# LEACHATE ABATEMENT INSIDE SOLID WASTE LANDFILL

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***Abstract*— Parameters such as chemical oxygen demand in leachate, organic biodegradable compound, specific weight, and settlements of solid waste disposed in large scale testing unit at Buenos Aires Sanitary Landfill were monitored for more than 20 years. The mathematical simulation formulae between these parameters and the solid waste age were established based on the data obtained from the testing landfill units, and justified by the data obtained at the closed landfill units. The long-term predictions for concentrations of leachate from the landfill were carried out through mathematical simulation of a set of formulae proposed. The results showed that the organic activity within the landfill was stabilized after 7 years of closing it, confirming the consolidation and biodegradable process and its rate over time. While the landfill reached this quasi-equilibrium state, the on-site treatment of leachate was achieved, with a significant reduction in costs.**

**An improvement of the initial conditions in the engineering design phase was discussed, as well as, some optimization in maintenance post-closure activities. Additionally, the landfill's reintegration process and, the expansion of its capacity with minimal impact on the environment, were considered.**

***Keywords*— Sanitary landfill, solid waste, biodegradation, leachate, settlement.**

## I. INTRODUCTION

Sanitary landfill (SLF) is still the most common practice of municipal solid waste (MSW) disposal in Latin American countries. Basically, SLF is a large-scale bioreactor where complex and, physical, chemical and biological reactions occur. While the MSW degrades, SLF gases are generated, top surface is settled down (Ling *et al*., 1998; Liu *et al*., 2006) and organic concentrations in leachate are attenuated gradually (Bookter and Ham, 1982; Durmusoglu *et al*., 2005; Durmusoglu *et al*., 2006; Jiangying *et al.*, 2004; Youcai *et al*., 2001). One of the main problems in the analysis of stabilization process is the monitoring field data. This data is critical to predict long-term conditions. Different literature was revised and, the problem was confirmed: limited monitoring period of time. In the present manuscript, field monitoring results compound a period of 21 years (7700 days), while the latest information does not collect more than 3 to 5 years of recording: Bowders *et al*. (2000), in "Settlement of Municipal Solid Waste Landfills", leachate and settlements were measured in Columbia landfill, USA for 180 days. In the same paper, cumulative settlement was registered in Lyndhurst landfill, Victoria, Australia for 700 days. Sowers (1967) studied the settlement of a building and new 10 feet fill on an old sanitary land fill of 25 feet thick for 2080 days. Machado *et al*. (2002), registered data of Bandeirantes SLF in Sao Paulo, Brazil for 2500 days. Youcai *et al.* (2001), in Shangai SLF in China measured field data for 1200 days. Kumar (2000), Coduto and Huitric (1990), and Edil *et al.* (1990) in Mission Canyon SLF, in California, USA, registered and analyzed field data for 1497 days. Edil *et al.* (1991) in Wisconsin SLF, USA, registered field data for 600 days. Sánchez-Alciturri *et al.* (1995) in Meruelo SLF in Spain, registered field data for 900 days. Merz and Stone (1962), in Spadra SLF in USA, registered field data for 500 days. Hossain (2003) in different waste landfills: Mountain View, Yolo county, Mid Penninsula, Atlantic, Richmond, Keele, and Spruce Ridge, covered a maximum period of 1350 days of field monitoring. Oweis (2006) made a theoretical study on landfill settlements due to mechanical and decompositional processes.

These waste landfills are a potential pollution source for surface and groundwater. To prevent contamination, sealing SLF surrounding strata and treating leachate are the usual practices. Leachate is formed in SLF due to the degradation of the waste together with percolation of rain water through the open discharge area or through the SLF cap (Rodriguez Iglesias *et al*., 2000). Leachate´s degradable compounds were used as a parameter to determine biodegradation effects over time (Lee *et al*., 2001).

Since all organic materials in the MSW undergo partial or total microbial decomposition (mineralization), leachate contains intermediate products together with high concentrations of toxic organics, heavy metals, and other xenobiotic materials. The exact composition is variable and site specific depending principally on the MSW´s type and age, and the operational methodology applied, that involves cover frequency and rain regime (Ehrig, 1983; Kjeldsen and Cristophersen, 2001). Proper SLF design and site management can significantly reduce the quantity and strength of leachate but will never eliminate it (Gurda and O´Hara, 1995).

The treatment of leachate is one of the most important issues in the management of a landfill. Conventionally, the leachate is pumped out from the SLF and led into the anaerobic or aerobic treatment plants. The processes for leachate treatment are always very complex