

Assessing planning proposals within the buffer of a landfill



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Assessing planning proposals within the buffer of a landfill

1. Introduction

1.1. Scope

This guideline is intended for use by planning and responsible authorities under the *Planning and Environment Act 1987*.

It provides information and advice on assessing planning permit applications and planning scheme amendments that would lead to development within the buffer of ¹ an operating or closed landfill. More specifically, it advises on what level of assessment a planning or responsible authority should require to inform its decision, and recommends a staged, risk-based approach.

The advice in this guideline is consistent with and builds on the advice to planning and responsible authorities in *Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills*² (the Landfill BPEM). Sections 5.1.5, 8.2.1 and 8.2.2 of the landfill BPEM are the focus of this guideline.

Note: Assessment of the development or expansion of a landfill is not within the scope of the guideline.

1.2. Legal status

This guideline provides information and advice. It is not legally binding.

2. Why are landfills an important planning consideration?

Landfills are an important part of Victoria's waste management infrastructure. However, they can also have impacts on the surrounding environment and community, including long after they have ceased operating. In particular:

- **Operating landfills** can potentially discharge landfill gas, offensive odours, noise, litter and dust.
- **Closed landfills** can potentially discharge landfill gas for more than 30 years after they last accept waste.

At the time of publication, Victoria has 79 operating landfills and more than 200 closed landfills.³

2.1. The need for buffers

Environment Protection Authority Victoria (EPA) regulates landfills to ensure compliance with the *Environment Protection Act 1970* and its subordinate legislation, including the *Waste Management Policy (Siting, Design and Management of Landfills)* (the Landfill WMP). EPA's purpose in regulating landfills is to protect the environment and surrounding community.

Buffers separate landfills and 'sensitive land uses'. Landfill buffers are used to manage the risk of:

- landfill gas from operating and closed landfills (see **Appendix 1** for more information on landfill gas)
- amenity impacts from operating landfills, including odour, noise, dust and litter (see **Appendix 2** for more information on landfill amenity impacts).

Buffers do not offer landfill operators an alternative to controlling the offsite impacts of landfills or meeting their legal obligations. Instead, buffers are a tool used to manage the risk of impacts from unintended events, such as equipment or management failures or abnormal weather events.

Definition: Sensitive land use (in the context of landfill gas and amenity impacts)

Whether a land use is deemed sensitive depends on the particular risk posed:

- In the context of landfill gas, any building or structure is considered sensitive, because of the risk of explosion or asphyxiation.
- In the context of amenity impacts, which may include odour, dust, noise and litter, identification of sensitive uses requires consideration of the protection of beneficial uses. The Environment Protection Act 1970 defines 'beneficial use' as:

A use of the environment or any element or segment of the environment which is conducive to public benefit, welfare, safety, health or aesthetic enjoyment and which requires protection from the effects of waste discharges, emissions or

¹ Where development is proposed directly on (as opposed to within the buffer of) a closed landfill, contact with EPA is recommended.

² *Siting, Design, Operation and Rehabilitation of Landfills* (EPA Publication 788.3, August 2015).

³ For further information on the location of landfills, see the *Statewide Waste and Resource Recovery Infrastructure Plan: Victoria 2015–44* (Sustainability Victoria).

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deposits or of the emission of noise.

- More specific guidance on sensitive land uses for odour and dust is provided in the *Recommended Separation Distances for Industrial Residual Air Emissions – Guideline*⁴ (the Separation Distance Guideline), where sensitive land use is defined as:

Any land uses which require a particular focus on protecting the beneficial uses of the air environment relating to human health and wellbeing, local amenity and aesthetic enjoyment, for example residential premises, child care centres, pre-schools, primary schools, education centres or informal outdoor recreation sites

- More specific guidance on sensitive uses for noise is provided in the SEPP (Control of Noise from Industry, Commerce and Trade) No. N-1 which defines the beneficial uses to be protected as normal domestic and recreational activities.

2.2. The role of planning in managing buffers

The Landfill BPEM provides guidance on buffers for operating and closed landfills.⁵ EPA requires landfills to comply with the Landfill BPEM, which is an incorporated document under the Landfill WMP.

EPA does not regulate sensitive land uses within landfill buffers. It is the planning system that determines all permitted land use and development, including within landfill buffers. Buffer requirements are implemented through appropriate planning policies and controls, including through zones and overlays, and making appropriate decisions on individual planning permit applications.

3. What planning provisions apply around landfills?

3.1. Legislative requirements

Section 4(1) of the *Planning and Environment Act 1987* sets out the following objectives of planning in Victoria:

- To provide for the fair, orderly, economic and sustainable use and development of land.
- To provide for the protection of natural and man-made resources and the maintenance of ecological processes and genetic diversity.
- To secure a pleasant, efficient and safe working, living and recreational environment for all Victorians and visitors to Victoria.
- To conserve and enhance those buildings, areas or other places which are of scientific, aesthetic, architectural or historical interest, or otherwise of special cultural value.
- To protect public utilities and other assets and enable the orderly provision and coordination of public utilities and other facilities for the benefit of the community.
- To facilitate development in accordance with the objective set out in the point above.
- To balance the present and future interests of all Victorians.

Planning Schemes in Victoria must seek to achieve these objectives.

Section 12(2)(b) of the *Planning and Environment Act 1987* requires a planning authority preparing a planning scheme amendment to take into account any significant effects which it considers the environment might have on any use or development envisaged in the amendment.

Section 60(1)(e) of the *Planning and Environment Act 1987* similarly requires a responsible authority deciding on a planning permit application to consider any significant effects which it considers the environment may have on the use or development.

