

Ammonia Fluxes in Landfills

R&D Technical Summary P1-306/TS

The turnover of the nitrogenous components of landfilled refuse was studied and reviewed in a former Department of the Environment-funded study, 'Nitrogen Balances in Landfills,' available as two publications in the CWM series. In the light of these laboratory studies, suggestions were made of a possible method for managing landfill sites likely to lead to the rapid and permanent reduction of leachate ammonia. This involved a strategy of ammonia treatment and recirculation of nitrified leachate. The aim of this research was to use laboratory studies to formulate a leachate pre-treatment and recycling strategy, and to demonstrate, at the Auchencarroch test cell facility, the efficacy of this in reducing leachate ammonia concentrations and accelerating site stabilisation.

The effectiveness of this strategy was tested in the former DoE-funded landfill test cells at Auchencarroch, Dumbartonshire. A landfill test cell containing pulverised municipal solid waste, designed for enhanced decomposition by leachate recirculation, was fitted with a system that automatically pumped landfill leachate and treated it in an aeration tank before returning it to the landfill. The construction of the aeration tank facilitated the nitrification of ammonia to nitrate which could be removed by denitrification to nitrogen gas within the anaerobic environment of the landfill. Continuous monitoring of gas quantity and quality enabled the effects of the addition of nitrate on methanogenesis to be assessed and the validity of the strategy tested.

Recirculation of treated leachate did not affect gas quality nor did it appear to reduce the gas quantity from before the time that the leachate was recirculated. Methane concentrations and gas flow increased during the study. Ammonia concentrations in the landfill leachate fell during recirculation of treated leachate, and little nitrate could be detected in the test cell during the first year of operation. Continued recirculation without treatment during the winter of 1999 mixed the leachate within the landfill, and ammonia concentrations increased to levels more representative of the start of the experiment. Treatment and recirculation during 2000 led

to permanent reductions in landfill leachate ammonia concentrations following routine recirculation without treatment during the winter of 2000 and spring 2001.

Treatment of ammonia was achieved at near optimal conditions without the need for pH control. Overall the procedure treated landfill leachate successfully without compromising gas production. As a strategy the process was viable since it demonstrated that methanogenesis can be maintained during nitrate addition, and the treatment system employed was robust enough to enable effective deployment in the field. Since the study was relatively short in the life of the landfill test cell, some questions still remain about the total nitrogen budget of the test cell and the eventual fate of the recirculated nitrogen, which only a tracer study can confirm.

This R&D Technical Summary relates to information from R&D Project P1-306 reported in detail in the following output:-

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