A STUDY ON THE IMPORTANCE OF GREENHOUSE GAS EMISSIONS FROM DUMPYARDS /LANDFILLS

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Abstract

Despite Chennai being the fifth largest city in terms of area, Chennai is the metro that generates the largest per capita amount of waste in the country. For Chennai which generates 6,404 tonnes of waste daily, the garbage generated by an average household includes 25% recyclable waste, 60% organic waste and 10% hazardous waste. At least 30% of garbage goes into drains, while many vacant plots and pavements have become unofficial dump yards. The city, with about 730 hospitals, also generates an average of 9,898kg of biomedical waste a day. The corporation spends an estimated 6.5 lakh a day on diesel for transporting garbage. Studies have shown that burning garbage in Chennai's dump yards at Kodungaiyur and Perungudi poses severe health hazards, even exposing nearby residents to the threat of cancer. Many people living near these dump yards have complained that air polluted by burning garbage has caused respiratory disorders. With Kodungaiyur and Perungudi dumpyards moving towards the end of their lifetime, the Chennai Corporation is toying with a new strategy to dispose the daily garbage being collected in the city. Perungudi & Kodungaiyur houses are the two major landfills in Chennai. The refuse generated from in the city is directly dumped without any processing. These dumpyard are reaching its capacity and plans are being put into place to scientifically close the dumpyards. However, currently no deals have been finalized to do the same. Local people struggle to live and fight for shifting dumpyard couple of years.

Key words: green house gases, dumpyards, methane, carbondioxide, sensors, test cells, air pollution, landfill gases

I.INTRODUCTION

Municipal solid waste management is an important part of the urban infrastructure that ensures protection of environment and human health. During the last few decades, man's relationship with environment has drastically changed due to industrialization. Large quantities of solid wastes are being disposed off on land, land being an effective medium for disposal of solid wastes. Due to increasing urbanization .The quantity of municipal and industrial waste generated by the society is constantly increasing. The problem associated with the disposal of wastes, began to assume gigantic proportion with the increase in population. For economic considerations the industrial and urban wastes are disposed off mostly by dumping in low lying and waste land areas located in and around the city limits. Disposal sites for urban trash, also called landfills or open dumps, is a major environmental problem present worldwide on account of the health hazards they pose, though this open dumping may solve the problem of utilizing useless lands for the disposal. Due to the all disposable activities, the Geotechnical Engineer is faced to new problem emerging from the task of protecting the environment and also on problems related to prevention of natural hazards.(2)

II.STUDY AREA-DUMPYARDS

There are three types of Dump Yards i) Open Dump Yards, ii) Controlled Dump Yards and iii) Sanitary Landfills. All the Chennai Dump Yards are so far Open Dump Yards. The existing dump site at Perungudi is located approximately 1.2 km south of the city center. The land fill lies between 2 km to 3 km west of the Buckingham canal and approximately 3.5km to 4.5km away from the Bay of Bengal coast line. The proposed development site occupies an extensive area of marsh land and mud slats adjacent to, and west of, the Perungudi sewage treatment works operated by Metro water. Metrowater's current land holding extends to approximately 364 ha of which approximately 25 ha has been over tipped with

municipal solid waste by Chennai corporation since 1987.The whole of the area is low lying, being closed to sea level and is poorly drained being occupied by extensive areas of marsh land and mud slats which are permanently wet and seasonally inundated. Velachery marsh lies immediately north to the site (1).

Characteristics of Open Dump Yards

The characteristics of open dump yards are given below

- Unplanned
- No cell planning and the waste is indiscriminately dumped
- No Leachate & Gas Management
- No fence & No record keeping
- Low initial cost, high long term cost
- High potential for fires and adverse environmental and health impacts

The study of the dumpyards has become important owing to the twin problems of health and safety. An analysis of the air sample collected in dump yards area reveals 40-60% of methane & Carbon-di-oxide. Hundreds of other contaminants -- most of which are known as "non-methane organic compounds". NMOCs usually make up less than 1% of landfill gas. Regulations insisting the close of dump yards by 2015 and selection of suitable methods (Biomining & Capping) for its' closing has also necessitated the need for the dump yard study.

III. WASTE DECOMPOSITION IN DUMPSITES AND THEIR IMPACTS

India is the second largest in population next to China as per the U.N. World Population Prospects (2004 revision) using the medium fertility variant. Chennai is one of India's metropolitan with 200 wards in 15 zones. With a population of 8.7 million and 500 grams per capita per day of waste generated, the metropolitan has just two dump yards and eight transfer stations to dispose 6,404 tonnes of waste generated per day. The dump yards at Kodungaiyur and Perungudi have been in use for more than two decades as they were earlier part of the city non-residential limit. Due to its prolonged use the air, water and soil conditions of the neighboring areas of the two locations have been contaminated to the greatest extent. The present study will lead to a focus on Managing and Monitoring Municipal Solid Waste Emissions. The waste generation, composition and categorization with respect to Chennai are given in Table 3.1, 3.2 and 3.3.