⁴ *Recommended Separation Distances for Industrial Residual Air Emissions – Guideline* (EPA Publication 1518, March 2013).

⁵ The Landfill BPEM provides guidance on landfills that are licensed by EPA. The *Landfills Exempt from Licensing – Guideline* (EPA Publication 1563, April 2014) confirms that the separation distances specified in the Landfill BPEM also apply to landfills exempt from licensing.

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3.2. Victoria Planning Provisions

The State Planning Policy Framework (SPPF) provides broad guidance on how areas surrounding landfills should be treated in planning schemes and planning decisions, summarised in Table 1 below.

Table 1: SPPF provisions relevant to planning decisions within the buffer of landfills

Clause	Relevance
Clause 10.02 (Goal)	Explains the overall goal of the SPPF in fostering the objectives of planning in Victoria, which include: 'To secure a pleasant, efficient and safe working, living and recreational environment for all Victorians and visitors to Victoria.'
Clause 11 (Settlement)	States: 'Planning is to prevent environmental problems created by siting incompatible land uses close together.'
Clause 13 (Environmental risks)	States: 'Planning should adopt a best practice environmental management and risk management approach which aims to avoid or minimise environmental degradation and hazards. Planning should identify and manage the potential for the environment, and environmental changes, to impact upon the economic, environmental or social well-being of society.'
Clause 13.04–2 (Air quality)	Has the objective: 'To assist the protection and improvement of air quality.' Includes a strategy to: 'Ensure, wherever possible, that there is suitable separation between land uses that reduce amenity and sensitive land uses.' Includes as a policy guideline the <i>Recommended Buffer Distances for Industrial Residual Air Emissions</i> (since replaced by the Separation Distance Guideline, which itself refers to the Landfill BPEM).
Clause 17.02–2 (Design of industrial development)	Addresses industrial land generally and includes a strategy to: 'Provide adequate separation and buffer areas between sensitive uses and offensive or dangerous industries and quarries to ensure that residents are not affected by adverse environmental effects, nuisance or exposure to hazards.' Includes as a policy guideline the <i>Recommended Buffer Distances for Industrial Residual Air Emissions</i> (since replaced by the Separation Distance Guideline, which itself refers to the Landfill BPEM).
Clause 19.03–5 (Waste and resource recovery)	Includes a strategy to: 'Protect waste and resource recovery infrastructure against encroachment from incompatible land uses by ensuring buffer areas are defined, protected and maintained.' Includes as policy guidelines both the Landfill WMP and the Landfill BPEM.
Clause 52.10 (Uses with adverse amenity potential)	Defines those types of industries and warehouses which if not appropriately designed and located may cause offence or unacceptable risk to the neighbourhood. Garbage disposal in a landfill is shown with a Note 1 meaning the threshold distance is variable, dependent on the processes to be used and the materials to be processed or stored, and must be referred to EPA. Applies to development of landfills, but not to development within the buffer of a landfill.

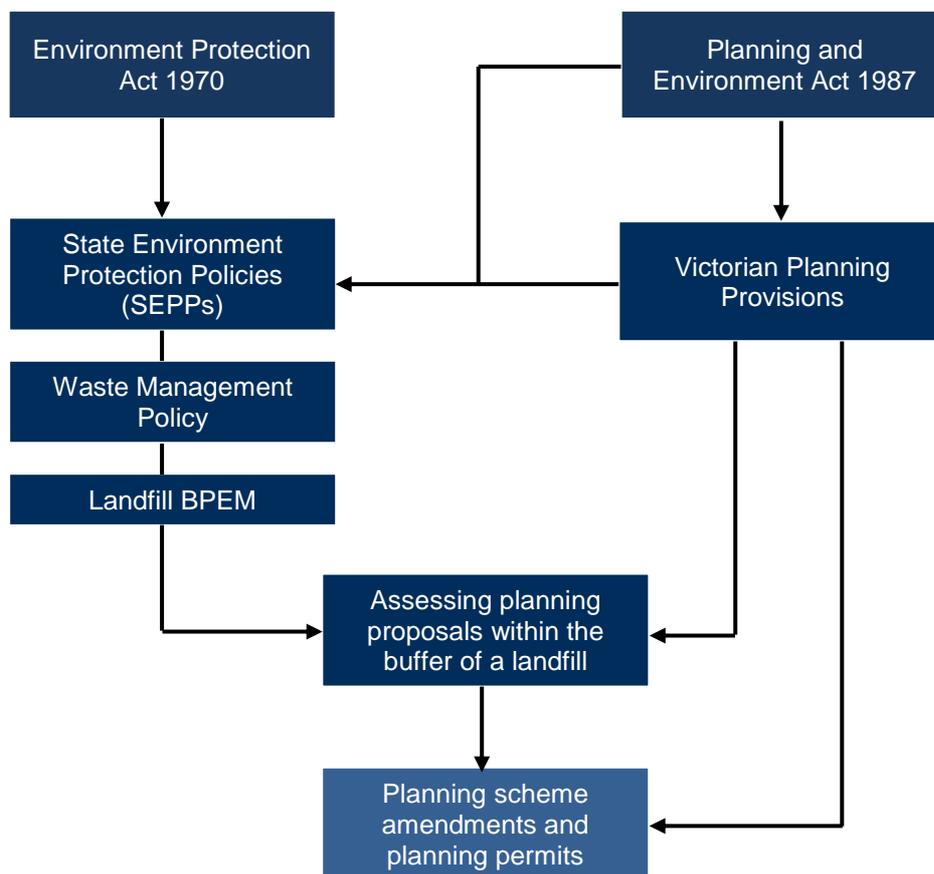
The potentially contaminated land framework contained within the planning system triggers consideration of the potential for contamination based on the current or previous use of a particular site. Its consideration would apply to development or rezoning of a closed landfill for a sensitive use, but not routinely to land within the buffer of a landfill.

