Guidelines for the assessment and remediation of site contamination

Public consultation
Guidelines for the assessment and remediation of site contamination (public consultation)

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Disclaimer
This publication is a guide only and does not necessarily provide adequate information in relation to every situation. This publication seeks to explain your possible obligations in a helpful and accessible way. In doing so, however, some detail may not be captured. It is important, therefore, that you seek information from the EPA itself regarding your possible obligations and, where appropriate, that you seek your own legal advice.

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Abbreviations

ACM  asbestos-containing materials
ASC NEPM  National Environment Protection (Assessment of Site Contamination) Measure
CEMP  construction environment management plan
CSM  conceptual site model
CVI  chlorinated hydrocarbon vapour intrusion
DQO(s)  data quality objective(s)
DSI  detailed site investigation
EIL  ecological investigation level (for information about limitations and application refer to Schedule B1 of the ASC NEPM)
EPA  Environment Protection Authority (South Australia)
EP Act  Environment Protection Act 1993
EPP  Environment Protection Policy
ERD Court  Environment, Resources and Development Court
ESL  ecological screening level (for information about limitations and application refer to Schedule B1 of the ASC NEPM)
EV  environmental value
GIL  groundwater investigation level (for information about limitations and application refer to Schedule B1 of the ASC NEPM)
GPA  groundwater prohibition area in accordance with section 103S of the EP Act
HIL  health investigation level (for information about limitations and application refer to Schedule B1 of the ASC NEPM)
HSL  health screening level (for information about limitations and application refer to Schedule B1 of the ASC NEPM)
ISO  International Organisation of Standards
ITRC  Interstate Technology and Regulatory Council
LBSC Act  Land and Business (Sale and Conveyancing) Act 1994
LOR  limits of reporting
ML  management limit (for information about limitations and application refer to Schedule B1 of the ASC NEPM)
NAPL  non-aqueous phase liquid
PAHs  polycyclic aromatic hydrocarbons
PCA  potentially contaminating activity
PSI  preliminary site investigation
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>PVI</td>
<td>petroleum hydrocarbon vapour intrusion</td>
</tr>
<tr>
<td>QA/QC</td>
<td>quality assurance/quality control</td>
</tr>
<tr>
<td>(the) Regulations</td>
<td>Environment Protection Regulations 2009</td>
</tr>
<tr>
<td>ROA</td>
<td>remediation options assessment</td>
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<tr>
<td>RVR</td>
<td>remediation validation reporting</td>
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<tr>
<td>SAQP</td>
<td>sampling and analysis quality plans</td>
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<tr>
<td>SCAO</td>
<td>Site Contamination Assessment Order</td>
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<tr>
<td>SRO</td>
<td>Site Remediation Order</td>
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<tr>
<td>SRO</td>
<td>Site Remediation Order</td>
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<tr>
<td>SRP</td>
<td>site remediation plan</td>
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<tr>
<td>SSRA</td>
<td>site-specific risk assessment</td>
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<tr>
<td>UCL</td>
<td>upper confidence limit</td>
</tr>
<tr>
<td>VI</td>
<td>vapour intrusion</td>
</tr>
<tr>
<td>VOC(s)</td>
<td>volatile organic compound(s)</td>
</tr>
<tr>
<td>VOCCs</td>
<td>volatile organic chlorinated compounds</td>
</tr>
</tbody>
</table>
Summary

The Environment Protection Authority (EPA) has prepared this guideline to describe the legislative and policy framework for the risk-based assessment and remediation of site contamination in South Australia. It provides information about the EPA’s expectations regarding the assessment and remediation of site contamination in South Australia to protect human health and the environment. The guideline promotes guidance, consistent understanding and compliance with relevant legislation. It describes the responsibilities for site contamination and the roles of parties involved in the assessment and remediation processes.

Site contamination is an important environmental, health, economic and planning issue. If it is not adequately recognised, considered and addressed there may be a resulting risk to human health and/or the environment. Site contamination can affect one or more elements of the environment including (but not limited to) soil, groundwater and soil vapour.

The guideline is intended to provide information about the protection of human health and the environment in a manner consistent with the objects of the Environment Protection Act 1993 (the EP Act) as defined in section 10 of the EP Act. The guideline addresses relevant South Australian regulatory and policy requirements in relation to site contamination. It is also intended to be consistent with the policy framework and guidance provided in the National Environment Protection (Assessment of Site Contamination) Measure 1999 (ASC NEPM), as amended in 2013.

The guideline has primarily been developed as guidance for site owners and persons identified as responsible (or liable) for site contamination, site contamination auditors1 (auditors) and site contamination consultants2 (consultants), and persons with an interest in the assessment and remediation of site contamination.

In addition, the guideline provides a glossary of key terms relevant to site contamination auditing. It also contains appendices that provide additional information, including a summary of relationships between legislation and EPA guidance, legislative penalties, salinity levels for determination of groundwater environmental values, checklists of reporting requirements and the electronic format of documents to be provided to the EPA.

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1 Defined in section 3(1) of the EP Act
2 Defined in section 3(1) of the EP Act
Part 1

Roles and responsibilities
Assessment and remediation of site contamination

1 Introduction

1.1 Purpose

Site contamination is a complex social, economic and environmental issue that, if not adequately addressed, can pose a significant risk to human health and the environment. Site contamination can affect one or more elements of the environment including (but not limited to) soil, groundwater and soil vapour.

This guideline has been developed to assist relevant parties with adopting a consistent and compliant interpretation of relevant legislation, policy and guidance, to ensure that the assessment and remediation of site contamination is conducted to the level expected by the South Australian Environment Protection Authority (EPA). It also details the responsibilities and roles of parties involved in the assessment and remediation of site contamination.

The intention of this guideline is to promote the principles of ecologically sustainable development for the protection of human health and the environment in a manner consistent with the objects of the Environment Protection Act 1993 (EP Act) and addresses relevant South Australian regulatory and policy requirements in relation to site contamination. It also promotes the policy framework and guidance provided in the National Environment Protection (Assessment of Site Contamination) Measure 1999 (ASC NEPM) as amended in 2013.

This guideline has primarily been developed to provide information to site owners and persons identified as responsible (or liable) for site contamination, site contamination auditors, site contamination consultants and persons with an interest in the determination, assessment, remediation and auditing of site contamination. It seeks to explain possible obligations in a helpful and accessible way. As such, it is a guide only and does not necessarily provide information that relates to every situation. Therefore, it is important in some circumstances that information is sought directly from the EPA itself. Where appropriate, it is also recommended that persons seek their own legal advice.


1.2 EPA site contamination guidance

This guideline has been prepared to reflect developments and learnings regarding site contamination in South Australia since 2009 and, most importantly:

- legislative experience and knowledge developed through regulatory processes since the commencement of the site contamination provisions in the EP Act (July 2009)
- to align and consistently promote the framework for the assessment of site contamination in accordance with the amendment of the ASC NEPM (May 2013).

This guideline supersedes a number of previously issued EPA guidelines and information sheets that relate to the assessment and remediation of site contamination (see section 1.4 of this guideline). It is to be read in conjunction with other guidance published by the EPA in relation to site contamination. A list of supporting current EPA guidelines and information sheets and other publications relevant to the assessment, remediation and auditing of site contamination is included in Appendix 1 of this guideline.

Specific guidance has also been prepared by the EPA in relation to the site contamination audit system, which describes the legislative requirements and other obligations for auditors. Auditors should refer to the EPA publication: Guidelines for the site contamination audit system.

1.3 Application of this guideline

The EP Act and the Environment Protection Regulations 2009 (Regulations) include a range of different requirements for auditors, consultants, landowners and occupiers. Key legislative provisions have been highlighted throughout the

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3 Section 3(1) of the EP Act defines ‘environment’.
4 Section 3(1) of the EP Act provides definition of site contamination auditors.
5 Section 3(1) of the EP Act provides definition of site contamination consultants.
guideline in text boxes where appropriate. Legislative requirements have also been identified in this guideline with the use of the word 'must' or 'required'. Where ‘must’, ‘must not’ or ‘required’ is used in this guideline, failure to comply will have caused, or is likely to cause, a situation where the person is in breach of the EP Act, the Regulations or relevant guidelines issued by the EPA.

The legislation imposes significant penalties for offences and breaches, including expiations, fines and/or imprisonment. Relevant fines and penalties are identified throughout this guideline. This guideline is not intended to provide details of all relevant legislative provisions. Persons should seek their own legal advice and interpretation where needed.

1.4 Currency of this guideline

This guideline supersedes and replaces the following guidelines and information sheets previously published by the EPA:

- EPA 830/09—Site contamination: What is site contamination? (2009)
- EPA 838/08—Site contamination: Determination of background concentrations (2008)
- EPA 839/08—Site contamination: How to determine actual or potential harm to water that is not trivial resulting from site contamination (2008)
- EPA 814/09—Site contamination: Responsibility for assessment and remediation of site contamination (2009)
- EPA 829/08—Site contamination: Honesty in reporting (2008)
- EPA 623/06—Environmental management of on-site remediation (2006)
- EPA 589/05—Soil bioremediation (2005)
- Site contamination: Guidelines for the assessment and remediation of groundwater contamination (2009)
- Composite soil sampling in site contamination assessment and management (2005)

This guideline should be read in conjunction with other guidance published by the EPA in relation to site contamination (refer to Appendix 1 of this guideline).

This guideline may be replaced, amended or updated periodically by the EPA. All persons should refer to the EPA website for details of the most recent version of this guideline and other EPA publications related to site contamination. When an update occurs, the EPA will try to notify as many relevant people as possible.

1.5 National Environment Protection (Assessment of Site Contamination) Measure 1999

The ASC NEPM provides a national risk-based framework for the staged or tiered assessment of site contamination in Australia. Information collected at each stage or tier of assessment is used to inform and plan the scope of subsequent work. The framework provides the means for prioritising work and focusing on the higher risk issues associated with site contamination.

The purpose of the ASC NEPM is to establish a nationally consistent approach for the assessment of site contamination. The ASC NEPM’s framework promotes sound environmental management practices that should be adopted by the community, including regulators, site assessors, consultants, auditors, landowners, developers and industry parties.

The desired outcome of the ASC NEPM is to provide adequate protection of human health and the environment, where contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination.

Refer to Appendix 2 for further information about the relevant fines and penalties.
The ASC NEPM comprises a policy framework supported by two schedules. This guideline and other EPA documents in the site contamination series are intended to be consistent with the policy framework and guidance provided in the ASC NEPM.

The EPA expects that the assessment of site contamination in South Australia will be carried out in accordance with the guidance provided in the ASC NEPM and relevant EPA publications.

The ASC NEPM does not provide guidance on the clean-up (remediation) of site contamination. However, it does provide details of environmental outcomes\(^7\) for achieving remediation and/or management at a site.

The ASC NEPM is available for download from the ComLaw website: <www.comlaw.gov.au>. The website for the former Standing Council on Environment and Water (SCEW) provides supporting information about the ASC NEPM, including frequently asked questions and the ASC NEPM Toolbox, which are available at: <www.scew.gov.au/nepms/assessment-site-contamination>.

1.6 Work health and safety

There should be appropriate work health and safety measures in place for any personnel involved in the assessment and remediation of site contamination in accordance with applicable work health and safety legislation (refer to the Work Health and Safety Act 2012).

1.7 Protection of the environment during assessment and remediation

There should be appropriate protection of the environment during site assessment and remediation. Guidance on how to address minimum measures that should be adopted to ensure the protection of the environment during site assessment and remediation are provided in Schedule B2, section 15 of the ASC NEPM. Causing environmental harm is a criminal offence and severe penalties may apply. For additional information about the general environmental duty and environmental harm provisions of the EP Act, refer to the EPA publication: Compliance and enforcement regulatory options and tools.

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\(^7\) Principle 16 of the ASC NEPM provides details of the hierarchy process to achieve desired and site-specific environmental outcomes.
2 Triggers for assessment, remediation and auditing

2.1 Overview

A general overview of the assessment, remediation and auditing process is shown in Figure 1 of this guideline. The extent and duration of the process may vary, depending on the level and complexity of issues associated with the site and the relevant trigger. These factors will influence the level of assessment required, whether remediation is necessary and whether an audit is to be carried out. Refer to Part 3 of this guideline for information about the risk-based assessment process and Part 4 for guidance about remediation.

2.2 Types of triggers

Site contamination assessment should be undertaken whenever contamination has been identified at a site, or when there is a reasonable suspicion site contamination exists due to a current or previous contaminating activity at the site. Remediation should be implemented where measures are required to address the risk resulting from the site contamination. In some instances, a site contamination audit may be required.

The specific drivers and triggers for the assessment, remediation and auditing of site contamination at a site may be via statutory or regulatory requirements. Additionally, they may be triggered by non-statutory and voluntary mechanisms. The nature of the trigger will determine the extent of assessment and/or remediation, including the requirement for a site contamination audit. If required, the EPA recommends that auditor engagement be undertaken as early as possible to ensure clear objectives and endpoints of the assessment(s) are established in accordance with the ASC NEPM and the relevant EPA guidelines.

2.3 Legislative and guideline triggers

The EPA may require a person to carry out assessment and/or remediation (which may include an audit) as:

- a condition of a Site Contamination Order (section 3.2 of this guideline)
- part of an agreement based on a voluntary proposal (section 3.2.3 of this guideline)
• a condition of an environmental authorisation, environment improvement program, environmental performance agreement or works approval issued under the EP Act\(^8\)

• part of the agreement(s) or arrangement(s) of a special management area declared by the EPA\(^9\) (refer to section 18.2 of this guideline).

Further information about compliance and enforcement tools available under the EP Act are provided in the EPA publication: *Compliance and enforcement regulatory options and tools (2009).*

2.4 **Voluntary triggers**

The assessment, remediation and auditing of site contamination may be carried out where there is no legislative requirement to do so. Landowners, occupiers or other interested persons may commission assessments for other purposes including due diligence, transfer of liability, insurance or financial purposes for land acquisition or divestment and corporate requirements.

2.5 **Planning and development triggers**

The *Development Act 1993* is the legislation that provides for planning and regulates land development in South Australia. The appropriate consideration of potential site contamination in rezoning and development decisions is important to ensure that land is fit for its proposed form of land use.

At the time of publication of this guideline, the EPA and the Department for Planning, Transport and Infrastructure have commenced a review of the site contamination planning framework. It is anticipated that the framework will outline the triggers for the assessment and auditing of site contamination, which will support and provide consideration of site contamination for land development and planning related issues.

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\(^8\) Refer to the EPA publication: *Information for licensees (2009)*

\(^9\) Refer to section 103N of the EP Act for information about special management areas.
3 EPA regulation and administration of site contamination

3.1 The role of the EPA

The EPA is the statutory body responsible for administering the EP Act and the Regulations\(^\text{10}\). The EP Act provides the following provisions for the EPA to regulate activities that have, or may have, an adverse environmental impact:

- general environmental duty, section 25 of the EP Act, which states that ‘a person must not undertake an activity that pollutes, or might pollute, the environment, unless the person takes all reasonable and practicable measures to prevent or minimise any resulting harm’
- regulations and Environment Protection Policies (EPPs), which may be accompanied by codes of practice, guidelines or Standards
- environmental authorisations, including licences for the activities described in Schedule 1 of the EP Act, works approvals and exemptions
- recording information on the EPA Public Register
- environmental offences (eg, causing serious or material environmental harm, or causing an environmental nuisance).

The EPA also undertakes the following activities:

- providing responses to development applications referred to it through the Development Act 1993
- contributing to Form 1 statements under the Land and Business (Sale and Conveyancing) Act 1994.

The EP Act also contains specific provisions in relation to site contamination. These provisions include:

- Site Contamination Orders and voluntary proposals
- the site contamination audit system
- water restriction or prohibition areas (refer to section 18.1 of this guideline)
- special management areas (refer to section 18.2 of this guideline).

In some instances, for example, where there may be a risk to public health, the EPA may carry out investigations for specific assessment areas (refer to section 3.3 of this guideline).

3.2 Orders and voluntary proposals

The EPA may issue a Site Contamination Assessment Order (SCAO) and Site Remediation Order (SRO) under the EP Act to an appropriate person, in accordance with section 103C and 103D of the EP Act\(^\text{11}\). It is an offence to not comply with an SCAO or SRO, and the penalties for non-compliance are substantial\(^\text{12}\).

In addition, if the requirements of an SCAO or SRO are not complied with, the EPA can undertake any action required by the order or engage other persons to do so on its behalf. The EPA can then recover the costs and expenses incurred by undertaking this work from the person to whom the order was issued.

Persons issued with an SCAO or SRO may appeal (pursuant to section 106 of the EP Act) to the Environment, Resources and Development Court (ERD Court) against the order or any variation of the order. An appeal must be made within 14 days after the order is issued or the variation made. It is recommended that persons appealing should seek appropriate legal advice.

Further information about the EPA issuing SCAOs and SROs is provided in sections 3.2.1 and 3.2.2, respectively.

\(^\text{10}\) Refer to section 18 of the EP Act.

\(^\text{11}\) The EPA can also issue Environment Protection and Clean-up Orders (refer to Part 10, Divisions 2 and 4 of the EP Act) for environmental harm, which may include requirements in relation to site contamination.

\(^\text{12}\) The penalty for failing to comply with an SCAO or SRO is: if the offender is a body corporate—$120 000; if the offender is a natural person—Division 1 fine.
3.2.1 Site Contamination Assessment Orders (section 103H)

An SCAO may be issued by the EPA under section 103H of the EP Act in the event that the EPA is satisfied that site contamination exists at a site or suspects that site contamination exists at a site due to a potentially contaminating activity (of a kind prescribed by regulation as having taken place there (refer to section 3.4 of this guideline)). An SCAO is issued to an appropriate person(s) who may be either an individual or a corporation.

The SCAO must require the appropriate person to determine the nature and extent of the site contamination (amongst other requirements). If the order is issued to an owner of the site, as distinct from a person who caused the site contamination, the order must be limited in its application to site contamination on or below the surface of the site.

3.2.2 Site Remediation Orders (section 103J)

An SRO may be issued by the EPA under section 103J of the EP Act in the event that the EPA is satisfied that site contamination exists at a site and considers that remediation of the site is required, taking into account current or proposed land uses.

An SRO is issued to an appropriate person(s) who may be either an individual or a corporation. An SRO may require the treatment, containment, removal or management of the chemical substances present at the site (among other requirements). If the order is issued to an owner of the site, as distinct from a person who caused the site contamination, the order must be limited in its application to site contamination on or below the surface of the site (refer to section 5.1 of this guideline).

The EPA may also issue an emergency Site Remediation Order. Refer to section 103J of the EP Act.

3.2.3 Voluntary proposals

Sections 103I and 103K of the EP Act allow the EPA to agree not to issue an SCAO or SRO to a person (which may include an individual or a corporation). This can occur if that person undertakes to carry out assessment or remediation with EPA approval and agreement. The relevant sections of the EP Act set out the requirements for voluntary site contamination assessment proposal and/or voluntary site remediation proposal. Should a person not comply with an EPA approved proposal, it is likely that regulatory action will occur.

3.3 EPA Assessment Areas

The EPA, when necessary, undertakes assessment of site contamination. This may be related to site contamination that poses a risk to human health and where there is no known person who has liability for site contamination. This will typically be in situations when site contamination has been identified (often groundwater contamination) that extends outside the boundaries of a site, which may affect a number of adjacent land parcels. The EPA defines these areas as ‘EPA Assessment Areas’. Information about established EPA Assessment Areas is available from the EPA website. The EPA will actively engage with all affected owners and occupiers of land in accordance with the EPA Community Engagement Framework and section 19 of this guideline.

Auditors and consultants are advised to contact the EPA when carrying out assessment and remediation within a current EPA Assessment Area.

Site contamination assessment work carried out by the EPA (or by others on behalf of the EPA) forms part of a report that describes ‘an environmental assessment’ 13. In accordance with section 109 of the EP Act, the EPA is required to maintain an EPA Public Register and, in doing so, records and makes available assessment reports on the EPA Public Register.

