

**Protocol for
Performance Evaluation and Monitoring of the
Common Hazardous Waste Treatment Storage and
Disposal Facilities including Common Hazardous
Waste Incinerators**



**CENTRAL POLLUTION CONTROL BOARD
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Ministry of Environment & Forests

FOREWORD

Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 notified, stipulate necessary provisions for proper collection, reception, transport, treatment, storage and disposal of hazardous waste in an environmentally sound manner.

26 Common Hazardous Waste Treatment, Storage and Disposal Facilities (TSDFs) spread across the Country in 12 States and one UT are in operation. These Common TSDFs including hazardous waste incinerators play a major role in treatment and disposal of hazardous waste in an environmentally sound manner.

Though, Central Pollution Control Board (CPCB) has published guidelines in respect of the TSDFs, which needs to be followed and complied by the TSDF operators, but uniformity in procedures adopted by SPCBs/PCCs for compliance assessment is lacking. This necessitated development of a 'Protocol for Performance Evaluation and Monitoring of the Common Hazardous Waste Treatment, Storage and Disposal Facilities including Common Hazardous Waste Incinerators'. In order to evolve guidelines for storage of incinerable hazardous waste to prevent recurrence of fire accidents as those at Hyderabad and Ankleshwar and to prepare the afore-said protocol, two separate Committees were constituted by CPCB under the Chairmanship of Shri R.K.Garg. The Committees visited TSDFs located in Gujarat, Maharashtra, Andhra Pradesh and Himachal Pradesh and interacted with the stakeholders. This report has been finalized after incorporating the inputs, suggestions and views received from the Committees, State Pollution Control Boards as well as operators of TSDFs.

The contributions made by Shri R.K. Garg, Chairman of the mentioned Committee, Shri J. S. Kamyotra, Member Secretary, CPCB and other members of the Committee, officials of SPCBs and TSDF Operators, in report preparation deserve acknowledgement. The sincere efforts of Shri H.K. Karforma, Additional Director, Late Shri B.P.Shukla, Additional Director & In-charge HWMD and Shri J. Chandra Babu, Environmental Engineer are duly acknowledged.

Hopefully this document would be useful to the stakeholders in performance evaluation of TSDFs and hazardous waste incinerators and maintaining safety at their respective premise. The Operators of Common TSDFs including HW incinerators are expected to follow the protocols, whereas, State and Central regulatory authorities are required to ensure its compliance.

May 24, 2010

A handwritten signature in black ink, appearing to read 'S.P. Gautam', is written above the printed name '(S.P. Gautam)' in a bold, sans-serif font.

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C O N T E N T S		
S.No	Description of Item	Page Number
1.0	Introduction	1
2.0	Rules and the guidelines applicable for development and operation of the common hazardous waste treatment, storage and disposal facilities	3
2.1.	Environmental impact assessment notification S.O.1533 (E) dated 14 September 2006	3
2.2.	Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2008	3
2.3.	Gaseous emission norms for common hazardous waste Incinerators notified under the Environment (Protection) Act, 1986 as Environment (Protection) Fifth Amendment Rules, 2008 dated 26 June 2008	5
2.4.	Salient features of the relevant guidelines	5
2.4.1	Criteria for hazardous waste landfills	5
2.4.2.	Guidelines for proper functioning and up-keep of disposal sites	7
2.4.3	Guidelines for storage of incinerable hazardous waste	7
3.0	Need for development of protocol for performance evaluation and monitoring of TSDFs and hazardous waste incinerators	12
3.1.	Main observations made by the Committee during the visits to TSDFs	12
3.2.	Accidents in TSDFs	13
3.3.	Need for performance evaluation	14
4.0	Protocol for performance evaluation of TSDFs	14
4.1.	Basic Information to be provided by the operator of the facility	14
4.2.	Periodic Information to be submitted on quarterly basis by the operator of the facility	15
4.3.	Performance evaluation by SPCB/PCC	15
4.4.	Performance evaluation by CPCB	15
4.5.	Protocols for the captive facilities	15
5.0	Summary	16

List of Tables		
Table - 1	State-wise Status of Hazardous Waste Generation (as in February 2009)	18
Table - 2	State-wise Status of Common Hazardous Waste Treatment, Storage and Disposal Facilities - Landfill Capacities vis-à-vis Land Disposable HW Generation	19
Table - 3	Gaseous Emission Norms for Common Hazardous Waste Incinerators notified under the Environment (Protection) Act, 1986 as Environment (Protection) Fifth Amendment Rules, 2008 dated 26 June 2008.	20
Table - 4	Fingerprint Analysis Requirement for Hazardous Waste Treatment, Storage and Disposal Facilities.	21
Table - 5	Comprehensive Analysis Requirement for Hazardous Wastes - Generator/TSDF Operator	22
Table - 6	Criteria for Direct Disposal of Hazardous Waste into Secured Landfill	24
Table - 7	Proposed Leachate Disposal Standards in addition to the General Standards for Discharge of Environmental Pollutants	25
List of Annexure		
Annexure – I:	Rules/Standards and the Guidelines Applicable for Common Hazardous Waste Treatment, Storage and Disposal Facilities & Common Hazardous Waste Incinerators.	27
Annexure -II :	Procedure followed for Waste Acceptance and Disposal by the Common Hazardous Waste Treatment, Storage and Disposal Facility Operator.	29
Annexure -III:	Protocol for Performance Evaluation of Common Hazardous Waste TSDF and Common Hazardous Waste Incinerator Part A: 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)	30

Annexure -IV:	Protocol for Performance Evaluation of Common Hazardous Waste TSDF/Common Hazardous Waste Incinerator Part B: Information on Operation of TSDF to be provided by the Operator of the TSDF on Quarterly Basis.	39
Annexure -V:	Monitoring Protocol for the Common TSDF Operators and HW Incinerators	45
Annexure -VI:	Submission of Quarterly Report by the SPCB/PCC to MoEF, CPCB on Performance of Operation of the Common TSDF/HW Incinerator (for the period from..... to))	48
Annexure-VII:	Compatibility of Hazardous Waste	51

Abbreviations

BOD	-	Biochemical Oxygen Demand
CETP	-	Common Effluent Treatment Plant
CO	-	Carbon Monoxide
COD	-	Chemical Oxygen Demand
CPCB	-	Central Pollution Control Board
EC	-	Electrical Conductivity
EIA	-	Environmental Impact Assessment
EMP	-	Environment Management Plan
FPA	-	Finger Print Analysis
GW	-	Ground Water
GWT	-	Ground Water Table
HW	-	Hazardous Waste
HW (M, H & TM) Rules	-	Hazardous Waste (Management, Handling & Transboundary Movement) Rules
ISO	-	International Standard Organization
Kg	-	Kilogram
KL	-	Kilolitre
Km	-	Kilometre
LRT	-	Liquid Release Test
MEE	-	Multiple Effect Evaporator
MoEF	-	Ministry of Environment & Forests
MSL	-	Mean Sea Level
MTA	-	Metric Tons per Annum
NABL	-	National Accreditation Board for Laboratories
NAAQS	-	National Ambient Air Quality Standards
PAH	-	Poly Aromatic Hydrocarbons
PFLT	-	Paint Filter Liquid Test
PCC	-	Pollution Control Committee
PM	-	Particulate Matter
RL	-	Reduced Levels
RPM	-	Respirable Particulate Matter
SEP	-	Solar Evaporation Pond
SLF	-	Secured Landfill
SPCB	-	State Pollution Control Board
SPM	-	Suspended Particulate Matter
SS	-	Suspended Solids
STP	-	Sewage Treatment Plant
TPA	-	Tons per Annum
TDS	-	Total Dissolved Solids
TOC	-	Total Organic Carbon
TSDF	-	Treatment, Storage and Disposal Facility

1. Introduction:

Hazardous Waste generated by the industries can cause environmental pollution and adverse health effects if not handled and managed properly. In order to manage hazardous waste (HW) mainly solids, semi-solids, solvents and other industrial wastes not covered by the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981, and to enable the authorities to control handling, transport, treatment and disposal of hazardous waste (HW) in an environmentally sound manner, Ministry of Environment & Forests (MoEF) promulgated Hazardous Waste (Management & Handling) Rules on 28 July 1989 under the provisions of the Environment (Protection) Act, 1986. In September 2008, the said rules were repealed and new rules entitled "Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008" (here after referred as HW (M, H & TM) Rules) were notified. These rules were further amended in the year 2009.

According to the HW (M, H & TM) Rules, any waste, which by virtue of any of its physical, chemical, reactive, toxic, flammable, explosive or corrosive characteristics causes danger or is likely to cause danger to health or environment, whether alone or when in contact with other wastes or substances has been defined as 'hazardous wastes' and includes wastes generated mainly from the 36 industrial processes referred under Schedule - I of the said Rules. In addition, some wastes become hazardous by virtue of concentration limits as well as hazardous characteristics listed under Schedule - II of the said Rules.

Based on the data provided by the State Pollution Control Boards (SPCBs) and Pollution Control Committees (PCCs), Central Pollution Control Board (CPCB) has compiled state-wise inventory of hazardous waste generating industries and published a document entitled 'National Inventory of Hazardous Waste Generating Industries and Hazardous Waste Management in India in February 2009' based on the information received for the year 2007-08. As per the information (**Table 1**), there are about 36,165 number of hazardous waste generating industries, generating about 6.2 million metric tons of hazardous wastes every year. The data also reveals that the quantum of hazardous waste, which has to go for final disposal in secured land fill (SLF) is about 2.7 million metric tons (i.e. 43.78 %), disposal by incineration is about 0.4 million metric tons

(i.e. 6.67 %) and recyclable waste is about 3.1 million metric tons (i.e. 49.55 %) of total hazardous waste generation in the Country. For disposal of land fillable wastes either captive facilities or common facilities of adequate capacities are required to be established, so as to dispose of such wastes without causing any harm to the public and the environment.

