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CENTRE FOR ENVIRONMENTAL STUDIES, ANNA UNIVERSITY
CHENNAI 600 0025 INDIA

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Biodegradation of Wastes And Environmental Impact Assessment

Work Bank Aided: Environmental Management Capacity Building Technical Assistance Project (ENVIS-EMCBTAP)

The Environmental Information System (ENVIS) is a project funded by the Ministry of Environment & Forests of Government of India to facilitate generation and dissemination of information on various facets of Environment. Several ENVIS Centres have been established all over India and each centre has been allotted specific subject areas. Our ENVIS Centre (05) located at the Centre for Environmental Studies, Anna University focuses on the subject areas of "Biodegradation of Wastes and Environmental Impact Assessment". Activities of our Centre include collection, classification, retrieval and dissemination of information in the subject areas allotted. Listing of current technical papers and thesis titles followed by abstracts of the papers are published once in six months. Yet another important activity of our centre is answering quarries from users.

Our ENVIS Centre has been, now, identified by MoEF as EMCB- ENVIS Node under World Bank aided Environmental Management Capacity Building Technical Assistance Project (EMCBTAP) to enhance our activities. Activities of ENVIS-EMCB Node include publishing Newsletter every month, launching website in the subject areas allotted with regional language interface, creation of database, collection of monthly news items, answering quarries and establishing linkage with users/organizations

Environmental Impacts of Construction of Sewage Treatment Plant- Plant-II

4.0 Environmental Management Plan (EMP)

4.1 Objectives

The Environmental Management Plan (EMP) addresses the requirements for successfully mitigating the likely adverse impacts and identifies the post project monitoring requirements needed for the successful implementation of the suggested mitigation measures. The institutional arrangements needed for implementing the mitigation measures and conducting post project monitoring have been identified in the form of a monitoring plan. Mitigation measures are being suggested for those project activities, which have been found to have major or moderate environmental impacts. The recommended mitigation measures are to be implemented by the prospective contractor in close co-ordination with traffic police and Pollution Control Boards.

4.2 Construction Phase Impact Management

The recommended measures needed to minimise and mitigate the construction phase impacts are discussed hereunder.

The precautionary measures suggested to mitigate the impacts likely due to clearing of vegetation during the construction phase include:

Clearing of vegetation at the sites proposed for sewage treatment plant, Sewage Pumping Station and along the alignment of sewer lines and pumping main should be done in such a way that maximum number of trees are saved. Wherever it is not avoidable, planting of trees would be done to compensate the loss.

- Locating the structures at all project sites, so as to minimize felling of trees, to the extend possible.

- Adjusting the alignment of sewer lines and pumping main to the extent feasible so as to minimise damage to the root systems.

It is recommended that commercially and aesthetically important plants based on the nature of the soil and plant characteristics shall be planted. The most common plant species are cocosnusifera (coconut), Tamarind, Delonix regia (Gulmohar) and Bougainvillea shall be planted along the area.

The aesthetic value and the biological diversity along the pumping main corridor can be enhanced by planting trees. Trees that provide good shade and large canopy such as Delonix regia can be planted. The barren land area can be made greener by planting suitable plant species such as Bombox malabariamand, Anthocephalus kadamba, etc.

4.3 Management of Noise Impacts

Following precautionary measures are recommended for the management of noise impacts.

- To minimise the impact, construction operations in residential and sensitive areas should be restricted to between 7.30 a.m. and 6.00 p.m.

- Prior information should be provided if the blasting is significant.

- Noise level should be reduced by provision of encasement to generator sets and 4.6 concrete mixers at the sites.

- Operators of heavy machinery and workers in near vicinity should be provided with ear plugs and other protective measures for safety.

4.3.1 Managing impacts due to movement

Precautionary measures in order to avoid adverse impacts due to traffic congestion are as follows:

The most suitable route for delivery and haul equipment with due consideration for load limits, traffic pattern and the character of the area traversed should be selected. Traffic controls and diversions, marked with signs, lights and other measures (flags) should be provided. This is necessary to minimise confusion and ensure public safety. Police and fire departments should be informed before any route is closed. Also, routes should not be closed until an alternative road is identified. The prescribed safe, legal laid limits of all bridges and surface roads that may be traversed by the heavy equipment used at the project sites shall be followed.

4.4 Managing Impact On Air Pollution

Construction activities and the consequent transportation activities add to the air pollution in the region. Impact of the air pollution will be moderate and short term at sewage pumping station's, STPs and while laying sewer lines.

4.4.1 Precautionary Measures

- It is recommended that the construction equipment, machinery and diesel engines be maintained in good condition so as to reduce emissions.

- Dust should be controlled by sweeping and sprinkling with water.

- Trucks carrying sand to and from the construction site should be covered or wetted in accordance with the construction specifications to minimise release of dust.

4.5 Managing Impact Due To Labour Camps

Considering the long construction period of the project, the local and migrant laborers will pose some stress on utility services, such as water supply and sanitation.

4.5.1 Precautionary measures

- Planning of labor camps needs to be done with adequate water supply, sanitary facilities and drainage in temporary colonies of the construction workers. Necessary transportation facilities to the laborers shall be provided.