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13 Refer to regulation 16(1)(f) of the Regulations for details of an EPA environmental assessment.
3.4 Site contamination audit system

The site contamination audit system is a key strategy in the effective management of site contamination in South Australia.

The EPA administers the audit system to ensure that site contamination audits are carried out in accordance with relevant legislation and EPA guidelines. The role of the EPA is to ensure that an acceptable quality of auditing is maintained.

The EPA carries out certain activities including:

- the accreditation of auditors
- implementation of a quality assurance program
- developing, issuing, updating and implementing guidelines for use by auditors, consultants, industry, local government, planning authorities and the community on the assessment, remediation and auditing of site contamination
- recording audit information on the EPA Public Register (refer to section 20.1 of this guideline)
- regulating audit conditions where appropriate, such as notation of audit reports on Certificate of Titles for individual land parcels.

For detailed information about the site contamination audit system refer to the: Guidelines for the site contamination audit system (2014).
4 Auditors, consultants and other persons

4.1 Site contamination auditors

A site contamination auditor (auditor) is an expert professional accredited by the EPA to undertake an independent review of assessment and/or remediation work carried out by site contamination consultants. Only a natural person (that is an individual and not a corporation) may be granted accreditation\(^{14}\). Only a person, accredited by the EPA, can carry out a site contamination audit (audit). It is a criminal offence for a person to hold himself or herself out as a site contamination auditor unless that person is accredited.

For further information about auditors and audits, refer to the Guidelines for the site contamination audit system (2014).

Auditors are the only persons considered by the EPA as qualified to provide an opinion on the suitability of land for sensitive use\(^{15}\) where site contamination is suspected or known to exist.

In exercising their functions and duties under the EP Act, auditors owe a primary duty of care to the environment and to the health and safety of the people of South Australia above all others (including any duty to the person who has commissioned them to conduct the audit).

An auditor’s role is to independently and objectively examine and review the accuracy and completeness of the assessment and/or remediation work carried out by others and to complete a site contamination audit report.

The independence and integrity of the auditor are fundamental aspects of the audit system. The obligations of auditors with regard to conflict of interest and honesty are detailed in section 103X of the EP Act. Auditors must be able to demonstrate that the audits they carry out are not subject to a conflict of interest, that they have exercised their own professional judgment and the opinions they express in the audit documentation have been reached independently.

Severe penalties exist for auditors in relation to conflicts of interest and providing false or misleading statements\(^{16}\).

For detailed guidance on the roles and responsibilities of a site contamination auditor, refer to: Guidelines for the site contamination audit system (2014).

4.2 Site contamination consultants

A site contamination consultant (consultant) is defined in section 3(1) of the EP Act.

A national scheme for the certification of site contamination practitioners has been established. The scheme is known as Site Contamination Practitioners Australia (SCP Australia). SCP Australia aims to provide improved outcomes for all stakeholders involved in site contamination by ensuring, through a recognised certification process, that those dealing with site contamination issues have the necessary level of knowledge, expertise and skill. For further information see: <http://scpaustralia.com.au/>.

It is proposed that from 1 July 2016, the EPA will require all reports submitted to the EPA to be prepared, or reviewed and approved, by a certified practitioner. The requirement includes reports associated with:

- Site Contamination Assessment Orders
- Site Remediation Orders
- voluntary site contamination assessment proposals
- voluntary site remediation proposals
- any site contamination work commissioned by the EPA

\(^{14}\) Refer to section 103V of the EP Act for accreditation of site contamination auditors.

\(^{15}\) Refer to section 3(1) of the EP Act for the definition of sensitive land use.

\(^{16}\) Refer to relevant sections pursuant to Part 10A of the EP Act and Appendix—Divisional penalties and expiation fees.
4.5 Planning authorities

Planning authorities have an important role in reducing the risk of exposure to the public and the environment from site contamination when rezoning land and making development decisions under the Development Act 1993. Appropriate consideration should be given to site contamination issues.

One of the principles of the ASC NEPM recommends planning authorities ensure that a site being considered for a change in land use, and which the planning authority ought reasonably to have known to have a history of use that is indicative of potential site contamination, is suitable for its intended use.

Refer to section 2.5 of this guideline for further information about planning and development triggers for assessment, remediation and auditing.

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17 Section 3(1) of the EP Act provides the definition of an owner.
18 Section 3(1) of the EP Act provides the definition of an occupier.
Part 2

Legislative and policy framework
5 Site contamination and the legislative framework

5.1 Overview

Primarily, this guideline outlines, for consultants and auditors, the key legislation and policy information that relates to the assessment, remediation and auditing of site contamination in South Australia.

The EPA’s interpretation of relevant sections of the EP Act, which are described in the guideline, is aimed at providing clear and consistent advice for the determination, assessment and remediation of site contamination.

Specifically, the guideline provides the EPA’s interpretation of the definition of site contamination for the regulation of the relevant provisions of the EP Act.

5.2 Purpose and development of the legislation

The EPA promotes the objects of the EP Act\textsuperscript{19}, which consider the protection of the environment and human health for future generations. The objects promote the principles of ecologically sustainable development and ensure that all reasonable and practicable measures are taken to protect, restore and enhance the quality of the environment.

The EP Act provides the definition of environmental harm,\textsuperscript{20} which includes an environmental nuisance\textsuperscript{21}. In a contemporary sense, environmental harm is caused by the act of polluting. This typically relates to an incident that takes place at a point in time. The environmental harm incident must have occurred post commencement of the EP Act (1 May 1995).

In a number of circumstances, the time frame within which the harm to the environment\textsuperscript{22} took place may not be precisely known and, therefore, is considered ‘historic’ in nature. The site contamination provisions in the EP Act are intended to retrospectively\textsuperscript{23} address harm that is likely to have occurred before the commencement of the EP Act.

The EP Act defines key terms that relate to the assessment, remediation and auditing of site contamination. Additionally, the EP Act establishes a general environmental duty\textsuperscript{24}, which creates an obligation for persons to avoid causing pollution, environmental nuisance and environmental harm\textsuperscript{25}.

The EP Act requires the statutory notification to the EPA of a particular type of site contamination\textsuperscript{26}, specifically, the notification of site contamination that affects or threatens underground water.

Selected key provisions of the EP Act that relate to site contamination and relevant EPA guidelines have been included in Appendix 1. The EPA encourages consultants and auditors to understand and refer to the relevant sections of the EP Act for the assessment, remediation and auditing of site contamination in South Australia.

\textsuperscript{19} Refer to section 10 of the EP Act for the objects of the Act.
\textsuperscript{20} Refer to section 5 of the EP Act for the definition of environmental harm.
\textsuperscript{21} Refer to section 3(1) of the EP Act for the definition of environmental nuisance.
\textsuperscript{22} Refer to section 3(1) of the EP Act for the definition of the environment. Refer also to the Glossary in this guideline.
\textsuperscript{23} Refer to section 103B of the EP Act for the application of Part 10A – Special provisions and enforcement powers for site contamination.
\textsuperscript{24} Refer to section 25 of the EP Act for general environmental duty.
\textsuperscript{25} Refer to section 5 of the EP Act for environmental harm.
\textsuperscript{26} Refer to section 83A of the EP Act.
5.3 Definitions

Site contamination is defined in the EP Act as follows:

<table>
<thead>
<tr>
<th>Section 5B—Site contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) For the purposes of this Act, site contamination exists at a site if—</td>
</tr>
<tr>
<td>(a) chemical substances are present on or below the surface of the site in concentrations above the background concentrations (if any); and</td>
</tr>
<tr>
<td>(b) the chemical substances have, at least in part, come to be present there as a result of an activity at the site or elsewhere; and</td>
</tr>
<tr>
<td>(c) the presence of the chemical substances in those concentrations has resulted in—</td>
</tr>
<tr>
<td>(i) actual or potential harm to the health or safety of human beings that is not trivial, taking into account current or proposed land uses; or</td>
</tr>
<tr>
<td>(ii) actual or potential harm to water that is not trivial; or</td>
</tr>
<tr>
<td>(iii) other actual or potential environmental harm that is not trivial, taking into account current or proposed land uses.</td>
</tr>
<tr>
<td>(2) For the purposes of this Act, environmental harm is caused by the presence of chemical substances—</td>
</tr>
<tr>
<td>(a) whether the harm is a direct or indirect result of the presence of the chemical substances; and</td>
</tr>
<tr>
<td>(b) whether the harm results from the presence of the chemical substances alone or the combined effects of the presence of the chemical substances and other factors.</td>
</tr>
<tr>
<td>(3) For the purposes of this Act, site contamination does not exist at a site if circumstances of a kind prescribed by regulation apply to the site.</td>
</tr>
</tbody>
</table>

The provisions relating to site contamination are primarily within Part 10A of the EP Act. This Part is entitled ‘Special provisions and enforcement powers for site contamination’, and includes sections 103A to 103ZB. Site contamination provisions are also found in Part 5 and Schedule 3 of the Regulations.

Various definitions are provided in section 3(1) of the EP Act. Definitions (from section 3) that are relevant to the assessment, remediation and auditing of site contamination include:

- activity (refer to section 6.3 of this guideline)
- appropriate person
- background concentrations (refer to section 6.4 of this guideline)
- cause
- chemical substances (refer to section 6.2 of this guideline)
- land (refer to section 6.5 of this guideline)
- occupier
- owner
- remediate
- sensitive use
- site

Section 5(3) of the EP Act enables the Regulations to prescribe that, in certain situations, site contamination will be taken not to exist at a site. Currently, there is nothing prescribed for this purpose.
Assessment and remediation of site contamination

- site contamination audit
- site contamination auditor
- site contamination audit report
- site contamination audit statement
- site contamination consultant
- undertake
- waste
- water (refer to section 6.6.2 of this guideline).

The Glossary in this guideline provides a range of definitions related to the assessment, remediation and auditing of site contamination. The Glossary reflects definitions outlined in the ASC NEPM for national consistency.
6 Site contamination determination framework

6.1 Overview

The key steps in the determination of the existence of site contamination are provided in Figure 2. This includes references to all components of site contamination, which are further described in sections 6.2 to 6.8 of this guideline.

Figure 2—Key steps in determining the existence of site contamination

Notes:
1. The definition of water is provided in section 6.6.2 of this guideline.
2. The definition of land use is provided in section 6.5 of this guideline.
6.2 Chemical substances

A chemical substance is defined in section 3(1) of the EP Act to mean any organic or inorganic substance, whether a solid, liquid or gas (or combination thereof), and includes waste.

In relation to the presence of chemical substances in the environment, the EPA considers chemical substances to be present from either or both:

- naturally occurring processes
- the release of chemical substances from an activity undertaken at the site or elsewhere.

Chemical substances that are anthropogenic in origin are termed in this guideline as ‘manufactured’ chemical substances or ‘non-natural’ chemical substances.

The source of naturally occurring chemical substances is typically from processes such as erosion and weathering of mineral deposits. Chemical substances may be found in soils, groundwater and soil vapour at varying naturally occurring background concentrations. These concentrations will be dependent on, and are influenced by, topography, geography and the physical, biological and chemical properties in the soil and/or groundwater.

Chemical substances analysed for the purpose of determining groundwater hydrogeochemical properties (for example, cations and anions) should not be considered in the determination of harm to water unless they have been identified as a potential chemical of interest associated with an activity undertaken at the site or elsewhere.

6.3 Activity

Section 3(1) of the EP Act defines an ‘activity’ as the storage or possession of a pollutant.

A potentially contaminating activity (PCA) is an activity that has an increased likelihood of causing site contamination. The identification of whether a PCA has occurred at or adjacent to a site will assist in determining whether site contamination is suspected to exist and can help to determine who has responsibility for assessment and remediation.

It is necessary to consider whether a potentially contaminating activity or land use has occurred on a site, as this may be a trigger for assessment, remediation and/or auditing of a site.

Refer to section 2.2 of this guideline for information about triggers for assessment and remediation.

The occurrence of a prescribed PCA is the basis for the EPA to suspect that site contamination exists at a site. Where this is the case, the EPA may issue a Site Contamination Assessment Order in accordance with section 103H of the EP Act (refer to section 3.2 of this guideline).

In determining if a prescribed PCA has occurred, the EPA will consider all current and former uses of the site. Consideration will also be given to whether a PCA has occurred in the vicinity of the site as the migration of chemical substances from the site or an adjacent site may result in site contamination elsewhere.

Additionally, the presence of chemical substances (for example nitrates) in isolation associated with the following activities, and no other known contributions, are not considered to represent activities associated with the determination of site contamination:

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28 Anthropogenic means created/produced by people or caused by human activity.
29 Regulation 50 provides the definition of potentially contaminating activities.
• septic tanks
• wastewater and mains water pipework connections
• domestic use of fertilisers (in accordance with manufacturer’s specifications).

A reproduction of Schedule 3 Parts 1 and 2 of the Regulations, current at the time of publication, which provides the prescribed potentially contaminating activities, is included in Appendix 7 of this guideline.

6.4 Background concentrations

6.4.1 Definition

The definition of the term ‘background concentrations’ is provided in section 3(1) of the EP Act. This section requires the EPA to establish guidelines on how to carry out an assessment to determine background concentrations. This section of this guideline is provided for this purpose.

The EPA considers that the background concentration of a chemical substance on or below the surface of a site is the sum of:

• the concentration of the chemical substance that occurs naturally (if any)
• the ambient concentration of the chemical substance (if any) that results from diffuse or non-point sources by general anthropogenic activities not attributed to industrial, commercial or agricultural activities.

The concepts in the determination of background concentrations are represented in Figure 3. Additionally, the ASC NEPM defines background concentrations as meaning the naturally occurring, ambient concentration of a chemical substance in the local area of a site.

![Figure 3—Concepts in the determination of background concentrations](image)

The first step in determining whether or not site contamination exists is to assess whether chemical substances are present above background concentrations (if any). Additionally, an activity introducing the chemical substance must have taken place at the site or elsewhere for site contamination to exist. By definition, site contamination cannot be determined to exist unless background concentrations (if any) of relevant chemical substances have been established. Therefore, site contamination is only present if the concentrations (obtained during the assessment) exceed background concentrations.

If a chemical substance is not naturally occurring, the EPA considers there is no background concentration of that chemical substance. In such instances, any detection of that chemical substance above the appropriate laboratory reporting/detection limit, that is, limits of reporting (LOR) is in concentrations above the background concentration.

In some instances, however, it is not necessary to establish background concentrations to determine whether actual or potential harm exists. For example, in relation to a chemical for which constituents are known and that is not expected to have been released to the environment from any source other than the site, background data is not necessary. This is the case for most manufactured chemical substances (for example, refined petroleum hydrocarbons) but also includes some chemical substances that can be found naturally occurring in the environment.
Natural chemical substances fall into this category. When a natural chemical substance enters an environment in which it was not previously associated, due to an anthropogenic activity, this is considered to be above the natural background concentrations. An example of this includes the release of crude oil from deeper to shallower aquifers as a result of drilling activities. In this instance, the appropriate background concentration to be adopted is ‘zero’.

Certain regions of South Australia are known to have naturally occurring metals and metalloids in soils, surface water and/or groundwater.

For further information about determining naturally occurring chemical substances, refer to:


In the absence of undertaking a background concentration assessment for a chemical substance that may also have a naturally occurring concentration in the environment, the EPA will consider the background concentration to be the LOR.

The EPA acknowledges that, in some instances, chemical substances widely considered to be of a manufactured origin are also found to be naturally occurring in the environment. The process to address this potential issue for the purpose of determining whether site contamination exists is detailed in the subsequent sections. The assessment of background concentrations is expected to be undertaken in accordance with the following framework.

The EPA expects that when assessing background concentrations, as defined in section 3(1) of the EP Act, the assessment will be undertaken in accordance with Schedules B1, B2 and B5 of the ASC NEPM.

6.4.2 Background concentration—soils

Consideration of background soil quality (that is, the background concentration of chemical substances in soil) should be undertaken in accordance with the guidance provided in Schedules B1, B2 and B5 of the ASC NEPM.

The specific determination of the ambient background concentration is required for derivation of some of the ecological investigation levels (refer to Schedule B1, section 2.5.7 of the ASC NEPM, and section 6.4 of this guideline). The method for the assessment of soil quality should be undertaken in accordance with Schedule B2 of the ASC NEPM.

Assessment of the ambient background concentration is only relevant when considering metals or metalloids. The background concentration for organic chemical substances of anthropogenic origin should normally be ‘zero’.

6.4.3 Background concentration—groundwater

The EPA considers there to be no background concentration for non-naturally occurring chemical substances identified in groundwater (that is, manufactured chemical substances). However, the EPA acknowledges that in the course of undertaking groundwater assessments for the purpose of site contamination, some chemical substances may be present from naturally occurring processes or as a result of anthropogenic activities, that is, the release or loss of chemical substances.

A desktop assessment of the background groundwater quality should be completed prior to undertaking intrusive investigations at a site.

The EPA will consider non-intrusive investigations to demonstrate background concentrations for groundwater if the following conditions are met:

- the information has been sourced during the preparation of a preliminary site investigation (PSI)
- the preliminary assessment or PSI is comprised of a desktop review that includes accurate and reliable information that is used to develop and inform the localised groundwater quality.
Intrusive investigations to demonstrate background concentrations may not be necessary if suitable information is available through a desktop review of existing data. The approach for the assessment of background groundwater quality is provided in Schedule B6 of the ASC NEPM. The methodology for the collection of data to assess groundwater quality should be conducted in accordance with Schedule B2 of the ASC NEPM (also refer to Part 3A and Part 3B of this guideline).

Guidance on the scope of a groundwater assessment and consequently assessment of the determination of background concentrations in groundwater is provided in Schedule B2, section 8.1.2 of the ASC NEPM.

6.4.4 Background concentration—soil vapour

The EPA considers that if petroleum or chlorinated hydrocarbons are detected in soil vapour, these results would not typically represent background concentrations. In some instances, they may be naturally occurring. However, this would not generally be the case.

Refer to section 13 of this guideline for technical guidance on the assessment of soil vapour and vapour intrusion.

Some bulk ground gases (also referred to as hazardous ground gases and landfill gas) may also be present due to naturally occurring processes. In these circumstances, the results would be considered to represent background concentrations. The contribution of these bulk ground gases (such as methane) would need to be considered separately from any gases associated with a specific potentially contaminating activity (that is, landfill gas generated from a landfill) (refer to section 14.3 of this guideline).

If remediation or mitigation of soil vapour and/or naturally occurring ground gases is identified during the course of assessment, it is recommended that consultants (and auditors as required by legislation) determine if a potentially hazardous circumstance exists. Refer to section 7.2 of this guideline.

6.4.5 Naturally occurring chemical substances and background

Naturally occurring chemical substances, such as acid sulfate soils and naturally occurring explosive levels of methane, can pose a risk of harm if disturbed.

Where there are naturally occurring chemical substances in soils, surface water, groundwater and soil gas (vapour) that pose a risk of harm to human health/environment (taking into account the current or proposed land use(s)), assessment or management may be required to mitigate or prevent the risk of harm. This scenario may be identified during the process of preparing a conceptual site model (CSM)\textsuperscript{30} for a site, where an exposure pathway to a receptor may exist. Advice may be sought from the EPA in developing appropriate management measures.

If disturbed, as the result of an activity undertaken at or in the vicinity of a site, the consequent elevated concentration of the naturally occurring chemical substance may result in site contamination. For example, the release of a naturally occurring chemical substance through its mobilisation in soils and/or groundwater, as a result of a change in pH. The observed mobilised naturally occurring chemical substances may result in site contamination either by:

- actual or potential harm to the health and/or safety of human beings that is not trivial, taking into account the current or proposed land uses
- actual or potential harm to water that is not trivial
- other actual or potential environmental harm that is not trivial, taking into consideration the current or proposed land uses.

\textsuperscript{30} For further guidance on preparing a conceptual site model (CSM) refer to section 11.5 of this guideline.
6.5 Land use

The determination of whether site contamination exists in relation to human health and safety and the environment takes into account the current or proposed land uses for a site. The EPA considers proposed land use to be that proposed through a mechanism provided by the Development Act 1993.