The hierarchy in management of hazardous waste is to reduce, reuse, recycle and re-process and final option of disposal of wastes having no potential for value addition, in disposal facilities in an environmentally sound manner. The disposal facilities may be having only a secured land fill (SLF) or may be having incinerator alone for organic wastes or combination of secured landfill & incinerator. Presently, some of the common disposal facility operators have not installed incinerator due to non-availability of adequate quantity of incinerable hazardous waste generation in their delineated areas for economical operation of incinerator. Two facilities have installed plasma pyrolysis system instead of a conventional incinerator for organic waste treatment.

At present, there are 26 common Hazardous Waste Treatment, Storage and Disposal Facilities (TSDFs) in operation spread across the Country in 12 States namely Andhra Pradesh, Gujarat, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal as well as in UT namely Daman, Diu, Dadra & Nagar Haveli. 35 new sites for development of TSDF have been notified by the respective State Governments and these are at different stages of development.

Data on the secured landfill capacities at common hazardous waste TSDFs and their operating life span reveals that the capacities of the secured landfill facilities vary from 0.25 million metric tons to a maximum total capacity of 12 million tons and annual capacity of 0.01 to 0.6 million metric tons. The life span of the landfills is in the range of 12 - 40 years. A few of the landfills have already been in operation for about 10 years and some of the cells in these have already been capped and some are in operation. State-wise status of capacities of TSDFs in operation (excluding captive facilities) is given in the **Table.2**.

2.0. Rules and the guidelines applicable for development and operation of the common hazardous waste treatment, storage and disposal facilities:

The Rules, standards and guidelines relevant to the management of hazardous waste and the TSDFs are given in the **Annexure -1**. Salient features of the afore said rules as well as main guidelines are given in the subsequent paras.

2.1. Environmental impact assessment notification S.O.1533 (E) dated 14 September 2006:

According to the environmental impact assessment (EIA) notification dated 14 September 2006, establishment of an integrated facility having incineration & landfill or incineration alone requires 'Environmental Clearance' from the Ministry of Environment & Forests (MoEF) as per the procedures stipulated under these Rules.

In case of establishment of a secured landfill (SLF) alone, environmental clearance is to be obtained from the State Environmental Appraisal Committee constituted by the State Government /UT administration.

2.2. Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2008:

The Rules relevant to the TSDFs are summarized below:

According to Rule 3 (j) of the Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2008 and amendments made thereof, 'facility' means any establishment wherein the processes incidental to the handling, collection, reception, treatment, storage, recycling, recovery, reuse and disposal of hazardous wastes are carried out.

As per Rule 3 (m), 'hazardous waste site' means a place of collection, reception, treatment, storage of hazardous wastes and its disposal to the environment which is approved by the competent authority.

As per Rule 3 (r), 'operator of a facility' means a person who owns or operates a facility for collection, reception, treatment, storage or disposal of hazardous wastes.

The occupier of hazardous waste is required to perform the responsibilities as stipulated under Rule 4 of the said Rules for handling, treatment, storage, transport and disposal of hazardous waste.

The Occupier or Operator of a Hazardous Waste Treatment, Storage and Disposal Facility (TSDF) is required to obtain authorization as per provisions laid down under Rule 5 of the said Rules for the purpose of generation, processing, treatment, package, storage, transportation, use, collection, destruction, conversion, offering for sale, transfer of the hazardous waste.

Rule 7 stipulates that the operator of facilities may store the hazardous waste for a period not exceeding ninety days and shall maintain a record of sale, transfer, storage and re-processing of such wastes and make these records available for inspection to the regulatory authorities. However, Rules empower State Pollution Control Boards (SPCBs) and Pollution Control Committees (PCCs) to extend the storage period maximum up to six months of their annual capacity.

Rule 18 (1) of the HW (M,H & TM) Rules, 2008 deals with the joint responsibilities of the State Government, operator of a facility, occupier, or any association of occupiers for identifying sites for establishing the TSDFs. Rule 18 (2) deals with the design and setting up of TSDFs as per the guidelines of CPCB and obtaining of approval from SPCBs with regard to the design and layout of the TSDFs. Rule 18 (3) deals with the monitoring by SPCB w.r.t the setting up and operation of TSDFs. Rule 18 (4) and 18 (5) deal with the responsibility of the operator of a TSDFs for safe operation of the TSDFs during its operational and ensuring its safety during post-closure period and maintaining of records w.r.t the hazardous waste handled.

Rule 19 deals with the requirement of proper labeling and packaging of hazardous wastes for its safe handling, storage and transportation.

Rule 20 deals with the transportation of the hazardous waste in accordance with the HW (M, H & TM) Rules as well as rules framed under the Motor Vehicle Act, 1988 and other guidelines issued from time to time. These Rules also deals with the requirement of obtaining of 'No Objection Certificate' for final disposal to a facility existing in a State other than the State where the hazardous waste is generated.

Rule 21 deals with the requirement of six colored manifest copies as per Form 13 of the HW (M, H & TM) Rules so as to ensure the waste is collected, transported, stored, treated and disposed of in an environmentally sound manner.

Rule 25 deals with the liabilities of the operator of a facility in case of damages caused to the environment due to the improper handling, storage and disposal of hazardous waste.

2.3. Gaseous emission norms for common hazardous waste incinerators notified under the Environment (Protection) Act, 1986 as Environment (Protection) Fifth Amendment Rules, 2008 dated 26 June 2008:

Common Hazardous Waste Incinerators are required to comply with the gaseous emission norms notified under the Environment (Protection) Fifth Amendment Rules, 2008, dated 26 June 2008 (**Table 3**).

2.4. Salient features of the relevant guidelines:

2.4.1. Criteria for hazardous waste landfills:

These guidelines provide mainly criteria for location, site selection, site investigation, planning & design, requirements of landfill liner & cover, construction & operation, inspection, monitoring and record keeping, apart from requirement of post-closure financial assurance as well as contingency plans for emergencies.

These guidelines also emphasize adoption of single liner system or double liner system depending upon the rainfall, type of sub-soil and the water table beneath the base of the landfill. In a place where rainfall is high and /or sub-soil is highly permeable (e.g. gravel, sand, silty sand) and /or the water table is within 2.0 m to 6.0 m, the guidelines suggest to adopt double composite liner. The specifications of the single composite liner, double composite liner system and cover system are given below:

2.4.1 (i). Specifications of the single composite liner system:

- a). A leachate collection layer of thickness 30 cm or more and coefficient of permeability in excess of 10^{-2} cm/sec (10^{-4} m/sec).

- b). A single composite liner comprising of
 - i). A HDPE geomembrane of thickness 1.5 mm or more and
 - ii). A compacted clay (or compacted amended soil) layer of thickness 150 cm or more having a coefficient of permeability of 10^{-7} cm/sec (10^{-9} m/sec) or less. At locations where availability of clay is limited, amended soil will be constituted by mixing bentonite or any other suitable clay to locally available soil to achieve the desired permeability.

2.4.1(ii). Specifications of double composite liner system:

- a). Primary leachate collection layer of thickness 30 cm or more and coefficient of permeability in excess of 10^{-2} cm/sec (10^{-4} m/sec).
- b). A primary composite liner comprising of
 - i). A HDPE geomembrane of thickness 1.5 mm or more
 - ii). A compacted clay (or compacted amended soil) layer of thickness 45 cm or more having a coefficient of permeability of 10^{-7} cm/sec (10^{-9} m/sec) or less
- c). A secondary leachate collection layer (also called leak detection layer) of thickness 30 cm or more and co-efficient of permeability in excess of 10^{-3} cm/sec (10^{-5} m/sec)
- d). A secondary composite liner comprising of
 - i). A HDPE geomembrane of thickness 1.5 mm or more
 - ii). A compacted clay layer of thickness 45 cm or more having a co-efficient of permeability of 10^{-7} cm/sec (10^{-9} m/sec) or less

2.4.1 (iii). Specifications of cover system: The minimum specifications of the cover system given below are from top surface downwards to the waste:

- a). A surface layer of local top soil which supports self sustaining vegetation and which has a thickness not less than 60 cm;
- b). A drainage layer of thickness 30 cm or more having a coefficient of permeability in excess of 10^{-2} cm/sec (10^{-4} m/sec)
- c). A single composite barrier comprising of
 - i). A HDPE geomembrane of thickness 1.5 mm or more and
 - ii). A compacted layer clay (or compacted amended soil) layer of thickness 60 cm or more having a coefficient of permeability of 10^{-7} cm/sec (10^{-9} m/sec) or less. At locations where availability of clay is limited, amended soil will be constituted by mixing bentonite or any other suitable clay to locally available soil to achieve the desired permeability.
- d). A regulatory layer (optional) of thickness 30 cm having coefficient of permeability greater than 10^{-2} cm/sec (10^{-4} m/sec). Such a layer shall be provided whenever there is requirement of (i) gas collection or (ii) transition filter between waste and soil

2.4.2. Guidelines for proper functioning and up-keep of disposal sites:

These guidelines suggest responsibilities of the Occupier, transporter, operator of a facility, Toxicity Characteristics Leaching Procedures (TCLP) limits, waste acceptance for direct disposal (i.e finger print & comprehensive analysis parameters) (**Table 4 & Table 5** respectively), criteria for direct disposal of hazardous waste into secured landfill (**Table 6**), leachate standards (**Table 7**).

