

Hazardous Waste and Environmental Impact

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Abstract— Growth and development is the necessity for any country's progress but should not effect the livelihood of future generations, says the United Nations World Summit on Sustainable Development. Industries are very important part of evolved country, and surplus hazardous waste that comes out due to it, is constant and unavoidable. Apart from all the measures for sustainable and efficient use of resources, it's time we must look into better waste management systems since it is possibly harmful to environment and human health if not treated well. Presently India shows a clear area of concern over the issue through its strict norms and regulations for the industries. Hazardous waste treatment and disposal requires better strategies to choose the most convenient and ecological techniques. This paper gives an insight on the various hazardous wastes being generated from industries, nature and various characteristics of waste, necessity of waste management, churn out various steps to be taken to design and plan the models methods, any changes towards the regulations related to hazardous waste disposal and impact on environment and health. It also indulges various aspects of the Indian industrial scenario towards cost efficient and proper methods of disposal of Hazardous Waste and its Treatment. The Government of India has promulgated the Hazardous Waste (Management & Handling) Rules in 1989 through the Ministry of Environment and Forests under the aegis of Environment (Protection) Act [E(P) Act], 1986. Proper treatment, storage prior to treatment or disposal and safe disposal of Hazardous Wastes is the need of the hour. However, the site(s) to be selected for this purpose should fulfil certain criteria. The methodology of site selection may differ from country to country.

Index Terms—Hazardous Wastes, Treatment, Waste Management

I. INTRODUCTION

Development and growth goes hand in hand which suggests waste generation in solid, liquid or gas type that finally gets discharged within the atmosphere. These wastes square measure dangerous to setting and creates downside to the living sustenance resource of all living organisms not solely to its nature but additionally its wide use. Wastes within the type of air emissions contaminating air quality, leaching surface and spring water, biological waste accumulation and soil degradation. Landfilling of solid venturous waste creates direct downside to surface and spring water by activity through soil so control such wastes during a property manner. Water and air emission laws have been existing since long and government bodies are responsive enough for its ground implementation. For air and water, the majority fits the legal necessities laid down by the govt however the quality arises within the case of solid waste management and treatment for a similar is usually

not possible at user site. The complicated chemistry of the hazardous solid waste additionally to the toxicity could be a major downside.

There is a growing drawback everywhere the planet for the safe disposal of Hazardous Waste generated from anthropogenetic sources. Hazardous Wastes may be classified (Babu and Gupta, 1997) into- (i) Solid wastes (ii) Liquid wastes (iii) vapourish wastes (iv) Sludge wastes. HPC (2001) defines HW as any substance, whether or not in solid, liquid or vapourish type, that has no predictable use and that by reasons of any physical, chemical, reactive, toxic, flammable, explosive, corrosive, radioactive or infectious characteristics causes danger or is probably going to cause danger to health or surroundings, whether or not alone or once in touch with alternative wastes or surroundings, and may be thought of per se once generated, handled, stored, transported, treated and disposed off. This definition includes any product that releases venturous substance at the top of its life, if indiscriminately disposed off. The HW has to be disposed off during a secured manner in sight of their characteristic properties.

Hazardous Wastes (HWs) are disposed off at Treatment, Storage and Disposal Facility (TSDF), a centralised location taking care of Hazardous Wastes generated from the waste generators in the near areas. The TSDF will help the small and medium scale industries generating HW in disposing their wastes effectively and efficiently.

II. CATEGORIES OF HAZARDOUS WASTES

The Government of India has promulgated the Hazardous Waste (Management & Handling) Rules in 1989 through the Ministry of Environment and Forests (MOEF) under the support of Environment (Protection) Act, 1986. Under the Hazardous Waste (M&H) Rules, the hazardous wastes are broadly divided into 18 categories. The details are given in above mentioned table. Moreover, the role and responsibilities of the waste generator, state/central pollution controls boards and state Government is clearly defined. In order to encourage the effective implementation of these rules, the MOEF has further brought out the Guidelines for Hazardous Waste (M & H) Rules in 1991.