There are no zones, overlays or particular provisions in the Victoria Planning Provisions with specific requirements or guidance on making planning decisions in relation to land within the buffer of a landfill.

However the following provisions can be applied as a tool to manage development within landfill buffers:

1. Special Use Zone (Clause 37.01 Victorian Planning Provisions) - offers the ability to tailor a zone where other available zones, overlays and local policies cannot give effect to the desired objectives or requirements.
2. Environmental Significance Overlay (Clause 42.01 Victorian Planning Provisions) - can be applied to a land fill buffer to identify areas where the development of land may be affected by environmental constraints and create a permit triggers for buildings, works and subdivision.

Figure 1: Relationship of this guideline to the Victorian Planning Provisions



4. What does the Landfill BPEM advise planners?

The Landfill BPEM is EPA's primary publication on landfills. It advises planning and responsible authorities on buffers for operating landfills (section 5.1.5) and closed landfills (sections 8.2.1 and 8.2.2). The advice, summarised below, is similar for both.

4.1. Default buffer distances

Table 2 below summarises the default buffer requirements in the Landfill BPEM for different types of landfills. The default distances are the same for both operating and closed landfills, although the buffer for operating landfills is to manage the risk of landfill gas and amenity impacts, while the buffer for closed landfills is to manage the risk of landfill gas impacts only. It typically takes at least 30 years for a closed landfill to stabilise to the point where the potential for harmful landfill gas migration ceases.

Note that landfills accepting Category C Prescribed Industrial Waste (PIW) are not within the scope of this guideline. It is recommended that the planning authority refer the application to EPA for site specific advice given the variable gas generation risk of PIW.

Table 2: Landfill buffer distances

Landfill type	Distance from buildings and structures
Landfill accepting municipal (putrescible) waste	500 metres
Landfill accepting solid inert waste	200 metres

4.2. Varying the default buffer distances

The Landfill BPEM allows for the default buffer distance to be reduced based on:

1. a risk assessment that considers design and operational measures; and
2. evaluation demonstrating the environment would be protected and amenity not adversely affected.

4.3. Measuring buffers

For operating landfills, buffers should be measured from the sensitive land use to the edge of the nearest landfill activity that poses a landfill gas or amenity risk, such as a landfill cell (active, closed or future) or leachate ponds.

For closed landfills, buffers should be measured from the sensitive land use to the edge of the nearest landfill cell.

If the landfill cell locations are uncertain, then the boundary of the landfill premises should be used instead.

4.4. Buffer encroachment

The Landfill BPEM provides specific advice to responsible authorities considering a planning permit application for development within a landfill buffer and planning authorities considering a planning scheme amendment that would have the effect of allowing development within a landfill buffer. This advice also applies to an increase in the extent of development within an already encroached buffer area. The Landfill BPEM recommends in each circumstance either:

1. requiring an environmental audit be conducted under section 53V of the *Environment Protection Act 1970* (section 53V Audit) that assesses the risk of harm to the proposed development or amendment area from the landfill; or
2. using relevant information, where sufficient, from a previous assessment or audit (available on the EPA website).

This guideline provides more information below to assist planning and responsible authorities in the implementation of this advice when making decisions about development within landfill buffers, and encourages a risk-based and cost-effective approach.

5. Recommended approach to assessing planning proposals within the buffer of a landfill

Assessing a planning proposal within the buffer of a landfill should involve considering the following two questions.

5.1. Does the planning proposal fall within a landfill buffer?

In identifying whether a planning proposal falls within a landfill buffer, consider that the landfill buffer distance may be either:

- the default buffer distance set in the Landfill BPEM; or
- a site-specific buffer distance determined by the council.

Councils have the option of determining site-specific buffer distances that reflect the risk posed by individual landfills. For example, buffer distances for closed landfills can often be reduced as the risk decreases over time. This determination relates to all of the land surrounding the landfill, not just one particular site.

Providing guidance on site specific buffers is not within the scope of this guideline, however, Councils can request EPA's advice on developing an appropriate process to determine site-specific buffer distances in their municipality. Generally, this involves gathering and assessing site-specific landfill information with the assistance of a professional environmental consultant with demonstrated experience in assessing risks to developments from landfills.

If the proposal does not fall within the landfill buffer, no further assessment relating to the potential impacts of that landfill is required. If the proposal does fall within the landfill buffer, proceed to section 5.2.

5.2. Is the landfill operating or closed?

If the buffer is for a **closed landfill**, the assessment can be limited to the risk of landfill gas impacts only. This does not mean there is no risk of amenity impacts from a closed landfill. For instance, there may be landfill gas type odour before the landfill has been capped. However, the potential odour impacts from a closed landfill are significantly less than those of an operating landfill, so it is appropriate for the assessment within a closed landfill buffer to be based solely on landfill gas migration.

Closed landfills:

For the recommended approach to assessing planning proposals within a closed landfill buffer, refer to Section 6

Section 6 provides the recommended approach to considering landfill gas risks during the assessment of a planning proposal within a landfill buffer. The recommended approaches are consistent with, and build on, the advice in the Landfill BPEM.

The purpose of this approach is to ensure the level of assessment undertaken is commensurate with the degree of risk involved. Alternative approaches based on this principle and consistent with the Landfill BPEM may also be appropriate.