An important concept to consider is that chemical substances may exist at a site, but the presence of these substances may or may not result in the existence of site contamination due to the type of land use. For example, the presence of a chemical substance in soils at an industrial site may not result in site contamination. However, if the land use was changed to a sensitive use, the same concentration of the chemical substance may cause site contamination to exist. (‘Sensitive land use’ is defined in section 3(1) of the EP Act.)

It is important to understand that the determination of the existence of site contamination based on actual or potential harm to water that is not trivial is not dependent on land use. Further information about the liability for site contamination, where it is caused by a change of land use, is provided in section 8.3 of this guideline.

Refer to section 2.2 of this guideline for information about the triggers for assessment, remediation and auditing that relate to changes to land use in planning and development processes.

6.6 Actual or potential harm to water that is not trivial

6.6.1 Overview

The EPA considers it crucial that auditors and consultants have a clear understanding of section 5B of the EP Act. This section defines whether or not site contamination exists. Of particular importance is understanding the component of section 5B that considers actual or potential harm to water that is not trivial.

As site contamination typically relates to historic harm, identified ‘impacts’ to the environment may represent actual harm. In most circumstances, the aspect of whether the impact or harm is trivial will be determined by the facts of each matter, as identified at each stage of assessment. However, site contamination is not merely actual harm, as the EP Act also contemplates potential harm.

The following section details each component of ‘actual or potential harm to water that is not trivial’.

6.6.2 Water

Section 3(1) of the EP Act states the following:

<table>
<thead>
<tr>
<th>Section 3(1)—Water means</th>
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<tbody>
<tr>
<td>(a) water occurring naturally above or under the ground; or</td>
</tr>
<tr>
<td>(b) water introduced to an aquifer or other area under the ground; or</td>
</tr>
<tr>
<td>(c) an artificially created body of water or stream that is for public use or enjoyment</td>
</tr>
</tbody>
</table>

In South Australia, water quality is protected by the EP Act and the Environment Protection (Water Quality) Policy 2003 (WQ EPP), which provides for the protection of the state’s surface, marine and underground water resources. The WQ EPP aligns South Australia with the National Water Quality Management Strategy (NWQMS). Its main objective is to ‘…achieve the sustainable management of waters, by protecting or enhancing water quality while allowing economic and social development’.

For technical information about the assessment of groundwater, refer to section 12 of this guideline.
6.6.3 Actual harm to water

The EPA understands that there are many opinions on what is considered to be ‘harm to water’ (in particular groundwater). These opinions are based on the (actual or potential) use of the groundwater; published criterion (state, national and international); risk assessment (simple and complex); water parameters (yield, chemistry, depth, quality); receptors (human, environment, age and duration of exposure); and the chemical substance (toxicity, volatility).

Whilst all these considerations are important, they are factors for inclusion in a subsequent risk assessment. Additionally, the EPA considers, for groundwater, that it is not possible to simply provide a list of chemical substances and a corresponding value (or set of values) that, if exceeded, represents harm.

‘Harm’ is defined as: injure, damage or hurt. Therefore, ‘actual harm’ is when damage has already occurred.

The EPA considers that actual harm to water (groundwater) exists when a chemical substance (from anthropogenic origin, manufactured or non-natural), resulting from an activity undertaken at the site or elsewhere, is detected in groundwater (above LOR). That is, the chemical substance should not be present in the groundwater and its presence (regardless of concentration) represents harm to the groundwater.

6.6.4 Potential harm to water

‘Potential’ is defined as: ‘capable of coming into being or action; latent’. The EP Act states ‘potential harm includes risk of harm and future harm’.

Therefore, the EPA considers that potential harm to water (groundwater) may exist when a chemical substance (from anthropogenic origin, manufactured or non-natural), resulting from an activity undertaken at the site or elsewhere, is capable of causing actual harm to groundwater.

Such future harm may occur through natural processes, such as migration within an aquifer or through soils.

6.6.5 Determination of ‘not trivial’

‘Trivial’ is defined as being of little value or importance, something that is not worth mentioning or, in a legal sense, beneath the dignity of the Court.

Actual or potential harm to groundwater may exist at a site. However, it may not represent site contamination if the harm is trivial. Nevertheless, the harm would remain at the site.

The EPA considers the following circumstances to represent actual harm to groundwater that is trivial:

- concentrations of a chemical substance detected in groundwater that is isolated and has no current or future exposure pathway(s), and will not migrate off the site; and
- further assessment or remediation will not be required. This includes groundwater monitoring events and/or the triggers for assessment and remediation as outlined in section 2.2 of this guideline.

In such circumstances, site contamination does not exist as the harm is trivial.

Additionally, the presence of chemical substances (for example, nitrates) associated with the following activities are likely to represent harm to water that is trivial:

- septic tanks
- wastewater and mains water pipework connections

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31 Section 5(2) of the EP Act states for the purposes of the Act what potential harm includes.
6.7 Actual or potential harm to health or safety of human beings that is not trivial, taking into account the current or proposed land uses

The determination of actual or potential harm to the health or safety of human beings that is not trivial should be based on the findings of preliminary, detailed and site-specific investigations, conducted as part of a risk-based assessment. The EPA recommends that consultants, require auditors to, use the framework outlined in Schedule B2 of the ASC NEPM and other relevant guidance issued by the EPA.

Consideration must be given to the appropriate application of human health investigation levels (HILs), health screening levels (HSLs), interim HILs for soil vapour and asbestos screening levels, described in the ASC NEPM. Selection of appropriate landuse scenarios and potential exposure pathways (in the context of an appropriate CSM and data quality objectives (DQO)) should also be considered when defining actual or potential harm to human health or safety.

6.8 Actual or potential environmental harm that is not trivial, taking into account the current or proposed land uses

Determining whether the conditions for environmental harm have been met may be based on the findings of preliminary or detailed ecological risk assessments conducted in accordance with Schedules B2 and B5 of the ASC NEPM and other relevant guidance issued by the EPA (refer to section 10.3 of this guideline).

Consideration must be given to the appropriate application of ecological investigation and screening levels (described in the ASC NEPM). On selection of appropriate landuse scenarios and potential exposure pathways (in the context of the CSM and data quality objectives (DQO)), the EPA recommends consultants and auditors consider whether actual or potential environmental harm that is not trivial, taking into account the land uses, exists.

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32 Prior to conducting a detailed ecological risk assessment, it is recommended that consultants and auditors discuss the issues with the EPA.

33 Consult with the EPA for guidance on areas of high ecological value.
7 Notification requirements

7.1 Mandatory notification—Section 83A

Section 83A of the EP Act requires a specific person (owner, occupier, auditor and/or consultant) to notify the EPA in writing as soon as reasonably practicable after becoming aware of the existence of site contamination at a site or in the vicinity of a site that affects or threatens water occurring naturally under the ground or introduced to an aquifer or other area under the ground. Refer to section 6 of this guideline for the framework on the determination of site contamination.

Groundwater contamination can travel and expand over large distances, which can become a significant risk to human health. For this reason, notification of groundwater contamination to the EPA is very important.

At the time of notification, the risks associated with the groundwater contamination may not be understood. The triggers for further assessment, remediation or auditing will be determined by the facts of each case. In some circumstances, the EPA may require further assessment, remediation and/or auditor engagement using site contamination regulatory provisions (refer to section 2.3 of this guideline).

If a person, who has a duty to report, is relying on another person to undertake reporting, then proof that reporting has occurred should be confirmed.

Refer to the EPA publication: Section 83A - Notification of site contamination that affects or threatens underground water, for guidance.

7.2 Hazardous circumstances—acute or chronic risk to human health

Hazardous circumstances include those that pose an acute or chronic risk to the health or safety of human beings (human health) and/or an acute risk to the environment. They may also include circumstances arising from activities undertaken at a site, including remediation.

7.2.1 Human health

Hazards to human health may be acute (imminent exposure) or chronic (threshold and non-threshold). The ASC NEPM describes the process for assessing hazard identification to human health as the following:

- the types of (adverse) health effects that may be caused by chemical substances (as defined in the EP Act)
- the time and duration of exposure that is required for an adverse health effect to occur.

The EPA considers that an acute exposure risk, via any pathway, represents actual or potential harm to the health or safety of human beings that is not trivial.

A chronic exposure risk is considered to represent an actual or potential long-term effect on human health.

For further information about the identification of an acute and chronic exposure risk from vapour, refer to ‘Risk Assessment Framework’ in: Guidelines for the assessment and management of sites impacted by hazardous ground gases (NSW EPA 2012).

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34 Refer to section 83A of the EP Act for the definition and mandatory requirements for notification of site contamination of underground water.

7.2.2 Responsibility for notification

The responsibility of hazard identification lies with auditors and suitably qualified and experienced consultants, as part of the assessment, remediation and auditing of site contamination.

When a hazardous circumstance is identified from assessment work or remediation being undertaken at a site, it is advised that the EPA be notified as soon as reasonably practicable. Whilst there is no statutory requirement for consultants to notify the EPA, the EPA considers that a consultant has a professional duty to ensure that the people of South Australia are not exposed to hazards resulting from site contamination. This notification ensures that appropriate risk mitigation measures and community engagement may be undertaken by the EPA and, where possible, the person who has liability for the site contamination.

Refer to section 19 of this guideline for information about community engagement. Specific requirements for auditors in relation to notification of hazardous circumstances are described in the EPA publication: Guidelines for the site contamination audit system (2014).

In general, any hazardous circumstance notification should occur verbally as soon as an auditor or consultant becomes aware of the issue. Formal notification in writing should be provided within 48 hours.

In addition, where appropriate (e.g., an immediate, uncontrolled explosion hazard), advice should also be provided to the:

- police, fire or ambulance (000)
- EPA Pollution and Environmental Incident Reporting Line: (08) 8204 2004 or 1800 623 445 (country).
8 Liability for site contamination

8.1 Appropriate persons

Once it has been determined that site contamination exists, it is necessary for the EPA to consider who has liability for the site contamination.

In specified circumstances the EPA can issue a Site Contamination Assessment Order or a Site Remediation Order to the ‘appropriate person’. The ‘appropriate person’ is determined by the EPA in accordance with the EP Act. There are several ways in which a person can become an ‘appropriate person’ (or have liability for site contamination) and these are discussed in the following sections.

The EP Act adopts the ‘polluter pays principle’. This means the person who caused the site contamination is responsible for implementing and funding the assessment, remediation and, if necessary, an audit.

Site contamination is often historic in nature, and the person or company who caused the site contamination may not be the same person or company who currently owns or occupies the site. In order for the polluter pays principle to be successful, the determination of the appropriate person is retrospective in its application. This allows historic site contamination, that occurred prior to the commencement of the EP Act, to also be addressed.

Where the EPA is satisfied that site contamination exists, the person who caused the site contamination at the site will be the ‘appropriate person’ and can be issued with a Site Contamination Assessment Order or Site Remediation Order.

The EP Act sets out some circumstances where it is not considered practicable to issue an order to the person who caused the site contamination. In such cases, the EPA may issue the order to the site owner, if the owner is the ‘appropriate person’ for the purposes of section 103C of the EP Act.

If the EPA suspects that site contamination exists because a potentially contaminating activity has occurred at the site, the EPA can only issue a Site Contamination Assessment Order to the owner of the site, provided the owner is an ‘appropriate person’ for the purposes of section 103C of the EP Act. In such cases, section 103H(3) provides that ‘the order must be limited in its application to site contamination on or below the surface of the site’.

Section 103G of the EP Act allows the ERD Court to order that a director of a body corporate is the appropriate person in certain circumstances.

8.2 More than one appropriate person

If there are two or more appropriate persons (for example, multiple polluters), the EPA may determine that the order be issued to any one, or more, appropriate persons. Two or more people issued with an order are jointly and severally liable to comply with the requirements of the order.

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36 Refer to sections 103H and 103J of the EP Act for relevant provisions for the EPA issuing orders.
37 Refer to section 103C of the EP Act for the definition of an appropriate person.
38 Refer to the EPA publication: Site Contamination: Site contamination auditors.
39 Refer to section 103B of the EP Act for information about the site contamination provisions and retrospectivity.
40 Refer to section 103J(1)(a) of the EP Act.
41 Refer to section 103C(3) of the EP Act.
42 Refer to section 2.2 of this guideline.
8.3 Causing site contamination by changing site use

The EP Act defines who ‘is taken to have caused site contamination’\(^{43}\). Typically, this is the person who occupied the land ‘when there was an activity on the land that caused or contributed to the site contamination’\(^{44}\). However, ‘if site contamination would not have resulted at a site but for a change of use of a kind prescribed by regulation\(^{45}\), the person who brought about the change of use of the site is to be taken to have caused the site contamination for the purposes of the EP Act\(^{46}\).

As previously discussed, it is important for the EPA to determine who has liability for site contamination. It should be noted whether actual or potential harm to water (groundwater) that is not trivial (site contamination of groundwater) has previously been determined to exist and a subsequent change of use is proposed at a site (that is, by a developer), as the liability for the site contamination of groundwater may not necessarily lie with the developer. The EPA will determine liable persons and consider each case on its facts.

For example, an industrial site may have chemical substances in the soils that present no risk to human health, water or the environment based on its current land use and, hence, ‘site contamination’ may not exist. However, if a person decides to develop the site for a sensitive use\(^{47}\) that, as a consequence of the change in use, results in harm or potential harm to human health, ‘site contamination’ may exist as a result. As the site contamination only arose due to the change in land use, the person who brought about the change is taken to have caused the site contamination for the purposes of section 103D(2) of the EP Act and, therefore, is the ‘appropriate person’ to be issued with a Site Contamination Assessment Order or a Site Remediation Order.

8.4 Refusal of entry onto land

Where an order has been issued that requires assessment or remediation of land not currently occupied by the person who caused the site contamination, permission must be obtained from the occupier/owner of this land to gain access and carry out the necessary assessments or remediation. If permission is withheld or withdrawn to access the land, the EPA may issue a Site Contamination Assessment Order or a Site Remediation Order to the owner/occupier of the land as if they were the appropriate person. For further information about orders, refer to section 3.2 of this guideline.

8.5 Transfer of liability

Section 103(E) of the EP Act allows for the total or partial transfer of liability for site contamination from vendor to purchaser or transferee in certain circumstances. For further information, refer to the EPA Information Sheet: Site contamination: Transfer of liability (2010).

8.6 Off-site liability and auditor engagement

Given the complexity of some site assessments, in particular where site contamination extends beyond the site boundary, the EPA expects and may require an auditor to be engaged if a potential health risk is identified.

Figure 4 summarises the circumstances where the EPA considers it necessary for the person with liability to either engage an auditor and/or discuss the issues with the EPA prior to completion of any investigations. Figure 4 assumes that site contamination exists. It is assumed that the liability for on- and off-site contamination has been determined (refer to section 8.1 of this guideline). Where current residential land use exists, and no potentially contaminating activity and/or known site contamination issues have been identified, an audit is generally not required. Where commercial/industrial land is being redeveloped for a sensitive use, it is generally expected that an audit would be required by the planning authority prior to granting development/planning consent/approval.

\(^{43}\) Refer to section 103D of the EP Act.
\(^{44}\) Refer to section 103D of the EP Act.
\(^{45}\) Refer to regulation 51 of the Regulations.
\(^{46}\) Refer to section 103D(2) of the EP Act.
\(^{47}\) Refer to Part 1, section 6.5 of this guideline.
Figure 4—Trigger for auditor engagement in managing off-site contamination issues

Notes:

1. This would include a site where a change to a sensitive use is proposed, taking into account the triggers identified in section 2.2 of this guideline. Auditor engagement is likely to be requested by the planning authority or the EPA. This may be associated with planning and development processes/approvals/consent (refer to section 2.5 of this guideline).

2. Auditor to discuss with the EPA prior to completion. Related key issues to discuss with the EPA may include project assessment and remediation milestones/time frames, remediation (management) endpoints, vulnerable populations, and community and stakeholder engagement.

3. This would include the following waterbodies: inland, marine and groundwater. Where an unacceptable risk to an environmental value has been identified, discussion with the EPA to take place prior to completion of final reports to identify appropriate risk-based management options. For further information refer section 11.4 of this guideline.

4. Not necessary unless advised or required by the EPA. Discussion to take place with the EPA prior to completion of final reports to identify appropriate risk-based management options.

5. The assessment, remediation and auditing of non-sensitive use sites where site contamination extending off site poses a risk to receiving environmental values necessitates discussion with the EPA prior to completion of final reports, to identify appropriate risk-based management options.
9 Legislative reporting provisions and other information

9.1 Reports by auditors and consultants

Section 103ZA of the EP Act states:

<table>
<thead>
<tr>
<th>Section 103ZA—Reports by site contamination auditors and consultants</th>
</tr>
</thead>
<tbody>
<tr>
<td>A site contamination auditor or site contamination consultant must, in any written report that the auditor or consultant prepares in relation to a site, clearly qualify any statement of the auditor's or consultant's opinion as to the existence of site contamination at the site by specifying the land uses that were taken into account in forming that opinion.</td>
</tr>
<tr>
<td>Penalty: Division 5 fine</td>
</tr>
</tbody>
</table>

Refer to section 6.5 of this guideline for information about land use descriptions.

In reports, consultants and auditors are required to make qualified statements regarding the existence of site contamination for specified land uses under section 103ZA of the EP Act. Refer to Appendix 4 of this guideline for further information about reporting requirements.

Refer to Appendix 2 for divisional penalties.

The EPA does not consider it acceptable for a consultant to determine the suitability of land for a sensitive use where site contamination is suspected or known to exist at a site. In these instances, the EPA expects an auditor to be engaged to carry out a site contamination audit and prepare a site contamination audit report.

9.2 False or misleading information and reports

Consultants and auditors are, in many cases, reliant on the accuracy and completeness of the information that is provided to them. The information is used to design and/or review assessment or remediation programs. If the information provided is misleading, incomplete or deficient, then the conclusions by the consultant or auditor may be significantly incorrect or flawed.

The EPA also relies on the accuracy and completeness of reports to make decisions about risk to the health and safety of human beings and the environment.

Three sections of the EP Act (sections 103ZB, 119 and 120A) relate to honesty in reporting provisions.

If the EPA becomes aware that a person has not or may not have complied with section 103ZB, the EPA will investigate the matter and will, where appropriate, instigate further regulatory action (which may include criminal prosecution).

The EPA expects that consultants and auditors will make their clients aware of this provision before commencing assessment and/or remediation at a site.

Further information about compliance and enforcement is provided in the EPA publication: Compliance and enforcement regulatory options and tools (2009)

9.3 Information declaration form

The EPA has prepared a form that is intended to assist those who provide information to consultants or auditors that are preparing reports in relation to site contamination. It is expected that the use of this form will increase the reliability of the information provided to the consultant or auditor. A copy of the form is provided in Appendix 8 of this guideline.
The EPA suggests that consultants and auditors provide the form to the appropriate person(s) for completion prior to the commencement of an assessment and/or remediation program. It is recommended that consultants who provide information to auditors will complete this form in relation to the information they provide to the auditor.

The EPA further recommends that the completed form be included as part of the consultant’s or auditor’s report irrespective of whether or not the report is intended for provision to the EPA. Consultants and auditors are advised to accurately record and retain information provided by relevant persons.
Part 3A

Assessment: Overview and reporting framework
10 Assessment of site contamination

10.1 Overview

This section provides an overview of the tiered risk-based assessment process that should be applied in South Australia. It provides the EPA's approach for the assessment of site contamination, which promotes the protection of human health and the environment.

It is expected the assessment of site contamination will be carried out in a manner that is consistent with the recommended general process described in the flowchart in Schedule A of the ASC NEPM and the guidance provided in Schedule B of the ASC NEPM.

This section also provides a description of what is expected to be addressed in the reporting at each stage of an assessment. This guidance is not exhaustive as each site contamination assessment will present different issues in relation to the site's physical characteristics, chemicals of interest and risk receptors. It is expected that when additional specific assessments are undertaken that they are included in reports.