2.4.3. Guidelines for storage of incinerable hazardous waste:

After review of the existing guidelines of CPCB for storage of incinerable hazardous waste, the revised guidelines for storage and handling of incinerable hazardous waste are suggested as follows:

2.4.3(i)Storage area (Storage shed):

- a. Flammable, ignitable, reactive and non-compatible wastes should be stored separately and never should be stored in the same storage shed.
- b. Storage area may consist of different sheds for storing different kinds of incinerable hazardous wastes and sheds should be provided with suitable openings.
- c. Adequate storage capacity (*i.e. 50 % of the annual capacity of the hazardous waste incinerator*) should be provided in the premises.
- d. Storage area should be designed to withstand the load of material stocked and any damage from the material spillage.
- e. Storage area should be provided with the flameproof electrical fittings and it should be strictly adhered to.
- f. Automatic smoke, heat detection system should be provided in the sheds. Adequate fire fighting systems should be provided for the storage area, along with the areas in the facility.
- g. There should be at least 15 meter distance between the storage sheds.
- h. Loading and unloading of wastes in storage sheds should only be done under the supervision of the well trained and experienced staff.
- i. Fire break of at least 04 meter between two blocks of stacked drums should be provided in the storage shed. One block of drum should not exceed 300 MT of waste.
- j. Minimum of 1 meter clear space should be left between two adjacent rows of pallets in pair for inspection.
- k. The storage and handling should have at least two routes to escape in the event of any fire in the area.

- l. Doors and approaches of the storage area should be of suitable sizes for entry of fork lift and fire fighting equipment;
- m. The exhaust of the vehicles used for the purpose of handling, lifting and transportation within the facility such as forklifts or trucks should be fitted with the approved type of spark arrester.
- n. In order to have appropriate measures to prevent percolation of spills, leaks etc. to the soil and ground water, the storage area should be provided with concrete floor or steel sheet depending on the characteristics of waste handled and the floor must be structurally sound and chemically compatible with wastes.
- o. Measures should be taken to prevent entry of runoff into the storage area. The Storage area shall be designed in such a way that the floor level is at least 150 mm above the maximum flood level.
- p. The storage area floor should be provided with secondary containment such as proper slopes as well as collection pit so as to collect wash water and the leakages/spills etc.
- q. All the storage yards should be provided with proper peripheral drainage system connected with the sump so as to collect any accidental spills in roads or within the storage yards as well as accidental flow due to fire fighting.

2.4.3 (ii).Storage drums/containers:

- a. The container shall be made or lined with the suitable material, which will not react with, or in other words compatible with the hazardous wastes proposed to be stored.
- b. The stacking of drums in the storage area should be restricted to three high on pallets (wooden frames). Necessary precautionary measures should be taken so as to avoid stack collapse. However, for waste having flash point less than 65.5 ° C, the drums should not be stacked more than one height.

- c. No drums should be opened in the storage sheds for sampling etc. and such activity should be done in designated places out side the storage areas;
- d. Drums containing wastes stored in the storage area should be labeled properly indicating mainly type, quantity, characteristics, source and date of storing etc.

2.4.3 (iii).Spillage/leakage control measures:

- a. The storage areas should be inspected daily for detecting any signs of leaks or deterioration if any. Leaking or deteriorated containers should be removed and ensured that such contents are transferred to a sound container.
- b. Incase of spills / leaks/dry adsorbents/cotton should be used for cleaning instead of water.
- c. Proper slope with collection pits be provided in the storage area so as to collect the spills/leakages.
- d. Storage areas should be provided with adequate number of spill kits at suitable locations. The spill kits should be provided with compatible sorbent material in adequate quantity.

2.4.3 (iv).Record keeping and maintenance:

- a. Proper records with regard to the industry –wise type of waste received, characteristics as well as the location of the wastes that have been stored in the facility need to be maintained.

2.4.3 (v).Miscellaneous:

- a. Smoking shall be prohibited in and around the storage areas;
- b. Good house keeping need to be maintained around the storage areas.

- c. Signboards showing precautionary measures to be taken, in case of normal and emergency situations should be displayed at appropriate locations.
- d. To the extent possible, manual operations within storage area are to be avoided. In case of manual operation, proper precautions need to be taken, particularly during loading / unloading of liquid hazardous waste in drums.
- e. A system for inspection of storage area to check the conditions of the containers, spillages, leakages etc. should be established and proper records should be maintained.
- f. The wastes containing volatile solvents or other low vapor pressure chemicals should be adequately protected from direct exposure to sunlight and adequate ventilation should be provided.
- g. Tanks for storage of liquids waste should be properly dyked and should be provided with adequate transfer systems.
- h. Storage sites should have adequate & prompt emergency response equipment systems for the hazardous waste stored on-site. This should include fire fighting arrangement based on the risk assessment, spill management, evacuation and first aid.
- i. Immediately on receipt of the hazardous waste, it should be analyzed and depending upon its characteristics its storage should be finalized.
- j. Only persons authorized to enter and trained in hazardous waste handling procedures should have access to the storage site.
- k. Mock drill for onsite emergency should be conducted regularly and records maintained.

2.4.3(vi) Recommended storage time and the quantity of the incinerable hazardous waste:

Normal storage of incinerable hazardous waste at the incinerator site should be restricted to maximum of six months subject to obtaining of

approvals as per Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2008 and further amendments made thereof.

2.4.3.(vii) Hazard analysis and safety audit:

For every incinerator facility, a preliminary hazard analysis should be conducted. Safety Audit internally by the Operator every year & externally once in two years by a reputed expert agency should be carried out and same should be submitted to the SPCB/PCC. Such conditions should be stipulated by SPCBs while granting authorization under Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2008 to the incinerator operators.

Note: All the above guidelines for storage of incinerable hazardous waste are also applicable for captive hazardous waste incinerators.

3.0. Need for development of protocol for performance evaluation and monitoring of TSDFs and hazardous waste incinerators:

The Common Hazardous Waste Treatment Storage and Disposal Facility operators or Common Hazardous Waste Incineration operators are required to strictly follow the rules stipulated under the HW (M, H & TM) Rules, 2008 and amendments made thereof as well as guidelines issued by CPCB from time to time for development as well as operation of the Common TSDFs/Common Hazardous Waste Incinerators.

In order to assess implementation of the said rules as well as the guidelines especially with respect to design and construction of TSDFs, procedures for acceptance of wastes, their analysis, treatment and disposal practices followed by the TSDFs operators, Central Pollution Control Board (CPCB) conducted a survey of operational TSDFs in different States during 2007-2008. The Committee appointed by CPCB also undertook visit to a few TSDFs.

3.1. Main observations made by the Committee during the visit to TSDFs: The procedure in general followed by the TSDFs starting from receipt of wastes from generators to the final disposal is delineated in **Annexure II**. Based on the visits, the following observations were made:

- 3.1.1.**The design of secured landfill facilities as well as laying of liners during the construction stage in some of the TSDFs is not as per the CPCB guidelines. Some of the operators have started operation of the facilities without obtaining necessary approval as required under the Rules from the respective State Pollution Control Board/Pollution Control Committee.
- 3.1.2.**The provision made for solidification/stabilization is not satisfactory in some of the facilities.
- 3.1.3.**In most of the TSDFs, solar evaporation ponds are used for treatment of leachate and as final disposal option. Some operators are using incinerator for evaporation of leachate, which is the cause of high VOCs in the flue gas.
- 3.1.4.**Regular ground water monitoring around the capped SLFs is not being done by some of the TSDF operators.
- 3.1.5.**Monitoring of gaseous emissions from vents of capped cells for total VOCs and H₂S is not being conducted by any of the TSDF operators.
- 3.1.6.**At some sites wherever incinerators have been provided or incinerators proposed to be installed, huge quantum of incinerable hazardous wastes (organic wastes) have been kept haphazardly without any labeling and not stored in a systematic way without a provision of fire fighting arrangements. In storage of wastes, no criteria for compatibility seems to be followed.
- 3.1.7.**Arrangements for carrying out mixing for optimizing the incinerable waste feed menu are not satisfactory.
- 3.1.8.**The on-line monitoring systems attached with the incinerators are not periodically calibrated in most of the cases.
- 3.2. Accidents in TSDFs:** In the last two years, there have been two major fire accidents in the Common Hazardous Waste Treatment, Storage and Disposal Facilities in the Country. In addition to the above, there has been a failure of secured landfill in a TSDF located in Andhra Pradesh due to improper selection of site and possibly due to poor construction of the SLF. These accidents would have caused adverse impact on the environment and hence there is a need to avoid recurrence of such accidents.

3.3. Need for performance evaluation: In order to fill the gaps in the existing procedures and in submission of the information by the operators of the facilities and to improve the verification of performance of the TSDFs by the State regulatory authorities, it is felt necessary to develop a protocol for performance evaluation of the TSDFs.

4.0. Protocol for performance evaluation of TSDFs: The protocol for evaluation of the TSDFs has been prepared in two parts as given below:

- a). Basic Information to be provided by the operator of facility in the prescribed format at the time of setting up of the facility or prior to the commissioning of the facility and by 31 December 2009 for the existing facilities; and
- b). Periodic information to be provided on quarterly basis by the operator of the facility during its operation.

