

# THE STRIPPING OF DISSOLVED METHANE FROM LANDFILL LEACHATES PRIOR TO THEIR DISCHARGE INTO SEWERS

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**SUMMARY:** In the UK and many other countries, a common option used for disposal of landfill leachate is pumping into the public sewerage system, for contaminants to receive treatment in combination with domestic sewage. Leachates routinely contain concentrations of dissolved methane well in excess of those needed to give rise to explosive atmospheres within sewers, and this paper addresses this problem, and considers the technical issues. The paper describes studies that have been carried out at 5 landfills in the UK and Ireland, to investigate stripping of methane from various leachates, using a purpose-built, pilot-scale set-up. The paper shows how these results can be used to design full-scale methane stripping plants, and a case study is presented for design and commissioning of a plant capable of treating 1000m<sup>3</sup>/d of leachate, and reducing levels of dissolved methane from above 10 mg/l, to below the widely-adopted discharge consent of 0.14 mg/l.

## 1. INTRODUCTION

In the United Kingdom, and in many other countries, the commonest option used for the disposal of landfill leachates is by pumping to sewer, where contaminants in leachate will be treated in combination with domestic sewage.

Especially where leachate has been pumped directly from landfilled wastes, but also in other situations, it can contain relatively high concentrations of dissolved methane gas. In theory, concentrations could exceed 25 mg/l of dissolved methane (see Figure 1), but since landfill atmospheres may typically contain only up to 60 percent methane gas by volume, dissolved concentrations are more usually found that lie in the range 10 - 15 mg/l of methane. Such levels are typical at a wide range of sites, but even at landfills where relatively diluted leachates are collected from surface seepages, perimeter ditches etc., concentrations of methane in the order of 2 - 5 mg/l are often measured, and values can vary considerably on a day-to-day basis.

Failure to consider the possibility of an explosive hazard, arising within the confined atmosphere of a sewer, as a result of the introduction of leachate containing high levels of dissolved methane, would therefore represent negligence on the part of a landfill operator. In a number of instances, methane stripping systems have been marketed as "packages" for use with leachates, and been installed, but have not performed either adequately or reliably.

The paper therefore describes studies that have been carried out at a number of landfill sites in the UK and in Ireland, to investigate the controlled stripping of methane from a variety of

landfill leachates, using a purpose-built, pilot-scale, set-up. The paper describes results obtained, and describes as a case study how a large, full-scale methane stripping treatment plant has been designed, constructed, and commissioned at one particular landfill.

## 2. METHANE IN LANDFILL LEACHATES

Methane is a fairly common constituent of natural groundwaters, and in the UK events during the 1980s, such as fatalities as a result of an explosion in a pumping station at Abbeystead (Health and Safety Executive, 1985), or work on a major aqueduct system at Carsington (Pearson and Edwards, 1989), have shown that a serious hazard can result from its presence.

In a landfill environment the dangers that can arise from uncontrolled migration of landfill gas that contains methane are widely recognised, and incidents such as at Loscoe in Derbyshire (Derbyshire County Council, 1988), and elsewhere, have made people widely aware of potential hazards.

Dangers from dissolved methane within landfill leachates, where it readily and frequently reaches concentrations of 15 mg/l or greater, are much less-widely recognised, and at many landfill sites, leachate continues to be pumped into the public sewerage system, with no measures taken to prevent hazard from release of the dissolved methane gas.

A concentration of dissolved methane as low as 1.4mg/l is known to be capable of giving rise to an explosive methane level, in atmospheres in contact with such liquid (Buswell and Larson, 1987; Larson, 1938). Therefore, in accordance with mine safety procedures, a factor of safety of 10 times is increasingly being applied to discharges of leachate being made to sewer, and a consent of 0.14mg/l of dissolved methane is widely applied by receiving sewerage authorities.

In order to meet this consent, removal of more than 99 percent of the methane dissolved in leachates may therefore often be required (i.e.: from typically 15mg/l to less than 0.14 mg/l). This removal must be achieved, reliably and consistently, if a consent to discharge is not to be breached.

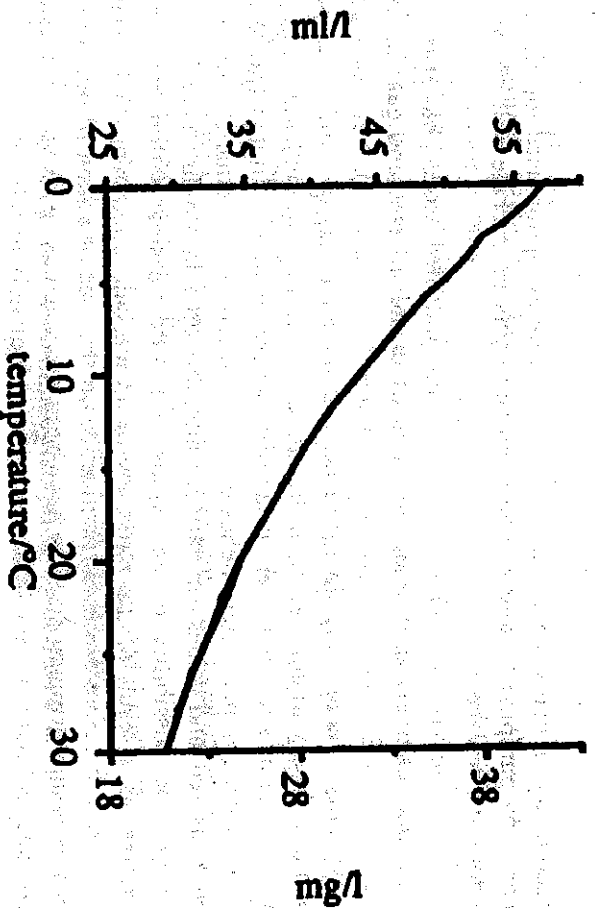


Figure 1 Solubility of methane in distilled water at 1 atmosphere after Yamamoto, et. al., (1976)