Use of Landfill Mining in Solid Waste Management

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INTRODUCTION

The concern about public health and environmental quality problems and risks associated with existing as well as newly designed municipal solid waste landfills has made it nearly impossible to site new landfills in many parts of the US. This, coupled with the rapid exhaustion of available landfill space in existing landfills, is creating a crisis in solid waste management for many municipalities. Costs associated with alternative municipal solid waste management approaches, including shipping the waste to distant locations where active landfill sites exist, now exceed $100/ton in some areas compared with less than $10/ton a few years ago. The public health and environmental quality concerns and escalating costs have provided the impetus that has been needed to develop and implement an active approach to the management of solid wastes that will protect public health and the environment.

Even where the potential for long-term protection of environmental quality, public health, and groundwater quality is maximized based on landfill design and site characteristics, it is still difficult, if not impossible, to site a new landfill because of local opposition. The public has little faith in the ability of public regulatory agencies to protect its health and welfare. As discussed by Lee and Jones (1989a,b) a bold new approach is needed to properly manage municipal garbage. As outlined here, such an approach could be accomplished in three principal steps. First, in order to conserve remaining space in currently used landfills, recycling should be practiced for at least 40 to 50% of typical household wastes and some commercial wastes. Second, to free new landfill space, a landfill mining operation should be initiated at currently used landfills as well as at previously closed landfills. This will not only free additional landfill space, but also provide for controlled exhumation and treatment of the wastes to undertake site remediation that may be indicated and to properly prepare the site for the continued handling of solid waste at the site. Third, a fermentation/leaching system such as that described by Lee and Jones (1989b) should be developed at the landfill site to enable responsible, protective management of new municipal solid waste without siting new landfills.

There is considerable concern about the personal hazards to workers as part of landfill mining because of the burial of hazardous materials in many landfills and the presence of explosive gases (methane). The workers will have to be highly protected and an intensive monitoring program will have to be conducted to ensure that a worker is not exposed to any significant hazards arising from burial of hazardous chemicals or products in the landfill. From an overall public health and environmental protection point of view, it is far better to go into landfills and remove the hazardous materials such as drums of chlorinated solvents, automobile batteries, etc., before they contaminate groundwaters in the vicinity of the landfill than to allow this to occur at a later date. These materials, if found, will have to be treated as a hazardous waste and disposed of following procedures that are used for similar materials developed today.

The issues of municipal solid waste recycling, the first component of this municipal solid waste management approach, have been discussed elsewhere and will not be reviewed here. The concepts, elements, and utility of a fermentation/leaching system for municipal solid waste management have also been discussed elsewhere (Lee and Jones, 1989b). The focus of this paper will be on concept and utility of landfill mining as a key part of a new approach for municipal solid waste management. While the information on costs and specific operation presented herein was provided to the authors by R. Flanagan (1989) of Landfill Mining, Inc., this paper represents the work and position of the authors; it was not undertaken by, for, or under the direction of Landfill Mining, Inc.

LANDFILL MINING PROCESS

"Landfill mining" is the process of exhuming existing or closed solid waste landfills, and sorting the exhumed materials for recycle, processing, or other disposition. Landfill Mining, Inc. has a patented process for landfill mining. The key to its operation, schematically shown in Figure 1, is a set of conveyers and screens (manufactured by Powerscreens, Inc.) that sorts the solid wastes into three size fractions, "oversized material," intermediate-sized waste, and "dirt/humus." The oversized materials, which represent about 15% of the total waste mined, consist of metallic goods, white goods, plastics, and rubber.

Figure 2 shows the separation of dirt/humus material from the intermediate-sized waste; this separation is made using a screen grid with 2.5-inch openings. Based on the information obtained at the Collier County, FL landfill mining operations, Landfill Mining, Inc. indicated (Flanagan, 1989) that the smaller fraction, the "dirt-humus," represents about 75 to 80% of the mined waste after removal of the oversized materials, or about 60 to 70% of the total mined waste. Also illustrated in Figure 2 is the sorting of the intermediate-sized fraction. This fraction is passed over a magnet to separate the ferrous (iron) fraction which at the Collier County, FL facility represented about 5% of the total processed waste. The remaining intermediate-sized waste, representing about 15% of the total waste mined, is composed primarily of plastic, rubber, wood, glass, brass, aluminum and cloth. That fraction has considerable BTU value and much of it can be combusted. It can also be further processed by separating and possibly recovering or recycling the plastic, metals, and other materials.