If the buffer is for an **operating landfill**, the risk of landfill gas and amenity impacts should be assessed.

Operating landfills:

Where the proposed use is not sensitive to amenity impacts as defined in section 2.1:

For the recommended approach to assessing planning proposals within an operating landfill buffer, see Section 6

Section 6 provides the recommended approach to considering landfill gas risks during the assessment of a planning proposal within a landfill buffer. The recommended approaches are consistent with, and build on, the advice in the Landfill BPEM.

The purpose of this approach is to ensure the level of assessment undertaken is commensurate with the degree of risk involved. Alternative approaches based on this principle and consistent with the Landfill BPEM may also be appropriate.

Where the proposed use is sensitive to amenity impacts as defined in section 2.1:

The planning authority is recommended to refer the application to EPA for site specific advice.

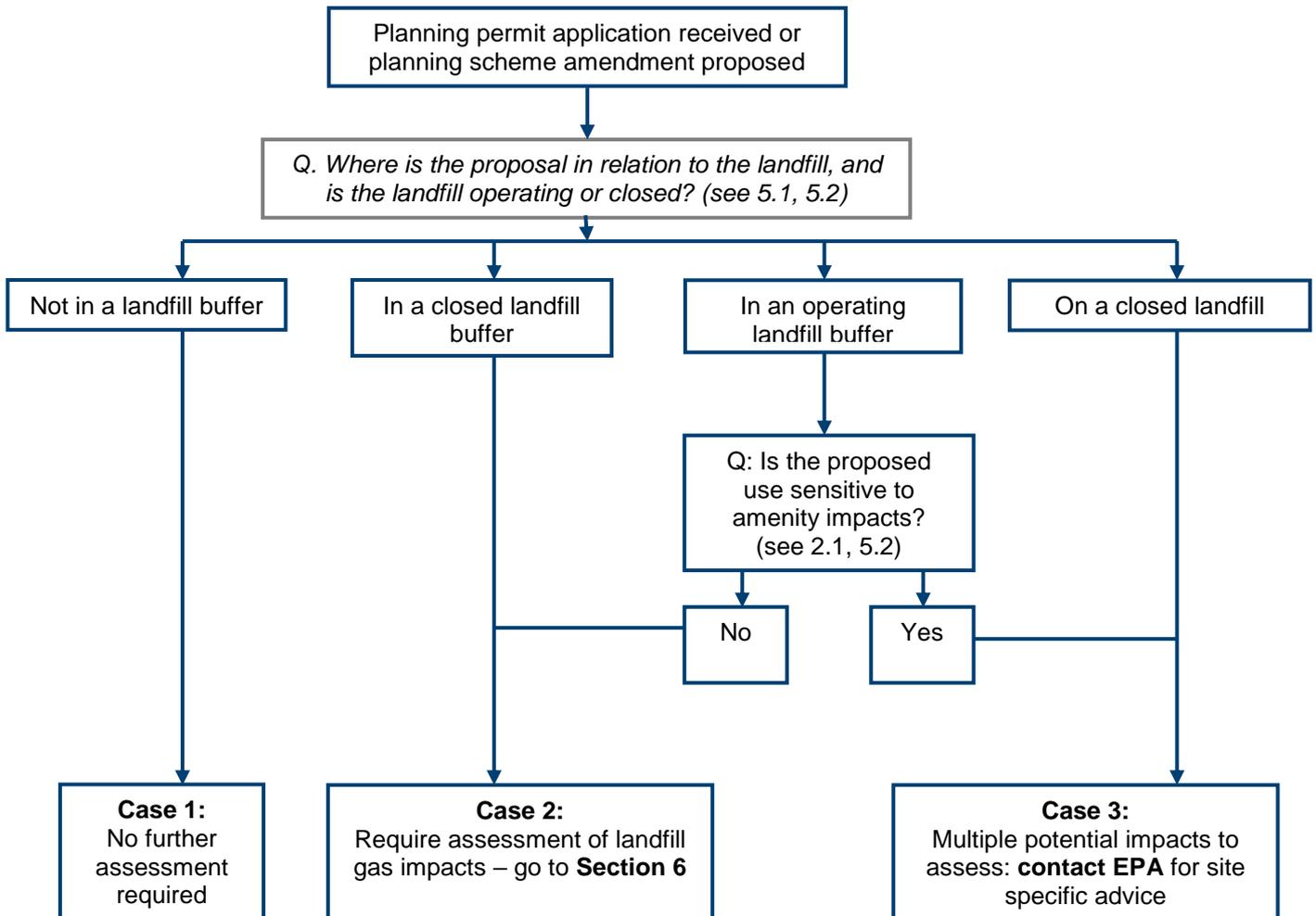
The assessment of sensitive use developments within the buffer of operating landfills is complex, in particular:

- For an operating landfill, risks may change with time, particularly during upset operating conditions, the location of the tipping face within the landfill, or if the landfill expands in future.
- Should amenity impacts occur at the development site, there may be no way to mitigate these through protective design measures in the development.

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Figure 2 below provides a summary of the recommended approach for assessing planning proposals within the buffer of a closed or operating landfill, as outlined above.

Figure 2: Recommended approach to assessing planning proposals within landfill buffers - overview



6. Assessing the risk of landfill gas impacts

The Landfill BPEM generally recommends that planning and responsible authorities require a section 53V Audit to assess the risk of landfill gas migration impacting on proposed development within the landfill buffer. This guideline is designed to support the intent of this recommendation by offering a risk based approach to inform its implementation.

