

IX: HAZARDOUS WASTE MANAGEMENT

9.0 INTRODUCTION

The Government of India has promulgated the Hazardous Waste (Management and Handling) Rules, 1989 and the aegis of Environment (Protection) Act, 1886 through the Ministry of Environment and Forests (MoEF). In exercise of the powers conferred vide sections 6, 8 & 25 of the Environment (Protection) Act, 1986 the Central Government through the MoEF notified the amendments to the rules laid-forth vide the Gazette of India, Extraordinary, Part II – Sec 3 – subsection (ii), dated 06/01/2000. According to the notification, these rules are called as “Hazardous Wastes (Management and Handling) Amendment Rules, 2000.”

Hazardous Waste is any residue that may cause significant hazard to Human Health or Environment unless adequately handled, stored, transported, treated and disposed.

The Major groups of Industries that generate hazardous wastes include inorganic and organic chemicals, petroleum refineries, iron and steel, non-ferrous metals (smelting and refining), leather tanning and finishing, and metal finishing.

Migration of chemicals through ground and surface waters increases contaminants in drinking water sources and inturn affects human health. Chemical contamination of vegetation and crops through contaminated irrigation water, application of sludges and deposition of air emissions results in trophic transfer of hazardous chemical. A variety of health hazardous resulting from handling and disposal of hazardous wastes have been documented. The severe amongst these include mutagenic, carcinogenic and teratogenic effects.

Hazardous Wastes Treatment and Disposal, therefore, need to be properly planned and sited to protect people and Environment from any adverse

impacts. In addition, there is an urgent need for identification and assessment of abandoned hazardous wastes disposal sites and remediation of the affected sites to prevent further damage to human health and environmental quality.

9.1 GUIDELINES FOR SELECTION OF HAZARDOUS WASTE TREATMENT & DISPOSAL SITE

9.1.1 SITE SELECTION

The selection of an ideal site is a difficult task. However, the selection of a best site can be achieved by following sequential steps of the methodology given below:

- ü General evaluation considering various features of the region / site such as climate, ecology, landuse, logistics, topography, soil properties, aesthetics etc.
- ü Site selection process through constrain mapping featuring Remote sensing applications and ranking of the available sites using site sensitivity indices
- ü Conducting Environmental Impact Assessment (EIA) studies and other techno-economic feasibility studies

a. General Evaluation of Site Selection

This mode of evaluation is based on a number of factors such as physical features, ecological features, landuse features, logistics, climate and human values. The various aspects covered under these features are

i. Physical Features

- ü Topography
- ü Land stability
- ü Seismic stability
- ü Surface soils
- ü Surface water and streams
- ü Subsurface geology and aquifers

ii. Human Values

- ü Landscape
- ü Recreation
- ü Historical and archaeological monuments
- ü Population density
- ü Employment opportunities
- ü Health status of population

iii. Ecological Features

- ü Flora and fauna
- ü Conservation value
- ü Habitat

iv. Climate

- ü Wind direction
- ü Temperature
- ü Moisture

v. Landuse Features

- ü Development potential
- ü Landuse designation
- ü Agricultural use
- ü Transportation corridor
- ü Extraction industries / mining

vi. Logistics

- ü Proximity to users
- ü Transport access
- ü Availability of utilities (Hospitals, fire services etc.)
- ü Adjacent land use

b. Site Sensitivity Indices

The site sensitivity indices are prepared for ranking the available sites with respect to thirty-four (34) selected attributes. These attributes are based on the migration, characteristics, and waste management practices for the wastes to be disposed at the TSDF. They are grouped under:

- ü Receptor related attributes
- ü Pathway related attributes
- ü Waste characteristics related attributes
- ü Waste management practices related attributes

Attributes considered for calculation of Site Sensitivity Indices

i. Receptor Related

- ü Population within 500 meters
- ü Distance to nearest drinking water source
- ü Distance nearest off site building
- ü Presence of major transportation routes
- ü Land use / Zoning
- ü Critical environments
- ü Use of site by nearby residents

ii. Waste Characteristics Related

- ü Toxicity
- ü Radioactivity
- ü Persistence
- ü Ignitability
- ü Reactivity
- ü Corrosivity
- ü Solubility
- ü Volatility

iii. Pathway Related

- ü Distance to nearest surface water
- ü Depth to ground water
- ü Type of contamination
- ü Soil permeability
- ü Bedrock permeability
- ü Depth to bedrock
- ü Susceptibility to erosion and run-off
- ü Climatic features with respect to air pollution
- ü Susceptibility to seismic activity
- ü Precipitation effectiveness index

iv. Waste Management Practice Related

- ü Physical state
- ü Hazardous waste quantity per annum
- ü Waste incompatibility
- ü Co-disposal with municipal wastes
- ü Use of liners
- ü Leachate treatment
- ü Site security
- ü Safety measures
- ü Incineration with off-gas cleaning