10.2 Tiered risk assessment process

The recommended framework for undertaking a tiered risk assessment is specifically outlined in Schedule B6 of the ASC NEPM. Concurrently, Schedule B2 of the ASC NEPM provides information about the design and implementation of soil, groundwater and soil vapour sampling programs and the presentation of site assessment reports.

A Tier 1 qualitative risk assessment (refer to Figure 5 of this guideline) may comprise preliminary site investigations (PSI) and detailed site investigations (DSI).

The objectives of these investigations are to:

- identify relevant contamination issues
- identify contaminants of concern
- identify areas of potential contamination and the potentially affected element of the environment (ie, soil, water, soil vapour)
- compare site data with generic investigation and screening levels.

The results of a Tier 1 qualitative assessment are reviewed against generic screening and investigation levels, including management levels. An initial screen of the data is required of consultants and auditors to determine whether further assessment is needed or whether sufficient information has been gathered to inform risk-based decisions for remediation in accordance with Part 4 of this guideline.

Tier 2 and Tier 3 quantitative risk assessments involve stages of the DSI and site-specific risk assessments (SSRA). A Tier 2 SSRA is considered quantitative, and may be undertaken as a staged approach where site-specific data is obtained to either:

- modify Tier 1 generic screening and investigation criteria
- create modified Tier 2 site-specific criteria.

Where this is not possible, the tiered risk assessment may proceed directly to a quantitative Tier 3 SSRA.

A Tier 3 SSRA may be required where Tier 2 modified criteria are exceeded and the potential for unacceptable risk to human health and/or the environment exists.
10.3 Investigation and screening levels

The following section describes the generic investigation and screening levels in the ASC NEPM adopted by the EPA. It also provides guidance on the application of the levels to determine whether site contamination exists and whether further investigation is required. The levels are not clean-up or response levels, nor are they to be used for desirable soil and/or groundwater quality. Similarly, the levels should not be interpreted as allowing discharge of chemicals up to these concentrations.

Tier 1 generic investigation and screening levels are applicable to the first stage of risk assessment. Soil, soil vapour and groundwater assessment levels are provided for commonly encountered contaminants that are applicable to generic landuse scenarios (soil and soil vapour) and environmental values (groundwater). The selection and use of the investigation and screening levels should be considered in the context of the iterative development of a conceptual site model (CSM) and include:

- health investigation levels (HILs)
- interim HILs for volatile organic chlorinated compounds (interim HILs)
- health screening levels (HSLs)
- ecological investigation levels (EILs)
- ecological screening levels (ESLs)
- groundwater investigation levels (GILs)
Assessment and remediation of site contamination

- petroleum hydrocarbon management limits (MLs).

Each Tier 1 level has specific application considerations (including landuse scenarios, depth, soil type and properties) and limitations that are required to be considered on a site-specific basis. They are taken into consideration to determine whether they are appropriate to be used and how they should be applied.

The application of the HSLs must be in the context of the site assessment framework described in the ASC NEPM. The framework includes the application of ESLs for consideration of ecological risks and MLs for consideration of risks to in-ground infrastructure, formation of low-density non-aqueous phase liquids (NAPL), fire and explosion hazards, and aesthetic issues.

Detailed guidance on the application of investigation levels (ILs), screening levels (SLs) and MLs, including supporting references, is provided in the ASC NEPM and supporting Toolbox.

Auditors and consultants are expected to familiarise themselves with this guidance and demonstrate the suitability of the application of selected ILs and SLs in reports.

In relation to the appropriate application of Tier 1 levels, appropriate data analysis, including summary statistics, should be applied as described in Schedule B1 and B2 of the ASC NEPM. As a minimum, the maximum and 95% UCL of the arithmetic mean should be compared with the Tier 1 levels.

Refer to Schedule B2, section 13 of the ASC NEPM for guidance on data quality assessments.

The Tier 1 assessment levels are to be used in the context of a Tier 1 screening risk assessment. However, where relevant assessment levels are not included, alternative assessment levels may be sourced from other jurisdictions or developed on a site-specific basis as part of the Tier 2 and 3 risk assessments.

Where alternative assessment levels are adopted, the relevance of exposure assumptions for the adopted assessment levels is required to be fully justified and documented in the assessment report. Where site-specific assessment levels are developed, the methodology should also be justified and documented.

10.4 Protection of the environment during assessment

There should be appropriate protection of the environment during site assessment. Guidance on how to address minimum measures that should be adopted to ensure the protection of the environment during site assessment is provided in Appendix 5 of this guideline.

10.5 Work health and safety

There should be appropriate work health and safety measures in place for any personnel involved in the assessment of site contamination in accordance with applicable work health and safety legislation (refer to the: Work Health and Safety Act 2012).

Guidance on how to address work health and safety issues applicable to both assessment and remediation is provided in Appendix 5 of this guideline.
11 Reporting framework

11.1 Overview and key components

The guidance provided in Schedule A and Schedule B2 of the ASC NEPM promotes a nationally consistent approach to the assessment of site contamination.

The key components of site contamination investigations as described in Schedule B2 of the ASC NEPM are as follows:

- desktop studies
- site inspection
- site history
- development of a conceptual site model (CSM)
- identification of data gaps
- development of data quality objectives (DQO)
- design of a sampling strategy, and sampling and analysis quality plans (SAQP)
- data collection
- data validation, analysis and interpretation, including risk assessment and iterative development of the CSM
- coherent accurate and reliable reporting.

The EPA expects consultants and auditors to apply the framework outlined in Schedule B2 of the ASC NEPM for characterising site contamination at a site.

11.2 Preliminary site investigation (PSI)

The PSI should be conducted with the framework and guidance provided in Schedule A and Schedule B2 of the ASC NEPM. The scope of the PSI should be sufficient to identify the potential chemicals of interest and the elements of the environment that are potentially affected by those contaminants.

An initial assessment, based on readily available information, should be incorporated into the PSI to determine whether the risk of site contamination exists. This desktop assessment should be undertaken before the development of an intrusive sampling program. Determination of background concentrations should also be undertaken at this stage via desktop or intrusive investigations (refer to section 6.4 of this guideline).

Preliminary investigations usually include:

- a desktop study to identify site characteristics—site location, site layout, building construction, geological and hydrogeological setting
- a site history assessment to identify historical owners/operators/occupiers, land uses and activities
- a site inspection to validate anecdotal evidence or historical information, and to identify additional evidence of potential contamination
- interviews with site owners, operators and/or occupiers
- preparation of a report.

Preliminary investigations usually commence with a site history. The scope of the PSI should be sufficient to identify potential chemicals of interest and the elements of the environment that are potentially affected by those contaminants and, therefore, the potential for site contamination to exist.

This desktop assessment should be undertaken before the development of an intrusive sampling program.
Assessment of environmental values (groundwater) and background concentrations should be undertaken at this stage via desktop or intrusive investigations.

While it is not necessary to delineate the extent of contamination at the preliminary investigation stage, in some instances, limited sampling may be undertaken. For example, where a potentially contaminating activity is identified (site history) a limited soil sampling plan may be undertaken. The preliminary investigations should be sufficient to determine whether site contamination exists.

If the results of the PSI indicate that site contamination is present or is likely to be present, an intrusive investigation will be required. Monitoring data should be screened against the relevant ILs, SLs and MLs. The relevant ILs, SLs and MLs should be selected on the basis of the land use and environmental values identified in the conceptual site model.

Where there is insufficient information to delineate the extent of contamination to enable site management strategies to be devised, then detailed site investigations (DSI) will be required.

Appendix 3 provides a checklist of information that should be included in an SSRA.

Limited sampling may be undertaken during a PSI. It is not necessary to delineate site contamination at the PSI stage. It is critical that background concentrations are determined if intrusive investigations are undertaken. If a thorough PSI concludes a history of non-contaminating activities and there is no other evidence or suspicion of contamination, no further investigation is required.

11.3 Detailed site investigations (DSI)

A DSI is required when the results of a PSI indicate that contamination is present or is likely to be present, and there is insufficient information to delineate the extent of contamination to enable management strategies to be devised.

The DSI should identify the nature of the contamination and delineate its lateral and vertical extent to a sufficient enough degree that an appropriate level of risk assessment may be undertaken. Where necessary, this provides the basis for the development of an appropriate remediation or management strategy.

Depending on the results of the site history investigations, the PSI and DSI may be incorporated into a single phase of investigation.

Appendix 3 provides a checklist of information that should be included in a DSI.

Under some circumstances, further assessment of contaminants exceeding Tier 1 investigation or screening levels may not be required, for example, where the extent of the exceedance and further assessment is not cost effective. Where no further assessment is proposed, a clear and transparent explanation should be provided in the DSI reports.

11.4 Site-specific risk assessment (SSRA)

A site-specific risk assessment (SSRA) may be necessary if the results of the Tier 1 (PSI or DSI) assessments indicate that site risks cannot be adequately remediated. If required, an SSRA should be conducted in accordance with the Tier 2 and 3 framework and guidance provided in Schedule A and Schedule B2 of the ASC NEPM.

Appendix 3 provides a checklist of information that should be included in an SSRA, which may be presented as part of the DSI reporting or may be prepared as a stand-alone document.

11.5 Conceptual site model (CSM)

A conceptual site model (CSM) is an essential component in the assessment of site contamination. It should inform the appropriate selection and application of Tier 1 ILs, SLs and MLs.

The overall aspects that should be incorporated in the CSM are described in Schedule B2, section 4 of the ASC NEPM.
As the approach to the assessment of site contamination in South Australia is risk based, the EPA considers that a weight-of-evidence approach demonstrating multiple lines of evidence is required to adequately prepare a well-characterised CSM.

The development of a CSM is an iterative process.

A preliminary CSM should be developed as part of the PSI and refined during each subsequent stage of assessment as new and more detailed information becomes available. The CSM should inform the appropriate selection and application of Tier 1 ILs, SLs and MLs.

It is important for auditors and consultants to understand the complexities associated with the assessment of a site. The CSM assists with identifying the key sources of contaminants, exposure pathways and receptors associated with the site. The ASC NEPM explicitly states that the ‘complexity of the CSM corresponds to the scale and complexity of the known or potential site contamination’. The sources of contamination may be associated with an activity undertaken at the site or, in some cases, may be from an off-site location.

In most cases where an activity related to the release of chemical substances from a primary source (for example underground storage systems) to the environment has occurred, secondary sources are most likely to be present as one of the following:

- non-aqueous phase liquid (NAPL)
- dissolved-phase contamination in groundwater
- sorbed contamination in soil.

Defining the primary and secondary sources of contamination is critical for the development of the CSM. Determining the subsequent zone of influence is essential for identifying potential receptors.

This will assist with better characterisation of the various elements of the environment, to determine potential preferential pathways, the zone of influence (related to the assessment of vapour contamination) and identification of the various receptors (human health and/or the environment).

Establishing a well-characterised CSM, with consideration of known or potential primary and secondary sources of contamination and potential preferential pathways, will better assist with determining any further assessment and/or remediation that may be necessary to manage the risks posed to the receptors associated with the site.

A CSM may be presented in a written format or in visual representation.

Appendix 3 of this guideline provides the recommended outline for the required elements of a CSM.

Further guidance on the iterative process for development of the CSM is provided in Schedule B2, section 4.2 of the ASC NEPM.
Part 3B

Assessment: Methodology Groundwater and Vapour Intrusion
12 Framework for the assessment of groundwater

12.1 Introduction

Part 3B of section 12 of this guideline provides the framework for the assessment of site contamination of groundwater in South Australia. The framework promotes the key site characterisation principles outlined in Schedules A and B2 of the ASC NEPM, in conjunction with the objects of the EP Act, specifically the protection of the environment for future generations.

Section 6 of this guideline provides the EPA’s position on the determination of site contamination and further describes actual or potential harm to water that is not trivial. The EPA considers water to include groundwater, and site contamination of groundwater is herein termed groundwater contamination.

12.2 Objectives

The assessment of groundwater for the purpose of determining whether site contamination exists at a site is ultimately for the protection of the existing environment and human health. Additionally, the objects of the EP Act promote the protection of the environment for future generations.

If groundwater contamination exists at a site, it is considered that there has been harm to that groundwater. During the course of undertaking desktop and intrusive investigations, the risk(s) associated with harmed groundwater will determine any remediation that may be required. Site contamination may still remain at a site, but through the process of assessment and remediation, an acceptable risk may be achieved where no further remediation is required.

The framework for the assessment of groundwater contamination takes into consideration risk-based decision making for remediation of the site contamination. This is the ultimate objective for addressing groundwater contamination.

12.3 Overview

The assessment of groundwater contamination is expected to form part of preliminary and detailed site investigations. The potential for groundwater contamination originating from other sites and causing potential harm to the site being assessed must also be considered.

Further information about undertaking PSI and DSI investigations is provided in Part 3A of section 11 of this guideline.

Guidance on the assessment of groundwater contamination is provided in Schedule B2 of the ASC NEPM.

When groundwater contamination is identified at a site, the following should be taken into consideration by consultants and auditors:

- Is the site the source of the groundwater contamination or does the groundwater contamination arise from outside the site?
- Will the groundwater contamination have any adverse impacts on the land uses that are being considered at the site?
- Does the groundwater contamination impact, or have the potential to impact, on the environmental value of the groundwater?
- Does the groundwater contamination have the potential to migrate outside the site boundaries or has it already migrated off-site?
- Is the groundwater contamination likely to present a human health risk to off-site receptors?
It is then necessary to consider remediation\footnote{Remediation is defined in section 3(1) of the EP Act and includes the treatment, containment, removal or management of chemical substances.} necessary to eliminate or prevent, as far as reasonably practicable, actual or potential harm to water that is not trivial (refer to Part 4 of this guideline).

When site contamination exists that affects or threatens water, landowners, occupiers, auditors and consultants have a duty to notify the EPA as described in section 83A of the EP Act (refer to Part 2, section 7 of this guideline).

When site contamination exists that affects or threatens groundwater and the EPA considers that action is necessary to protect human health (site-specific determination), the EPA may consider declaring a water restriction or prohibition area under section 103S of the EP Act (refer to Part 4, section 18.1 of this guideline).

The EPA has developed a reporting format for providing groundwater monitoring results to the EPA for notification and reporting purposes. The format requires the well permit numbers issued by DEWNR to be clearly identified for each monitoring well and related analytical data.

For guidance on this format, refer to the EPA publication: \textit{Notification of site contamination that affects or threatens underground water} (2008).

\section*{12.4 Groundwater assessment and delineation}

An initial hydrogeological assessment, based on readily available information, should be incorporated into the PSI. This assessment should be undertaken prior to the development of a sampling analysis and quality plan. This allows for initial site characterisation of local and regional hydrogeology, including the understanding of background concentrations of naturally occurring chemical substances in groundwater. This is generally undertaken as a desktop assessment and may include obtaining information from the EPA’s Public Register.

If the results of the PSI indicate that groundwater contamination is present or is likely to be present, an intrusive investigation will be required. The results of these investigations would be incorporated into the detailed site investigations and reporting.

Groundwater monitoring data should be screened against the relevant groundwater investigation levels (GILs) (refer to Table 1C, Schedule B1 of the ASC NEPM) selected on the basis of the environmental values identified in the conceptual site model.

The EPA expects that site-specific consideration should be given to water quality impacts that cause variations from ambient water quality even when GILs are not exceeded, particularly where these variations may be a result of a potentially contaminating activity. An example is elevated concentrations of metals in groundwater due to changes in water acidity (pH).

When determining the extent of groundwater contamination, the EPA generally considers non-detect boundaries of the chemical substances will define the lateral and vertical extents of the contamination. In certain circumstances, inferred extents of chemical migration, that is, using groundwater modelling programs, may be suitable to define the boundary of contaminant plumes in groundwater. However, this would represent supporting information to a multiple-lines-of-evidence assessment and conceptual site model. It is recommended that consultants discuss the use of modelling programs with auditors when engaged to complete an audit for a site.

\section*{12.5 Groundwater environmental values}

The EPA considers it essential that groundwater environmental values are determined at the Tier 1 stage of investigation. The EPA considers the multiple-lines-of-evidence approach is required to define appropriate groundwater environmental values for a site, thus forming part of the preliminary CSM.

Environmental values of waterbodies are considered to be the qualities of those waterbodies (inland, marine and groundwater) that need protection to ensure they are safe and suitable for the relevant purpose(s) or use(s). These...
values may be specified by the EPA for certain waterbodies in the South Australia Environment Protection (Water Quality) Policy (WQEPP) as updated from time to time.

Where the identification of an appropriate EV requires the collection of site-specific groundwater quality data (for example, salinity cannot be determined from a desktop or background assessment), the sampling and methodology should be consistent with Schedule B6 of the ASC NEPM.

The identification of appropriate EV for groundwater can be determined by comparing the field- or laboratory-measured total dissolved solids (TDS) in mg/L in groundwater with the values provided in the table in Appendix 6 of this guideline. If salinity concentrations are measured in alternative units, conversion to mg/L TDS is required to compare the data with the values provided in Appendix 6.

Where more than one EV for groundwater has been identified based on field- or laboratory-measured salinity levels, the EPA does not consider it reasonable to average the concentrations for the site. The EPA expects consultants and auditors to select the most conservative EV for groundwater and hence provide the highest level of protection to human health and the environment.

The EPA considers field sampling and/or laboratory analysis for salinity levels in mg/L TDS is the only approach to determine appropriate groundwater environmental values. If variability in the concentrations of salinity is observed during field or laboratory analysis, the EPA expects auditors and consultants to select the most conservative groundwater environmental value. The EPA considers this approach to defining groundwater environmental values protective of human health and the environment.

The EPA also considers other information obtained during preliminary investigations to provide supporting information to consultants and auditors when defining groundwater environmental values (for example, regional hydrological and geological information obtained as part of desktop site history investigations).

12.6 Light non-aqueous phase liquids (LNAPL)

The EPA considers the decision-making process for the assessment and remediation of non-aqueous phase liquid (NAPL) should be the same as for any other chemical substance. That is, NAPL requires adequate assessment and remediation so that it poses no unacceptable risk of harm to human health or the environment.

Direct and indirect indications of light non-aqueous phase liquids (LNAPL) associated with petroleum hydrocarbon contamination is provided in CRC CARE Technical Report 23. Where LNAPL is present and contains volatile organic compounds (VOCs), a site-specific assessment of vapour risk may be necessary. The EPA’s recommended approach to undertaking the assessment of vapour intrusion is provided in Part 3B, section 13.1 of this guideline.

Guidance on the assessment of LNAPL is provided in Schedule B2, section 8 of the ASC NEPM.

12.7 Dense non-aqueous phase liquids (DNAPL)

Determining the presence or absence of DNAPL is an important consideration for the development of the conceptual site model. However, direct visual observation of DNAPL does not occur at most DNAPL sites. Instead, the presence of DNAPL is usually inferred from converging lines of evidence. Site-specific considerations will dictate lines of evidence that should be pursued, which will be understood from the development of the CSM.

Further guidance on site investigation methods and interpretation techniques is provided in Schedule B2, section 8.3.3 of the ASC NEPM.

Similar to LNAPL, a site-specific assessment of vapour risk is likely to be required where DNAPL is present. Further information is available in Part 3B, section 13.2 of this guideline about the assessment of vapour intrusion.
13 Framework for the assessment of vapour intrusion

13.1 Overview

Site contamination may exist due to the presence of vapour intrusion arising from primary or secondary sources of contamination associated with petroleum and chlorinated hydrocarbons (vapour contamination).

For the purpose of triggering the requirement to undertake a vapour intrusion (VI) assessment, this guideline acknowledges that the presence of actual or potential volatile, semi-volatile or bulk ground gases have been identified within an element of the environment.

If an actual or potential hazardous circumstance is identified at any stage of the VI assessment, the EPA expects to be notified in accordance with Part 2, section 7 of this guideline.

13.2 Objectives

Where a PSI/DSI has identified actual or potential vapour contamination, there may be a risk to the health or safety of human beings on or off the site.

For the purpose of undertaking VI assessment, the EPA assumes that a PSI (as a minimum) has been completed. This is presented in Figure 6 in relation to identifying the presence of chemical substances that present a risk to the health or safety of human beings that is not trivial.