The state of dumpsites in Asian countries is all similar: indiscriminately dumped, seemingly unplanned heaps of uncovered wastes, most of the times open burning (Figure 3.1); pools of leachate (Figure 3.2); rat and fly infestations, domestic animals roaming freely (Figure 3.3); and families of scavengers picking through the wastes (Figure 3.4). Open dumpsites do not have the necessary facilities and measures to control and safely manage the liquid and gaseous by -products of waste decomposition.

Fig.1 Dumpsites – Open burning

Fig.2 Dumpsites – Potential source of water problem

Fig.3 Dumpsites – Animal Roaming

Fig.4 Dumpsites - Families of Scavenger

The biodegradable components of waste (food and yard wastes) generally undergo anaerobic degradation in a dumpsite/landfill environment. The decomposition involves multistage dynamic processes, depending on the creation of a suitable environment subject to placement of wastes occurred at different times, heterogeneous nature of the wastes with different rates of biodegradability and the spatial variability in the physical and chemical environment of the waste materials.

Table 3.1 Generation

Per capita Generation per day	700gms
Estimated Generation of Solid Waste Per day	Garbage 4500 MTs. Building debris 700 MTs

Table 3.2 Composition

Physical Analysis	
Food waste	8.00 %
Green waste	32.25 %
Timber(wood)	6.99 %
Consumable plastic	5.86 %
Industrial Plastic	1.18 %
Steel & Material	0.03 %
Rags & Textiles	3.14 %
Paper	6.45 %
Rubber & Leather	1.45 %
Inerts	34.65 %

Chemical Analysis	
Moisture Content	27.60 %
PH Value	7.68
Organic Content	39.06 %
Carbon content	21.53 %
Nitrogen Content	0.73 %
Phosphorous P_2O_5	0.63 %
Potassium K_2O	0.63 %

Table 3.3 Waste Generation By Category

Category	**Waste %**
Residential	68 %
Commercial	16 %
Halls, Schools, Institutions	14 %
Industrial	2 %

IV. LANDFILL GASES – POTENTIAL HEALTH HAZARDS

Land filling is an important component of the several methods available for safe municipal waste disposal, land filling has been economical. However leads to emissions similar in characteristics as methane landfill gas (LFG) is predominantly methane with proportionate amount of carbon dioxide contained in it. Hence, landfill gas is also identified as a potential green house gas. Landfill gases are also composed of traces of other gases including nitrogen, oxygen, sulfur etc. Landfill gas is potentially hazardous as its major content is methane which affects the respiratory tract on inhalation by depriving the amount of oxygen in the atmosphere at very high levels. Hence, continuous monitoring and assessment of landfill gases becomes essential. Alternate application of landfill gas in energy production should also be analyzed to address the increasing energy crisis. Landfill gases for energy applications will be a potential green technology for energy production.

V. HEALTH ISSUES AND TOXIC EFFECTS

Most of the health and toxic effects related to LFG are centralized around the landfill site and are primarily of relevance to workers on the site. In the right conditions, LFG may be combustible, suffocating, and toxic, as is hydrogen sulphide. On-site works in areas such as manholes related to leachate or condensate management provide a potential area for accumulation of toxic gases. Additionally, accumulation of LFG in enclosed or low-lying areas on or near landfills may cause displacement of air, thereby creating an oxygen-deficient atmosphere. This oxygen deficiency may be severe enough to pose a suffocation hazard to persons in the area. While some of the trace compounds in LFG are toxic at sufficient exposure concentrations, other compounds are considered carcinogenic over long-term exposure. However, most of the short and long-term health effects due to LFG are restricted to the landfill site and can be addressed utilizing properly developed health and safety procedures and systems.

VI. CONCLUSION

The detailed studies on Landfill (GHG) gas emissions and their effects on environment especially to the health impacts on the neighborhood needs an intensive study on the monitoring of the GHG at different locations within a specific radii of the selected dumpyard ; a detailed analysis of health complaints of patients from the health records of the primary and secondary health centres for establishing a correlation between GHG levels at different locations and health hazards; to implement green engineering concepts for GHG management. The requirements for idealizing such a study necessitates a detailed review of sensors for detecting greenhouse gases

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