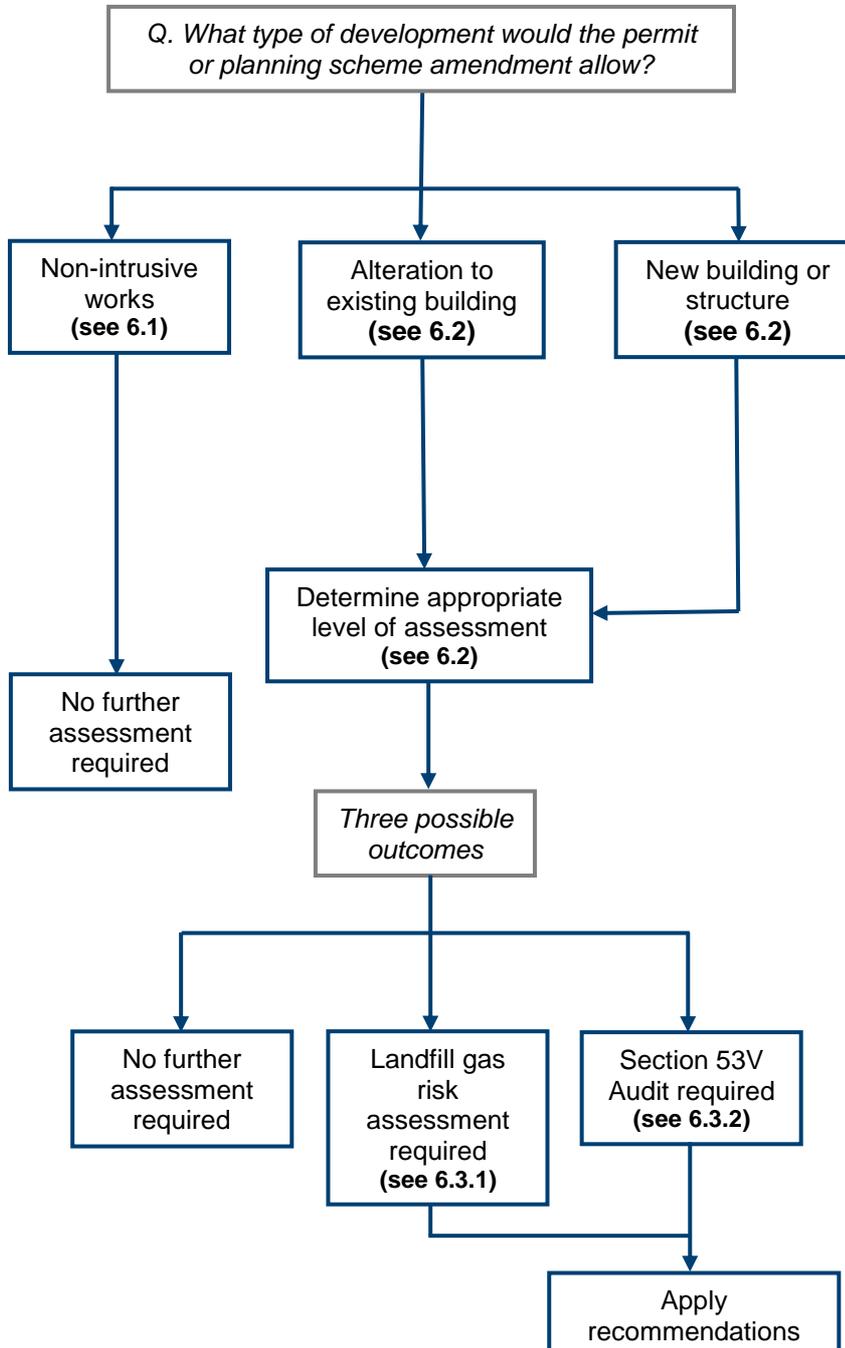
6.1. Levels of assessment

This section of the guideline provides a standardised, risk based approach for the planning or responsible authority to determine the appropriate level of assessment for landfill gas risks. Section 5 above specifies when this standardised approach should be applied. In summary, the approach is designed for planning proposals within landfill buffers where amenity impacts are unlikely and landfill gas is the primary concern (this scenario is defined as Case 2 in Figure 2 above).

An overview of the recommended approach is shown in Figure 3, with further detail set out below.

Please be aware that this approach should only be applied for Case 2 planning proposals – refer to Figure 2

Figure 3: Recommended approach to assessing the risk of landfill gas impacts – overview



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6.1.1. Non-intrusive works

Proposals for 'non-intrusive works' do not need to be assessed for risk of landfill gas impacts.

Definition: Non-intrusive works

Non-intrusive works are those that do not involve enclosed structures, excavation or significant ground disturbance. They include but are not limited to:

- alterations to buildings and structures that do not require ground disturbance
- fencing
- street and park furniture
- vehicle crossovers
- satellite dishes
- minor signage

6.2. Determining the appropriate level of assessment required

EPA recommends that planning and responsible authorities use the following four-step approach to determine if and what level of assessment of the risk of landfill gas impacts is required:

Step 1: Assign a proposal score.

Step 2: Assign a landfill score.

Step 3: Use the proposal score and landfill score to calculate an overall score.

Step 4: Determine the level of assessment required.

Step 1: Assign a proposal score

Step 1 involves reviewing the planning permit application or proposed planning scheme amendment and assigning the proposal a score using Table 3 below.

Table 3: Proposal scores

Score	Proposal type
1	Alterations to an existing building using similar construction style and standards (excluding below ground structures)
2	Buildings and structures that exclude below ground structures such as basements or lift shafts.
3	Buildings and structures that include below ground structures such as basements or lift shafts.

