

## **Bio-solids and Solid Waste Treatment**

### **1. INTRODUCTION**

Landfills especially those from Municipal Solid Waste (MSW) must not be ignored. Rather after filling they must be cared for, and covered or capped. This is because biological degradation and chemical leaching processes do not stop with closure. As such the following monitoring processes are required:

- landfill gas (volume and composition).
- Leachate (volume and composition).
- Groundwater (composition).
- Settlement (landfill bottom, landfill surface).
- Biological degradation processes in the landfill body.
- Efficiency of bottom liner and caps cover systems.
- Efficiency of the water budget layer 'regeneration layer', top soil layer.

Based on the results after monitoring, the following should be implemented where and when necessary:

- Repair or reconstruction of landfill gas extraction facilities and gas utilization equipment.
- Repair or reconstruction of leachate collection systems.
- Repair or reconstruction of landfill capping systems.
- Maintenance of vegetation.
- Biological in-situ stabilization by leachate infiltration or aeration of the landfill body.

The duration of landfill post-closure care varies and depends on the extent or nature of the problem. However, in some countries the duration is often fixed by legislation.

#### **1.1 PROBLEMS ASSOCIATED WITH LANDFILL POST-CLOSURE CARE**

The main problem associated with landfill post-closure care is that the process is expensive. As soon as the process of capping is over, the society or population loses interest in it. As a consequence the public is no longer willing to pay for post closure care. There is also great resistance for people to acquire land that is so closed to landfill sites for fear of them being linked to any environmental hazards that may result in these sites hence the payment of high compensation.

#### **1.2 SOME SOLUTIONS TO THE ABOVE PROBLEMS**

Landfills or areas close to them could be utilized by municipal authorities (in most cases not individuals) for the construction of facilities such as:

- Recreation parks
- Ski slopes
- Restaurants with a view
- Energy plants (e.g. wind turbines)
- Storage areas
- Waste treatment plants

Despite these solutions in utilizing post closure landfill sites, there exist still some difficulties in putting them in to practical usage. The hindrances include:

Government service and other agencies in authority are still working or searching for more stringent criteria for landfills.

- Non-Governmental Organizations (NGOs) and Environmentalists continue to prevent people from utilizing landfills.
- The high cost for post-closure control of landfill emissions to avoid risk on site users.
- Most landfills are situated far in the forest making it difficult for possible utilization of the land.

Despite all these, some landfills have been successfully used for real estate development. Probably because they are located near major transportation routes while older landfills are located in growing urban or suburban population centers, where demand for real estate is high.

## **2 POST-CLOSURE MAINTENANCE**

### **2.1 INSPECTION PROGRAM**

For an efficient condition of post-closure functioning of a landfill, a regular maintenance program is very vital. The plan should contain an inspection schedule and a list of all maintenance activities to be carried out. Records of inspection with the details of observations and changes in the functioning of sites and its systems should be kept. The records should also provide a continuity of the inspection process regardless of changes to personnel conducting the inspections.

Site inspections involve a walkover to actually see the systems functioning and to critically look for evidence of any developing problems and those that have actually developed. A useful tool in sidewalks could be the use of aerial photography especially on large areas to detect the extent of settlement or vegetative stress as well as other detectable structures. It should be noted that aerial photography can often be used alongside sidewalk and not as a replacement to it. Optical topographic surveys can be used to quantify and record the extent of settlement on the site.

### **2.2 MAINTENANCE PROGRAM**

A good maintenance program must be developed and this should reflect the results of the inspection and or monitoring with some knowledge of previous experience. It should be implemented to assure effectiveness of the landfill system. It is often better for a Preventive Maintenance Work Schedule to be implemented periodically for 2 to 3 years after cover to prevent loss of vegetation and gully development. The

maintenance process in general is often neglected in Developing countries with very severe consequences like landslides or slope failure or blocked drainage systems. This is mostly due to ignorance, negligence or lack of finances to undertake maintenance projects as a whole. The fact is, an inspection exercise or inspection could have been effected and certain observations or faults recorded but the implementation of maintenance work is then often neglected.