The ASC NEPM provides a framework for vapour assessment that must be considered by consultants and auditors. Further technical guidance on vapour intrusion assessment is provided in Part 3B, section 13 of this guideline. The EPA expects consultants and auditors to understand the limitations presented in the ASC NEPM and technical guidance documents when undertaking vapour assessments. In order to demonstrate that vapour intrusion/emission pathways are unlikely to be active or present a significant risk, multiple lines of evidence are required to be documented in a weight-of-evidence (commonly termed ‘multiple lines of evidence’) approach.

For further information about the multiple-lines-of-evidence approach and preferential pathways, refer to Schedule B2, section 9.2.4 and 9.3.4 of the ASC NEPM.

The assessment of vapour contamination and soil gas should only be undertaken by qualified and experienced professionals. Qualified and experienced persons undertaking preliminary and screening vapour assessments will be able to determine whether a site-specific assessment is required. The EPA will not accept reports that are undertaken by non-experienced persons, and may use regulatory measures to require the engagement of such a person.

As vapour contamination is known to be associated with both volatile and semi-volatile organic compounds, and other ground gases, the guideline separates the assessment process into the following three general sources of hazardous ground gases:

- petroleum hydrocarbon
- chlorinated hydrocarbon
- bulk ground gases.

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49 Guidance on appropriate qualifications and experience for environmental professionals is provided in Schedule B9 of the ASC NEPM.

50 Definition of hazardous ground gases: chemical substances present in either a gaseous or volatile phase (as presented in the NSW EPA 2012 guidelines). CIRIA C665 (2007) also presents a definition of hazardous ground gases as ‘gases generated below ground causing adverse impact to human health, environment or building structures’.

51 A definition of bulk ground gases is provided in section 1.3.1 of the: Guidelines for the assessment and management of sites impacted by hazardous ground gases (NSW EPA 2012).
If vapour intrusion is suspected of posing an existing or imminent threat to human health, including from inhalation exposure or risk of explosion, then immediate mitigation or management strategies should be implemented.

The EPA expects consultants and auditors to undertake vapour assessments in accordance with the tiered risk-based assessment and reporting framework outlined in Part 3A, section 10.2 of this guideline. Further guidance on components of a vapour assessment that should be incorporated into the tiered risk assessment are outlined in Figure 6.

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**Figure 6—Vapour intrusion (VI) assessment framework**

- **Tier 1**
  - PSI/DSI
  - Conduct preliminary VI assessment
  - Refer to Schedule B2 and B4 ASC NEPM
  - Prepare/review CSM
  - NAPL present?
  - Dissolved phase present?
  - VOCs present in soils?
  - Exposure pathway assessment
  - Prepare SAQP

- **Tier 2**
  - DSI/SSRA
  - Conduct screening VI assessment
  - Refer to Schedule B4 and B7 ASC NEPM
  - Revise CSM
  - Exposure pathway assessment
  - Is there an acceptable risk?
  - Is validation assessment required?

- **Tier 3**
  - SSRA
  - Conduct detailed VI assessment
  - Refer to Schedule B4 and B7 ASC NEPM
  - Revise CSM
  - Exposure pathway assessment
  - Is there an acceptable risk?
  - Is validation assessment required?

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It is recommended that consultants and auditors have an understanding of international technical documents and tools for the assessment of VI, specifically:

- Interstate Technology and Regulatory Council (ITRC): <www.itrcweb.org>
13.3 Preliminary vapour intrusion assessment

The EPA considers that once a well-characterised CSM has been established (refer to section 10.5) key findings for the completion of a preliminary VI assessment are most likely to have been addressed.

Using the multiple-lines-of-evidence approach and identification of open and closed preferential pathways at the Tier 1 risk assessment stage will assist consultants and auditors with defining the drivers for further assessment of VI.

As outlined in the framework for the assessment of VI identified in Figure 6 of this guideline, the EPA considers the main triggers for VI assessment to include the following:

- observation of measurable NAPL (undertaken during field investigations)
- determination of VOC saturated soil contamination within the vadose zone (saturated NAPL)
- determination of dissolved phase hydrocarbons
- volatile and semi-volatile chemical substances sorbed to soil (soil contamination).

The EPA considers the above factors to be critical information that should be identified at the Tier 1 risk assessment stage.

Auditors and consultants should also give greater consideration to modelled vapour contamination (from contaminated soil and/or groundwater) that may be incorporated in a preliminary VI assessment. The EPA considers this information to represent one line of evidence (refer to section 11.5 of this guideline).

The limitations and uncertainties associated with this approach need to be carefully understood by the professional practitioners undertaking this assessment.

Consultants, professional practitioners and auditors must identify the primary and secondary sources likely to have contributed to the chemical substances present in one or more of the contaminated elements of the environment.

CRC CARE Technical Report 23 defines primary sources as infrastructure associated with the activity that was undertaken either at or in the vicinity of the site. Secondary sources (commonly known as ‘contaminant sources’) relate to the contaminated element of the environment and the phase of the chemical substances causing the contamination, for example, soil and groundwater contamination. This information should be incorporated into the CSM established at the Tier 1 stage. The approach to the preparation of a CSM is iterative—as further information becomes available during the preliminary VI assessment, the CSM may require revision.

For further information about preparing a conceptual site model for PVI assessment, refer to Part 3A, section 11.5 of this guideline.

For further information about preparing a conceptual site model for PVI assessment, refer to Section 2 of the CRC CARE Technical Report 23.

For further information about site characterisation and preparing a conceptual site model, refer to Schedule B2, section 9.2.3 of the ASC NEPM.
13.4 Screening vapour intrusion assessment

The application of screening distances, and investigation and screening criteria, is considered at the screening VI assessment stage. This may form part of the Tier 1 and/or Tier 2 risk assessment stage as outlined in Figure 6 of this guideline.

Screening distances, in the context of vapour intrusion assessment, takes into consideration a sufficient distance between the source(s) of contamination and the receptor. Screening distances generally consider the ability for the volatile chemical substance to attenuate or degrade within the sub-surface.

Generally, the CSM prepared at the PSI or DSI stage of assessment allows consultants and auditors to determine appropriate screening measures that can be applied. Schedule B2, section 9.2.4 of the ASC NEPM provides general guidance on the lateral screening distances that may be considered when undertaking a screening VI assessment.

For specific guidance on petroleum hydrocarbon screening distances, refer to Part 3B, section 13.1 of this guideline.

Soil vapour data obtained from the preliminary VI assessment stage should be screened against the relevant investigation and screening levels specific to petroleum and chlorinated hydrocarbons, as provided in the ASC NEPM.

For further guidance on the application of screening and investigation levels specific to a petroleum hydrocarbon VI assessment and a chlorinated hydrocarbon VI assessment, refer to Part 3B, section 14.1 and 14.2 of this guideline, respectively.

It is also important for consultants and auditors to understand and acknowledge, during the screening VI assessment stage, the triggers for moving straight to a detailed VI assessment. An example of a trigger may include the identification of preferential pathways where concentrations in groundwater are less than two metres from the receptor. This should have been identified in the CSM at the Tier 1 risk assessment stage (that is, site-specific data is required to understand the zone of influence).

This approach considers the multiple-lines-of-evidence method of determining any further site investigation work that may be necessary, including whether validation assessment is required.

13.5 Detailed vapour intrusion assessment

Tier 2 and Tier 3 risk assessments, which involve either a DSI or SSRA, may be necessary when the results of Tier 1 preliminary or screening VI assessments require further site-specific vapour assessment.

The EPA considers that review of the CSM and preferential migration pathways, collection of additional site-specific data, and/or any adjustments to the relevant investigation/screening levels that are undertaken at this time, will form part of the DSI or SSRA for the site. As discussed in Part 3A, section 11.5 of this guideline, the EPA considers the development of the CSM to be an iterative process. Depending on site conditions and the elements of the environment assessed, review of the CSM at this stage will allow for further analysis of the data gaps and uncertainties that may be presented. It will also assist in predictive modelling, validation and/or remediation works that may be necessary.

An SSRA should be undertaken where non-slab building foundations or future buildings do not exist. Guidance on undertaking an SSRA is provided in Part 3A, section 11.4 of this guideline.

The EPA considers the following aspects, without being limited, are essential for the development of a detailed VI assessment:

- DQO
- CSM
- application of the ASC NEPM interim HILs for VOCCs and appropriate data evaluation
- derivation of site-specific screening data based on the chemical behaviour ie, diffusion and advection
- site-specific hydrogeological and geochemistry information
• collection of site-specific geological conditions/parameters, ambient air and other localised factors that may influence VI
• mass balance of the secondary sources (i.e., compounding of chemical substances in the subsurface contaminated media)
• building foundation design for the application and derivation of site-specific attenuation factors;
• sampling technique/methodology, such as
  – passive sampling methodologies as a screening tool for qualitative soil vapour assessment (lateral extent of the soil vapour plume)
  – active sampling techniques to define the lateral and vertical dimensions of the soil vapour plume for quantitative soil vapour assessment
• point-in-time sampling versus seasonal variability
• anaerobic or aerobic condition of the site-specific geology
• depth to groundwater and variability (characterisation of site-specific hydrogeology).

Guidance on the methodology and types of intrusive VI sampling techniques is provided in Schedule B2, section 9.4 of the ASC NEPM.

For specific guidance on the passive and active methods of soil vapour sampling, refer to Schedule B2, section 9.5 of the ASC NEPM.

At the completion of the detailed VI assessment, consultants and auditors should have adequately characterised and understand the risks posed by vapour contamination and understand remediation required to eliminate the actual or potential harm to the health or safety of human beings (refer to Part 5, section 16 for the reporting framework for remediation).

### 13.6 Field work, sampling and environmental factors

The EPA recommends that during the stage of intrusive field sampling for the assessment of vapour, consultants and auditors consider other field investigations that may be necessary at a site. The EPA considers it appropriate, in certain circumstances, to incorporate and undertake intrusive field investigations of all elements of the environment simultaneously.

For example, if a sampling and assessment plan has been prepared (refer to Part 3A of this guideline) for intrusive groundwater investigations, it would be prudent to undertake soil vapour sampling at the same time, to reduce:
• timing for mobilisation and field assessment
• financial expenses
• inconvenience normally associated with site accessibility and to community engagement participants.

For guidance on the preferred methods for the installation of soil vapour probes/bores, methods of sampling (active and passive techniques) and general guidance on the methodology and types of VI sampling available, refer to:

• Schedule B2, sections 9.4.2 and 9.4.3 of the ASC NEPM
• Appendix D: ‘Installation of soil vapour probes/wells’ of the CRC CARE Technical Report 23

Additionally, the following international technical documents and tools provide guidance on installation and sampling:
• Interstate Technology and Regulatory Council (ITRC): <www.itrcweb.org>
Assessment and remediation of site contamination

The EPA’s preferred approach for the collection of soil vapour data is from a subsurface medium, such as sub-slab or ‘vapour pin’, and/or data collected from varying depth intervals. Consideration of localised geological conditions and preferential pathways may also assist with targeted soil vapour sampling work.

Additionally, it is recommended that qualitative and semi-quantitative field screening techniques are used during field work.

The use of photo-ionisation detectors and/or flame-ionisation detectors are essential when undertaking field assessment for VI. It is essential that appropriate lamp outputs are used, which are specific for the type of VOC being assessed.

In-situ qualitative drilling techniques may also provide real-time characterisation during field/site works. Passive (such as in situ membrane samplers) and active (including membrane interface probe) screening techniques are recommended at the preliminary and screening VI stage of the assessment to provide an improved understanding of the lateral and vertical extent of soil vapour. This technique provides an initial characterisation of subsurface VOCs for the installation of permanent soil vapour sampling locations.

If available, crawl spaces (the space between the floor of the building and ground surface) provide an alternative vapour sampling medium. Crawl spaces allow for an alternative to indoor air for sample collection, as direct sample collection from the crawl space reduces the confounding petroleum hydrocarbon sources that may be found indoors.

Schedule B2, section 9.3.5 of the ASC NEPM provides a range of environmental factors that should be taken into consideration when undertaking soil vapour sampling. The timing of sampling, including rainfall events, temperature, soil moisture and temporal variability are some key factors that importantly contribute to the stages of VI assessment.

For further guidance on the approaches to sample collection and analysis, refer to Schedule B2, section 9.5 of the ASC NEPM.

Section 5 of the CRC CARE Technical Report 23 provides guidance on undertaking indoor air sampling. The document presents the complexities of attributing source contribution when evaluating indoor air data specifically for petroleum hydrocarbon compounds.

The EPA considers the same complexities when undertaking chlorinated hydrocarbon VI assessments. Schedule B2, section 9.3.1 of the ASC NEPM also provides additional information about common confounding sources when undertaking indoor air sampling.

The EPA strongly advises consultants and auditors to only obtain indoor air samples when absolutely necessary. That is, indoor air sampling should only occur if there is evidence that vapour intrusion at the building is possible, that represents a potential risk to human health. In the event that indoor air sampling is necessary, the potential for factors such as the opening and closing of doors and windows, the operation of heating/cooling and chemical use and storage within the home will need to be addressed.

The EPA expects to be advised prior to contacting a person to seek permission to enter a sensitive use property (such as residents, schools, child cares, kindergartens). Such entry may require engagement with the local community and other stakeholders. Part 5 of this guideline provides guidance to consultants and auditors about engaging with local communities or members of the public.
14 Vapour intrusion—technical considerations

14.1 Petroleum hydrocarbon vapour intrusion assessment

14.1.1 Overview

The assessment and reporting framework for VI assessment is outlined in section 13 and Figure 6 of this guideline. The following provides further clarity on specific technical aspects of undertaking a VI assessment for petroleum hydrocarbons (PVI).

The CRC CARE Technical Report 23 provides greater clarity on the decision framework provided in the ASC NEPM, expanding on the principles and necessary requirements. The CRC CARE Technical Report 23 also provides guidance to auditors and consultants on the PVI remediation process and identifies the appropriate time frames for when remediation may be required.

It is important that auditors and consultants understand the limitations presented in the ASC NEPM and CRC CARE Technical Report 23 for undertaking PVI assessment. The limitations are associated with, but are not limited to, the application of the HSLs, LNAPL plume size, potentially contaminating activities and freshness of the petroleum spill. Additionally, the CRC CARE Technical Report 23 acknowledges key principles for PVI assessment, which have been prepared by the US EPA and ITRC.

The CRC CARE Technical Report 23 also provides a literature review that summarises other available international guidance, specifically guidance documents prepared by the US EPA and the ITRC. The review provides examples of conditions specific to the Australian climate and demonstrates the importance of site-specific characterisation in relation to the affected media being assessed.

The literature review presented in Appendix A of the CRC CARE Technical Report 23 provides additional information about the derivation of the assessment methodologies and health screening/investigation criteria. The EPA recommends auditors and consultants consider this information when using the ASC NEPM and the CRC CARE Technical Report 23 as guidance for the assessment of petroleum hydrocarbon vapour intrusion.

14.1.2 Application of screening distances

The EPA recommends the screening considerations presented in Schedule B2, section 9.2.2 of the ASC NEPM are considered by consultants and auditors when undertaking preliminary and screening VI assessments for petroleum hydrocarbons.

The application of screening distances at the preliminary and screening VI assessment stage addresses the biodegradation of petroleum hydrocarbons in aerobic conditions. National and international soil gas and vapour data analysis confirms the scientific assumptions that biodegradation of petroleum hydrocarbon compounds in the subsurface occurs over ‘short vertical and lateral distances’. Examples of screening distances that may be applied for the assessment of petroleum hydrocarbon VI are provided in CRC CARE Technical Report 23. Section 9.3.2, Schedule B2 of the ASC NEPM provides further information about the biodegradation processes of petroleum hydrocarbons in varying soil conditions.

Auditors and consultants should only apply screening distances that are relevant to the site and, when doing so, understand the limitations and the use of screening distances.

For further general guidance on screening distances, refer to Schedule B2, section 9.2.2 of the ASC NEPM.

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14.1.3 Application of investigation and screening levels

As discussed in section 10.3 of this guideline, it is also important for consultants and auditors to apply and use relevant investigation and screening levels when carrying out screening and detailed VI assessments. HSLs can only be applied to the assessment of PVI. To take into account biodegradation, consultants and auditors must consider the limitations of applying the HSLs (such as site-specific geology and hydrogeology), and whether sufficient data is available to adjust the existing criteria to take into account biodegradation.

When applying the HSL tables from the ASC NEPM, the EPA expects a completed copy of the ‘HSL Application Checklist’ to be included in any report. Completion of the checklist will assist with identifying when site circumstances require the collection of site-specific data. When comparing results with historical data, consultants and auditors should consider any implications associated with the changes in reporting of total petroleum hydrocarbon and total recoverable hydrocarbon fractions.

The HSL methodology provides for a greater range of site conditions, such as soil texture, the depth of contamination and biodegradation of certain soil conditions. As such, the application of the HSLs requires greater understanding in comparison with other Tier 1 or PSI assessments of other elements of the environment. For this reason, the EPA considers that the assessment of vapour should only be undertaken by suitably qualified and experienced practitioners.

Refer to Figure 6 for additional information about the assessment and reporting framework for VI assessment.

14.2 Chlorinated hydrocarbon vapour intrusion assessment

14.2.1 Overview

The assessment and reporting framework for chlorinated hydrocarbon vapour intrusion assessment is outlined in Part 3B, section 14 and Figure 6 of this guideline. The following provides further clarity about specific technical aspects of undertaking a VI assessment for chlorinated hydrocarbons (CVI).

Schedules B2, B4 and B7 of the ASC NEPM provide an approach to the assessment of VI in Australia. However, additional supporting national guidance for a specific process for carrying out CVI assessment is currently not available. Additionally, consultants and auditors should apply the tiered risk-based approach (outlined in Part 3A, section 10 of this guideline) using multiple lines of evidence for the assessment of CVI.

The EPA requests that the CRC CARE technical reports that relate to the assessment of PVI are not adopted for the assessment of CVI.

14.2.2 Application of screening distances

In comparison with a screening assessment carried out for petroleum hydrocarbon VI, the attenuation or biodegradation of chlorinated hydrocarbon compounds in subsurface media is complex and relies on understanding site-specific lithological information, for example, the zone of influence or preferential pathways. Auditors and consultants should consider whether sufficient data is available to apply lateral exclusion distances at the screening CVI assessment stage.

The EPA does not consider vertical screening distances to be applicable to the assessment of CVI due to the complexities of modelling and predicting diffusion and advection of chlorinated hydrocarbons in the subsurface. However, if screening distances have been applied at the preliminary or screening VI assessment stage, it is important that a validation assessment is undertaken. In particular, if sensitive populations, including residential, child care, primary and secondary schools, have been identified as potential current or future receptors, soil vapour sampling forms part of the validation assessment. Furthermore, the determination for auditor engagement should be undertaken (refer to section 8.6 of this guideline for the triggers for auditor engagement).
14.2.3 Application of investigation and screening levels

The ASC NEPM provides interim health investigation levels (HILs) for volatile organic chlorinated compounds (VOCCs) for soil vapour for the purpose of assessing actual and/or potential harm posed from vapour intrusion. The methodology for the derivation of the HILs for volatile organic chemical compounds and semi-volatile chemicals is not fully developed (Schedule B7 of the ASC NEPM). The investigation levels that have been developed are for soil vapour data rather than for soil data assessment.

Further information about the derivation of the interim HILs for VOCCs is provided in Schedule B7, section 2.2.6 and Appendices A6 and B of the ASC NEPM.

The EPA and SA Health intend to establish fact sheets for action-level response frameworks for specific VOCCs, in particular, chlorinated hydrocarbons. Contact the EPA for further information about the use of, and obtaining, these fact sheets.

The interim soil vapour HILs for VOCCs has been derived by applying a conservative attenuation factor to published indoor air criteria assuming a reduction in concentration between indoor air to soil vapour. It is important to note that the interim soil vapour HILs have been developed for a 'slab-on-ground' building structure. The ASC NEPM explicitly states that further consideration of building types with crawl spaces or no slab structures require a site-specific assessment for non-slab-based foundations. The structural engineering of buildings is highly important when determining whether VI is likely to occur. It is recommended that an understanding of building type and foundation design, including the air exchange within the building, are included in the CVI assessment.