Note 1: For **planning scheme amendments**, a planning authority should consider what type of development the amendment would allow, either as of right or with a planning permit. A precautionary approach should be taken. For example, if land is proposed to be rezoned from Farming Zone to General Residential Zone, the amendment would have the effect of allowing further development and that development may foreseeably include below ground structures, so a score of 3 should be applied. If additional measures are imposed to preclude below ground structures, a score of 2 should be applied.

Note 2: For **subdivision applications**, a responsible authority should consider what type of development the subdivision would allow, either as of right or with a planning permit. If the subdivision would result in lots that could subsequently be developed as of right, the subdivision stage is the last opportunity in the planning process to require appropriate consideration of the landfill gas risk. If the subdivision would result in lots for which a permit would be required to develop, it is nevertheless appropriate for the risk of landfill gas to be assessed at the earliest available opportunity. For subdivision applications, a score of 3 should be applied unless measures are imposed to preclude below ground structures, in which case a score of 2 should be applied.

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Step 2: Assign a landfill score

Step 2 involves reviewing the information available to identify the key characteristics of the landfill, namely its:

- size (the volume of the landfill in m³)
- type (the predominant type of waste disposed in the landfill)
- age (from the approximate date waste was last disposed at the site).

Appendix 3 to this guideline sets out potential sources of information on these criteria.

Table 4 below should then be used to calculate an aggregate landfill source score by adding the scores for each of the size, type and age criteria.

Table 4: Landfill scores

Score	Landfill size
1	Less than 50m ³
2	51 to 500,000m ³
3	500,001 to 2,000,000m ³
4	2,000,001 to 5,000,000m ³
5	More than 5,000,000m ³ or unknown size
Score	Landfill type
1	Soil
3	Solid inert waste
5	Putrescible waste or unknown type
Score	Landfill age
1	More than 50 years since waste last placed
2	30 to 50 years since waste last placed
3	10 to 30 years since waste last placed
4	Fewer than 10 years since waste last placed
5	Operating landfill or unknown age

Step 3: Use the proposal score and landfill score to calculate an overall score

Step 3 is to multiply the proposal score by the landfill score to calculate an overall score.

Overall score: proposal score x landfill score (landfill size + type + age)

Step 4: Determine the level of assessment required

Step 4 is to apply the overall score to Table 5 to determine the level of assessment required.

Table 5: Determining the level of assessment required

Overall score	Level of assessment required
1–8	No further assessment is required
9–25	Require a landfill gas risk assessment (see section 6.3.1)
26–45	Require a section 53V Audit (see section 6.3.2)

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Note 3: If the overall score determines that a landfill gas risk assessment or section 53V audit is required, it is preferable that the assessment be undertaken at the beginning of the planning process in order for a fully informed planning decision to be made. However as there is no statutory trigger for this up-front assessment, these requirements may also be made through planning permit conditions or planning controls implemented as part of a planning scheme amendment. Sample planning permit conditions are set out in Appendix 4.

Note 4: Where the development also relates to potentially contaminated land and a section 53X audit/environmental site assessment requirement already applies, it may be possible to incorporate landfill gas assessment into this process. In these circumstances, a separate landfill gas risk assessment of section 53V audit would not be required. Contact EPA for advice.

6.3. Levels of assessment

6.3.1. Landfill gas risk assessment

Who can conduct a landfill gas risk assessment?

A landfill gas risk assessment should be conducted by a professional environmental consultant with demonstrated experience in conducting landfill gas risk assessments for developments near landfills. The planning permit applicant or planning scheme proponent should engage this person.

What is a landfill gas risk assessment?

A landfill gas risk assessment should include:

1. a conceptual site model, based on the characteristics of the landfill and proposal and the likely pathways of gas migration and exposure at the proposed development site.
2. sufficient environmental monitoring from the proposal site to inform the assessment and enable the environmental risks to be characterised (magnitude and likelihood of hazard)
3. an assessment of the environmental risk posed by the landfill to the proposed development site in accordance with a recommended methodology (see below)
4. site-specific recommendations for further action (including mitigation measures for the buildings and structure at the proposed development site if necessary).

What is the landfill gas risk assessment process?

EPA recommends that landfill gas risk assessments follow the methodology in either:

- *Assessing risks posed by hazardous ground gases to buildings* (Construction Industry Research and Information Association (CIRIA), Publication 665:2007); or
- *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings* (British Standard 8485:2015).

These two publications propose essentially the same methodology using different terminology.

What are the potential outcomes of a landfill gas risk assessment?

A landfill gas risk assessment should recommend:

1. what, if any, mitigation measures are required
2. what, if any, further assessment is required (such as monitoring or the need to complete a section 53V Audit).

How long does a landfill gas risk assessment take?

A landfill gas risk assessment will typically take 1 – 24 months (as outlined in the relevant standards *CIRIA Publication 665:2007*). The time required will depend on the type and frequency of environmental monitoring required to inform the assessment.

6.3.2. Section 53V Audit

Who can conduct a section 53V Audit?

EPA appoints auditors under the *Environment Protection Act 1970* and regulates their conduct (see **Appendix 5**). The planning permit applicant or planning scheme proponent should engage this person.

What is a section 53V Audit?

A section 53V Audit includes all of the elements of a landfill gas risk assessment, but is additionally quality assured by an EPA-appointed auditor and formally documented in a publicly available audit report. A section 53V Audit is the most rigorous form of landfill gas risk assessment available.

What is the section 53V Audit process?

First, a landfill gas risk assessment is undertaken in accordance with the steps described in section 6.3.1 above.