4.6 Other Recommendations

In order to minimise the construction phase impacts, a few construction site practices are being recommended.

When pipelines are laid or subsurface excavations are made in existing streets, cuts in the paving are unavoidable. Best construction practices would be applied to ensure that repaved trench areas blend with the existing pavements to the extent possible. Pedestrian bridges with handrails would be provided at all intersections when trenches remain open. Steel plates over trenches would be provided at driveways and intersections.

5.0 Conclusion

Though the important aspects to be kept in mind during construction of sewage wastewater treatment plants were discussed. Environmental Impact Assessment of such constructions are project and site specific in nature and to be, addressed in detail during formulation.

Open Dumps to Sustainable Landfills

1.0 Introduction

The management of solid wastes is an area of universal concern for both the developed and developing world. It is imperative that efficient, technically sound, and cost effective solid waste management solutions are developed in the near term for benefit of the burgeoning populations in the world's cities and the natural environments that must sustain them. This paper focuses on the Land disposal of solid waste and how current practice of open dumping could be improved to sustainable landfills in a phased manner

2.0 Open Dumps

Historically, countries dealt with solid waste by burying it in the ground, covering it up, and forgetting about it. Another approach was the uncontrolled burning of waste to reduce volume. The subsequent ash was then buried in the same manner as waste. A recent study of World Bank over 50 landfills in Asia, Africa and latin America has identified current practices, emerging features and necessary improvements in the land disposal of solid wastes (Johannessen and Boyer, 1999). The landfills visited in the Africa Region ranged from pen dumps to sanitary landfills. While decision makers in the region were aware that their countries had to upgrade open dumps to sanitary landfills, this was not regarded as a priority. An Open Dump Site is a land disp6sal site at which solid wastes are disposed of in a manner that does not protect the environment, is susceptible to open burning, and is exposed to the elements, disease vectors and scavengers. These unplanned heap of uncovered wastes, often burning and surrounded by pools of stagnated polluted water, rat and fly infestations with domestic animals roaming freely and families of scavengers picking through the wastes is not only an eyesore but a great environmental hazard.

As a default strategy for municipal solid waste - management, open dumps involve indiscriminate disposal of waste and limited measures to control operations, including those related to the environmental impacts of landfills. Very often, open dumping sites are swamp or low-lying areas with the wastes being used for reclamation. Liners are rarely used and little consideration is given to the water table and groundwater pollution and/or gas migration. Problems of shortage of cover, lack of leachate collection and treatment, inadequate compaction, poor site design and many ragpickers working at the site are common. The high percentage of organics, combined with much plastic, which forms layers when compacted, contributes to the build-up of methane gases at dumps. Files often break out and workers are made ill by the gases. In cities where plastic shopping bags are used to put out wastes for collection, waste pickers sometimes set refuse on fire in order to recover valuable inorganic items. Spontaneous fires also break out in dumps. This greatly adds to the air pollution from dumps. The roads leading to dumps and those on dumps themselves are often elementary, becoming impassable in the west season. Since most large dumps have hundreds of extra workers in the form of waste pickers and the municipal workers are not provided with protective gloves, the health risks at dumps are much higher than in sanitary landfills in industrialized countries. These workers are exposed to risk from human feces, slaughterhouse wastes, landfill gases, toxic dust, infectious biomedical wastes, snakes, scorpions, broken blass and explosions. Thus, these dumpsites are essentially uncontrolled, creating considerable health, safety and environmental problems.

3.0 Landfills

Landfills are a vital component of any well-designed Municipal Solid Waste Management (MSWM) system. They are the ultimate repository of a city's MSW after all other options have been exercised. The main differences among the landfills involve the degree of isolation, the means of accomplishing it and optimizing the landfill reactions. The rate and extent of decomposition of the land filled wastes are dependent on the design of isolation. Innovative planning and design can accelerate the decomposition and facilitate productive reuse of the landfill property after the landfill is closed. A number of general characteristics as listed in Table 1, distinguish a modern sanitary landfill from an open dump.

Table 1 Types of landfills

Type	Engineering Measures	Leachate Management	Landfill Gas Management	Operation measures
Open Dumps	None	Unrestricted contaminant release	None	Few, scavenging
Controlled dump	None	Unrestricted contaminant release	None	Registration and Placement /compaction of waste; uses daily of soil cover, measures for final top cover
Engineered Landfill	Infrastructure and liner in place	Containment and some level of leachate Management	Passive ventilation or flaring	Registration and Placement /compaction of waste; uses daily of soil cover, measures for final top cover
Sanitary landfill	Proper siting, infrastructure; liner and leachate treatment in place	Containment and leachate treatment (often biological and physico-chemical treatment)	Flaring	Registration and Placement /compaction of waste; uses daily of soil cover, measures for final top cover