14.3 Bulk ground gas assessment

This guideline does not provide a framework for the assessment of gases associated with operating or closed landfills in South Australia.
For further information about the assessment of operating or closed landfill sites in South Australia, refer to the EPA guideline: *Environmental management of landfill facilities (municipal solid waste and commercial and industrial general waste)* (2007).

The EPA considers bulk ground gases to include:

- methane (CH₄)
- carbon dioxide (CO₂)
- carbon monoxide (CO)
- hydrogen
- hydrogen sulfide (H₂S).

The chemical substances grouped as bulk ground gases are potentially explosive and can cause asphyxiation or a potential acute exposure risk. It should be noted that the NSW EPA 2012 guidelines make reference to relevant international guidance that is also adopted in South Australia for the assessment of risks posed by hazardous ground gases.

The EPA recommends consultants and auditors refer to the following publications for guidance on the assessment of bulk ground gases:

- *Guidelines for the assessment and management of sites impacted by hazardous ground gases* (NSW EPA 2012)

Where a determination of any acute risk associated with bulk ground gases is identified, this should be immediately reported to the EPA as a hazardous circumstance, as described in section 7.2 of this guideline.

### 14.4 Air quality and assessment

Site contamination may exist due to the presence of vapours arising from chemical substances or migration of bulk ground gases at a site. As soil gas and vapour have the potential to migrate through the subsurface and enter buildings or confined spaces, they also have the potential to migrate outside the site boundaries, with the potential to impact on adjacent land and land uses. Where relevant, auditors and consultants should consider the potential for chemical substances to affect air quality.

A background concentration assessment may be required for ambient air to understand outdoor air quality. The EPA considers that if indoor air or crawl space sampling is necessary, it is critical that an assessment of outdoor or ambient air is undertaken over a time frame that provides a sufficient average of the air quality conditions. It would be expected that outdoor air, crawl space and/or indoor air assessments are undertaken concurrently for comparative assessment. Additionally, understanding localised weather conditions will provide site-specific data for VI modelling, which may assist in reducing assumptions and pre-populated parameters that are used in VI models.

For further information about the assessment of outdoor or ambient air quality, refer to Schedule B2, section 9.3.1 of the ASC NEPM.

It is recommended that the following also be considered as part of the assessment of vapours and bulk ground gases:

- *National Environmental Protection (Air Toxics) Measure*
- *National Environment Protection (Ambient Air Quality) Measure*
In addition, it is recommended that the following EPA guidelines be considered:

- *Air quality impact assessment using design ground level pollutant concentrations (2006)*
- *Odour assessment using odour source modelling (2007)*
Part 4

Remediation
15 Remediation

15.1 Legislation

Remediation is defined in the EP Act as meaning to:

<table>
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<tr>
<th>Section 3(1)—Interpretation, remediate/remediation</th>
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<td>treat, contain, remove or manage chemical substances on or below the surface of the site so as to—</td>
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<td>(a) eliminate or prevent actual or potential harm to the health or safety of human beings that is not trivial, taking into account current or proposed land uses; and</td>
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<tr>
<td>(b) eliminate or prevent, as far as reasonably practicable—</td>
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<td>(i) actual or potential harm to water that is not trivial; and</td>
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<tr>
<td>(ii) any other actual or potential environmental harm that is not trivial, taking into account current or proposed land uses.</td>
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The EP Act allows the EPA to issue Site Remediation Orders and emergency Site Remediation Orders. The orders can require: the preparation of a remediation plan, a person with specified qualifications to be engaged to prepare the plan and undertake the work, an audit and consultation. The EP act also allows for the provision of voluntary site remediation proposals. For further information about orders and voluntary proposals refer to section 3.2 of this guideline.

15.2 Overview

The triggers for remediation consider the risk of current or future harm. Therefore, site contamination may exist, but it may not pose a risk. For this reason, the EP Act and the Regulations establish a risk-based legislative framework for addressing site contamination in South Australia.

If a site assessment indicates that the site poses unacceptable risks to human health or the environment, on or off site, and under either the present or proposed land use, remediation must eliminate or prevent the risk.

To make this determination, it is essential that adequate characterisation of the source(s) and exposure pathways has been completed. If the site is not adequately characterised, the remediation may fail. Such failures can result in the loss of significant sums of money, community frustration, legal action and regulatory action.

Hence the importance of completion of a well-defined conceptual site model, completion of the PSI and, if necessary, the DSI and/or SSRA. It is critical that the consultant determines the approach to remediation that will be most effective and appropriate for the site by identifying appropriate remediation goals, objectives and endpoints.

If chemical substances pose an unacceptable risk to the health or safety of human beings (at locations on or off the site) in relation to existing or proposed land use, an appropriate time frame for remediation commencement will need to be determined.

Remediation should only be carried out by suitably experienced and qualified consultants and/or contractors.

The review of the remediation plan will be assessed by either the EPA or an auditor, as outlined in Figure 5 of this guideline.

15.3 Remediation goals

In accordance with the EP Act, the primary goals of remediation in South Australia are to:

1. eliminate or prevent actual or potential harm to health or safety of human beings that is not trivial
2. eliminate or prevent, as far as reasonably practicable, actual or potential harm to water that is not trivial
3. eliminate or prevent, as far as reasonably practicable, actual or potential environmental harm that is not trivial.
It should be noted that remediation goals 1 and 3 consider the current or proposed land uses for the site.

15.3.1 Setting remediation goals—eliminate or prevent

The EP Act does not contemplate the extent (endpoint) required for the elimination or prevention of harm nor the timing of remediation works. Setting remediation goals can only be determined based on site-specific considerations and an understanding of the remediation objectives. It is acknowledged that it may be difficult to completely eliminate actual or potential harm and, in some circumstances, preventative remediation options are likely to be considered. Therefore, site contamination is likely to still exist, but the remediation goal(s) have been successfully achieved.

Generally, elimination of harm would be considered to occur when the site contamination, which poses the risk, is removed, for example, by removal of primary and/or secondary sources or treatment. Prevention would be considered to have occurred where the site contamination exposure pathways that remain at a site are managed in such a way that they are no longer active. For example, prevention would be considered to have occurred through the sealing of a site with a concrete slab to prevent access to residual contaminated soils remaining at depth.

In determining the reasonable practicability of eliminating harm to water or the environment, the EPA expects remediation measures will take into account technical, logistical and financial considerations. The measures should be cost-effective and commensurate with the significance of the environmental issues being addressed. If it is determined impracticable to eliminate the harm to water or the environment, the objective must be to prevent, as far as reasonably practicable, the harm.

The EP Act requires remediation to eliminate or prevent, as far as reasonably practicable, actual or potential harm to water. It does not distinguish land use in this determination. Water is defined as including groundwater (refer to section 6.6.2 of this guideline).

Where elimination of harm is impracticable or cannot be achieved, some form of control or isolation of the source is required (that is, to achieve the goal of ‘prevent’).

Further information about remediation management options to prevent actual or potential harm is provided in section 16 of this guideline.


The timing for remediation will be determined by the outcome of the risk-assessment process. For example, if human health exposure to any contaminated element(s) of the environment presents an unacceptable risk, the EPA will require remediation to be undertaken as soon as reasonably practicable.

The EPA may use legislative options to require the remediation to be undertaken within a specified period, such as issuing an SRO to the person liable for the site contamination (refer to section 8 of this guideline).

15.4 Remediation objectives

Remediation objectives vary greatly with the setting and circumstances.

The following factors should be taken into consideration when determining the objectives of the remediation:

- technical (physical ability to remove, treat, contain or manage the chemical substances within a reasonable time frame)

55 Refer to section 3.2.2: ‘Site Remediation Orders’ in this guideline for further information about the legislative requirements of an SRO.
Achieving remediation objectives commensurate with long-term goals for the site

Endpoint determination is often a contentious subject as it has a direct impact on remediation cost. The EP Act is specific about the endpoints for human health, environment and water. Elimination of actual or potential harm is always preferred. However, the EPA recognises that prevention may, in some circumstances, be the only viable option.

It is essential that target remediation endpoints are clearly determined prior to the commencement of remediation. These need to be agreed to by the EPA or the auditor. The endpoints are intended to provide sufficient conditions to ensure that remediation objectives and, ultimately, the goals of remediation are achieved.

An assessment of remediation options for meeting remediation objectives (eliminate or prevent) and endpoints that are feasible through the application of techniques (that is, remediation options), is required.

As well as feasible endpoints, the time frame, cost and other factors will also be important in the selection of remediation techniques. In some cases, a staged approach to remediation may be appropriate.

The EPA considers the natural endpoints identified in CRC CARE Technical Report 18 and CRC CARE Technical Report 22 to be applicable when remediating in South Australia, which include:

- achieving remediation objectives commensurate with long-term goals for the site
- justifying reasonable impracticability of remediation.

Remediation may include measures that are required to be implemented prior to or as part of construction and development activities at a site. It also includes ongoing measures that may be required to be implemented following construction to ensure the ongoing suitability of land for its intended use.

For further detailed guidance on key general environmental duty considerations during on- or off-site remediation, refer to Part 4, section 16 of this guideline.
15.5.2 Practicability considerations

While ‘practicable’ is not defined in the EP Act, it is defined in the Macquarie Dictionary as ‘capable of being put into practice, done, or effected, especially with available means or with reason or prudence; feasible’. The word ‘practicable’ is qualified by the word ‘reasonable’. Hence a person is not required to remediate to the extent practicable—rather a person is required to do whatever is possible to an extent that is reasonably achievable.

Remediation of site contamination, for the elimination or prevention of actual or potential harm to human health and safety, is not subject to that which is reasonably practicable.

As outlined in the CRC CARE Technical Report 18, consultants and remediation practitioners need to consider when reasonable impracticability has been reached. This may occur at a number of points during the review of efficacy of the remediation methodology. During remediation, revision of the conceptual site model and risk outcomes for the site may be necessary.

Technical impracticability may be invoked following remediation pilot trials or where the full-scale implementation of the remediation strategy occurs and the remediation goals and objectives are not achieved. Demonstration of a range of remediation strategies may be required.

Table 11 in CRC CARE Technical Report 18 outlines the key information that should be incorporated to support an argument for impracticability.

15.6 Remediation time frame

The EPA considers that remediation time frames should be reasonable, linked to the remediation goals and objectives and be based on site-specific conditions. The EPA considers it essential that the auditor or consultant determine the timing/staging of when remediation is necessary. The EPA recommends, at a minimum, the following factors be taken into consideration when developing remediation time frames:

- actual or potential harm to health or safety of human beings that is not trivial (ie, hazardous circumstance)
- risk assessment and exposure conclusions
- current and/or future land use(s) where remediation of vapour intrusion is required
- potential risks from exposure to groundwater contamination
- current and reasonably expected future land and groundwater use(s)
- sustainability
- hydrogeological characteristics
- type, source(s) and extent of contamination
- multiple elements of the environment that are contaminated and require remediation
- design and capabilities of the remediation technology
- reliability of exposure controls
- availability of treatment and/or disposal options
- community preferences (if appropriate)
- financial resources of the person who has liability for site contamination.

Consideration of the timeliness of remediation to eliminate or prevent the exposure risk from a contaminated element of the environment may be required. In particular circumstances, remediation may be focused on one element of the environment. In other cases, remediation may be undertaken using a holistic approach to effectively remediate multiple elements of the environment at the one time.
The EPA considers that the time taken to undertake remediation should be related to the level of risk identified at the site. There may be a need for higher-risk sites to be remediated using technologies that will bring about rapid remediation outcomes, even though the technology may not be the lowest-cost solution.

If an intermediate remediation goal is required, the time frame to achieve that goal should be reasonable and based on site-specific factors. At sites where it is anticipated that the time frame for achieving the final remediation goal will be lengthy, establishing time frames for intermediate remediation goals can provide a meaningful measure of progress.

### 15.7 Implementation and validation

After preparing a remediation plan approved by the EPA or auditor, the consultant will need to ensure (where relevant) that:

- any exemptions pursuant to the EP Act are obtained prior to implementation
- community communication and engagement has been undertaken (communication plan\(^{56}\))
- the time frames are appropriate
- adequate assessment quantifies and validates the efficacy of the remediation technology.

The EPA considers that in a chronic inhalation exposure circumstance, that is, actual or potential harm to human health from vapour intrusion, an appropriate trial or the ability to demonstrate the level of efficacy of the remediation technology is incorporated into the remediation plan.

Consultants and auditors should refer to section 17 of this guideline for guidance on the development of a site remediation plan.

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\(^{56}\) Refer to section 19 of this guideline.
16 Remediation techniques, technologies and options

16.1 General environmental duty

Non-compliance with this guideline is not, in itself, an offence. However, a consultant, remediation practitioner and/or auditor carrying out remediation at a site are required by law to ensure that the remediation complies with the EP Act, Regulations and relevant EPPs.

Section 3 of this guideline describes the regulatory tools available to the EPA to ensure compliance with the EP Act.

The EPA may use regulatory measures, such as Environment Protection Orders or Clean-up Orders to persons contravening section 25 of the EP Act. The EPA may also issue Site Remediation Orders to require a person who has liability for site contamination to undertake remediation using a specified approach and within a specified time frame.

Equally, if a person carrying out remediation does so in accordance with this guideline, this may indicate that reasonable and practicable measures have been taken to prevent or minimise any resulting environmental harm.

16.2 Protection of the environment during assessment

There should be appropriate protection of the environment during the site assessment and remediation of site contamination in South Australia. Guidance on how to address minimum measures that should be adopted to ensure the protection of the environment during on- or off-site remediation is provided in section 15, Schedule B2 of the ASC NEPM.

Further guidance on key considerations when undertaking remediation at on- and off-site locations is provided in Appendix 5 of this guideline.

16.3 Work health and safety

There should be appropriate work health and safety measures in place for any personnel involved in the assessment and remediation of site contamination in accordance with applicable work health and safety legislation (refer to the Work Health and Safety Act 2012).

Guidance on how to address work health and safety issues applicable to both assessment and remediation is provided in Appendix 5 of this guideline.

16.4 Soils

16.4.1 Soil bioremediation

Bioremediation is a unique type of remediation that generally requires considerable time and careful planning to achieve successful outcomes.

Bioremediation, when properly managed, is an environmentally sound and cost-effective method of treating soils containing organic chemicals. Bioremediation may enable appropriate reuse of the treated soil and minimise disposal of waste soil to landfill, whilst providing for adequate protection of human health and the environment.

The EPA supports and encourages the controlled use of bioremediation to assist with the remediation of site contamination in South Australia.

This guideline does not provide direction on the methods of bioremediation. Instead, it outlines appropriate management measures that can minimise environmental impacts arising from the process.

There are two types of bioremediation—ex situ (remove and treat) and in situ (treat in place—generally underground). Both methods can be carried out on soil and groundwater. However, the focus of this guideline applies only to the ex situ treatment of soils.
The EPA endorses the use of controlled bioremediation, particularly when the treated soil is suitable for reuse, thus reducing disposal of waste soil to landfill.

The EPA provides the hierarchy of its preferred approaches to soil bioremediation as follows:

1. on-site treatment of the chemical substances to reduce risk to an acceptable level
2. off-site treatment of excavated soil to reduce risk to an acceptable level, after which the treated soil is returned to the site
3. containment of soil on site with a properly designed barrier
4. disposal of affected soil to an approved landfill.

Prior to the commencement of a soil bioremediation project, the nature and extent of the chemical substances in the soil must be assessed, taking into account the assessment framework outlined in Part 3A of this guideline.

The bioremediation strategy should include laboratory or pilot-scale studies to show the efficacy and timing of the treatment process.

It is important to recognise that contaminated soils may also contain chemical substances that are not suitable for bioremediation. This should be considered when preparing the site remediation plan (SRP). Refer to section 18 for the remediation reporting framework.

16.4.2 Landfarming

Landfarming is a form of bioremediation. It is an above-ground process that involves placing contaminated soil on a prepared surface and aerating it by regular turning. Soil amendments may be added to enhance the efficacy and timing of the remediation process. The movement of oxygen through the soil stockpile promotes aerobic degradation of organic chemicals. Landfarming is a passive form of bioremediation, generally requires an extended time frame and is only successful for soils contaminated with volatile and semi-volatile chemical substances.

As landfarming will probably release emissions directly to the atmosphere, it should not be used where it may have an adverse effect on sensitive receptors, particularly in built-up or residential areas. As a remediation option, landfarming is ineffective in treating substances such as metals and complex PAHs.

The EPA considers that landfarming may be an acceptable form of bioremediation only:

- on large isolated sites that are remote from potentially susceptible receptors
- within approved EPA-licensed facilities where conditions are included in the EPA authorisation.

Care should be taken to ensure that additional pollutants are not introduced during the landfarming process.

16.4.3 On-site retention

In some instances, on-site retention of chemical substances in soils may be considered the only appropriate remediation option at a site.

If on-site retention of chemical substances in soils is considered an appropriate remediation option at a site, consultants, remediation practitioners and/or auditors must consult with the EPA prior to the commencement of remediation.

An example of an approach to establishing the SRP for the retention of chemical substances in soils at a site is provided in section 5 of the CRC CARE Technical Report 16: Safe onsite retention of contaminants Part 2: A risk-based approach (2013). The following provides the key steps:

1. Identify the environmental values and receptors that need to be protected (refer to section 12.3 of this guideline).
2. Assess the scenarios for risk exposure (CSM—refer to section 10.5 of this guideline).
Assessment and remediation of site contamination

3 Analyse and evaluate the risk exposure, and determine if remediation goals, objectives and endpoints are likely to be achieved (remediation options assessment (ROA) in accordance with section 17.2 of this guideline).

4 Prepare appropriate site management plan (SMP) to manage the risks and achieve the endpoints for remediation (refer to section 17.4 of this guideline).

5 Carry out the remediation in accordance with the SRP (undertake remediation and validation reporting (RVR), as required, in accordance with section 16.3 of this guideline).

6 Implement SMP (consider key issues outlined in Appendix 5 of this guideline).

Further information about the framework for carrying out remediation and reporting is provided in Figure 7 of this guideline.

The EPA recommends that consultants, remediation practitioners and auditors consider the factors affecting the acceptability of any in-situ remediation that may be proposed at a site.

Section 6 of CRC CARE Technical Report 16 provides some key factors related to the on-site retention of chemical substances in soils.

Section 17.4 of this guideline also provides other factors that the EPA considers important when developing the SRP for the retention of on-site chemical substances in soils.

Other factors that should be considered when carrying out the remediation and development of ‘containment cells’ at a site are provided in Appendix 5 of this guideline.

16.4.4 Stockpiles

Soil stockpiles, if not correctly managed, can represent a considerable source of dust, due to their height, uncompacted nature and (frequently) close proximity to sensitive receptors.

The EPA expects the following issues to be considered by the consultant, remediation practitioner and/or auditor when stockpiling soil at a site:

- Stockpiles should have a maximum height of about 3 m, or equal to or lower than the average height of surrounding structures. Stockpile height should reduce as it approaches the site boundary.
- Stockpile heights should be below fence lines when within about 5 m of the boundary.
- Stockpiles should be covered with an effective dust and/or odour mitigation covering. The contents of the stockpile will dictate the level of cover, ie, complete enclosure or the formation of a crust layer.
- Stockpiles should have sufficient moisture content before being handled.

Water can be applied prior to soil excavation or handling activities, and sufficient time should be allowed for water to infiltrate the soil or stockpile. Applying water to a stockpile during handling has minimal effect on reducing dust emissions. Consultants, remediation practitioners and auditors should consider the efficacy of using water jets or sprays to manage airborne dust, especially when handling stockpiles in open areas and in the vicinity of sensitive receptors.

In all cases, it is important that an appropriate level of community engagement is undertaken at all stages of the remediation project (refer to section 19 of this guideline). Local residents and stakeholders should be advised in advance about the likely duration, impacts, potential health risks and mitigation measures to be undertaken, followed by updates during the remediation period.