The sensitivity index for each attribute is evaluated on a four-level sensitivity scale ranging from 0 to 1 (0.0 – 0.25, 0.25 – 0.5, 0.5 – 0.75, 0.75 – 1.0)

The aspects to be considered for attribute measurement are identified depending on the importance of the attribute. Based on the field data available, this attribute can be graded on the four level scale for the particular site. A total of 1000 points are divided among the above listed four criteria of attributes @ 320, 280, 220 and 180 respectively using Delphi technique.

Each of the 34 attributes is given weights based on the magnitude of its impact. The value of the sensitivity index multiplied by the corresponding weightage would give the attributed score for each attribute. In the same way,

score for all the attributes will be calculated and final attributed score for the site is obtained. This score is compared with the similar scores of other sites available and all the sites are ranked as per the scores with the least score site given top ranking. The total scores (out of 1000) can thus be interpreted in terms of the sensitivity of the site as follows;

Score		Sensitivity
<300	:	Very Low
300 – 450	:	Low
450 – 600	:	Moderate
600 – 750	:	High
>750	:	Very High

c. Selection of Site

The first step in the search for suitable site is to select a geographic region. The principal consideration being

- ü Geological & Hydro-geological conditions likely to result in natural containment of hazardous waste.
- ü Atmospheric and Water Dispersion characteristic that will protect terrestrial and aquatic ecosystem
- ü Proximity to the principal areas of hazardous waste generation in the region
- ü Should be carried through multi-level screening process

Level – I : Constraint Mapping

Eliminates Environmentally Unsuitable sites

Level – II : Potential Size Selection

Land use & Infrastructure facility (major highway access, sites of existing / former waste disposal facilities / land designated for industrial use

Level – III : Community and Environmental Impacts

Scrutinize the sites selected in Level – II to eliminate areas which fall to meet additional socio-economic and environmental concerns as well as additional geologic and hydrogeologic factors such as

- ü Existing zones of development
- ü Agricultural land preserves
- ü Areas of mineral development
- ü Freshwater wetlands
- ü Visual corridors of scenic rivers
- ü Riverine and dam-related flood hazard areas

9.1.2 Siting of Hazardous Waste Treatment and Disposal Facilities

The siting of Hazardous Waste Treatment and Disposal Facilities requires involvement of 2 distinct selection procedures.

- ü Technical screening process based on Economic, Engineering and Environmental Suitability
- ü Public Approval

9.1.3 Goals for Siting Facility

- ü Minimize Health Risks
- ü Minimize Adverse Environmental Impacts
- ü Minimize Costs
- ü Maximize Public Acceptability

i. Selection

Selection should be a step-by step procedure involving the evaluation of alternatives.

ii. Defining Waste Management Problem

- ü Define nature and size of Hazardous Waste problem to be managed by the proposed facility
- ü By conducting surveys on Waste Generation, Handling & Management Practices

iii. Selection of Generic Technology

Based on the information on quantities and physical & chemical characteristics of the wastes, the possible treatment and disposal technologies are to be identified.

9.1.4 Site Characterization

a. Geology and Hydrology

The important components of Geological analysis

- ü Ground water system
- ü Soil or Rock permeability
- ü Structure within the over burden of rock that control the direction of movement or local concentration of fluid

b. Ground Water Quality

- ü Designing Ground water monitoring program based on Hydrogeological information, gradients, location, depth and condition of major aquifers.
- ü The water table of the site should be low

c. Soil Quality

- ü To determine the surface area and vertical extent of soil contamination
- ü Soil permeability should be low (so that the Leachate will not contaminate the ground water)

9.2 CONCLUSION

In view of identifying appropriate site for TSDF of Hazardous Wastes, Site Sensitive Indices are to be prepared with the attributes mentioned above like population density, land stability, habitation, wind direction, surface soils, sub-surface geology, and aquifer characteristics and the proximity of the users etc.