

Secured Landfills

The Bucket at the End of the Solid Waste Management Chain



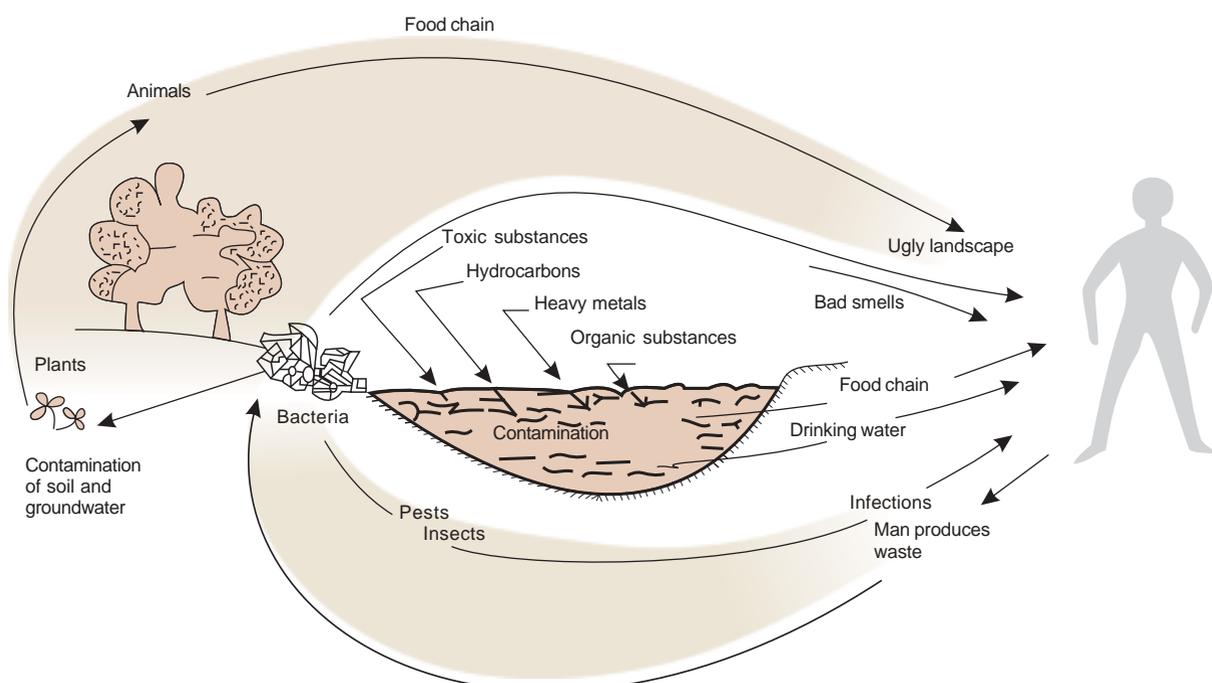
Clean streets, clean localities, clean markets... this is what most people look for from an efficient solid waste management system. Not much thought is given to where the waste has gone once it is out of sight. In other words: out of sight, out of mind! In India, currently over 80 percent of the municipal solid waste generated is dumped out in the open. At current estimates, that is almost 100,000 tons being added to our environment every day, and it is responsible for serious public health and environmental concerns including soil, water and air pollution, and accidents such as fire explosions, aeroplane crashes,¹ and so on.

What are the Impacts of Open Dumping?

- **Water pollution**—Surface and groundwater bodies can get contaminated by leachate² and hazardous substances released from the dumpsite. Potable groundwater may become toxic.
- **Soil pollution**—Toxic substances released into the soil are absorbed by surrounding vegetation and move into the food chain.
- **Dump fires**—When waste decomposes at dumpsites, methane is released; this gas is inflammable and can result in explosions or dump fires. The smoke from such fires contains toxic substances and is inhaled by the surrounding populace.
- **Global warming**—Methane released from dumpsites is one of the main contributors to global warming.
- **Source of disease**—Dumpsites breed flies, rodents, and pests which carry diseases into the surrounding population.
- **Other impacts**—Foul smell; visual ugliness; bird menace which can be a hazard to aeroplanes.

The primary goal of any solid waste management system is to safeguard public health and the environment. This is achieved by ensuring proper collection, transportation, recycling or processing and, finally, **safe disposal** of waste. The last step is lacking in most solid waste management systems implemented across the country.

