Rainwater collected in waste containers becomes contaminated and if allowed to build up can overflow the lip of the container and contaminate the surrounding area or slosh out of containers during transportation contaminating both the truck and roads etc. Rainwater in containers that is accepted into the TSDF becomes a management issue and can add to the generation of leachate within the landfill or add to the quantity of contaminated wash water that the landfill operator is required to manage (all of this occurs during the rain season when it is least wanted and management is most difficult).
- Tipper truck bodies must also be covered at all times, even when empty for the same reasons.
- Additional care should be taken to keep transport vehicles and waste containers clean and covered so that the best image is presented to the public and so that no contamination of areas outside the TSDF can occur.

To prevent degradation and maintain the quality of the water source, adequate control measures have been proposed to check the surface run-off, as well as uncontrolled flow of water into any water body. Following management measures are suggested to protect the water quality during the construction phase.

Avoid excavation during monsoon season

- Pit latrines and community toilets with temporary soak pits and septic tanks shall be constructed on the site during construction phase to prevent wastewater from entering the water bodies.
- > No discharge of wastewater to soil and ground water body
- To prevent surface and ground water contamination by oil/grease, leak proof containers should be used for storage and transportation of oil/grease. The floors of oil/grease handling area should be kept effectively impervious. Any wash off from the oil/grease handling area or workshop shall be drained through impervious drains, Clarifiers or oil/water separators shall be constructed and effluent should be treated appropriately before releasing it.
- Construction activities generate disturbed soil, concrete fines, fertilizer, oils and other wastes. On-site collection and settling of storm water, prohibition of equipment wash downs, and prevention of soil loss and toxic releases from the construction site are necessary to minimize water pollution.
- All stacking and loading areas should be provided with proper garland drains equipped with baffles to prevent run off from the site to enter any water body.
- Regular Monitoring of groundwater shall be performed in pre and post monsoon season at locations decided to appropriately represent the actual conditions.