Conversion of Dumped Waste To Efficiently Used Resource: A Review

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Abstract- *The study hereby is an attempt to evaluate the process of landfill mining as a remediation technique for Municipal Solid Waste dumpsites, which are an inherent feature of each city of note, in the developing countries. These dump sites, more often than not, nothing more than a piece of land where all of the city's refuse is collected, are threats to the environment and consume valuable land, which could otherwise be converted into a revenue generating asset. Many cities are extremely short on land and some are also facing the negative impacts of these dumps in terms of water contamination, air pollution and land degradation to name a few. Encouraged by the positive outcomes of studies carried out earlier, this study was aimed at applying the idea on a broader scale in terms of encompassing a number of cities across the country. Based on these, various revenue generating fractions were identified. From the current market cost of the land used as dumpsite and the materials from the landfill mining operation, the benefit-cost scenario was judged. It was found that for most of the scenarios the overall operation of mining the landfills was economical in terms of cost, but the intangible benefits, which cannot be monetized, are expected to be far greater than the rest.*

Keywords- Landfill, Dumpsites, landfill mining, excavation, remediation, segregation, waste, resource

I. INTRODUCTION

Mining waste disposal permanently brings about a contamination threat to groundwater of unprotected aquifers and surface water in dumping sites all over the world. The mining waste burden and management problems are particularly important due to the high volume of material disposed (Jadwiga S., et al 2004).

Many dumpsites existing in the cities in developing countries pose a threat for human health. All of them also have a common challenge of managing the old dumpsites in a scientific manner. Dumpsite is a widespread land disposal area and generally known for its common features are being exposed directly to the atmosphere or covered improperly with soil layer and without proper bottom liner support. These features could significantly contribute to pollution and contamination of the total environment. (Dubey A., 2016).

Historically, open dumps were commonly located on the fringe of urban development and as the cities developed, the urban fringe moved beyond the open dumps bringing residential and commercial development within their close proximity of the open dump. This brought about a conflict in land use, with dumps being considered incompatible with these uses raising community and regulatory concerns calling for its rehabilitation.

In many developing countries, solid waste disposal by open dumping is still under practice for reasons such as:

- Ignorance of the health risks associated with dumping of wastes
- Acceptance of the status quo due to lack of financial resources to do anything better
- Lack of political determination to protect and improve public health and the environment
- By traditions thus it is the oldest known way to handle MSW, just to fill a hole in the ground.

It thrives because of the false belief that it is the easiest and cheapest disposal method to use in those countries with difficulties in economy or where there is insufficient political will to allocate adequate public resources to improve the prevailing disposal practices. Each municipality operates one or more open dumpsites situated close to the towns and are widely regarded as uncontrolled and unsafe operations. The dumpsites are often poorly sited and operated by inexperienced or disinterested staff.

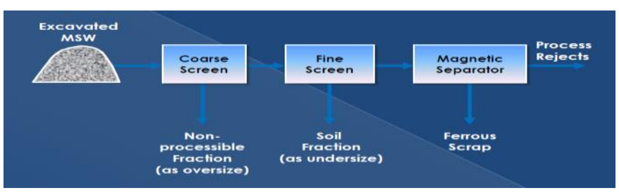
Wastes from mineral excavation both under US Resource Conservation and Recovery Act (RCRA, 1976 with further amendments) and EU regulations pursuant to Article 1 (a) of Council Directive 75/442/EEC (1975) on waste and article 1(4) of Directive 91/689/EEC (1991) on hazardous waste is considered non-hazardous, though many aspects related to its safe disposal and use with respect to the environmental behaviour and impact are applicable also to hazardous waste. (Jadwiga S., et al 2004).

Mining wastes include hard rocks, gravels, clays, pebbles, sands, limestones, chalks, siftings of fine fractions, dump tailings of flotation concentration of ferrous and nonferrous metal ores, sulphur ores, apatite-nepheline concentrates, coal wastes, halite flotation wastes, screenings of phosphorite, phosphoric ore fines, etc. (Jadwiga S., et al 2004).

Various methods of remediation can be deployed to neutralize the ill effects of the dump sites, and the threat they pose to the environment at large. Dump site remediation, in essence, is the operation of nullifying the ill impacts of the dump on the environment and simultaneously recovering utilizable material as and when possible. Some of the methods deployed to remediate MSW dumps are temporary solutions while others are of a more permanents nature unless subjected to large forces. Some of the mainstream remediation processes are landfill capping and closure, in-situ vitrification, sub-surface cut-off walls, and Landfill mining. (Mayurika C. Et al 2015).

II. METHODS

Mining is conducted in a number of ways, with the specific approach based on project goals and objectives and site specific characteristics. The equipment used for reclamation projects is adapted primarily from technologies already in use in the mining industry, as well as in construction and other solid waste management operations.



