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STUDY ON CLOSURE METHODS FOR BHANPUR DUMPSITE, BHOPAL

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Abstract : **Solid waste management is perhaps the most important service required by urban dwellers to maintain their quality of life. Huge amount of solid waste is generated in India, in Urban, municipal and industrial sectors which are finally disposed to the solid waste disposal sites. Bhopal is not an exception. BMC plans to undertake remediation and closure works at its Bhanpura dumpsite as NGT has ordered for scientific closure of the bhanpur dumping area. This represents a pioneering step forward for the sector, as through these interventions, open dumping will cease, its impacts will be mitigated, and future waste treatment and disposal will accord with the requirements of the SWM 2000 Rules and internationally accepted practices. There is an urgent need to remediate this dumpsite.**

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I. INTRODUCTION

The problem of municipal solid waste management (MSWM) has acquired an alarming dimension in the India during the last few decades. The quantity of solid waste generated has increased significantly and its characteristics have changed as a result of the change in the peoples' lifestyles due to swift industrialization and urbanization. As per CPCB estimates, around 57 million tons per annum of MSW is presently generated in the country, which is likely to increase to the volume over 150 million tons of waste a year by 2025.

Municipal Solid Waste (MSW) management in India is a state subject as per the Indian constitution 74th Constitutional Amendment Act and it is one of the most important obligatory functions of the ULBs. At the central level, the Ministry of Environment and Forests (MoEF) of the government of India has issued MSW (management and handling) rules in the year 2000 for MSWM. These rules lay out procedures for waste collection, segregation, storage, transportation, processing and disposal. Despite the notification of MSW Rules as early as in the year 2000, the local bodies are still not being able to achieve satisfactory source segregation of MSW.

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Bhopal, the capital city of the state of Madhya Pradesh in India is also grappling with the issues of MSW treatment & disposal. This study includes all the components of the SWM for the city including collection, transportation and segregation of municipal solid waste and its conversion into energy and closure of existing dumpsite and development plan of new sanitary landfill in Bhopal city.

II. BHANPUR DUMPSITE

Bhanpur dumpsite is situated on outskirts of Bhopal city. It is an uncontrolled unlined dumping ground, located in Bhopal, Madhya Pradesh and is very close to residential settlements and agricultural land. The dumpsite is potential threat to the environment due to uncontrolled release of leachate, landfill gas and SPM. The dumpsite is operational since last 35 years and receives Municipal Solid Waste (MSW) from entire Bhopal Municipal Corporation (BMC) area. As the new proposed site of dumping of MSW is proposed in Adampur Chhaoni, about 10-km east of the city, and about 1.2 km north of highway NH-86. Therefore the Dumpsite should be scientifically closed with the requirements and guidelines of MSW management and handling rules 2000As on date, out of the total 57.8Acres dumpsite, 36.9 acres is filled with garbage randomly.

Fig.1 Aerial View of Bhanpur Dumpsite

III. Environmental Impact of Bhanpur Dumping Site

- Contamination of the soil and groundwater due to uncontrolled dumping at the site.
- Patra River adjoining to the existing dumpsite is observed to be polluted with solid waste leachate and runoff from the dumpsite. The stream feeds some of the adjoining agricultural fields downstream (towards North).

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- The leachate (especially persistent organics) flowing into the stream are likely to have adverse impacts on the farms and may also have serious effects on exposure and can cause widespread pollution of water supplies.
- The existing site is largely near exhaustion and hence the risk of waste accumulation in the city (lower collection efficiency) could further cause adverse environmental issues.
- Dangerous items (such as broken glass, razor blades, hypodermic needles and other healthcare wastes, aerosol cans and potentially explosive containers and chemicals from local industries) pose risks of injury or poisoning or chronic illness, particularly to children and people who sort through the waste.
- Open burning of wastes has been routinely practiced on the site and this has been leading to air pollution and release of toxic compounds such as furans and dioxins, in the adjoining areas.
- Methane (one of the main components of landfill gas) is released from the anaerobic decay of organic matter in the landfill mounds. Methane is much more effective than Carbon Dioxide as a greenhouse gas, leading to climate change impacts.

Fig.2 Uneven Disposal of Waste at Bhanpur Dumpsite

IV. METHODOLOGY

The approach to the study is to meet the primary objective of design and development of an integrated system for management of solid waste generated in Bhopal city. Accordingly, the entire study is proposed to be organized into the following stages:

- The first stage would focus on understanding the current waste management practices of area including the status of waste collection & transportation and existing waste disposal site. Available information from the Bhopal Municipal Corporation (BMC) on various aspects of solid waste management such as quantity of waste generated, characteristics of waste, systems of waste collection, disposal facilities including the treatment facilities, composting/land fill practices will be collected and analysed to prepare a Concept Report.
- In the second stage of the study based on the generation trends and characteristics of the area, the concept for an integrated SWM system would be developed for standalone

system. The technologies as well as the facilities proposed will be further taken up for detailed cost estimation.

- In the next stage, the feasibility study would be carried out for the selected option including developing the strategies for efficient collection and transportation, treatment and final disposal of the inerts and rejects to the landfill, the suitability assessment of the identified site for development of Integrated SWM facility.
- Further, the analysis would also be carried out for various relevant wastes to energy technology options. The feasibility of various options will be examined through the lenses of technical, commercial, legal and environmental aspects and recommendations be made, accordingly.