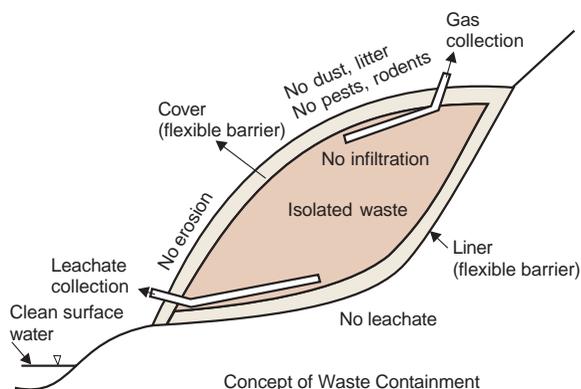
Figure 1: Environmental and Health Impacts of Open Dumping



¹ Improper storage of waste, especially hazardous waste, could lead to accidental spills, thereby increasing the risk of fires or explosions. Flight safety is affected because the garbage also attracts birds, increasing the risk of bird-hits and aeroplane crashes.

² **Leachate** is a toxic liquid that seeps through solid waste in a landfill and, in the process, extracts soluble dissolved and suspended materials from the waste. It contains waste, bacteria, toxic substances, heavy metals, among other things. In towns where biomedical or hazardous waste (for instance, batteries, bulbs, thermometers) mixes with the municipal waste stream, the leachate can cause serious health and environmental damage.

Figure 2: Secured Landfill



What is a Secured Landfill?

A secured landfill is an engineered facility designed for the safe disposal of waste. **'Landfilling'** means disposal of residual solid wastes on land in a facility designed with protective measures against pollution of groundwater, surface water and air including control of dust, wind-blown litter, bad odor, fire hazard, bird menace, pests or rodents, greenhouse gas emissions, slope instability, and erosion. It is a site where urban local bodies can take waste to be buried and compacted in a manner that ensures safe containment and degradation of waste over a period of time, ultimately becoming a part of nature.

What are the Essential Components of a Secured Landfill?

1. Liner system at the base and sides to prevent migration of leachate or landfill gas (largely methane) to the surrounding environment. Typically consists of a high-density polyethylene (HDPE) membrane, layers of clay, and sand or gravel (see Figure 2).
2. Leachate collection and treatment facility.

3. Landfill gas³ collection and control facility.
4. Fenced buffer zone and green belt around the landfill facility to serve as a visual and protective barrier.
5. On closure of a landfill cell, a final cover system at the top to prevent infiltration of water and support surface vegetation.
6. An environmental and waste monitoring system (including a weighbridge).
7. Safety provisions and basic amenities (for example, roads, lighting arrangements, water supply, protective gear, toilets, and health checks).

'Landfilling' is the process by which residual waste is placed in a landfill in a planned manner. It primarily consists of (a) placing incoming waste in a landfill cell using various equipment such as tractors, dozers, and so on; (b) compaction of waste, and (c) a daily cover (soil, debris, and so on) on the waste to prevent flies, birds, and odor. Landfilling is a technical operation requiring appropriate expertise and equipment (such as bulldozers or compactors). With proper

compaction a lot more waste can be disposed per unit area of land. For a well-designed and operated facility, waste can be landfilled up to 50 meters high (internationally, landfill heights can be over 100 meters), thus offering immense capacity for waste disposal per unit area of land.

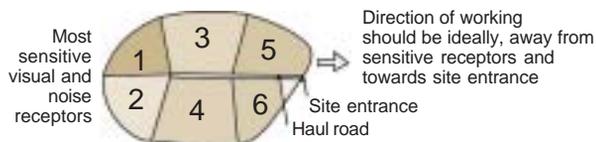
A secured landfill is developed in phases or **cells**. Landfilling is carried out in a particular cell; once filled to capacity the cell is closed and landfilling starts in a new cell. See Figure 3 for a typical phasing plan.

A landfill can be developed on flat plain land, sloping land (hilly area), in abandoned quarries, or even on an existing dumpsite. While municipalities are responsible for developing a secured landfill to meet their disposal requirements, the State Pollution Control Boards are required to authorize the landfills' development as well as regulate the operation of landfill sites to ensure that they adhere to the stipulated standards under the Municipal Solid Waste Rules (see Box 1).