4.1. Basic information to be provided by the operator of the facility:

Format for basic information, which needs to be submitted by the operator of a facility is annexed (**Annexure – III**). The details are to be furnished before the start of the operation of the facility based on the latest EIA studies conducted by the operator of the facility for obtaining environmental clearance from the MoEF/State authority, as applicable. In case of a facility which is already in operation, the information need to be provided based on the EIA studies carried out earlier by the facility operator, before **31 December 2009**.

Above information need to be submitted by the operator of the facility as one time exercise. Whenever, there is a change in the installed capacity or in the pre-treatment processes, construction of additional secured landfill cells, advancement in technology or additional facilities like recycling, reuse, mode of transportation etc., the operator of the facility is required to submit the updated information to the SPCB/PCC with a copy endorsed to the CPCB and MoEF.

4.2. Periodic information to be prepared and submitted on quarterly basis by the operator of the facility:

Periodic information as per the format enclosed (**Annexure -IV**) is required to be submitted by the facility operator to the SPCB/PCC with a copy endorsed to the CPCB/MoEF on quarterly basis. This information needs to be submitted to SPCB/PCC (with a copy to CPCB and MoEF) within fifteen days of the end of the quarter.

4.3. Performance evaluation by SPCB/PCC:

After receipt of the information (as per **Annexure -IV**) from the TSDF operators, the State Pollution Control Board/Pollution Control Committee will send the independent report (as per **Annexure -VI**) to the CPCB and MoEF commenting on the information provided by the operator based on their own observations during field visits and monitoring. The report should be sent within one month.

4.4. Performance evaluation by CPCB:

The Central Pollution Control Board may carryout evaluation randomly so as to cover each facility at least once in two years.

4.5. Protocols for the captive facilities:

Protocols for the captive secured landfills as well as captive hazardous waste incinerators may be prepared by the SPCB and PCC on the similar lines as suggested in this protocol.

5.0. Summary:

- 5.1.** All the common TSDF operators have to fill up the **Annexure -III and Annexure -IV** in respect of the facilities and submit to the respective SPCB/PCC with copies endorsed to CPCB and MoEF. The quarterly reports should be submitted within fifteen days of the end of the quarter.
- 5.2.** To have uniformity in monitoring of soil, ground & surface water, ambient air quality, gaseous emissions from vents provided to the already capped landfills, a monitoring protocol for common hazardous waste TSDFs

including HW Incinerators (**Annexure -V**) has also been suggested. This protocol may be followed by all the TSDF Operators. SPCB/PCC may incorporate conditions, while granting consents or authorizations to the TSDF/HW incinerator operators.

- 5.3.** After evaluation of performance of the TSDFs in the respective State/UT, a brief report needs to be submitted in the prescribed format (**Annexure -VI**) to CPCB and a copy of report endorsed to MoEF by all the SPCBs and PCCs within a month.
- 5.4.** Incompatible wastes should not be stored together in the same shed by the operator of the TSDF. A general criteria for compatibility of selected hazardous waste is given at **Annexure -VII**, as guideline. While storing or mixing of incinerable wastes for optimizing the feed, compatibility of the wastes has to be taken into consideration and tested.
- 5.5.** A scheme for financial support to the SPCBs and PCCs for carrying out performance evaluation of the TSDFs in line with the financial support being provided for monitoring of ambient air quality, surface water quality may be evolved by MoEF, if found feasible.
- 5.6.** Measures may be taken for putting in place an online tracking system for movement of the hazardous waste from generators to the final disposal so as to ensure safe disposal of hazardous waste in the Country.
- 5.7.** All the TSDF operators should be asked to strengthen and upgrade the existing laboratories, so as to carry out the monitoring and analysis of all required parameters and all the TSDF operators have to obtain Laboratory Accreditation as per Environment (Protection) Act, 1986 and strive hard to obtain accreditation as ISO 17025 through NABL system in a time bound manner.
- 5.8.** The protocol may be reviewed after three years in the first instance and thereafter every five years.

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Tables

Table 1. State-wise Status of Hazardous Waste Generation (as in February 2009) **

S. No.	Name of the State/UT	Quantity of Hazardous Waste Generation (MTA)			
		Land fillable	Incinerable	Recyclable	Total
1	Andhra Pradesh	211442	31660	313217	556319
2	Assam	3252	--	7480	10732
3	Bihar	3357	9	73	3439
4	Chattisgarh	5277	6897	283213	295387
5	Delhi (unverified)	3338	1740	203	5281
6	Gujarat	1107128	108622	577037	1792787
7	Goa	10763	8271	7614	26648
8	Haryana	30452	1429	4919	36800
9	H.P	35519	2248	4380	42147
10	J & K	9946	141	6867	16954
11	Jharkhand	23135	9813	204236	237184
12	Karnataka	18366	3713	54490	76569
13	Kerala	59591*	223	23085	82899*
14	Madhya Pradesh	34945	5036	127909	167890
15	Maharashtra	568135	152791	847442	1568368
16	Manipur	--	115	137	252
17	Meghalaya	19	697	6443	7159
18	Mizoram	90	Nil	12	102
19	Nagaland	61	Nil	11	72
20	Orissa	74351	4052	18427	96830
21	Punjab	13601	14831	89481	117913
22	Rajasthan	165107	23025	84739	272871
23	Tripura	0	30	237	267
24	Tamil Nadu	157909	11145	89593	258647
25	Uttar Pradesh	36370	15697	117227	169294
26	Uttarakhand	17991	580	11	18582
27	West Bengal	120598	12583	126596	259777
U.T.					
1	Daman, Diu, Dadra & NH	17219	421	56350	73990
2	Puducherry	132	25	36235	36392
3	Chandigarh	232	--	723	955
	Total	2728326 (43.78 %)	415794 (6.67 %)	3088387 (49.55 %)	6232507 (100%)

Note: * This figure of Kerala includes other wastes (8066.745 MTA) from Indian Rare Earth (IRE) and The Fertilizer and Chemicals Travancore Limited (FACT) also.
 ** As reported by SPCBs/PCCs

Source: CPCB document on 'National Inventory of Hazardous Waste Generating Industries and Hazardous Waste Management in India' as on February 2009. For further details please refer to CPCB website i.e. www.cpcb.nic.in.

Table 2: State-wise Status of Common Hazardous Waste Treatment, Storage and Disposal Facilities - Landfill Capacities vis-à-vis Land Disposable HW Generation

Sl. No.	Name and Location of TSDF	Secured landfill (SLF) Capacity in MTA	Total SLF capacity in MTA **	Generated Land Disposable HW in MTA		
I. Andhra Pradesh :						
1	TSDF, Dundigal	1,50,000	3,50,000	2,11,442		
2	TSDF, Visakhapatnam*	2,00,000				
II. Gujarat :						
3	NEIL , Nandesari, Vadodara	21,667	10,47,401	11,07,128		
4	GEPIL, Surat	1,00,000				
5	TSDF, Odhav, Ahmedabad	71,667				
6	TSDF at Vatva, Ahmedabad	63,067				
7	BEIL, Ankleshwar	1,20,000				
8	TSDF, Vapi	48,000				
9	TSDF, Alang	23,000				
10	TSDF, Bhachau	6,00,000				
III. Karnataka :						
11	TSDF, Debaspet	40,000			40,000	18,000
IV. Kerala :						
12	TSDF, Ambalmughal, Earnakulam	50,000	50,000	51,524		
V. Himachal Pradesh:						
13	TSDF at Baddi	50,000	50,000	35,519		
VI. Madhya Pradesh:						
14	MPWVM Limited, Pithampur	90,000	90,000	34,945		
VII. Maharashtra:						
15	TSDF, Taloja	1,20,000	2,50,000	5,68,135		
16	TSDF , Navi Mumbai	10,000				
17	TSDF , Butibori	60,000				
18	TSDF, Ranjangaon	60,000				
VIII Punjab :						
19	TSDF , Nimbua, Derabassi	13,000	13,000	13,601		
IX. Rajasthan:						
20	RWM Limited, Gudli, Udaipur	20,000	20,000	1,65,107		
X. Tamilnadu:						
21	TSDF, Gummadipoondi	1,00,000	1,00,000	1,57,909		
XI. Uttar Pradesh:						
22	TSDF, Kumbhi, Kanpur Dehat	17,500	60,167	36,370		
23	TSDF, Banthar, Unnao	20,667				
24	TSDF, Rooma, Kanpur	22,000				
XII. West Bengal :						
25	TSDF, Purba Shrikrishnapur, East Midnapur	1,20,000	1,20,000	1,20,598		
XIII Daman, Diu, Dadra & NH:						
26	TSDF, Motarandha, Silavasa, Dadra & Nagar Haveli	7,500	7,500	17,219		

Note: *
**

Proposed to be relocated
Total capacity is excluding captive landfill capacity

Table 3: Gaseous Emission Norms for Common Hazardous Waste Incinerators notified under Environment (Protection) Act, 1986 as Environment (Protection) Fifth Amendment Rules, 2008 dated 26 June 2008

1	2	3	4	5
		A.Emission		
			Limiting concentration in mg/Nm³, unless stated	Sampling Duration in minutes unless stated
	Common Hazardous Waste Incinerator	Particulate Matter	50	30
		HCL	50	30
		SO ₂	200	30
		CO	100	30
			50	24 hours
		Total Organic Carbon	20	30
		HF	4	30
		NO _x (NO and NO ₂ expressed as NO ₂)	400	30
		Total dioxins and furans	0.1 ngTEQ/Nm ³	8 hours
		Cd+ Th + their compounds	0.05	2 hours
		Hg and its compounds	0.05	2 hours
		Sb +As + Pb + Co + Cr + Cu + Mn + Ni + V + their compounds	0.50	2 hours
		<p>Notes:</p> <ul style="list-style-type: none"> i. All monitored values shall be corrected to 11 % oxygen on dry basis. ii. The CO₂ concentration in tail gas shall not be less than 7 %. iii. In case, halogenated organic waste is less than 1 % by weight in input waste, all the facilities in twin chamber incinerators shall be designed to achieve a minimum temperature of 950 ° C in secondary combustion chamber and with a gas residence time in secondary combustion chamber not less than 2 (two) seconds. iv. In case, halogenated organic waste is more than 1 % by weight in input waste, waste shall be incinerated only in twin chamber incinerators and all the facilities shall be designed to achieve a minimum temperature of 1100 ° C in secondary combustion chamber with a gas residence time in secondary combustion chamber not less than 2 (two) seconds. v. Incineration plant shall be operated (combustion chambers) with such temperatures, retention time and turbulence, as to achieve Total Organic Carbon (TOC) content in the slag and bottom ashes less than 3 %, or their loss on ignition is less than 5 % of the dry weight. 		