V. CLOSURE METHODS

As per MSW Rules, a Landfill once completely filled has to be capped with impervious liner in order to isolate the garbage to prevent air and water contamination. Based on study and existing site condition following closure options can be considered for the Bhanpur dumpsite:

- **Simple Closure**

Under this option, the existing garbage shall be leveled and capped with the top cover as specified under Draft MSW Management Manual 2014. Under this option entire 36.9 acres land shall be covered with vegetation. This will not help in land recovery.

- **Closure with Land Recovery**

At present, the garbage is scattered and has a scope of volume reduction by compaction. The waste can be easily shifted to any corner to form a frustum with steepest possible slope and maximum height. The Bhanpura dumpsite which once used to be outside the BMC boundary has now entered into the city limits and consequently the land value has increased many times. The simple closure does give a flat surface after capping however the same cannot be used to build structures due to low bearing capacity of underlying waste. In fact, building structure means digging foundation into the capped surface which cannot be done. Also the closed waste heaps will gradually and continuously settle down with time and is not suitable for any use other than parks, Golf Course etc.

It is estimate that with 1:4 side slope (V:H) and 18m height, it is possible to dump the entire waste into only 12 acres or 1/3rd part of the dumpsite which means 2/3rd Land recovery.

- **Closure with Land and Landfill Gas (LFG) Recovery**

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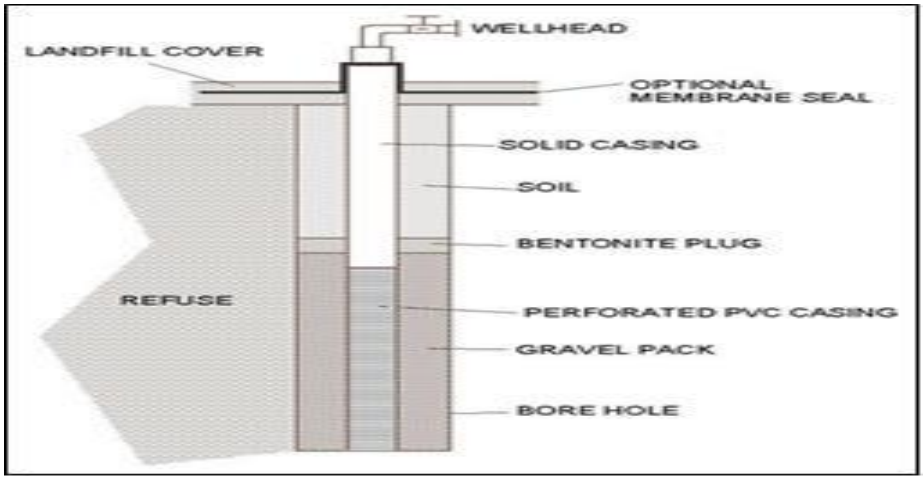

Fig. 3 A typical gas extraction well

More than half of typical Indian MSW consists of Organic matter like kitchen waste, leftover food etc. In absence of proper segregation, entire MSW ends up in to Landfills/Dumpsite whereas MSW Rules mandates that Raw MSW must be treated and only inert rejects should be disposed. The old garbage layers which are covered underneath fresh garbage layers undergo Anaerobic decomposition (provided sufficient moisture is there) which produces Landfill Gas as a by-product. Landfill Gas (LFG) is a mixture of 40-50% methane and remaining 50-60% Carbon dioxide with traces of Hydrogen Sulphide, Siloxanes etc. If not vented properly, LFG on continues accumulation builds up the internal pressure and may result in explosion. However releasing LFG into the air is also not a wise solution since both Carbon dioxide and Methane are greenhouse gases (latter one being ~ 20 times more potent in causing global warming than Carbon dioxide) and thus should be flared/used as fuel. To extract LFG, the surface of Landfill/dumpsite has to be capped with impervious lining first followed by drilling and installation of gas wells and gas collection pipe network. High organic and moisture content of waste strengthens the possibility of LFG in good amount. LFG production is a first order chemical reaction, there are some models/software available ("**Landgem**" being the most common) which estimates the LFG yield based on inputs like Garbage composition, age of the dumping ground/Landfill, Moisture content etc. However, these models assume that the Landfill/dumpsite will remain intact during the entire gas extraction period. Land reclamation is also a priority of municipal corporation which cannot be ignored and therefore Waste shifting, cut fill operation, compaction etc are inevitable. Also, these models assume that the waste dumped in the dumpsites/landfill has never burned which is again not true for Bhanpura. Burning of waste reduces LFG potential as well as reduces its methane content. Thus these models are unreliable to predict LFG yield from Bhanpur dumpsite.

VI. CONCLUSION

Closure with Land and landfill gas recovery will be the appropriate method for Scientific closure of Bhanpur Dumpsite. Land recovery is possible as the Garbage scattered randomly shall be confined to a part. The volume of Garbage shall be reduced by more than half through compaction. The gases produced within a landfill can be collected and used in various ways. The

landfill gas can be utilized directly on site by a boiler or any type of combustion system, providing heat. Electricity can also be generated on site through the use of micro turbines, steam turbines, or fuel cells. The landfill gas can also be sold off site and sent into natural gas pipelines. This approach requires the gas to be processed into pipeline quality, e.g., by removing various contaminants and components. The efficiency of gas collection at landfills directly impacts the amount of energy that can be recovered - closed landfills (those no longer accepting waste) collect gas more efficiently than open landfills (those that are still accepting waste).

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