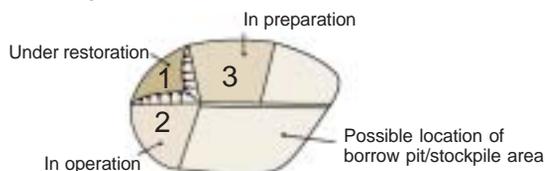
³ Landfill gas contains methane and carbon dioxide plus small amounts of some other gases. Methane being inflammable can cause fires or explosions. Accordingly, at most secured landfills this gas is collected and either burnt in a controlled manner or used to generate electricity. The gas is released over a long period of time as the waste degrades. Consequently, gas emissions from landfill sites must be monitored for many years even after the sites have stopped accepting waste.

Figure 3: Phased Development of Landfill Cells

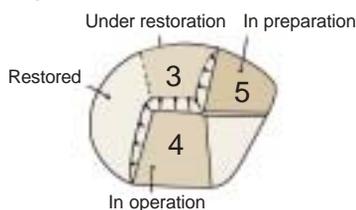
A: Phasing plan



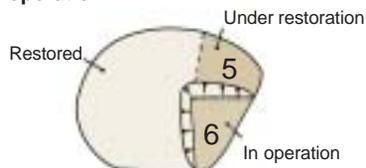
B: Phase 2 in operation



C: Phase 4 in operation



D: Phase 6 in operation



What Type of Waste Does a Municipal Secured Landfill Site Contain?

'Municipal solid waste' includes commercial and residential wastes generated in a municipal or notified area. By regulation, municipal secured landfills can also receive nonhazardous industrial solid waste. Construction and demolition debris may also be landfilled, or else used in place of the daily soil cover. Industrial hazardous wastes and biomedical wastes, however, cannot be disposed at municipal secured landfills, for which separate landfills are required in compliance with a different set of laws.⁴

As per the Municipal Solid Waste Rules, 2000, landfilling shall be restricted to nonbiodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing. Landfilling shall also be carried out for residues from waste processing facilities as well as pre-processing rejects from such waste facilities.

The Rules, however, also stipulate that **landfilling of mixed waste** may be undertaken if the same is found unsuitable for waste processing, or till installation of alternate facilities. The underlying premise is that **open dumping should be stopped on a priority basis**.

Box 1: Regulatory Requirements for Secured Landfills under Municipal Solid Waste Rules, 2000

- **Siting restrictions:** Secured landfills are required to be located in suitable geological areas away from ecologically fragile areas, airports, human habitation, water bodies, and so on.
- **Facilities at site:** Provision of buffer zone, approach roads, inspection and record keeping arrangements, availability of basic amenities for workers.
- **Liner specifications:** Standards are defined on the attributes of the liner.
- **Leachate collection and treatment:** Provisions are made for the collection and treatment of leachate, and also for minimizing leachate generation (using storm water drains).
- **Operating practises:** Compaction norms, covering of waste with soil or inert material.
- **Water and air quality monitoring:** Norms for testing of groundwater collected from wells and ambient air to check for release of pollutants into the surrounding environment. Periodicity of monitoring has also been prescribed.
- **Closure and post-closure care:** Attributes of landfill cover and vegetative layer, including monitoring requirements for post-closure period (at least 15 years).

⁴ Biomedical Wastes (Management and Handling) Rules, 1998, and Hazardous Wastes (Management and Handling) Rules, 1989.

Figure 4: Secured Landfill in Navi Mumbai: Tree Plantation on Closed Cell

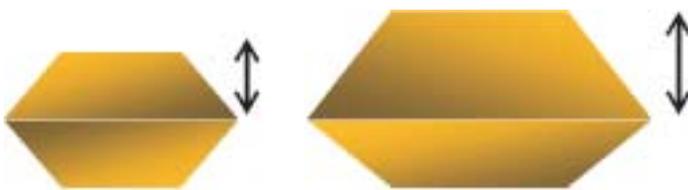


Can't We Treat or Recycle All Waste, and Do Without a Secured Landfill?

Experience in India and across the world has shown that it is not possible to treat or recycle all the waste. Landfill sites are required to dispose of rejects, that is, waste that cannot be

other components of a waste management system. For instance, in case of a malfunction in the treatment facility or unusual peaks in the waste stream (festivals, public events, heavy rains, natural disasters), the excess waste can be safely disposed of at the secured landfill.

