APPENDIX 2: EPA ASSESSMENT METHODOLOGY

The following appendix to EPA's assessment report describes the three stage methodology used to conduct EPA's landfill assessment.

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1 ASSESSMENT TEAM

The assessment was led by EPA's Landfill Centre, drawing upon expertise from staff with many years experience managing and regulating the landfill industry.

Where landfills required onsite testing work, EPA retained GHD as technical consultants. An international consultancy, GHD employs environmental engineers and scientists who have extensive experience in landfill design and management, and methane gas monitoring and assessment.

2 ASSESSMENT PROCESS

The initial stages of the project involved the collection and assessment of comprehensive information on landfills. After considering key site factors that may lead to methane movement offsite, EPA's team developed a questionnaire, which was sent to EPA regional offices.

EPA regional officers with extensive local knowledge of the landfills completed the questionnaires using detailed information from EPA's records. Where any information gaps were identified, follow-up discussions were held with EPA regional offices, local government and landfill operators, who supplied further information.

Geographic information system (GIS) maps on all landfills were provided with the kind assistance of the Department of Sustainability and Environment.

It should be noted that, in the past, a small number of landfills servicing fewer than 5000 people held a licence under previous government regulations. Although a licence is now not required by these landfills, they were included in the assessment if they were on EPA's database of formerly licensed landfills.

All information collected was then collated for assessment.

3 ASSESSMENT METHODOLOGY

3.1 Stage 1 landfill assessment

The objective was firstly to establish the likelihood of a landfill continuing to generate methane gas at significant levels, and whether methane gas generation posed a potential for adverse effects on the community or environment. Three separate and independent key criteria were established:

1. years since landfills last received waste
2. buffer distances between landfills and buildings
3. types of waste received by landfills.

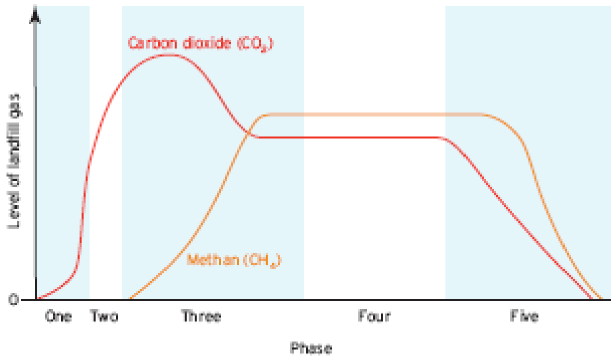
Using the information in EPA's database and results from the questionnaire, each of these criteria was used to identify landfills where it was unlikely that methane gas had moved beyond the landfill boundary or buffer zone. Landfills that could not be identified as having a lower likelihood of methane movement were subject to Stage 2 assessment. The Stage 1 assessment criteria are described in more detail below.

3.1.1 Years since a landfill last received waste, or licence removed[1]

The years elapsed since a landfill last received waste is critical in determining whether methane gas generation and movement has the potential to affect the community or environment. Most models of landfill gas generation define five phases within landfill waste, beginning with short phases of low methane generation, followed by a long period of peak methane

1 A small number of landfills servicing fewer than 5000 people held a licence under previous government regulations. A licence is now not required by these landfills, because they serve fewer than 5000 people, receive a small volume of waste and are considered low-risk.

production (phase 4) and then a gradual decline (phase 5) as the biodegradable wastes complete the decay process[2].



The five phases of gas generation after a landfill last receives waste.

The time taken for a landfill to reach phase 5 will vary according to many factors, including temperature, rainfall and volume of biodegradable waste. However, most landfills in Victoria would be expected to reach phase 5 within 10 years of last receiving waste. Methane production can still be significant within the landfill during phase 5 and, if so, requires ongoing management.

This criterion is supported by a landfill gas modelling report conducted by EPA in 2001. This report found that, at that time, Victorian landfills that closed prior to 1999 generated less than 38 per cent of all landfill-related methane in Victoria[3]. Seven years on (December 2008), landfills closed prior to 1999 would be contributing a much smaller percentage of all methane generated by Victorian landfills.

Landfills do not have a single age, as separate areas or cells are developed, filled and rehabilitated over the life of the landfill. In assessing potential effects, EPA took a conservative approach and based the age of the landfill on the most recently active cell.