Table 4: Fingerprint Analysis Requirement for Hazardous Waste Treatment, Storage and Disposal Facilities

Parameters for Fingerprint Analysis by the Operators of TSD Facilities	Method of Analysis
Physical Analysis	
Physical State of the waste (liquid/slurry/sludge/semi-solid/solid: inorganic/organic/metallic)	
Identification of different phases of the wastes (in cases of solid wastes contained in aqueous/non-aqueous liquids/solutions for slurries and sludge)	
Colour & Textures	
Specific Gravity	
Viscosity in case of liquid waste	
Flash Point	USEPA, SW-846; Method 1010 and 1020
Loss on drying at 105° C in case of solids	
Loss on ignition at 550° C	
Calorific Value in case loss on ignition \geq 20 %	
Paint Filter Liquid Test (PFLT) for liquids	USEPA, SW-846; Method 9095
Liquid Release Test (LRT) for liquids	USEPA, SW-846; Method 9096
Chemical Analysis	
pH	USEPA, SW-846; Method 9040, 9041 and 9045
Reactive Cyanide (ppm)	USEPA, SW-846; Vol. 1C Part II; Test Method to determine HCN released from Wastes
Reactive Sulfide (ppm)	USEPA, SW-846; Vol. 1C Part II; Test Method to determine H ₂ S released from Wastes

**Table 5: Comprehensive Analysis Requirement for Hazardous Waste
- Generator/TSDF Operator**

Comprehensive Analysis to be submitted by the Generators of Hazardous Wastes	Method of Analysis
Physical Analysis	
Physical State of the waste (liquid / slurry / sludge / Semi-solid / solid: inorganic, organic, metallic)	
Description of different phases of the wastes (in cases of solid wastes slurries and sludge) contained in aqueous / non-aqueous liquids / solutions	
Colour and Texture	
Specific Gravity	
Viscosity in case of liquids	
Calorific Value in case of organic wastes	
Flash Point	USEPA, SW-846; Method 1010 and 1020
% Moisture content (loss on drying at 105 °C)	
% Organic content (loss on ignition at 550 °C)	
Paint Filter Liquid Test (PFLT)	USEPA, SW-846; Method 9095
Chemical Analysis	
pH	USEPA, SW-846; Methods 9040, 9041 and 9045
Inorganic Parameters Analysis	
Cyanide (ppm)	USEPA; SW-846; Vol. 1C Part II; Test Method to determine HCN released from Wastes

Comprehensive Analysis to be submitted by the Generators of Hazardous Wastes	Method of Analysis
Sulfide (ppm)	USEPA; SW-846; Vol. 1C Part II; Test Method to determine H ₂ S released from wastes
Sulphur (elemental)	USEPA; SW-846; 9010, 9011, 9012
Concentration of relevant inorganic [as per Schedule 2 of HW (M, H & TM) Rules, 2008 and amendments made thereof].	USEPA; SW-846; Vol. 1A, 1B, 1C and Vol. 2
Organic Parameters Analysis	
Oil & Grease Extractable Organic (in special cases only)	
% Carbon	
% Nitrogen	
% Sulphur	
% Hydrogen	
Compatibility tests	
Concentration of relevant individual organics [as per Schedule 2 of HW (M, H & TM) Rules, 2008 and amendments made thereof]	USEPA; SW-846; Vol. 1A, 1B, 1C and Vol. 2
Toxicity Characteristics Leaching Procedure (For the listed parameters relevant to the process as presented in Method 1311 of SW 846; USEPA) for landfillable wastes	USEPA; SW-846; Method 1311, 1330

Table 6 : Criteria for Direct Disposal of Hazardous Waste into Secured Landfill

Leachate Quality	Concentration
pH	4-12
Total Phenols	<100 mg./l.
Arsenic	<1 mg./l.
Lead	<2 mg./l.
Cadmium	<0.2 mg /l.
Chromium-VI	<0.5 mg./l.
Copper	<10 mg./l.
Nickel	<3 mg./l.
Mercury	<0.1 mg./l.
Zinc	<10 mg./l.
Fluoride	<50 mg./l.
Ammonia	<1,000 mg./l.
Cyanide	<2 mg./l
Nitrate	<30 mg./l
Adsorbable organic bound Chlorine	<3 mg./l
Water soluble compounds except salts	<10 %
Strength	
Transversal Strength (Vane Testing)	>25 KN/m ²
Unconfined Compression Test	>50 KN/m ²
Axial Deformation	<20 %
Degree of Mineralization or Content of Organic Materials (original sample)	
Annealing loss of the dry residue at 550° C	<20 Wt. % (for non- biodegradable waste) <5 Wt. % (for biodegradable waste)
Extractable Lipophylic contents (Oil & Grease)	<4 Wt. %

Note:

- 1). *leachate quality is based on water leachate test i.e Leachability tests are conducted by preparing a suspension of waste and water i.e taking 100 gm of waste and filling up to 1 liter with distilled water, stirring or shaking for 24 hrs, filtering the solids and analyzing the filtrate.*
- 2). *Calorific value of the land disposable hazardous waste should be less than 2500 K. Cal/Kg*

Table 7: Proposed Leachate Disposal Standards in addition to the General Standards for Discharge of Environmental Pollutants

S.No	Parameter	Standards (in mg/l)			Marine Coastal Areas
		Inland Surface	STP	CETP	
1.	Adsorbable Organic Halogens (AOX)	0.50	-	-	0.50
2.	Poly Aromatic Hydrocarbons (PAH) each	0.059	-	-	0.059
3.	Benzene	0.14	-	-	0.14
4.	Toluene	0.08	-	-	0.08
5.	Xylene (Sum of o,m,p-xylene)	0.32	-	-	0.32

Note:

1. *In addition to the above, General Standards for discharge of environmental pollutants Part-A: Effluents notified, vide G.S. R. 422 (E), dated 19.5.1993 and published in the Gazette No. 174, dated 19.5.1993 under the Environment (Protection) Act, 1986, and rules made thereunder, shall also be applicable for disposal of leachate into sewage treatment plant, common effluent treatment plant, Inland surface water bodies or coastal areas.*
2. *For each Common Effluent Treatment Plant (CETP) and its constituent units, the SPCB/PCC shall prescribe standards as per the local needs and conditions; these can be more stringent than those prescribed above. However, in case of clusters of units, the SPCB/PCC may prescribe suitable limits.*
3. *The Bioassay test shall be substituted by 'Fish Toxicity' test, and a dilution factor of 2 (two) may be considered.*

Annexure

Rules/Standards and the Guidelines Applicable for Common Hazardous Waste Treatment, Storage and Disposal Facilities & Common Hazardous Waste Incinerators

Rules/Standards applicable for TSDFs/hazardous waste incinerators:

- 1). Environmental Impact Assessment Notification S.O.1533 (E) dated 14 September 2006;
- 2). Hazardous Waste (Management, Handling & Transboundary Movement) Rules 2008 notified on 24 September 2008;
- 3). Gaseous Emission Norms for Common Hazardous Waste Incinerators notified as Environment (Protection) Fifth Amendment Rules, 2008 dated 26 June 2008;
- 4). Norms for DG set, The Noise Pollution (Regulation and Control) Rules, 2000 , Effluent Discharge norms, surface/ground water norms and Ambient Air Quality norms.
- 5). General standards for discharge of environmental pollutants Part –A: Effluents notified vide G.S.R. 422 (E) dated 19 May 1993 and published in the Gazette No. 174, dated 19 May 1993 under the Environment (Protection) Act, 1986 and rules made there under, shall also be applicable for disposal of leachate into sewage treatment plant, common effluent treatment plant, inland surface water bodies or coastal areas.