Dust is defined by the EP Act to be an environmental nuisance. As such, failure to control dust is likely to result in the EPA taking regulatory action.

For further information about key considerations for soil stockpile management during remediation, refer to Appendix 5 of this guideline.
16.4.5 Asbestos

Guidance on the assessment of asbestos is provided in Schedule B2 of the ASC NEPM. The guidance is not applicable to asbestos materials in current buildings or structures including operational pipelines and fences. It also does not apply to asbestos materials that are wastes, such as planned demolition materials present on the surface of land awaiting removal. There are particular requirements for removal, transport and disposal of asbestos-containing materials (ACM) in legislation, including the EP Act and relevant EPA guidelines 57.

The assessment of asbestos must be undertaken by a competent person 58. Asbestos found at a site requires specialist skills and care in handling, removal and transportation to prevent the likelihood of asbestos fibres becoming airborne.

Depending on site-specific circumstances and the proposed remediation approach, conservative management of presumed asbestos contamination may avoid the need for a DSI where there is a high degree of confidence that the asbestos contamination is confined to bonded ACM in superficial soil. Where site circumstances are favourable, bonded ACM in sound condition can be used as the primary means of estimating contamination by subjecting soil samples to on-site sieving and gravimetric procedures. The determination of asbestos in soil should follow the procedures in Section 4, Schedule B1 of the ASC NEPM.

Asbestos-specific communication skills may also be needed to address potential concerns of workers and the community. The EPA will provide advice on this subject on a case-by-case basis when requested or as appropriate.

The EPA should be notified of any potentially hazardous circumstance relating to the presence of identified asbestos as free fibres in an uncontrolled environment in the course of an audit (refer to section 7 of this guideline).

For further information about key considerations for the management of asbestos during assessment and remediation, refer to Appendix 5 of this guideline.

16.4.6 Acid sulfate soils

Acid sulfate soils (ASS) are described in the EPA guideline Acid sulfate soil materials (2007). This guideline outlines the requirements related to on-site management of acid sulfate soils, and any off-site disposal or reuse 59. Acid sulfate soils may, in some circumstances, be detrimental to the current or proposed use of a site. In general, this would occur following oxidation. Once these soils are disturbed as a result of an activity, actual or potential ASS may result in site contamination.

16.5 Groundwater

16.5.1 Non-aqueous phase liquids (NAPL)

The extent to which risk may be reduced where NAPL mass is removed is a key consideration, as risks arise through NAPL constituents that partition into groundwater and soil vapour. The EPA considers the risk should be based on the constituent flux at the point of compliance or receptor exposure. This is considered appropriate because it determines whether assimilative or natural attenuation capacity in the aquifer is sufficient to mitigate risk.

When deciding remediation objectives for NAPL, consideration should be made to:

- reducing the NAPL saturation in the aquifer
- reducing the concentration of specific compounds present in the NAPL.

The identified remediation objectives need to be clearly described in any NAPL remediation plan.

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57 Refer to the EPA publication: Wastes containing asbestos: Removal, transport and disposal (2009).
58 Guidance on a competent person in the context of asbestos is provided in Schedule B2 of the ASC NEPM.
59 Refer to prescribed condition of accreditation under regulation 56(2)(c) of the Regulations.
Further consideration should include ongoing liability, financial and economic restrictions, stakeholder perception of risk and the principle of intergenerational equity. Where practicable removal does not meet risk-based criteria, other source control or isolation will be required.

Further guidance on selecting and assessing strategies is provided in the CRC CARE Technical Report 18: Selecting and assessing strategies for remediating LNAPL in soils and aquifers (2010).

16.5.2 Monitored natural attenuation (MNA)

If monitored natural attenuation (MNA) is determined to be the appropriate remediation option, the EPA considers that consultants and auditors identify this to be a reasonable and practicable approach. The EPA expects that sufficient data has been obtained at the assessment stage that demonstrates the groundwater conditions are favourable for natural attenuation of the chemical substances.


16.6 Surface waters

If a CSM identifies surface waterbodies (including fresh and marine) as potential receptors, any EVs of those waterbodies described in the WQEPP must be considered (refer to section 11.5 of this guideline).

The minimum considerations for the protection of fresh and marine surface waterbodies during any remediation activity is provided in Appendix 5 of this guideline.

The selection of an appropriate mitigation measure for managing surface water runoff should be made with reference to the waste hierarchy (avoid, reduce, recycle, disposal). If possible, preference should be given to management measures that prevent pollution of surface water. Disposal options should only be considered after other measures have been exhausted. Care must be taken to ensure that chemical substances are not dispersed into the environment as a result of a selected option.

Mitigation measures to avoid or reduce the generation of runoff of contaminated water to surface waterbodies, include:

- use of temporary rainproof covers
- temporary bunding around stockpiles, or location of stockpiles on waterproof surfaces such as asphalt or concrete, or under cover where available
- minimising the area being treated at any one time
- installation of temporary barriers (eg, hay bales, geo-fabric or similar)
- excavation of drainage or runoff water diversion trenches
- collection or absorption pits
- ponds to capture and treat the runoff (eg, remove sediment).

16.7 Aesthetics

Aesthetic issues generally relate to the presence of non-hazardous inert foreign material. The presence of these materials alone at a site would not generally result in site contamination. However, sites that may have been adequately assessed and/or remediated to address potential human health and environmental issues arising from site contamination may still contain residual foreign inert materials that require management.

Materials that are likely to result in aesthetic issues include waste materials that may present no health hazard (for example, concrete or brick fragments), have some soil discolouration from a relatively inert chemical waste (for example, ferric metals) or have a residual odour (for example, natural sulfur odour).
General considerations and circumstances that would trigger an assessment of aesthetics and the assessment process for aesthetic issues are described in Schedule B1, section 3.6 of the ASC NEPM.

Careful consideration should be given to the practicality of large quantities of fill materials, such as demolition rubble, being retained on land being assessed for its suitability for sensitive use, where reasonable use of the land may result in these materials being exposed and having to be disposed of after being excavated.
17 Remediation reporting framework

17.1 Overview

The reporting process for remediation is consistent with the policy framework and limited guidance provided in the ASC NEPM. The framework provided in Figure 7 of this guideline addresses specific South Australian regulatory and policy requirements that are not addressed or detailed by the ASC NEPM.

Figure 7—Process for undertaking remediation and reporting framework

- define remediation goals, objectives and endpoints
- consider appropriate technologies
- describe decision making process and preferred remediation method
- develop and implement site remediation plan
- determine whether precautionary mitigation is necessary to address risk to human health.

- revise conceptual site model (CSM)
- determine whether further assessment work is necessary
- assess efficacy of remediation option
- determine if remediation endpoints have been achieved and, if so, complete RVR.

- determine if SMP will achieve remediation endpoints
- develop and implement ongoing monitoring as required (section 17.4)
- implement statutory controls as required (section 18)
- determine appropriate reporting time frames
- revise CSM as required.

review by auditor or EPA as required
17.2 Remediation options assessment (ROA)

The remediation options assessment (ROA) should define the goals of remediation, and provide options for how the remediation objectives will be achieved to meet the definition of ‘remediate’ in the EP Act.

The ROA should consider all appropriate technologies and include a description of the decision-making process that led to the selection of the preferred remediation method. The ROA should outline the remediation methods and strategies to be implemented at the site. It should also address environmental aspects, impacts of the remediation process and how these will be managed.

Where appropriate, the ROA is to be submitted to the EPA or auditor for review, in accordance with Figure 7 of this guideline.

Appendix 4 provides a checklist of information as a minimum requirement that should be included in an ROA.

Appendix 5 provides key information as minimum appropriate environmental management measures that should be considered by the consultant, remediation practitioner and/or auditor prior to remediation.

Following the preparation of an approved ROA, it is recommended that a site remediation plan (SRP) be developed that documents the agreed remediation technique and option(s) that will be implemented to successfully achieve the desired remediation goals and objectives at the site.

17.3 Remediation and validation reporting (RVR)

The remediation and validation reporting stage is the process of demonstrating that contamination has been successfully remediated and the objectives and endpoints of the ROA have been achieved. Site validation requires sampling to demonstrate remaining soil/sediment, fill material, in-situ remediated material and/or any groundwater affected by the site contamination no longer poses a risk to human health and/or the environment.

Where remediation and validation work is conducted in stages, the reporting process may require a series of reports to support the staged remediation objectives achieved. The reporting stages may include:

- groundwater monitoring events
- soil vapour monitoring events
- revisions to the CSM
- revisions of the risk assessment post the staged remediation and validation work.

The scope of remediation and/or validation work should be conducted in accordance with the previously prepared SRP.

Where remediation is carried out, RVR reports are to be submitted to the EPA or auditor for review, in accordance with Figure 7 of this guideline.

Appendix 4 provides a checklist of information as a minimum requirement that should be included in an RVR.

Appendix 5 provides key information as minimum appropriate environmental management measures that should be considered by the consultant, remediation practitioner and/or auditor when undertaking remediation and validation at on- or off-site locations.

Figure 7 of this guideline provides a flow chart of the remediation and reporting framework, identifying the stages at which further validation and/or remediation may be required. It also identifies the process for when the development of a site management plan may be required.

17.4 Site management plan (SMP)

The development of a site management plan (SMP) is required where a site requires some form of management during the remediation phase of works or during post-remediation work. The development of an SMP may be required during the audit process and may be required as a condition of an audit report.
The EPA considers the development of an SMP to be appropriate in the following circumstances (but not limited to):

- complete remediation of chemicals in soils affecting an area is not practicable (for example, chemical substances below an impermeable structure)
- chemical substances in soils are being retained under a final cap or fully contained on site within an engineered containment cell (refer to section 16.4 of this guideline)
- remediation is likely to cause a greater adverse environmental impact than would occur if the site were left undisturbed
- actual or potential harm to waters that is not trivial remains ie, technical practicability has been determined (refer to section 15.5.2 of this guideline).

In these circumstances, clear statements as to the existence of site contamination must be made. If site contamination does not exist, management or mitigation measures would, therefore, not be required.

Ongoing monitoring may also be required where an element of the environment is contaminated, to determine the performance of remedial works or support natural attenuation, or where on-site containment is proposed. A site management plan may include provisions for:

- a groundwater monitoring and management plan (GMMP)
- a construction environmental management plan (CEMP)
- a soil vapour monitoring and management plan (SVMMP)
- site maintenance and inspection.

The development of an SMP is required to ensure the effective management and monitoring of the site contamination during the remediation process and/or at the post-remediation stage of works.

Similar to the development and carrying out of remediation in accordance with the RVR, the remediation reporting process may include:

- groundwater monitoring events
- soil vapour monitoring events
- revisions to the CSM
- revisions of the risk assessment post the staged remediation and validation work.

The scope of management or monitoring work should be conducted in accordance with the endpoints identified in the SRP or requirements of audit conditions.

Where an SMP or CEMP is required to be implemented, they must accurately and clearly describe:

- the nature and location of chemical substances remaining on the site
- the objectives of the plan
- how the chemical substances and/or site will be managed (ongoing remediation)
- who will be responsible for implementation
- the knowledge and abilities of those parties who are expected to implement the SMP or CEMP
- evidence of the responsible parties’ acceptance to implement the plan (where possible)
- contingency plans if the management and monitoring measures are not successful
- time frame over which actions specified in the plan will take place
- time frames for any reporting.
The length and contents of the management plans will depend on the complexity of site issues. Also, there must be sufficient detail within the plan for it to be readily understood and implemented.

Reports provided as part of the SMP are to be submitted to the EPA or auditor for review, in accordance with Figure 7 of this guideline.

Appendix 4 provides a checklist of information that should be included in an SRP.

Appendix 5 provides key information as minimum appropriate environmental management measures that should be considered by the consultant, remediation practitioner and/or auditor in the development of an SRP.
18 Statutory controls

18.1 Water restriction or prohibition areas

Section 103S of the EP Act states the following:

<table>
<thead>
<tr>
<th>Section 103S—Prohibition or restriction on taking water affected by site contamination</th>
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<tbody>
<tr>
<td>(1) If the Authority is satisfied that-</td>
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<tr>
<td>(a) there is site contamination that affects or threatens water; and</td>
</tr>
<tr>
<td>(b) action is necessary under this section to prevent actual or potential harm to human health or safety,</td>
</tr>
<tr>
<td>the Authority may, by notice in the Gazette, prohibit or restrict the taking of the water.</td>
</tr>
<tr>
<td>(2) A notice under this section must-</td>
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<tr>
<td>(a) specify the water to which it relates; and</td>
</tr>
<tr>
<td>(b) give particulars of site contamination affecting the water.</td>
</tr>
<tr>
<td>(3) A person must not contravene a notice under this section.</td>
</tr>
<tr>
<td>Penalty: Division 5 fine.</td>
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<tr>
<td>(4) The Authority may, by notice in the Gazette, vary or revoke a notice under this section.</td>
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</tbody>
</table>

A groundwater prohibition area (GPA) may be gazetted in circumstances where other methods or forms of remediation are not adequate to address the identified risks from chemical substances identified in the groundwater, resulting in site contamination.

The establishment of a GPA can eliminate the pathway between the groundwater contamination and human contact and thus prevent or eliminate human exposure to the contaminants of concern. A GPA provides a regulatory long-term means of prohibiting the use of groundwater for any purpose, with the exception of groundwater monitoring and, therefore, eliminates human exposure to contaminated water.

It is an offence to contravene the requirements of a notice under section 103S of the EP Act. This is essential for protecting an individual’s health and safety and possibly that of other community members.

Prior to the establishment of a GPA, the EPA will actively engage with residents and the wider community. Refer to Part 5, section 18 for further information about community engagement.

Information about established groundwater prohibition areas is available from the EPA website. Auditors and consultants are advised to contact the EPA when carrying out assessment and remediation within a GPA.

18.2 Special management areas

Section 103N of the EP Act provides a statutory framework within which relevant parties can work together to address and manage site contamination of a particular kind that may exist in a wide area, or areas, and ensure the adequate protection of human health and the environment. This process includes discussing the responsibility for assessment and management of the site contamination and any associated costs. The provision enables a more broad-based integrated solution to be negotiated between relevant parties than if the issue was dealt with on a property-by-property basis.

Section 103N of the EP Act provides the EPA with the power to establish a special management area (SMA), defined at the discretion of the EPA, by notice in the Gazette. The EPA must then publicise the issue and consult with relevant parties and the public in accordance with the EPA’s Community Engagement Framework. The EPA will endeavour to ensure remediation goals, objectives and endpoints, and/or the long-term management of the site contamination, are achieved.
Part 5

Community engagement and information
19 Community engagement and risk communication

19.1 Introduction

The assessment and remediation of site contamination may cause a range of community concerns relating to the potential or actual human health and environmental impacts associated with the contamination and/or the impacts and nuisance arising from the remediation process. Early risk communication and community engagement are key components of the assessment and management of site contamination.

Community engagement and risk communication in relation to site contamination should be conducted in accordance with the principles and approach provided in Schedule B8: ‘Community engagement and risk communication’ in the ASC NEPM.

The underlying principles to the approach taken in the ASC NEPM are that:

- an evaluation regarding the probable need for and nature and extent of community engagement should be carried out at the early stages of assessment
- interaction with the community must be an open, two-way engagement process
- engagement with the community is considered to be essential for sites with contentious issues.

The EPA considers the responsibility for primary community consultation and engagement lies with the person responsible for the site contamination.

19.2 Key principles

The ASC NEPM provides the key principles of ‘why, who, what and how’ for an approach to the preparation of an effective communication plan. The EPA recommends that consideration is given to when and who needs to be engaged to ensure open and transparent communication and engagement.

Any engagement with the community should be planned, prepared and implemented in accordance with an appropriate community engagement and risk communication plan. Information used for the purposes of community engagement should be presented in a way that translates scientific information into an understandable language for the relevant audience.

For a step-by-step approach to community communication and engagement, refer to sections 4 and 5 of Schedule B8: ‘Community engagement and risk communication’ in the ASC NEPM.

19.3 Informed consent

Prior to consultants and auditors undertaking work on third-party land, the EPA expects that informed consent will be obtained from the landowner.

Where there is an occupier of a site, written consent should be obtained from both the owner and occupier of the land. Before undertaking a site contamination assessment on third-party land, the owner/occupier should be made aware of related implications.

The following information is provided as guidance, and the EPA strongly recommends that consultants and auditors obtain legal advice about the risk to themselves in carrying out the work, before undertaking sampling on private land.

The nature, concentration and extent of chemical substances and site land use will have an effect on how contamination is managed on third-party land.

The EPA is required to record certain details of site contamination on the EPA Public Register pursuant to section 109 of the EP Act.
The EPA advises that where contamination on third-party sites is identified, the landowners should be informed and an appropriate risk management strategy implemented immediately in accordance with this guideline as soon as reasonably practicable, to ensure the protection of human health and the environment.

Once recorded, this information will be made available on the Public Register Index of the EPA website and to interested parties upon written enquiry to the Public Register Administrator of the EPA.

The existence of this information in relation to the land will also be identified by the EPA when responding to enquiries under the *Land and Business (Sale and Conveyancing) Act 1994* (LBSC Act) and the subordinate Regulations (LSBC Regulations) (via the ‘statement of environmental particulars’ contained within the statement under section 7).

This will typically occur at the time of sale of the property. There are also requirements for vendors in relation to identifying whether environmental assessments of the land have been carried out. For further information, refer to section 20.2 of this guideline.

The EPA advises consultants of the need to ensure that any sampling in relation to site contamination on private property should include a process whereby the landowners are informed by the consultant of the likelihood of the results having to be provided to the EPA and recorded on the EPA Public Register. It is recommended that discussion about any subsequent obligations (for both the EPA and the landowner) require relevant information to be passed on under the Form 1 statement of the Regulations under the LSBC Act.

**19.4 EPA role in community engagement**

The EPA regularly carries out community engagement, in particular when the EPA becomes aware of site contamination issues with the potential to affect sensitive receptors. The public statement on communications and engagement is described in the EPA’s: [Community Engagement Framework](#). The principles of this framework identify that all South Australians should be provided with open, transparent and accessible information. The EPA has committed to providing this to the community via various media, including print, television, radio, social media and the EPA website.

![The EPA has a dedicated hotline number that is accessible for community consultation enquiries. Further information is also available from the EPA website or by email.](#)
20 Access to site contamination information

20.1 EPA public register

The EP Act requires the EPA to create and maintain a public register. The EPA must record a variety of information on the Public Register under section 109(3) of the EP Act and as prescribed in Regulation 16.

Information specific to site contamination includes:

- details of serious or material environmental harm caused or threatened in the course of an activity
- details of site contamination of underground water notified to the EPA
- details of transfer of liability for site contamination agreements
- details of EPA approved voluntary site contamination assessment and remediation proposals and any reports associated with the approved proposal
- details of special management areas
- details of prohibition or restrictions on taking water
- notification of commencement or termination of site contamination audits
- site contamination audit reports
- details of each environmental assessment report carried out by or on behalf of the EPA
- reports prepared on behalf of the former South Australian Health Commission in relation to pollution of land or contamination of land by chemical substances
- non-statutory site audit reports completed prior to 1 July 2009;
- significant information about environmental authorisations (licences)
- development authorisations
- incidents of environmental harm
- details of Environment Protection Orders, Clean-up Orders and clean-up authorisations, Site Contamination Assessment Orders or Site Remediation Orders.

Information that has been placed on the Public Register is available on request from the EPA. Reports can be copied or inspected upon payment of a fee.

For further information about viewing or obtaining information, contact the EPA by telephone on 08 8204 2004 or 1800 623 445 (freecall for country users) or email.

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60 Environmental assessment, in relation to land, means an assessment of the existence or nature or extent of—(a) site contamination (as defined in the EP Act) of the land; or (b) any other contamination of the land by chemical substances, and includes such an assessment in relation to water on or below the surface of the land.