### **2.3 STORMWATER MANAGEMENT SYSTEM**

The storm water management system should be inspected to ensure that it has not been blocked or damaged by subsidence. Drainage pipes are inspected and cleaned. Regular clearing of surface drainage features for unwanted vegetation, silt, rocks, and other particles should be maintained. Manholes and catch basins should be inspected for damage and blockage.

### **2.4 REGRADING**

Regrading is performed to maintain the erosion layer. After inspection, signs of soil erosion and settlement are repaired by regrading. Erosion can cause rill formation and if not repaired can lead to exposure of infiltration layer or the sludge, while settlements can cause depressions and ponding of surface water.

### **2.5 VEGETATION**

Regular maintenance of the vegetative cover will promote the growth of desired vegetation. The vegetation should be mowed at least twice a year to suppress weeds. The application of fertilizers and pesticide most follow the desired application/dose. Deep rooted plants can easily damage underlying drainage and infiltration layers. If already established, they should be removed and the remaining holes repaired or closed. Dead roots should be removed else they form subsequent pathways for rain water in to the underlying layers. Unhealthy dying of plants can be a good indicator of settlements, or leachate or gas leakage through the cover or liner.

### **2.6 LEACHATE COLLECTION SYSTEM**

All active sewage sludge units that have liners and leachate collection systems must have their collection systems maintained for 3 years during post-closure period. Monitoring of leachate is often conducted as required by permits. However, if the owner/operator of a Municipal Solid Waste (MSW) landfill can show evidence that the leachate generated is no longer potentially harmful, permission may be allowed to cease leachate monitoring.

Regular checks are done to see that it functions properly especially pipes to see if they are blocked. It should be noted that leachate outcrops are an important indication of rapture in the liner or the infiltration layer allowing precipitation to enter and leachate to escape. Failure of the infiltration layer may be due to settlement, burrowing animals, deep rooted plants, or severe erosion.

## **2.7 GAS MONITORING AND COLLECTION SYSTEM**

Gas monitoring especially Methane gas concentration should be done at the site for 3 years during post-closure period. Methane gas should be monitored in any structure on the site without necessarily entering the site. Measured concentrations should not exceed 25 percent of the Lower Explosive Level (LEL) in air in a structure within the property line and may not exceed the LEL in air at the property line.

The gas collection system should undergo inspection and checks as frequent as necessary. Vent risers should not be clogged with dirt or rocks. Gas collection pipes should be flushed and cleaned with pressure as necessary.

## **2.8 SITE ACCESS AND SECURITY**

Public access to surface disposed sites must be restricted for 3 years during post-closure period. Some sites may require preventive measures to vandalism on structures, gas vents etc. Traffic control devices should be installed and visible enough to limit vehicles to areas where they would not damage installations or features on site. However, the closure plan should be able to determine the security measures to be employed (fences, traffic barriers, signs, etc). Irrespective of the kind of structure used in the construction of the site, they should be inspected periodically. Any obvious health and safety hazards should be remedied immediately.

## **3 CONCLUSION**

Landfills do require post-closure care especially if they were filled with waste which was not pretreated and if landfill operations did not manage to degrade organic waste and /or to leach chemical waste.

Landfills and its subsequent post-closure care are still not effectively practiced in the Developing countries probably due to negligence or because it is costly. However, where it is practiced, it is usually done insufficiently due to lack of trained personnel to carry it out efficiently.

If landfills are covered, the sites could be used economically and the post-closure care could be (at least) partly paid from the profit of the leaseholder. The leaseholder would insist on monitoring of landfill emissions which may endanger his business. Licensing of landfill would be possible only on the basis of a case to case study. From the point of view of landfill operators, post-closure care is much more expensive if the closed site is open to the public. The additional costs will be higher than the income or benefits of the land use.

## **4 REFERENCES**

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