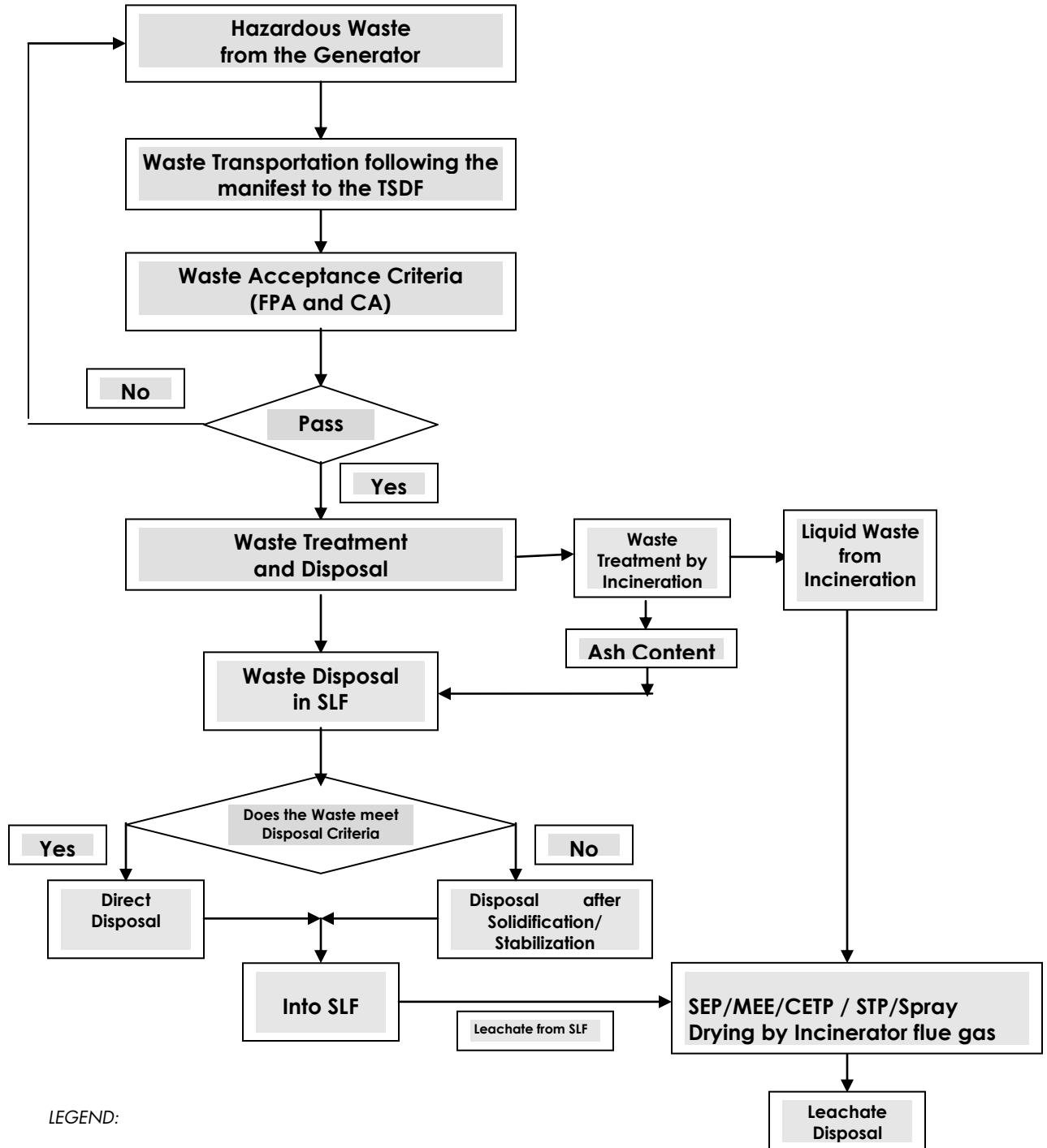
Guidelines applicable for TSDFs:

- 1). Criteria for Hazardous Waste Landfills (Hazardous Waste Management Series: HAZWAMS/17/2000-01)

- 2). Manual on Sampling, Analysis and Characterization of Hazardous Wastes (Laboratory Analytical Technique Series: LATS/16/2002-2003);
- 3). Guidelines for Conducting Environmental Impact Assessment: Site Selection for Common Hazardous Waste Management Facility (Hazardous Waste Management Series: HAZWAMS/25/2003-4);
- 4). Manual for Design, Construction and Quality Control of Liners and Covers for Hazardous Waste Landfills
- 5). Guidelines for Common Hazardous Waste Incineration (Hazardous Waste Management Series: HAZWAMS/30/2005-06)
- 6). Management of Hazardous Waste - Pre-Requisites for Issuing Authorization by SPCB/PCC (Hazardous Waste Management Series: HAZWAMS/31/2005-2006);
- 7). Management of Hazardous Waste - Guidelines for Proper Functioning and Upkeep of Disposal Sites (Hazardous Waste Management Series: HAZWAMS/32/2005-2006);
- 8). Management of Hazardous Waste - Guidelines for Transportation of Hazardous waste (Hazardous Waste Management Series: HAZWAMS/33/2005-2006);

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Procedure followed for Waste Acceptance and Disposal by the Common Hazardous Waste Treatment, Storage and Disposal Facility Operator



LEGEND:

FPA : Finger Print Analysis
 SEP : Solar Evaporation Pond
 CETP : Common Effluent Treatment Plant

CA : Comprehensive Analysis
 MEE : Multiple Effect Evaporator
 STP : Sewage treatment Plant

Protocol for Performance Evaluation of Common Hazardous Waste TSDF and Common Hazardous Waste Incinerator

Part A: 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)

I. General Information															
(1)	Name & Address of the HWTSDF	:													
(2)	Contact person Telephone Mobile No. Fax E-mail	: : : : :													
(3)	Month & Year of establishment	:													
(4)	HWTSDF established by	:													
(5)	HWTSDF presently operated by	:													
(6)	Total area of the TSDF in acres	:	<table border="1"> <thead> <tr> <th>Activity</th> <th>Area in Acres</th> </tr> </thead> <tbody> <tr> <td>SLF</td> <td></td> </tr> <tr> <td>Incinerator</td> <td></td> </tr> <tr> <td>Storage for incinerable waste</td> <td></td> </tr> <tr> <td>Other storage</td> <td></td> </tr> <tr> <td>Any other</td> <td></td> </tr> </tbody> </table>	Activity	Area in Acres	SLF		Incinerator		Storage for incinerable waste		Other storage		Any other	
Activity	Area in Acres														
SLF															
Incinerator															
Storage for incinerable waste															
Other storage															
Any other															
(7)	Location of the TSDF	:													

	a). Delineated Area of the TSDF if any (pl. enclose map of the delineated area)			
(8)	Industries or Industrial Estate nearby TSDF (Indicate type of industries)	:		
	(i) Total number of Member Industries (pl. attach map of the industrial estates)	:		
	(ii) Whether TSDF is located in industrial estate or not	:		
	(iii) Total HW generation by the member industries as per authorization	:	Type of wastes	
			Quantity in TPA	
			Landfillable	
			Incinerable	
			Recyclable	
	(iv) Total HW proposed to be disposed off by the member units annually	:	Type of wastes	
			Quantity in TPA	
			Landfillable	
			Incinerable	
			Recyclable	
(9)	Total Cost of the facility (in lacs of Rupees)	:		
	(i) Financing patterns	:		
	(ii) Subsidy, if any (Central Govt., State Govt.) in Rs.	:		
(10)	Date of Notification of the site by the State Govt.	:		
(11)	Level of Groundwater in and around the disposal facility (below ground level)	:		
	(i) Direction of ground water flow in the TSDF site	:		
	(ii) Depth of GWT in m during Monsoon period	:		
	(iii) Depth of GWT in m during Non-Monsoon Period	:		
(12)	Wind Pattern details (average) (enclose wind rose diagram)	:		
(13)	Land use around the disposal facility up to radius of 5 KM (Indicate any forest or monuments or sensitive areas)	:		

(14)	Rivers/Canals/Lakes, if any in & around the TSDF with approximate distance from TSDF	:	
(15)	Total rainfall (annual average in cms.)	:	
(16)	Geohydrological features of the TSDF Site	:	
(17)	Sources of water intake	:	
(18)	Electrical Resistivity Data around SLF	:	
(19)	Reduced level of TSDF w.r.t MSL	:	
(20)	Maximum Flood level of river, lakes, reservoir if any	:	
(21)	Details of Consent to Establishment/ Operation issued under Water & Air Acts (please enclose copy of Consents issued by PCB)	:	
(i)	Number and Date of issue of Consents under Water Act and its validity	:	
(ii)	Number and Date of issue of Consents under Air Act and its validity	:	
(22)	Authorization details (please enclose copy of authorization issued by PCB)	:	
(i)	Date of issue of Authorization	:	
(ii)	Validity of Authorization	:	
(23)	Details of Environmental Clearance (EC) (please enclose copy)	:	
(i)	Date of Issue of EC	:	
(ii)	EC issued by	:	
(iii)	EC issued for operation of TSDF , Incinerator/SLF	:	
(iv)	EIA prepared by	:	
II. Design Details of Storage, Treatment and Disposal Facility			
(1)	Facilities available with the TSDF in respect of Transportation, Laboratory, Storage, Treatment (chemical stabilization/solidification, incineration) & SLF and any other (pl. attach layout)	:	

(2)	Transportation :		
	(i)	No. of vehicles (Existing/Proposed) (own/hired)	:
	(ii)	Type of vehicles with capacity	:
(3)	Laboratory		
	(i)	No. of persons engaged in the analysis with qualification and experience	:
	(ii)	Lab Accreditation/recognition, if any	:
	(iii)	Instruments available in the laboratory (enclose list of equipments/instruments)	:
	(iv)	Comprehensive capabilities of analysis of parameters including detailed analysis and fingerprint (enclose list of parameters)	:
	(v)	Waste Acceptance criteria followed (enclose copy)	:
	(vi)	Time (in hrs) required for fingerprint analysis parameters	:
	(vii)	Time (in hrs) required for comprehensive analysis of relevant parameters	:
(4)	Storage Area		
	(a). Temporary Storage Area for Landfillable Wastes During Monsoon		
	(i)	Temporary Storage area size in sq. meters	:
	(ii)	Leachate collection and transportation provision made at the temporary storage area	:
	(iii)	Safety provisions made at the temporary storage area	:
(iv)	Spillage collection and transportation provision made	:	