Based on the above, EPA developed **Criterion 1** for classifying landfills as not a current priority for further assessment. These landfills have not received any waste for more than 10 years or have had their licence removed because they service a very small population and contain very small volumes of waste.

3.1.2 Buffer distances

EPA's best practice environmental management (BPEM) guidelines for landfills state that buffer distances of 500 metres between a landfill receiving biodegradable waste and dwellings should be maintained for protection of amenity. An undeveloped distance of this size is also considered to be sufficient to prevent methane gas movement into buildings more than 500 m away.

For the purposes of this assessment the term 'building' means any structure used for industrial, commercial or residential purposes within which methane could potentially accumulate.[4]

Based on the above, EPA developed **Criterion 2** for classifying landfills as not a current priority for further assessment. These landfills have a complete buffer of 500 metres from buildings.

3.1.3 Type of waste received

Landfills that have received organic waste are more likely to generate significant volumes of methane than landfills receiving only solid, inert waste.

Based on the above, EPA developed **Criterion 3** for classifying landfills as not a current priority for further assessment. These landfills have not received measureable quantities of biodegradable waste.

3.2 Stage 2 landfill assessment

A more detailed assessment of landfill characteristics was conducted on landfills that were not classed as low priority from Stage 1 assessment.

In Stage 2, landfills were assessed on the interaction of the following six characteristics:

- partial buffer distances between landfills and building developments
- types and volumes of waste sent to each landfill – as smaller landfills will usually generate smaller volumes of methane
- geology and porosity of surrounding land – as clay and rock geology generally prevent methane movement to a greater extent than sandy soils
- landfill design, and whether all landfill cells were lined with clay and/or clay composites as a barrier to leachate (liquid from landfills) and gas movement
- groundwater levels – as high levels may inhibit gas extraction from landfills
- an operating methane gas extraction system on the landfill, indicating that methane is actively removed from the landfill.

These criteria were collectively assessed for each landfill to determine the potential for methane gas movement offsite.

This process confirmed that a further number of landfills were not a priority for further assessment. These landfills were therefore not subjected to Stage 3 assessment.

2 The figure shown has been adapted from *Urban waste management – guidance note on recuperation of landfill gas from municipal solid waste landfills*. Lars Mikkel Johannessen (World Bank, 1999).

3 EPA publication 755, Methane generation from Victorian landfills (2001).

4 This does not include all buildings. For instance, methane is unlikely to accumulate in open storage sheds and warehouses that are not fully enclosed and are hence well ventilated.

3.3 Stage 3 landfill assessment

3.3.1 Further information review

Stage 1 and Stage 2 assessment methods identified landfills that were not a priority for further assessment. Remaining landfills were then subject to a greater level of scrutiny.

Firstly, a more detailed examination of landfill files and landfill audits was undertaken to ascertain if there was any additional information on methane production. A formal phone interview was also conducted with the landfill operator to confirm specific details and to gather any further available information.

3.3.2 Field investigation

EPA then conducted preliminary field monitoring of methane gas at the boundary of the landfills, where the further information review did not yield sufficient information to identify a landfill as low priority for further assessment. Environmental consultant GHD was engaged to undertake the fieldwork.

Field investigations involved constructing shallow gas monitoring bores around landfill boundaries and then recording methane concentrations within the bores on at least two occasions.

An EPA officer also undertook a landfill inspection of each landfill where monitoring was conducted.

Bore locations focused on areas closest to buildings and were not intended to form a complete bore network around the landfill. As the bores were shallow (less than two metres deep) they were intended to detect methane that could affect buildings. The bores were designed to detect methane at the depth of most building foundations and pathways of least resistance, such as stormwater drains.

The bores were intended to provide preliminary indications, to allow EPA to assess whether there was potential for methane to be present in surface soils. Some of these landfills may require further gas assessment so that more comprehensive data can be obtained.

Some landfills where monitoring was to occur are adjacent to old landfills which have been closed since the 1980s or earlier. In these cases EPA took a prudent approach and monitored the boundary of all landfills within that immediate vicinity.

All bores were constructed outside landfill cells and therefore did not directly intercept landfill waste. GHD's methodology for bore construction and monitoring is discussed in detail in its report in Appendix 3.