The non-recyclable part of the intermediate-sized and oversized materials is typically reburied in the mined area of the landfill. If this portion is reburied without further processing, this landfill mining operation typically achieves a 70% volume reduction. Bailing these materials will increase the volume reduction achieved; a two- to three-fold volume reduction is typically achieved by bailing municipal solid wastes. Communities may want to charge a surtax on those materials that will have to reburied after the five-year landfill fermentation/leaching described by Lee and Jones (1989b). Adoption of this approach will greatly promote the production of materials and goods that become or produce recyclable/degradable wastes and that will not produce residues that require permanent landfill space. Basically the costs of all those good and materials should be increased to cover the cost of the permanent space that they will require in their ultimate disposal by land burial.

COSTS

While the rate of mining with a single piece of processing equipment may be as high as 180 tons/hr, typical operation is at a rate of 50 to 150 tons/hr. Based on the information developed by Landfill Mining, Inc. from its operation in the Collier County, FL landfill, the cost of landfill mining is expected to be less than about $10/ton of waste mined. Much of that cost is associated with rental of the processing equipment; the rental fee is typically on the order of $16,000 to 19,000/month. The cost for mining a particular landfill site depends on a variety of factors including the desired rate of mining, availability or cost of equipment such as front end loaders, and acquisition of insurance.

The use of the "dirt-humus" fraction as landfill cover can save a city substantial funds in the purchase of cover material which is often cost several dollars per ton. The excess mined "dirt-humus" can also possibly be sold as landfill cover material for other nearby landfills. The use of the "dirt-humus" for other purposes such as fill will require site-specific evaluations to determine if it will leach or release contaminants that could be adverse to public health or the environment in the particular use. It should be noted, however, that the EP TOX test or TCLP test will not be reliable for evaluating the suitability of these materials for other uses (Lee and Jones, 1989a).

BENEFITS

According to Flanagan (1989), once the permits from the state agencies and the insurance coverage have been arranged, the mining operations can typically start within about 90 days. Since municipalities will likely provide insurance under their policies, landfill mining can be mobilized in a short time once the permits have been approved by the regulatory agencies. It is anticipated that agencies will find this approach, in conjunction with the fermentation/leaching, of interest since it will likely reduce potential for long-term groundwater contamination by the existing landfill which is likely to be unlined and to be contaminating the groundwaters of the region.

Landfill mining will provide for exhumation that will not only reclaim landfill space, but will also provide the opportunity to remediate existing public health and environmental quality problems associated with the existing or closed facility that would otherwise not be addressed until serious groundwater or contamination was detected. Further, it will allow the development of a lining system and design so that future processing and solid waste management activities undertaken at the site present a manageable risk to public health and environmental quality (Lee and Jones, 1989a,b).

For some sites, this approach could be financed in part with funds set aside for that portion of landfill closure associated with capping of the existing or previously closed landfill. Another factor to consider is that this process should free funds that would otherwise be used to truck garbage out of area or state and should minimize the long-term liability. Those funds freed because of this practice should be made available to solve problems that exist with the landfill at the outset, such as to clean up contaminated groundwaters arising from the past landfilling operation.

Landfill mining can also help solve the ash disposal problems that face communities that have adopted or will adopt garbage incineration. Part of the mined area can be used for disposal of the fixed incinerator ash. As discussed by Lee and Jones (1989a) prior to burial in a monofill that ash should be fixed with cement-silicate or other reagents to permanently immobilize the metals. Further, the fixed ash should be place in disposal cells in a manner to insure that at no time in the future will contaminants that do leach from the ash contaminate groundwaters in the area. Landfill mining can be used to develop temporary solid waste storage space for use while the incinerator is down for repairs, maintenance, etc. These wastes can then be incinerated at a later time.

As discussed by Lee and Jones (1989a) the cost of municipal solid waste management has or will soon increase to an amount that makes landfill mining highly competitive, especially in areas where the siting of new or expansion landfills is impossible. In the opinion of the authors landfill mining offers a key component of an approach that can help communities solve their garbage waste management crises at a readily affordable cost.

LITERATURE CITED

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