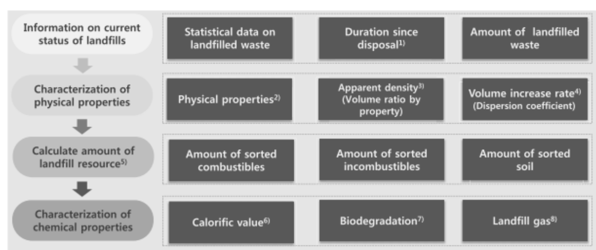
Although the first landfill mining operation was reported back in 1953 in Tel Aviv, it remains a relatively new approach to expand municipal solid waste (MSW) landfill capacity and avoid the high cost of acquiring additional land or other environmental purposes. Mining projects are typically not done just from the economic point of view (RenoSam 2009).

Typically, landfill mining consists of three basic operations (IWCS 2009):

- Excavating waste,
- Processing the excavated material, and
- Managing the excavated or processed material.

The first operation involves waste excavation using common equipment in surface mining and landfill operations like a backhoe or a hydraulic excavator. The excavated waste is subsequently processed to meet objectives of the specific projects like separating bulky materials, sorting hazardous material and other unidentified waste, screening soils from waste, and sorting materials for recycling or use as fuel. Additional processing (magnets for ferrous metal separation etc.) and management of the waste primarily depends on the project objectives, composition and condition of the retrieved materials, and processing cost and time (IWCS 2009).

According to Joseph et al. (2004), the landfill mining process involves a set of conveyers and screens that sort the solid waste into three separable fractions: oversized material, intermediate-sized waste and dirt/humus. The oversized materials consist of recyclable metallic goods, white goods, plastics and rubber. The intermediate-sized materials consist of partly decomposed organics, combustibles, recyclables and the fine fraction will mostly be stabilized soil. The main part of the process is the screening where the main separation is done for the oversized and the soil elements. Ferrous metals are generated from the main stream by employing a magnetic separator and the non-ferrous parts using an air classifier, which leaves behind the residue that could be combusted.
(Nagendra K.et al 2004)



III. RESULTS AND DISCUSSION

This result is been depicted from some different areas of a state, the amount of total waste generated per day, and also the amount of waste excavated from the landfill at a specified area. The waste include combustible waste, incombustible waste and soil matter present from the excavated materials which is segregated. The types of materials recovered from an excavation project are determined by the goals of the project, the characteristics of the dumped wastes, and the process design. In a typical excavation operation, once the oversize non-processibles, the dirt fraction, and the ferrous metals are removed, the remaining material may be recovered as fuel for a waste-to-energy facility, processed for recovery of other recyclables, or landfilled as residue. The soil fraction recovered by mining typical MSW sites will probably comprise the largest percentage by weight of all materials; a range of 50% to 60% can be expected, although values from 30% to 70% have been reported. The ratio of soil to other materials depends upon the type of waste dumped, landfill operating procedures, and the extent of degradation of the landfilled wastes. As mentioned earlier, in the Collier County, Florida demonstration project, about 60% (by weight) of all mined materials was recovered as a soil fraction.

IV. ENVIRONMENTAL SIGNIFICANCE

De Vocht and Descamps (2011) have argued that an Environmental Impact assessment (EIA) of an ELFM project should be wide in scope and in time. A systems perspective is required, as corroborated by Udo de Haes et al. (2000) and Finnveden and Moberg (2005). The negative local effects must be evaluated against not only the positive local environmental impacts but also the off-site effects. Apart from the impact of noise, light, visual disturbance on animal populations and the eutrophication effects of nitrogen and sulphur deposition from the WtE plant, landfill mining will result in the partial loss of ecosystems. The REMO landfill site currently consists of dry siliceous grassland, dry heath and wooded heath land ecosystems, which have gradually developed after completion of the landfilling activities. Future landfill mining will therefore lead to the temporary loss of habitat, which has been estimated as a loss of 2.2e14.4 ha in time periods of 5 years (De Vocht, 2009). However, gradual ecosystem restoration is possible after the landfill mining activity (De Vocht, 2009). Habitat surface can vary in function of the targeted conservation goals. When a 75% open landscape is aimed for, 162 ha of dry heath can be restored (De Vocht, 2009).

V. CONCLUSION

This review consists of analysis of the historical experience of dumpsites and focuses on paradigm attitudes. It starts with the recovery –'the hunting for valuables and energy' – and explores components such as land valorization and, finally, presents various advanced concepts of full revitalization of ecosystem services. The emphasis in the review is placed on the additional aspects of such emerging practices that have the major potential to improve the valorization, diminish negative environmental hazards, look upon methodologies of additional benefits by estimating social and environmental aspects. The future of open dumpsite excavation projects from social and environmental points of view is highly dependent on social attitudes, environmental and energy policies in general. ESS revitalization in the circular economy perspective is being regarded as the foremost holistic paradigm to promote the environmental practices from both, anthropocentric and eco-centric points of view.

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