	(b) Incinerable HW (Organics) Storage Area :		
	(i)	Number of sheds	:
	(ii)	Area of each shed in sq. meters	:
	(iii)	Distance between sheds in meters	:
	(iv)	Proposed quantities to be stored in each shed (in metric tons)	:
	(v)	Arrangement of stacking of drums	:
	(vi)	Compatibility criteria followed for storage	:
	(vii)	Arrangement made for smoke and fire detection	:
	(viii)	Arrangement for remedial action in case of fire	:
	(ix)	Arrangement for spillage/run off collection	:
	(x)	Arrangement made for control of fire accidents	:
(5)	Pre-treatment Facilities		
	(i)	Facilities provided/proposed for pre-treatment	:
	(ii)	List of Chemicals/stabilizing agents proposed to be used in the treatment processes	:
	(iii)	Arrangements for storage of chemicals/stabilizing agents	:
(6)	Incineration including other thermal treatment technology :		
	(i)	Total Installed Incineration Capacity in Tons per hour and in energy units	:
	(ii)	Expected incineration operating hours in a month	:
	(iii)	Make and Supplier of incinerator/ any other technology	:
	(iv)	Pollution Control Systems attached with the incinerator (enclose details along with a flow diagram)	:

	(v)	Arrangements made for mixing of incinerable wastes before feeding	:	
	(vi)	Safety measures adopted at the waste feed mixing area	:	
	(vii)	Criteria followed for waste feed mixing (enclose details)	:	
(7)	Secured land filling			
	(i)	Criteria followed for disposal of wastes in SLF (please attach details)	:	
	(ii)	Proposed Secured Landfill Capacity (in Tons)	:	
	(iii)	Proposed no. of Cells and capacity of each cell	:	
	(iv)	Construction details of the cell (provide a sketch)	:	
	(v)	Proposed liner system components and their specifications	:	
	(vi)	No. of vents proposed/provided with the capped cells	:	
	(vii)	No. of leachate collection wells proposed in each cell	:	
	(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 reduced levels (RL) as approved by the PCB)	:	
	(ix)	Designed life span of the SLF in years (total as well as cell-wise details)	:	
	(x)	Expected leachate generation in KL per annum	:	
	(xi)	Operational plan of the landfill	:	
	(xii)	No. of proposed/existing monitoring wells around TSDF (attach layout with GW flow direction)	:	

(8)	Leachate treatment details :		
	(i)	Proposed leachate treatment (by Multiple Effect Evaporator (MEE) /Solar evaporator/steam stripping followed by Incinerator spray drier or any other means)	:
	(ii)	Final mode of treatment and disposal of leachate other than above	:
III. Procedures for waste acceptance, characterization, mode of treatment and disposal			
(1)	Whether information proposed to be collected from the member industrial unit		(indicate Yes/No)
	(i)	Products manufactured	:
	(ii)	Stepwise process chemical reactions	:
	(iii)	Quantity of wastes generated as per the stoichiometric requirements	:
	(iv)	Characteristics of the waste (physical)	:
	(v)	Chemical characteristics of the waste (finger print as well as detailed analysis)	:
	(vi)	Category of the wastes (as per Schedule 1 or 2 of the HW (M, H & TM) Rules)	:
	(vii)	Any pre-treatment given, if so, type of treatment given by the generator	:
(2)	Whether TSDF accepting the waste from generator having the manifest		:
(3)	Copies of the manifest sent to SPCB/PCC and the generator of the waste, after treatment and disposal		:
(4)	Facilities provided for cleaning the transportation vehicles		:
(5)	Treatment and disposal provision made for liquid wastes generated from cleaning of vehicles		:
(6)	Check for any other relevant information in respect of waste acceptance procedures including packing and labeling		:

IV. Monitoring Data – Base Line			
(1)	ambient air quality (date of sampling, temperature, wind speed, wind direction and monitoring results for standard air quality parameters to be enclosed)	:	
(2)	Soil quality (up to 1m depth) (date of sampling, depth of sampling and the soil characteristics for standard soil parameters including heavy metals to be enclosed)	:	
(3)	Surface /Ground water characteristics (date of sampling, depth of ground water table and direction of flow/depth of surface water at which samples taken, characteristics for drinking water parameter to be indicated)	:	
(4)	Noise Levels in decibels (parameters to be monitored and indicated as per norms)	:	
(5)	Proposed permanent Ambient Air Quality Monitoring Stations around the TSDF (enclose location map with wind rose diagram of the area)	:	
V. Proposed Record keeping & maintenance with regard to the waste acceptance, treatment and disposal			
(1)	Maintenance of records w.r.t the waste receipt manifest from the member units	:	
(2)	System of record keeping w.r.t the finger print analysis and detailed analysis of the wastes of the member units	:	
(3)	System of decision making for deciding the requirement of pre-treatment of wastes /treatment by incineration/disposal into SLF	:	
(4)	Record keeping with respect to the Wastes treated and disposed within TSDF upon receipt of wastes from the member units	:	
(5)	Arrangement made for collection and handling of spillages	:	

(6)	System of record keeping with regard to the leachate generation in KL per annum and its treatment and final mode of disposal	:	
VI. Miscellaneous			
(1)	Provisions made for post –closure monitoring and maintenance (enclose copy of the escrow agreement)	:	
(2)	Emergency preparedness plan	:	
(3)	Details of Insurance policies, premiums, sum assured, including Insurances under Public Liability Insurance (PLI) Act etc	:	
(4)	Occupational Health, Facility safety systems, Risk management procedures	:	
(5)	Report on Health Status of the public living within 05 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)	:	
(6)	Certificate obtained from Department of Explosives/Directorate of Industrial Safety and Health for Fire Safety and Storage	:	
(7)	Fire fighting systems descriptions	:	
(8)	Personal protective equipments (provide list of equipments)	:	

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.

Station:

Signature of Operator of a Facility

Date:

Name :
Address :
Telephone No. :
Mobile No. :
E-mail :

Protocol for Performance Evaluation of Common Hazardous Waste TSDF/Common Hazardous Waste Incinerator

Part B: Information on Operation of TSDF to be provided by the Operator of the TSDF on Quarterly Basis (for the period from..... to)

I. General Information			
(1)	Name & Address of the HWTSDF	:	
(2)	Contact Person Telephone/Mobile No. Fax no.: E-mail:	: : : :	
(3)	Validity of Consent under Water (Prevention and Control of Pollution) Act, 1974	:	
(4)	Validity of Consent under Air (Prevention and Control of Pollution) Act, 1981	:	
(5)	Validity of Authorization under HW (M, H & TM) Rules, 2008	:	
(6)	Total number of Member Industries sent their waste during the period (from to.....) and the quantity of waste in tons (pl. attach list of member industries not sent their waste during the quarter)	:	

(7)	Statement w.r.t total quantity of HW received, treated and disposed or accumulated since commissioning of the facility					
S. No	Description	Type of HW and Quantity in Tons				
		Direct Landfillable waste	Incinerable	Landfillable waste which require pre-treatment	Any other	
(i)	Opening Stock of the hazardous waste					
(ii)	Total quantity of hazardous waste received during the quarter (from to.....)					
(iii)	Total hazardous waste treated and disposed of during the quarter (From to.....)					
(iv)	Closing Stock of the hazardous waste at the end of the quarter					
(v)	Cumulative receipt of hazardous waste since commissioning					
(vi)	Cumulative hazardous waste disposed of since commissioning					

(8)	Is the waste in stock properly labeled and stored	:																	
(9)	Performance of SLF related activities																		
	(i)	No. of Cells filled and capped till the previous quarter	:																
	(ii)	Cell number in use	:																
	(iii)	Quantity of Leachate generated in KL during the quarter	:																
	(iv)	Characteristics of leachate (enclose parameters with max., min. and average concentration for the quarter)	:																
	(v)	Mode of treatment and disposal of leachate (enclose characteristics of discharged leachate, if any)	:																
(10)	Performance of Incinerator/Plasma Pyrolysis																		
	(i)	Monthly average operating hours of incinerator/Plasma Pyrolysis	:																
	(ii)	Fuel consumption in KL/Energy Consumption during the quarter	:																
	(iii)	Operating parameters	<table border="1"> <thead> <tr> <th>Operating parameter</th> <th>Values in Range</th> </tr> </thead> <tbody> <tr> <td>Temperature in °C</td> <td></td> </tr> <tr> <td>Residence Time in seconds</td> <td></td> </tr> <tr> <td>Pressure in</td> <td></td> </tr> </tbody> </table>	Operating parameter	Values in Range	Temperature in °C		Residence Time in seconds		Pressure in									
Operating parameter	Values in Range																		
Temperature in °C																			
Residence Time in seconds																			
Pressure in																			
	(iv)	Stack gaseous emission monitoring results for the previous quarter	<table border="1"> <thead> <tr> <th>Para-meter</th> <th>Max</th> <th>Min</th> <th>Ave</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Para-meter	Max	Min	Ave												
Para-meter	Max	Min	Ave																

