Report on the session

Aerobic versus Anaerobic landfills

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Respectfully submitted:
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1. Background and Aim

To most researchers, the solid waste landfill is undoubtedly equivalent to anaerobic landfill. However, a landfill is predominantly 'anaerobic' only in main landfill body and in main lifetime of a landfill. Landfill is in aerobic condition for the beginning of operation; waste deposited near surface of landfill is exposed to air; the whole landfill layer will be aerobic long time after closure if it is not completely contained. Like anaerobic bioreactor concepts, several other landfill techniques are proposed using aerobic degradation or early stage of anaerobic digestion.

The objective of this session was to understand and compare different landfill techniques: aerobic, semi-aerobic, acidogenic landfill.

2. Program

There were five presentations arranged in this session. The final program was:

(1) Results from a Large-Scale Aerobic Landfill System (M. Hudgins & L. Green).

(2) Aerobic vs Anaerobic Bioreactor Landfill Case Study - The New River Regional Landfill (Debra D. Reinhart & Townsend, T.)

(3) Experiences of acidogenic treatment of waste in landfill environments. (A. Lagerkvist)

(4) Characteristics and Mechanism of Semi-Aerobic Landfill on Stabilization of Solid Waste (T. Shimaoka & Hanashima, M.)

(5) Aerobic in situ Stabilization of old landfills shown exemplary for the old landfill Kuhstedt, Germany (M. Ritzkowski, K.U. Heyer and R. Stegmann)

1. The order of these papers coincides with the time-change of degradation phase in landfill, and they cover all possible landfill concepts at this time.

3. Presentation and discussions

The first two papers report aerobic landfill, in which air is injected mechanically. (They were presented by T. Matsuto and M. Barlaz because the authors could not come.) Hudgins reported the result of pilot scale and full-scale aerobic landfill. Advantage listed on his slides are reduction of global warming methane gas, reduction of leachate generation due to evaporation, and increased settlement of waste, though operational data were not shown. Instead, Matsuto showed the results from lysimeter tests that were done by M. Hanashima in 1970's in Japan. In his study, along with an-

aerobic lysimeter, aerobic ones with different air flow rate were tested for five years. The results showed apparent advantage of aerobic landfill in reduction of leachate strength. In aerobic lysimeter, BOD decreased by 3 orders of magnitude within 6 months, and nitrogen decreased by 2 orders, while they stayed in the same order in anaerobic one.

Full-scale bioreactor project, called 'bioreactor demonstration project', was reported by Reinhart, in which both aerobic and anaerobic landfills tested. Although the project is in a preliminary stage, some findings concerning aerobic landfill were reported, as well as experimental arrangement and monitoring scheme, etc. Among useful information for comparison with anaerobic landfill are: Energy requirement is 12 times higher than anaerobic landfill with gas extraction, and loss of income by energy recovery is disadvantage. From moisture balance estimation, water requirement is not significant in aerobic operation, etc. Data available for quantitative comparison between aerobic and anaerobic are expected to come out soon.

Acidogenic degradation was reported by Lagerkvist. This early stage of anaerobic degradation has several advantages: spontaneously or naturally established; stable for the change of environment such as pH and temperature; easy to control etc. Due to enhancing mobility of metals, it can be used to detoxify organic waste for recycling.

Shimaoka talked about semi-aerobic landfill, which has structural configuration to allow air diffuse into landfill through leachate collection pipes. Natural aeration is the key for this concept. In his experiment using lysimeters of five meter high, mass balance is estimated by measuring leachate and gas, and BOD, nitrogen, and gas composition in the lysimeter were monitored. BOD and nitrogen in leachate remarkably decreased in the bottom aerobic zone, and the aerobic environment was observed to extend toward inside as time proceeds.

In the project presented by Ritzkowski, air is injected through wells to promote stabilization of waste in old landfill. Controlled degradation processes, reduction of methane generation, reduced leachate strength were main objectives. Using 25 wells, extraction of landfill gas and air injection were alternately done. Old waste drilled from the landfill was subjected to analysis.

There were lively question & answer for each presentation, and it was helpful to understand each technique. No general discussion followed due to running out of time. For fair judgement of these alternatives, not only a list of advantages, but also scientific solid data are strongly required.