Second, an audit of the risk assessment takes place as follows:

1. client engages auditor to conduct section 53V Audit
2. client and auditor define and agree on the audit scope and objectives⁶
3. auditor reviews existing information, including landfill gas risk assessment
4. auditor collects and verifies evidence to support findings relating to audit criteria
5. auditor evaluates data to determine compliance with audit criteria
6. auditor prepares audit report stating auditor's professional opinion on the risks posed by the activity or industrial process to the environment, with justification
7. auditor provides copy of audit report to client. Audit report is also made public on the EPA website.

What is the outcome of a section 53V Audit?

The outcome of a section 53V Audit is an audit report. The audit report includes conclusions on whether a landfill gas migration risk exists at the audit site and, if so, recommendations for mitigation measures.

How long does a section 53V Audit take?

Based on audits conducted to date, a section 53V audit to assess landfill gas risk will typically take 2-24 months.

6.4. Mitigation measures

6.4.1. What are mitigation measures?

Landfill gas mitigation measures can significantly reduce the risk of ground gases moving into buildings and accumulating to dangerous levels.

Mitigation measures can be passive or active.

Passive mitigation measures

Passive mitigation measures are incorporated into a building during construction and require little or no maintenance. They include but are not limited to:

- reinforced building floor construction with concrete slabs and gas-resistant membranes
- underfloor venting
- in-ground vertical venting wells to create a preferential pathway for gas to escape before reaching a building.

The *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings* (BS8485:2015) should be referred to for further detail.

⁶ Where the risk of odour impacts also needs to be assessed (see section 7 below), this can be included within the scope of the section 53V Audit. This may be more cost-effective than conducting a separate odour assessment.

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Care must be taken that passive mitigation measures incorporated into the building are not breached by construction work.

Active mitigation measures

Active mitigation measures control the migration of landfill gas by:

- extraction from the ground; or
- maintaining a positive pressure of air to prevent gas from entering under or within a building.

Active mitigation measures need to be operated and maintained over the life of the building, unless risks have been subsequently demonstrated to be below the level requiring active mitigation and the system can revert to passive venting, and this has been verified by a suitably qualified professional. They are more expensive than passive measures.

6.4.2. What mitigation measures should be required?

If a landfill gas risk assessment or section 53V Audit has been undertaken, any resulting recommendations about mitigation measures should be followed.

6.4.3. Design and verification

All gas mitigation measures (whether passive or active) are site-specific. They need to be **designed**:

- to a level that will protect against the risk of ground gas; and
- to work in combination with the ground floor and service entry designs of each building.

All gas mitigation measures must also be **verified** to ensure they are fit for purpose and have been installed correctly. This involves:

1. before installation, review of mitigation designs by a professional environmental consultant with demonstrated experience in gas mitigation measure design and
2. before the building is occupied, written confirmation that measures have been installed in accordance with the manufacturer's instructions by a professional environmental consultant with demonstrated experience in gas mitigation measure installation, or the supplier.

Further information on the installation and testing of mitigation measures is set out in BS 8485:2015 and CIRIA 665:2007. Note the 2015 update of BS 8485:2015 also contains information on verification of installed mitigation measures.

6.5. EPA's role in landfill gas assessment

EPA has a statutory role in regulating gas emissions from landfills via works approvals, licences and compliance notices under the *Environment Protection Act 1970*. EPA also administers the environmental audit system established under that Act, which is a tool to inform planning and responsible authorities about landfill gas risks associated with planning proposals.

A planning or responsible authority can request EPA's advice on specific planning proposals by providing notice to EPA of relevant planning scheme amendments or planning permit applications under the *Planning and Environment Act 1987*.

EPA's role in providing advice on planning proposals does not extend to review of individual landfill gas risk assessments on behalf of Council. Where an independent review of a landfill gas risk assessment is considered warranted, Council may choose to arrange for a peer review of the report by a professional environmental consultant with demonstrated experience in conducting landfill gas risk assessments for developments near landfills.

Appendix 1 – landfill gas

The risk posed by landfill gas to nearby developments depends on:

1. the magnitude of the gas hazard (the Source)
2. the sensitivity of the development (the Receptor)
3. the likelihood of gas reaching the development in such volumes and concentrations to become dangerous (the Pathway).

The Source – Pathway – Receptor concept is shown in Figure 2 below and described in further detail below.

Figure 2: Source – Pathway – Receptor concept



Source

Landfill gas is primarily generated by the decomposition of waste in a landfill.

The amount of landfill gas generated depends on the size and age of the landfill and the type of waste within it. Putrescible waste degrades more quickly than inert waste (such as bricks and concrete) and produces more landfill gas.

Landfill gas continues to generate within a landfill for many years after the landfill stops accepting waste. Peak production of landfill gas generally occurs one to two years after waste is last placed, but production can continue for over 30 years.

Landfill gas can be flammable, explosive, toxic, corrosive, odorous and present an asphyxiation (suffocation) hazard.

Pathway

If there is a build-up of landfill gas pressure in a landfill, the gas can move outward and upward.

The pathway will be affected by:

- the design of the landfill – best practice landfill design includes landfill liners, leachate collection systems, landfill gas treatment systems and landfill caps to reduce the risk of landfill gas migration.
- the geology of the subsurface between the landfill and the receptor – permeable geologies such as sands and fractured rock allow landfill gas to migrate more easily than less permeable geology such as clay.

Service trenches in proximity to landfills can also be preferential pathways for landfill gas.

Gas can enter buildings through:

- gaps around pipes and service entries
- gaps and cavities in walls
- cracks in floors
- cracks and gaps in basements.