	(v)	Date of calibration of the instruments	:	
	(vi)	Salt residue generation if leachate re-circulated for quenching purpose in Tons	:	
	(vii)	Final mode of disposal of salts generated from the incinerator/MEE	:	
	(viii)	Total quantum of ash generated in Tons	:	
	(ix)	Final mode of disposal of ash generated from the incinerator	:	
	(x)	Total quantum of scrubbed solution generated (in litres) and its mode of disposal	:	
(11)	Pre-treatment /Treatment Facility			
	(i)	List of Chemicals/stabilizing agents used in the pre-treatment processes in Tons during the quarter	:	
		a).Binding agents (Cement/lime /fly ash or any other agent) in Tons	:	
		b). Caustic in Tons	:	
		c). Aggregates in Tons	:	
		d). Any other	:	
	(ii)	Total quantity of wastes treated by Stabilization/ Solidification process in Tons	:	
(12)	Monitoring and other Miscellaneous Details (attach details wherever applicable)			
	(i)	Ambient air quality	:	
	(ii)	Ground water quality from monitoring wells	:	
	(iii)	Gaseous emissions from vents provided to the capped SLF	:	
	(iv)	Soil characteristics	:	

	(v)	Amount deposited in Escrow Fund during the quarter (Rupees in lacs)	:	
	(vi)	Cumulative amount in Escrow (Rupees in lacs)	:	
	(vii)	Any accidents including fire/explosion/landslides occurred and measures taken (attach details separately if required)	:	
(13)		Any major changes observed in the characteristics of the waste of the member units (provide list of such member industrial units with details)	:	
(14)		Self assessment with regard to the status on environmental consequences due to the operation of TSDF (pl. attach details)	:	
(15)		Remedial measures proposed for restoration in case of damages caused due to the improper operation of the facility (pl. attach details)	:	
(16)		Electrical Resistivity Data around SLF (to be submitted at the end of the last quarter only)	:	
(17)		Progress towards online tracking of vehicles carrying wastes from the generator	:	
(18)		Report on Health Status of the public living within 05 KM radius and workers appointed by the facility operator (pl. attach details once in a year)	:	
	(i)	Workers removed from the services if any during the quarter and the reasons thereof	:	
(19)		Environment Management Plan (EMP) Compliance	:	

(20)	Any other operations carried out in the facility (like pre-treatment of incinerable waste for use in Kilns or recycle or re-use of other wastes)	:	
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Declaration

Certify that the contents stated above are true to the best of my knowledge and based on the records as available with this facility.

Station:

Date:

Signature of Operator of the Facility

Name :

Address :

Telephone No. :

Mobile No. :

E-mail :

Monitoring Protocol for the Common TSDF Operators and HW Incinerators

1.0. Ambient Air Quality Monitoring:

- (a) Number of Monitoring Stations:** Air quality monitoring stations at upwind, downwind and at three stations at 120° angle around the TSDF is necessary. The locations of air quality monitoring stations depend on the stack height and location of any particular ecologically sensitive feature around the disposal facility. Location of air quality monitoring stations may be decided by the operator of the TSDF in consultation with SPCB/PCC.
- (b) Additional Parameters to be monitored:** Apart from the standard parameters stipulated under the National Ambient Air Quality Standards (NAAQS), additional parameters, namely, Total Volatile Organic Compounds (VOCs), Polycyclic Aromatic Hydrocarbons (PAH), to align the monitoring Programme with the potential impacts of TSDF operations, should be monitored.
- (c) Frequency of Ambient Air Quality Monitoring:**

 - (i). Parameters, namely, SPM, RPM, NO_x and SO_x should be continued to be monitored as per NAAQS criteria (minimum of 104 measurements in a year taken twice a week, 24 hourly).
 - (ii). In addition, VOCs (total), and PAH should be monitored at least twice in a year (pre-monsoon and post-monsoon).

2.0. Monitoring of Stack Gaseous Emission from Incinerator:

(a) Parameters to be monitored and the frequency:

It is recommended to carryout quarterly monitoring of the stack gaseous emission for the parameters as stipulated under the gaseous emission norms notified under the Environment (Protection) Fifth Amendment Rules, 2008 dated 26 June 2008. However, SO₂,

NO_x, HCl and CO to be monitored continuously using on-line monitoring system.

3.0. Monitoring of the Vent Gases attached with the capped SLF:

- (a). **Suggested parameters and the frequency:** Parameters, namely, total VOCs and H₂S should be monitored at least **once in a month** through the vents of the capped cells till designed life span of the TSDF.

4.0. Ground Water Monitoring:

It is recommended to monitor ground water characteristics at least once **in a quarter** till designed life span of the TSDF.

- (a) **Parameters to be analyzed:** It is recommended that ground water should be analyzed for 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.
- (b) **Sampling Locations:** It is recommended that the ground water samples should be collected at least up to a distance of 5 KM from the TSDF location.

If no open wells or tube wells are available, action needs to be taken to provide at least **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 at least up to first layer aquifer. Depending upon the situation, if required, the monitoring wells till second aquifer should also be extended in consultation with the SPCB/PCC.

The directions of the ground water flow have to be established in consultation with the State Ground Water Board or any other authority. The ground water flow direction has to be ascertained periodically and reported at least **once in three years** so as to know any changes in the ground water flow directions due to any changes in the local conditions such as draw down of ground water.

5.0. Surface waters: Monitoring of surface waters (nullah/ river, impoundments) at upstream and downstream and in adjoining area is necessary at least **once in a quarter**. It is also necessary to collect the sample of benthal deposit of the stream upto a distance of 500 m from the TSDF. It is recommended that the surface water samples should be analyzed for pH, Colour, EC, Turbidity (NTU), SS, TDS, TOC, DO, BOD, 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.

6.0. Soil samples Monitoring:

(a) Parameters to be analyzed: It is recommended that the soil samples should be analyzed for pH, EC, Colour, TDS, TOC, TSS, PAH, heavy metals (such as Pb, Cd, Cu, Zn, Cr, Hg, Ni), CN, F, As and Mn.

(b) Sampling Location & Frequency of Sampling: At least one number of composite soil sample is required to be collected upto a depth of 1 m beneath the soil surface for every grid size of 250 X 250 m up to a radius of 500 m from the centre of the TSDF. It is recommended that the soil samples should be collected and analyzed for the suggested parameters at least once in a year i.e. pre-monsoon.

7.0. Biological indicator: Plantations of locally available sensitive plants to be made in all directions of the TSDF and at different distances and to observe and record periodically the health of each plant.

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Submission of Quarterly Report by the SPCB/PCC to MoEF, CPCB on 'Performance of Operation of the Common TSDF/HW Incinerator (for the period from..... to)'

(1)	Name & Address of the SPCB	:	
(2)	Date of Visit to Common TSDF/Common HW Incinerator	:	
(3)	Name and contact addresses of the officials visited TSDF /HW Incinerator Telephone/Mobile No. Fax no.: E-mail:	:	
(4)	Name & address of the TSDF/HW Incinerator inspected	:	
	Contact Person Telephone/Mobile No. Fax no.: E-mail:	: : : :	
(5)	Validity of Consent under Water (Prevention and Control of Pollution) Act, 1974	:	
(6)	Validity of Consent under Air (Prevention and Control of Pollution) Act, 1981	:	
(7)	Validity of Authorization under HW (M, H & TM) Rules, 2008	:	
(8)	Total number of member industries sent their waste during the period (from to.....) and the quantity of waste received in tons	:	
(9)	Member Industries which have not sent their waste (pl. attach list of such member industries)	:	

(10)	Statement w.r.t Total Quantity of HW received, treated and disposed, accumulated since commissioning of the facility			
S. No	Description	Type of HW and Quantity in Tons		
		Direct Landfillable waste	Incinerable	Landfillable waste which require pre-treatment
(i)	Opening Stock of the hazardous waste			
(ii)	Total quantity of hazardous waste received during the quarter (from to.....)			
(iii)	Total hazardous waste treated and disposed of during the quarter (from to.....)			
(iv)	Closing Stock of the hazardous wastes at the end of the quarter			
(v)	Cumulative receipt of hazardous waste since commissioning			
(vi)	Cumulative hazardous waste disposed of since commissioning			
(09)	Comments on compliance to the conditions of the Consents under Water Act, Air Act and Authorization under HW (M,H & TM) Rules	:		

(10)	Comments on the monitored data provided by the Operator in comparison with the monitored data of SPCB, if any (Ambient air quality, GW from monitoring wells, Gaseous emissions from the incinerator stack, vents provided to the capped SLF, soil characteristics around SLF)	:	
(11)	Any abnormal observations w.r.t operation and maintenance of the TSDF/HW Incinerator	:	
(12)	General comments based on field visit (w.r.t storage conditions, stacking, labeling, records, spillages, leachate, fire protection & control and other safety measures, house keeping, on-line monitoring instruments any other)	:	
(13)	Actions taken if any	:	

Station:

Date:

Signature :

Name :

Address :

Tel. Phone No. :

E-mail :

Compatibility of Selected Hazardous Waste

1	Oxidizing Mineral Acids	1																		
2	Caustics	H	2																	
3	Aromatic Hydrocarbons	H _F		3																
4	Halogenated Organics	H _F	H _{GF}		4															
5	Metals	GF H F			H _F	5														
6	Toxic Metals	S	S							6										
7	Sat Aliphatic Hydro-carbons	H _F																		7
8	Phenols and Creosols	H _F																		8
9	Strong Oxidizing Agents		H	H _F		H _F		H												9
10	Strong Reducing Agents	H _F GT			H _{GT}								GF _H	H _F						10
11	Water and Mixtures containing water	H			H _E		S													GF _{GT} 11
12	Water reactive Substances			Extremely reactive, do not mix with any chemical or waste material																12

Legend:

E - Explosive
 GF - Flammable Gas
 H - Heat Generation

F - Fire
 GT - Toxic Gas
 S - Solubilisation of Toxins