However, the choice of an acceptable site for a good functioning of TSDF is that the key facet and depends upon many factors like waste characteristics, site characteristics, public acceptance and prevailing laws. The power siting ought to conjointly incorporate the protection of human health,

TABLE I
CATEGORIES OF HAZARDOUS WASTES

Waste Category	Waste Type	Regulatory Quantities
1	Cyanide wastes	1 kg per year as cyanide
2	Metal finishing wastes	10 kg per year the sum of the specified substance calculated as pure metal
3	Waste containing water soluble chemical compounds of lead, copper, zinc, chromium, nickel, selenium, barium and antimony	10 kg per year the sum of the specified substance calculated as pure metal
4	Mercury, arsenic, thallium, and cadmium bearing wastes	5 kg per year the sum of the specified substance calculated as pure metal
5	Non-halogenated hydrocarbons including solvents	200 kg per year calculated as nonhalogenated hydrocarbons
6	Halogenated hydrocarbons including solvents	50 kg per year calculated as halogenated hydrocarbons
7	Wastes from paints, pigments, glue, varnish, and printing ink	250 kg per year calculated as oil or oil emulsions
8	Wastes from Dyes and dye intermediates containing inorganic chemical compounds	200 kg per year calculated as inorganic chemicals
9	Waste oil and oil emulsions	1000 kg per year calculated as oil or oil emulsions
10	Tarry wastes from refining and tar residues from distillation or pyrolytic treatment	200 kg per year calculated as tar
11	Sludges arising from treatment of wastewater containing heavy metals, toxic organics, oils, emulsions, and spent chemicals, incineration ash	Irrespective of any quantity
12	Phenols	5 kg per year calculated as phenols
13	Asbestos	200 kg per year calculated as asbestos
14	Wastes from manufacturing of pesticides and herbicides and residues from pesticides and herbicides formulation units	5 kg per year calculated as pesticides and their intermediate products
15	Acid/alkali/slurry wastes	200 kg per year calculated as acids/alkalies
16	Off-specification and discarded products	Irrespective of any quantity
17	Discarded containers and container liners of hazardous and toxic wastes	Irrespective of any quantity
18	Wastes from Dyes and dye intermediates containing organic chemical compounds	50 kg per year calculated as organic chemicals

atmosphere and property values in an exceedingly community. tho' the choice of a perfect web site confirming with the higher than factors may be a tough task, few tips square measure obtainable (Guidelines, 1991) in India for choice of best web site for a similar purpose. In India, unauthorized marketing of HWs is however continued and in most of the places, the HW is being utilised to fill the low-lying areas (HPC, 2001), that isn't acceptable.

III. CATEGORISATION OF WASTE

When implementing any waste management plan, separating them on the basis of its characteristics is very essential. Before exploring about any treatment and control of waste, its components must be known to lay proper strategy. The best way is to acknowledge those manufacturing units that produce hazardous waste and then differentiate them according to the nature of the waste and the risk they create.

Risk from the hazardous waste can be classified into following:

1. High Risk: It is highly toxic and has the tendency to accumulate in the ecosystem e.g. Cyanide Waste, Chlorinated solvents, Wastes that are dioxin based.
2. Intermediate Risk: Wastes containing metal hydroxides that are extremely toxic due its low mobility and insolubility.
3. Low Risk: It is primarily organic wastes that are biodegradable.

IV. THE CONCERN ABOUT HAZARDOUS WASTE MANAGEMENT

1. Cause of mass life and material damage and loss (disability, death, fire, explosion);
2. Environmental damages: water, solid, and air pollution (underground and surface drinking water);
3. Potential increase of chemical bioaccumulation that is hard for biodegradability (chlorine containing chemicals);
4. Long term irreversible health risks (mutagenicity, teratogenicity, and carcinogenicity),
5. High concern of trans-boundary movement of toxic wastes;
6. Cause of massive toxic health damages.

V. REGULATORY REGIME FOR WASTE MANAGEMENT

Indian waste management rules are founded on the principles of "sustainable development", "precaution" (measures should be taken to avoid environmental degradation and hazards) and "polluter pays" (polluter must bear costs for damages and harm caused to environment by his own acts)

A. Bio-medical Waste (Management and Handling) Rules, 1998

The Bio-medical Waste (Management and Handling) Rules gives the proper norms of disposing bio-medical wastes and explains about detailed framework for the process and mechanisms to be followed for their effective disposal. Bio-Medical Waste means any waste generated in health care processes like diagnosis, treatment or immunisation of human

beings or animals, research activities concerning production or testing of 'biological'

As per the BMW Rules, every occupier must take all necessary steps to ensure that BM Waste is (i) handled in a manner not causing any adverse effect to human health and environment, (ii) segregated in containers at point of generation, (iii) handled and disposed off in accordance with prescribed standards.

B. The Batteries (Management and Handling) Rules, 2001

The Batteries (Management and Handling) Rules ("Batteries Rules") was notified to effect a regulatory mechanism for dealing in and disposal of used lead acid batteries and their components. The Batteries Rules apply to all the manufacturer, importer, reconditioner, assembler, dealer, recycler, auctioneer, bulk consumer (like departments, organisations purchasing more than 100 batteries) and consumer.

Import of batteries will be allowed only upon producing valid registration with Reserve Bank of India and MoEF and providing an undertaking in prescribed format along with a copy of the latest half-yearly return.