Controlled contaminant Release Landfill	Proper siting, infrastructure, with low-permeabilit y final top cover	Controlled release of leachate into the environment, based on assessment and proper siting	Flaring or passive ventilation through top cover	Registration and Placement /compaction of waste; uses daily of soil cover, measures for final top cover
Landfill Bioreactor	Proper siting, infrastructure, liner and leachate recirculation/gen erat ion system	Controlled recirculation of leachates for enhanced degradation and stabilization of wastes and leachates	Landfill gas recovery	Registration and Placement /compaction/ daily cover/closure/mi ning and meterial recovery

The modem implementation of a traditional landfill for municipal solid waste (MSW) has often been referred to as a "dry tomb" as depicted in Figure 1. This is a lined hole filled with waste and then capped to prevent the infiltration of water. Two new methods called the anaerobic bioreactor and the aerobic biocell are attempting to supplement this method of Dry Tomb Landfill. While almost minor at first glance, the concept comprises a substantial departure from old dumps, and modern landfills in that rather than being places where waste is placed in indefinite isolation from the environment, the bioreactor and biocell landfills transform the landfill into an active treatment process, which opens up a whole range of options.

The anaerobic bioreactor or landfill bioreactor, is similar in design to a dry tomb landfill. It has a leachate collection and recirculation system, geomembrane liners, final cover, and gas collection system. (Reinhart 1998). In this type of system, the gas that is predominantly produced is methane, which can be collected and purified for sale and/or use. The level of methane production will be related to the level of organic waste present in the landfill. If the organic stream is diverted from the landfill, the resulting methane will be lower than in other anaerobic bioreactors. Another advantage of this design is that it has the capability of stabilizing the waste much faster than the dry tomb landfill. Waste may not stabilize for thirty years in dry tomb landfills while in an anaerobic bioreactor that may occur in less than ten.

The aerobic biocell, is set up just like the anaerobic except for the presence of an air bioreactor, the ultimate objective is to maximize the speed of decomposition of the contents. Air is percolated through the landfill to encourage aerobic decomposition and the accompanying preferential production of carbon dioxide instead of methane (Stessel 1994). Since methane production is not the aim of this landfill, the level of organic waste will not affect its performance as much as the anaerobic system is affected. This design also allows for the rapid stabilization of the contained waste.

An additional advantage of both of these landfill designs is that they allow for-the possibility of landfill mining. It is the process of exhuming existing or closed solid waste landfills and sorting the exhumed materials for recycle, processing or other disposition (Lee and Jones, 1990; Hogland et al, 1997; Carius et al, 1999; Cosu et al, 1999). The objectives of landfill mining could be one or more of the following.

- Conservation of landfill space
- Reduction in landfill area
- Elimination of potential contamination source
- Rehabilitation of dump sites
- Energy recovery from recovered wastes
- Reuse of recovered materials
- Reduction in waste management system costs
- Redevelopment of landfill sites
- Monitor and assess the current status of the match the affordability and sustainability leachate quality around the existing dumpsite.
- Study the feasibility of stabilizing the partly degraded organic wastes by vermicomposting.
- Study the feasibility of using the stabilized wastes from the dumps as compost as well as daily cover material.
- Rehabilitates the dump sites through macrophytes,

The results from the studies shows that samples from Perungudi dumpsite contained about 30-50% combustible materials such as textile, wood, plastics, etc., with an average of 40%. The moisture content varied from 20-50% with an average value of 40% and the samples were slightly alkaline with pH varying between 7.6 and 8.6. The non-combustible fraction was about 1030% with an average of 20%. The soil fraction varied from 30-65% with an average of 40%, 22% being fine size (<2mm). In solid 12%, from Kodungaiyur dumpsite, the combustibles constituted about 2-12% non-combustibles 10-50% and the soil fraction 30-80%. The pH values were near neutral and ranged from 6.7 8.2 and the moisture content 20-30%. Physical characteristics of the fine fraction showed that the Bulk density varied from 700-1100 kg /M3 with an average of 965 kg /M3 and the organic matter varied from 90-160 g/kg, while the ash content constituted 840-910 g/kg indicating that the soil fraction was mostly stabilized and inorganic in nature. Chemical analyses of the water and acid extracts of the samples indicate that the trace metals and other constituents are within the limits prescribed by the CPCB for compost.

Comparison of constituents of solid wastes of Perungudi and Kodungaiyur indicates that the combustibles were low and the soil fraction was very high in samples from Kodungaiyur. This is attributable to the unorganized dumping and leveling of fresh water at Perungudi especially during the monsoon. The results of the study support the feasibility of mining compost/daily cover soil from the solid waste dump sites where the dumping has been done in a controlled manner. The high moisture content of the samples that require drying prior to component separation appears to be a limitation.

6.0 Conclusion

Municipal Solid waste management services in most of the countries comes a poor third in municipal priorities, after water supply and sanitation. However they are under pressure from their own legislation to move away from the current disposal practices of open dumping to sanitary landilling. Such a change is unlikely to occue in the nearest future due to limitations on finance, shortage of technical resources and lack of institutional arrangements (Michel Pugh, 1999). It is advisable to have small incremental improvements in landfill design and operation rather than an attempt to make a single large technological leap. This approach should also match the afforbability and sustainability considerations.

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