Figure 5: Increase in Landfill Height for Bigger Landfill Area



reused, composted or recycled. There are many waste processing methods such as composting, biomethanation, and incineration which help to reduce the amount of waste. Ultimately, however, there is a remaining waste stream consisting of rejects or residues (for instance, nonbiodegradable rejects from a compost facility, ash from a Refuse Derived Fuel facility) that needs to be disposed safely at a landfill.

In addition, secured landfills serve as a necessary backup to

Isn't a Secured Landfill a Wasteful Use of Land?

Secured landfills are a necessary requirement for any urban area. However, making land available for such a landfill does not imply that thereafter it cannot be used for any other purpose. As mentioned earlier, landfills are developed in phases. If the efficiency of recycling and waste treatment improves over time, it is possible to reduce the land provided for subsequent landfill cells, or reallocate it for additional treatment

capacity. **After closure, the landfill area can be restored for other uses**, for example, parks, golf courses, and even human habitation (if the necessary safeguards have been taken).

Do We Have Secured Landfills in India?

There are only a few landfill sites in India. These too came up after the Municipal Solid Waste Rules, 2000, came into being. The first few secured landfills in India were built around 2004–05 in cities like Navi Mumbai, Bangalore, Surat, and Ahmedabad. Most cities, including the metros—Delhi, Mumbai, and Kolkata—still do not have proper and scientifically designed secured landfills. Instead the norm is uncontrolled disposal at open dumpsites (typically in low lying areas) which are sources of severe pollution. Several landfills are now being developed across the country, not only in the metros but also in smaller cities such as Gwalior, Chandigarh, and Dehradun.

Is it Possible to Make Secured Landfills More Cost Effective and Land Use Efficient?

In a country such as India, it is extremely difficult for each small town to develop its own separate secured landfill. Neither do they have the necessary financial and human resources nor is it feasible to find land sites to develop so many landfills. Most countries across the world have addressed this challenge by developing **Regional Landfills**.

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What is a Regional Landfill?

A 'regional landfill' refers to a **common landfill for a cluster of municipalities**. It allows for the development of a single, large facility instead of many small landfills dotting the landscape. A single regional landfill could cater to as many as 15–20 municipalities.

Being relatively large in size, regional landfills offer several **advantages**:

- Significant lowering of construction and operating costs per ton of waste (by as much as 60–80 percent).
- Sharing of fixed costs across a larger number of municipalities.
- Better quality of operations using modern equipment (typically usable only in large facilities).
- Hiring of appropriate professional expertise.
- Development of a proper green belt around the facility to serve as a visual barrier.
- Significant lowering in land requirement per ton of waste (because with a larger land area, it is possible to landfill up to a greater height—up to 40–50 meters and even higher in some cases). Figure 5 provides an illustration of this point.

While large tracts of land may not be available within or near municipal boundaries, these may be acquired in relatively less developed areas located at some distance from municipalities, up to even 50–60 km

away. The additional transportation costs are usually offset by the cost savings as described in the advantages.

Regional landfills are being used not only in developed countries such as the United States, the United Kingdom, Germany, Sweden, and Poland, but also in developing countries such as Argentina, Brazil, Mexico, Palestine, and Egypt. In India, the approach is being adopted in the states of Gujarat, West Bengal, and Andhra Pradesh; others, such as Tamil Nadu, Kerala, and Maharashtra are also considering adopting this approach.

The Bottom Line

India is growing rapidly, and waste generation is growing at between two or three times the rate of population growth. The 'out of sight, out of mind' approach has to be replaced by a mature understanding of the ill effects of poor waste management. Along with necessary efforts to reduce, recycle, and reuse waste, citizens and decisionmakers need to urgently understand that secured landfills are an essential element of a complete solid waste management chain. They need to work towards introducing well-designed and efficiently managed secured landfills that are not seen as an environmental evil but as an essential means for safeguarding public health and the environment.

April 2008

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The Governments of Australia, Austria, Belgium, Canada, Denmark, France, Ireland, Luxembourg, the Netherlands, Norway, Sweden, Switzerland, the United Kingdom, the United States of America, the United Nations Development Programme, The World Bank, and the Bill and Melinda Gates Foundation.

AusAID provides WSP-SA programmatic support.

ACKNOWLEDGMENTS:

This information note was reviewed by Catherine Revels, Shubhagato Dasgupta, Shafiul Azam Ahmed, Prof Manoj Datta (IIT-Delhi), and A. N. Purandare (Eco-Designs Ltd).

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