C. The E-waste (Management and Handling) Rules, 2011

The E-waste (Management and Handling) Rules, 2011 ("E-waste Rules") intend to regulate and putting in place an environmentally better e-waste management system by regulating issues of disposal, importing and recycling of e-wastes. The E-waste Rules apply to all the producer, consumer or bulk consumer (including factories under Factories Act) involved in the manufacturing, sale, purchase, and processing of electrical and electronic equipment or components, along with all collection centres, dismantlers and recyclers of e-waste.

D. The Plastic Waste (Management and Handling) Rules, 2011

The Plastic Waste (Management and Handling) Rules, 2011 set up a regulatory framework for manufacturing, proper usage and efficiently recycling of plastic bags to ensure management of plastic waste. Plastic waste means any plastic product such as carry bags, pouches, etc. which has been disposed after use or end-of-life.

Every recycler to seek registration with SPCB. Such registration is valid for a period of 3 years. Further, in order to ensure that amount is given for usage of plastic, Rule 10 states that no retailer can give plastic carry bags free of cost. There is no specific penalty provided for non-compliance and thus, penalty under EPA will apply as per which the person-in-charge may be imprisoned for up to 5 years and/or fined up to INR 100,000.

E. The Hazardous Wastes (Management, Handling and Trans boundary Movement) Rules, 2008

The Hazardous Wastes (Management, Handling and Trans boundary Movement) Rules, 2008 were framed for regulating generation, storage, reuse, recycling, import, transportation and treatment of hazardous wastes. India signed and ratified the

Basel Convention, 1992 dealing with trans boundary movement and disposal of hazardous waste. The restrictions on cross-border transportation of hazardous waste for purposes of recycling as provided in the Basel Convention are incorporated in the HWM Rules. Rule 2(l) defines hazardous waste as any waste which by virtue of its physical or other characteristics (described as chemical, toxic, inflammable, reactive, explosive, etc.) causes or can cause danger to health or environment, either standalone or in combination with other substances.

As such it is mandated that every occupier must (i) sell hazardous waste only to a registered recycler, (ii) transport such waste in the manner prescribed, (iii) prevent accidents, and (iv) increase awareness.

Identification of Hazardous Waste Generation

The data shows that the Hazardous Waste generation is maximum in Maharashtra (45.47%) followed by Gujarat (9.73%). Minimum Hazardous Wastes is reported in Chandigarh (0.0069%). The number of industries that generate Hazardous Wastes are maximum in Maharashtra (30.38%) followed by Gujarat (22.93%). The data shows that, 13011 industries are generating 4415954 TPA of Hazardous Wastes in India.

Waste Characterisation

The Hazardous Wastes in India is characterised and documented in literature (HPC, 2001; SDNP, 2003). The Hazardous Wastes are categorised into three groups viz., Recyclable, Incinerable, and Disposable. The Hazardous Wastes generation trends in Maharashtra and India (total) are similar. The quantity of disposable Hazardous Wastes (inorganic in nature to be disposed off in landfill) is high.

Quantification of Hazardous Wastes

The quantity of Hazardous Wastes generation reported in India is 4415954 TPA from 373 districts out of 524 districts. According to one estimate (SDNP, 2003), the land required to dispose 5.3 million tons of Hazardous Wastes in an engineered landfill, assuming the average density of waste to be around 1.2 tonnes/m³ and the depth of the landfill 4 m, would be around 1.08 km² every year. This information may be applied to future waste projections to arrive at future land requirements for the disposal of hazardous waste

Implementation of TSDF

"The TSDF should be properly designed based on the Hazardous Wastes expected at the site. The typical layout available in literature (Babu and Ramakrishna, 2000) may be used as a helping tool in this aspect. Periodical monitoring of the site should be carried out during the post-closure period. The monitoring scheme includes the ambient environmental quality and different activities pertaining to the direct and indirect operation of TSDF such as Amenity items, Site inspections, Habitat survey, Aftercare measures, and future

planning etc.

VI. CONCLUSION

Thus, this paper presented the impact of hazardous waste on environment.

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- [7] Biologicals is defined under Rule 2(6) to mean any preparation made from organisms, micro-organism, product of metabolism and biochemical reactions intended for use in the diagnosis, immunisation or the treatment of human beings or animals or in related research work.
- [8] See Rule 2(5) of Bio-Medical Waste Rules
- [9] See Rule 2 of the Batteries Rules
- [10] Environmentally sound e-waste management is taking of all steps required to ensure that e-waste are managed in a manner which shall protect health and environment against any adverse effects which may result from hazardous substance contained in such e-wastes
- [11] See Rule 2 of the E-waste Rules
- [12] See Rule 3(m) of the PWM Rules
- [13] See Rule 4 of the Hazardous Waste Management Rules, 2008.
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