Receptor

Gas can accumulate in confined spaces, such as:

- wall cavities
- beneath floor slabs
- within voids
- drains.

Appendix 2 – landfill amenity impacts

Odour

Odour from an operating landfill can be caused by a range of operational issues, but generally falls into two categories:

1. fresh waste odour
2. landfill gas odour.

The primary causes of **fresh waste odour** are:

- lack of daily cover over the waste at the end of the day's operations – this can be an insufficient depth of material being placed over the waste or an inappropriate type of material used
- poor tip face management, resulting in an excessively large area of fresh waste being exposed for the day's operation
- poor acceptance procedure, which fails to identify highly odorous loads that need to be covered immediately.

The primary causes of **landfill gas odour** are more complex but at a high level include:

- poorly performing or lack of a landfill gas collection system
- inadequate capping – this could contribute to landfill gas coming through the cap or limit the ability to draw gas from the waste mass
- poor leachate management – leachate can be an odour source in itself and also lead to the gas extraction system becoming flooded and therefore limiting its ability to remove gas from the waste mass.

Noise

Noise from an operating landfill can be caused by:

- trucks, including engine and exhaust noise and reversing “beepers”
- communications systems such as PA systems and external telephone bells
- machinery and equipment used for resource recovery operations, for example concrete crushing equipment.

Litter

Litter, such as plastic bags, may be carried by the wind to impact areas near the landfill.

Key determinants of the extent of offsite litter impacts include:

- weather – in particular greater impacts may be expected on windy days
- orientation and elevation of the tipping area in the landfill
- the litter control strategy of the landfill, which may include measures such as litter screens and fencing.

Dust

Dust may be generated by traffic associated with the landfill, earth stockpiles at the landfill or the delivery of dusty loads.

Key determinants of the extent of dust impacts include:

- weather – in particular greater impacts may be expected on windy days
- presence of natural or constructed wind breaks
- dust suppression activities
- the nature of roads within/to the landfill – sealed/unsealed.

Appendix 3 – sources of landfill information

Key sources of reliable and publicly available landfill information include:

- on the EPA website (www.epa.vic.gov.au):
 - EPA licences and works approvals
 - annual performance statements by EPA licence holders
 - EPA post-closure pollution abatement notices (PC PANs) for closed landfills
 - EPA's priority sites register (sites for which EPA has issued a clean up notice or pollution abatement notice)
 - audit reports
- from the relevant council:
 - records of council-operated landfills
 - planning records
- from the [Land Victoria Land Information Centre](#):
 - aerial photographs
 - historical maps and plans
 - survey information
 - title searches.

If there is insufficient or unreliable information to determine the size, type or age of the landfill, these should be considered 'unknown' for the purpose of using Table 4.

Appendix 4 – sample planning permit conditions

The sample planning permit conditions below correspond to the levels of assessment potentially required as an outcome of the process set out in section 6.2 of this guideline. A responsible authority may select the relevant corresponding condition and adapt it as required by the relevant circumstances.

Note that where a planning application also refers to potentially contaminated land (refer s4.4) modifications to these conditions will be required. Contact EPA for advice.

Requiring a landfill gas risk assessment

Before the plan of subdivision is certified under the *Subdivision Act 1988*, the commencement of works (other than works required to comply with this condition), the owner of the land must to the satisfaction of the responsible authority:

- a. engage a professional environmental consultant with demonstrated experience in the assessment of landfill gas risks to conduct an assessment of the potential for landfill gas to impact on the development and prepare and submit to the responsible authority the scope of the proposed risk assessment
- b. upon approval of the scope of the risk assessment by the responsible authority, have the consultant conduct the risk assessment and prepare a report to be submitted to the responsible authority which contains the consultant's opinion as to any potential risk associated with landfill gas beneath the land and any recommendations for the management or monitoring of the gas. The consultant must provide an opinion on whether an audit is required under section 53V of the *Environment Protection Act 1970*
- c. implement any recommendations of the risk assessment report
- d. if the risk assessment report recommends an audit under section 53V of the *Environment Protection Act 1970*:
 - i. engage an environmental auditor appointed under section 53S of the *Environment Protection Act 1970* to prepare and submit to the satisfaction of the responsible authority a scope of the proposed audit which includes consideration of both landfill gas and odour risk
 - ii. have the environmental auditor conduct an audit under section 53V of the *Environment Protection Act 1970* in accordance with the agreed scope
 - iii. implement any recommendations of the audit report.
- e. if the risk assessment report or audit report requires ongoing management or monitoring, the owner must enter into an agreement under section 173 of the *Planning and Environment Act 1987* with the responsible authority requiring the implementation of any ongoing requirements.

The owner/operator under this permit must pay the reasonable costs of the preparation, execution and registration of the section 173 agreement.

Requiring a section 53V Audit to assess landfill gas risk

Before the plan of subdivision is certified under the *Subdivision Act 1988*, the commencement of works (other than works required to comply with this condition), the owner of the land must to the satisfaction of the responsible authority:

- a. engage an environmental auditor appointed under section 53S of the *Environment Protection Act 1970* to prepare and submit to the satisfaction of the responsible authority a scope of the proposed audit which includes consideration landfill gas
- b. have the environmental auditor conduct an audit under section 53V of the *Environment Protection Act 1970* in accordance with the agreed scope
- c. implement any recommendations of the audit report. If any recommendations require ongoing management or monitoring, the owner must enter into an agreement under section 173 of the *Planning and Environment Act 1987* with the responsible authority requiring the implementation of any ongoing requirements.

The owner/operator under this permit must pay the reasonable costs of the preparation, execution and registration of the section 173 agreement.