61 Prior to 1 July 2009, site audit report means a detailed written report that sets out the findings of a site audit. A site audit, in relation to land, means a review (carried out by a person recognised by the Authority as an environmental auditor) that examines environmental assessments or remediation of the land for the purposes of determining—(a) the nature and extent of contamination of the land by chemical substances present or remaining on or below the surface of the land; and (b) the suitability of the land for a particular use; and (c) remediation that is or remains necessary for a particular use, but does not include a site contamination audit (as defined in the EP Act) completed on or after 1 July 2009.
There can be no guarantee that the EPA holds any or all information relating to a site. If the EPA holds no information about a site, this should not be interpreted as meaning that a site is not affected by site contamination or pollution. Persons with an interest in a site should always carry out their own enquiries and/or assessments to ensure that their interest in the site is not compromised by site contamination or pollution. Information held on the EPA Public Register may assist this process.

To view or obtain information recorded on the EPA Public Register, contact the EPA by telephone 08 8204 9128 or email.

20.2 Form 1 statements and Section 7 enquiries

The LBSC Act and LSBC Regulations are set in place to provide consumer protection for those buying property in South Australia.

Sections 7 and 8 of the LBSC Act provide that all mortgages, charges and prescribed encumbrances affecting the land and particulars of certain prescribed matters be provided by a vendor or their agent to a prospective buyer of land or small business before settlement. The LBSC Regulations prescribe that a Form 1 must be provided to prospective buyers that includes those particulars.

The EPA is required by the LSBC Regulations to provide certain information relating to property. In relation to site contamination, this includes questions set out in Schedule 1 of the LBSC Regulations, incorporating the section: ‘Particulars relating to environment protection’ and certain information relating to mortgages, charges and prescribed encumbrances affecting the land. This information is included in the ‘Form 1 Statement’ which forms part of the contract of sale documents for property sales.

Appropriate persons under the Land and Business (Sale and Conveyancing) Act 1994 can make a direct enquiry to the EPA with payment of a fee for a Section 7 search, which includes the information that the EPA is required to provide to assist with the preparation of the Form 1 statement. The request must be made in writing and provide the current certificate of title reference of each parcel of land in question.

Those particulars may include information relating to site contamination, in response to the questions relating to the prescribed encumbrances or the ‘Particulars relating to environment protection’ set out in the Regulations. The EPA provides that information directly in the form of a ‘Section 7–EPA response’ letter.

Any person can make an enquiry—called a Section 7 direct enquiry—to the EPA upon payment of a fee. The EPA will then provide a response to these questions, as previously described, where this information is held by the EPA.

To make a Section 7 enquiry, contact the EPA’s Senior Administration Officer–Section 7 on 08 8204 2179 or email. For further information, see the relevant EPA publication: Section 7, Land and Business (Sale and Conveyancing) Act 1994 and the role of the EPA.

20.3 Information on the EPA website

A listing of selected site contamination information is available through the Site Contamination Index on the EPA Public Register Directory.

Requests for copies of documents listed on the index will be provided at no charge.

20.4 Advice regarding reports

It is important to note that information viewed or obtained from the EPA may only represent an extract of the information held by the EPA, for example, an executive summary from a larger, more detailed report.

Also, records held by the EPA may represent only a portion of information that has been produced for a site, and may only cover a subset of the environmental issues present at the site. Where this is the case, interested persons should be
aware that further detailed information may exist in the report and that the extract(s) may not fully or accurately represent this information. Consideration should also be given to any appendices or referenced documents in the report that may provide further information.

Site contamination reports vary in their scope and detail. This must be taken into account when interpreting the information contained in the reports.

It is recommended that where the information obtained suggests that ongoing responsibilities exist for site contamination, that appropriate advice be sought from an environmental professional (for example, consultant or auditor).

20.5 Currency of reports

Consultant and audit reports provide information useful to land occupiers, planning authorities, local councils, the EPA and the community. Reports may contain information relating to the existence of site contamination, provide a history of site development and identify requirements for site management.

Reports are based on the condition of the site at the time the report is completed. They do not represent any changes that may have occurred to the condition of the site or site contamination since the date of report completion. In many instances, more than one report will be prepared for a site over time. Interested persons are advised to check the dates of all available reports to ensure the most recent and most relevant information has been obtained for the site.

All persons who rely on consultant and audit reports are advised to check the currency and details of the documents. If a person is unsure of the currency, they should contact the EPA for advice. Persons relying on reports are also advised to ensure that any extracts or pages of a report are read in the context of the complete report.

20.6 EPA contact information

Persons can contact the EPA for enquiries or advice in relation to site contamination:

Manager Site Contamination
Environment Protection Authority
GPO Box 2607
Adelaide SA 5001

Telephone: (08) 8204 2004
Free call (country): 1800 623 445
Email: epasitecontam@epa.sa.gov.au.
21 Glossary

The following definitions are relevant to site contamination auditing. Where a definition is amended in the source document, the definition in the source document takes precedence over the definition presented below. Definitions taken from the Environment Protection Act 1993 or the Environment Protection Regulations 2009 are identified by an asterisk (*).

audit refer to site contamination audit.

auditor refer to site contamination auditor.

audit report refer to site contamination audit report.

audit statement refer to site contamination audit statement.

background concentrations* in relation to chemical substances on a site or below its surface, means results obtained from carrying out assessments of the presence of the substances in the vicinity of the site in accordance with guidelines from time to time issued by the Authority.

chemical substance* means any organic or inorganic substance, whether a solid, liquid or gas (or combination thereof), and includes waste.

(the) client the person who commissions a scope of works by a consultant or an audit.

contamination the condition of land or water where any chemical substance of waste has been added at above background level and represents, or potentially represents, an adverse health or environmental impact. This definition of contamination is provided in the ASC NEPM.

element in relation to the environment any of the principal constituent parts of the environment (land, air, water, organisms and ecosystems) that may be impacted by site contamination and includes amenity values (such as aesthetic impacts) and human-built structures.

environment* means land, air, water, organisms and ecosystems, and includes:

(a) human-made or modified structures or areas; and

(b) the amenity values of an area.

groundwater contamination site contamination of underground water.

groundwater restriction or prohibition of use area an area declared under section 103S of the EP Act.

hazardous circumstance means a state of danger to human beings or the environment, whether imminent or otherwise, resulting from the location, storage or handling of any substance having toxic, corrosive, flammable, explosive, infectious or otherwise dangerous characteristics.

land* land as a physical entity, including land covered with water.
1 use for residential purposes; or
2 use for a pre-school within the meaning of the Development Regulations 1993.
(Note: under the Regulations of the Development Act 1993, the definition of pre-school includes a nursery, kindergarten or childcare centre); or
3 use for a primary school; or
4 use of a kind prescribed by regulation. (Note: no uses are currently prescribed).

**site** means an area of land (whether or not in the same ownership or occupation).

**site contamination** exists at a site if:
1 chemical substances are present on or below the surface of the site in concentrations above the background concentrations (if any); and
2 the chemical substances have, at least in part, come to be present there as a result of an activity at the site or elsewhere; and
3 the presence of the chemical substances in those concentrations has resulted in—
   (a) actual or potential harm to the health or safety of human beings that is not trivial, taking into account current or proposed land uses; or
   (b) actual or potential harm to water that is not trivial; or
   (c) other actual or potential environmental harm that is not trivial, taking into account current or proposed land uses.

**Site Contamination Assessment Order** a Site Contamination Assessment Order issued under Part 10A of the EP Act.

**site contamination audit** a review carried out by a person that—
Assessment and remediation of site contamination

1 examines assessments or remediation carried out by another person in respect of known or suspected site contamination on or below the surface of a site; and

2 is for the purpose of determining any one or more of the following matters:
   (a) the nature and extent of any site contamination present or remaining on or below the surface of the site
   (b) the suitability of the site for a sensitive use or another use or range of uses
   (c) what remediation is or remains necessary for a specified use or range of uses.

**Site contamination audit report**
a detailed written report that—
   (a) sets out the findings of the audit and complies with the guidelines from time to time issued by the EPA; and
   (b) includes a summary of the findings of the audit certified, in the prescribed form, by the site contamination auditor who personally carried out or directly supervised the audit.

**Site contamination audit statement**
a copy (that must comply with the regulations) of the summary of the findings of the audit certified, in the prescribed form, by the site contamination auditor who personally carried out or directly supervised the audit.

**Site contamination auditor**
a person accredited under Division 4 of Part 10A of the *Environment Protection Act 1993* as a site contamination auditor.

**Site contamination consultant**
a person other than a **site contamination auditor** who, for fee or reward, assesses the existence or nature or extent of site contamination.

**Site Remediation Order**

**soil vapour probes**
Soil vapour probes may be installed in open ground or via holes drilled through sealed surfaces, such as driveways or parking areas (‘near slab’) or beneath foundations (‘sub-slab’). Sampling installations may be permanent, semi-permanent or temporary, depending on access and the need to re-sample.

**special management area**
a declaration under section 103N of the EP Act.

**suspicion of site contamination**
site contamination is suspected to exist at a site because a potentially contaminating activity has taken place there. Note: refer section 103H(1)(b) of the EP Act.

**Tier 1 assessment**
a risk-based analysis comparing site data with generic published screening criteria (Tier 1 criteria) for various environmental values.

**Tier 2 assessment**
a site-specific assessment in which risks to potentially exposed populations are assessed using site-specific data on pathways, and the characteristics of the exposed populations. In Tier 2, site data is compared with generic criteria modified for site-specific conditions.

**Tier 3 assessment**
is a further step from a Tier 2 evaluation and examines the specific risk-driving factors in more detail. This often involves additional data collection and may incorporate more sophisticated modelling techniques. In Tier 3, site data is compared with site-specific target levels.
volatile
Physical property of a chemical that indicates its potential to transform from an adsorbed, dissolved or liquid phase into a vapour phase under standard atmospheric conditions. Highly volatile substances have a low boiling point or subliming (high vapour) pressure.

(a) water occurring naturally above or under the ground; or
(b) water introduced to an aquifer or other area under the ground; or
(c) an artificially created body of water or stream that is for public use or enjoyment.

water restriction and prohibition area (GPA)
an area where a declaration has been made by the EPA under section 103S of the EP Act.

well
a hole drilled into an aquifer for the purpose of monitoring or extracting groundwater. This generic term includes groundwater bores, water wells and tubewells.
The principal legislation dealing with site contamination in South Australia is the *Environment Protection Act 1993* and, in particular, Part 10A of the EP Act deals with site contamination. The relationship of guidance published by the EPA to the legislation relevant to site contamination is summarised below.

Table 1—Links between legislation and EPA guidance relevant to site contamination

<table>
<thead>
<tr>
<th>Section of EP Act</th>
<th>Overview</th>
<th>Link to primary EPA guidance document</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 3</td>
<td>Various definitions: appropriate person, background concentrations, chemical substance, remediate, sensitive use, site, site contamination audit, site contamination auditor, site contamination audit report, site contamination consultant and water</td>
<td>Guideline for the assessment and remediation of site contamination, Guidelines for the site contamination audit system</td>
</tr>
<tr>
<td>Section 5B</td>
<td>Definition of site contamination</td>
<td>Guideline for the assessment and remediation of site contamination</td>
</tr>
<tr>
<td>Section 83A</td>
<td>Notification of site contamination of underground water</td>
<td>Site contamination: section 83A EP Act—Notification of site contamination that affects or threatens underground water</td>
</tr>
<tr>
<td>Section 103C</td>
<td>General provisions as to 'appropriate persons'</td>
<td>Guideline for the assessment and remediation of site contamination</td>
</tr>
<tr>
<td>Section 103H</td>
<td>Site Contamination Assessment Orders (SCAO)</td>
<td>Compliance and enforcement regulatory options and tools</td>
</tr>
<tr>
<td>Section 103I</td>
<td>Voluntary site contamination assessment proposals</td>
<td>Compliance and enforcement regulatory options and tools</td>
</tr>
<tr>
<td>Section 103J</td>
<td>Site Remediation Orders (SRO)</td>
<td>Compliance and enforcement regulatory options and tools</td>
</tr>
<tr>
<td>Section 103K</td>
<td>Voluntary site remediation proposals</td>
<td>Compliance and enforcement regulatory options and tools</td>
</tr>
<tr>
<td>Section 103S</td>
<td>Prohibition or restriction on taking water affected by site contamination</td>
<td>Guideline for the assessment and remediation of site contamination</td>
</tr>
<tr>
<td>Sections 103T-Z</td>
<td>Site contamination audit system</td>
<td>Guidelines for the site contamination audit system</td>
</tr>
<tr>
<td>Sections 103ZB, 119, 120A</td>
<td>Honesty in reporting</td>
<td>Guideline for the assessment and remediation of site contamination</td>
</tr>
</tbody>
</table>

Additional relevant EPA guidance includes the following:

- *Site contamination consultant (2014)*
- *Overview of the site contamination audit system (2014)*
- *Site contamination auditors (2014)*

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62 Current at time of publication. Please check the [EPA website](https://www.epa.sa.gov.au).
- Site contamination audit reports and audit statements (2014)
- Site contamination: Information for licensees (2009)
- Acid sulfate soil materials (2007)
Appendix 2—Summary of penalties and fees

There are a number of offences (and associated expiation fees and penalties) relating to site contamination. Key offences are identified throughout this guideline. A summary of the consequences for relevant divisional penalties provided in the EP Act is shown in the following table for convenience of reference only. The summary is based on the Appendix—‘Divisional penalties and expiation fees’ of the EP Act. The penalties and fees are as provided by section 28A of the Acts Interpretation Act 1915 and are correct on the date of publication.

Table 2—Summary of relevant division penalties

<table>
<thead>
<tr>
<th>Division</th>
<th>Maximum imprisonment</th>
<th>Maximum fine</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15 years</td>
<td>$60 000</td>
</tr>
<tr>
<td>3</td>
<td>7 years</td>
<td>$30 000</td>
</tr>
<tr>
<td>4</td>
<td>4 years</td>
<td>$15 000</td>
</tr>
<tr>
<td>5</td>
<td>2 years</td>
<td>$8 000</td>
</tr>
<tr>
<td>6</td>
<td>1 year</td>
<td>$4 000</td>
</tr>
</tbody>
</table>

A number of maximum penalties and expiation fees are also specified in the Regulations for specific offences. These have also been identified throughout this guideline.
Appendix 3—Assessment reporting checklist

<table>
<thead>
<tr>
<th>Table 3—Summary of PSI, DSI and SSRA reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Report section and information to be included where relevant</strong></td>
</tr>
<tr>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>Executive summary</td>
</tr>
<tr>
<td>Background</td>
</tr>
<tr>
<td>Objectives of investigation</td>
</tr>
<tr>
<td>Scope of work</td>
</tr>
<tr>
<td>Determination of site contamination</td>
</tr>
<tr>
<td>Notifications (eg, s 83A, audit)</td>
</tr>
<tr>
<td>Risk to human health and/or environment</td>
</tr>
<tr>
<td>Summary of conclusions and recommendations</td>
</tr>
<tr>
<td>Site information</td>
</tr>
<tr>
<td>Site identification (include address, allotments and plans, certificate(s) of title, coordinates, maps etc)</td>
</tr>
<tr>
<td>Site owner / site occupier</td>
</tr>
<tr>
<td>Site plan (layout, scale, north arrow, other site features)</td>
</tr>
<tr>
<td>Local government authority and zoning</td>
</tr>
<tr>
<td>Current and proposed site use and identification of site users</td>
</tr>
<tr>
<td>General information</td>
</tr>
<tr>
<td>Name of person requesting work</td>
</tr>
<tr>
<td>Clear statement of the scope of work</td>
</tr>
<tr>
<td>List of previous reports and brief description of works previously undertaken</td>
</tr>
<tr>
<td>Site contamination audit details (if site contamination auditor engaged)</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Report section and information to be included where relevant</th>
<th>Reference: guideline, NEPM Schedule</th>
<th>Preliminary site investigation (PSI)</th>
<th>Detailed site investigation (DSI)</th>
<th>Site specific risk assessment (SSRA)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Site history</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Past and current ownership and occupier details</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Past and current aerial photography</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Past and current certificate(s) of title back to original deeds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State and local government records</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other information sources (local residents, historical societies etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Past and current potentially contaminating activities (PCA) undertaken at or in the vicinity of the site</td>
<td>NEPM B2, section 3.3</td>
<td>✓</td>
<td>Summary</td>
<td>Summary</td>
</tr>
<tr>
<td>Chemical substances associated with past and current PCA’s</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Localised PCA’s at the site or in the vicinity of the site (product spills, storage areas, stockpiling or filling, asbestos etc.)</td>
<td>NEPM B2, section 3.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identification of ecological receptors within 500 m radius (surface waters, wetlands etc.)</td>
<td>NEPM B2, section 3.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Local geology and hydrogeology</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface elevation and topography</td>
<td></td>
<td>Desktop review, or intrusive if required</td>
<td>Summary</td>
<td></td>
</tr>
<tr>
<td>Regional and site-specific soil and geological records</td>
<td>NEPM B2, section 3.5</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geophysical data</td>
<td></td>
<td>If required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drilling logs / well logs (including soil strata, construction details, water level and quality)</td>
<td>NEPM B2, section 3.5</td>
<td></td>
<td></td>
<td>Summary or refer to DSI</td>
</tr>
<tr>
<td>Aquifer types (confined, unconfined etc.)</td>
<td></td>
<td>Desktop review, or intrusive if required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groundwater flow direction, flow rate, quality and current or potential future use</td>
<td></td>
<td>Desktop review, or intrusive if required</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

88
<table>
<thead>
<tr>
<th>Report section and information to be included where relevant</th>
<th>Reference: guideline, NEPM Schedule</th>
<th>Preliminary site investigation (PSI)</th>
<th>Detailed site investigation (DSI)</th>
<th>Site specific risk assessment (SSRA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey of existing groundwater wells and registration details</td>
<td>Water Connect</td>
<td>√</td>
<td></td>
<td>Summary or refer to DSI</td>
</tr>
<tr>
<td>Other geological and hydrogeological properties</td>
<td>NEPM B2, section 3.5</td>
<td>Desktop review, or intrusive if required</td>
<td></td>
<td>Summary</td>
</tr>
</tbody>
</table>

**Site inspection**

| Current site use and surrounding site use                      |                                       |                                   | √                                | √                                |
| Visual evidence / other observations of site contamination (discoloured soil, bare soil patches, odours etc.) |                                       |                                   | √                                | √                                |
| Condition of existing groundwater wells (if present)           | NEPM B2, section 3.6                  | √                                |                                   | Summary or refer to PSI           |
| Presence and condition of site structure and improvements (roads, buildings, storage tanks etc.) | NEPM B2, section 3.6                  |                                   | Summary or refer to PSI           | Summary or refer to PSI           |
| Potential for asbestos containing materials (ACM)              |                                       |                                   |                                   |                                   |
| Any other environmentally significant features                 |                                       |                                   |                                   |                                   |

**Background concentrations**

| Determine background soil quality | NEPM B1, section 2.5.7 | √ | √ | √ |
| Determine area not affected by activities at or in the vicinity of the site for background groundwater quality | NEPM B6, section 3.3 | Desktop review, or intrusive is required | √ | √ |
| Sufficient collection of up-gradient groundwater quality data | NEPM B6, section 3.3 | Desktop review, or intrusive if required | √ | √ |
|                                                                 | NEPM B2, section 8.1.2 |                                   |                                   |                                   |
|                                                                 | GAR Part 3B            |                                   |                                   |                                   |

**Investigation levels**

<table>
<thead>
<tr>
<th>Determine appropriate soil criteria taking into account current or proposed land use</th>
<th>GAR Part 3A</th>
<th>√</th>
<th>√</th>
<th>√</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental value assessment</td>
<td>NEPM B1</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td>GAR Part 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Report section and information to be included where relevant</td>
<td>Reference: guideline, NEPM Schedule</td>
<td>Preliminary site investigation (PSI)</td>
<td>Detailed site investigation (DSI)</td>
<td>Site specific risk assessment (SSRA)</td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>-------------------------------------</td>
<td>------------------------------------</td>
<td>-----------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Determine existence of actual or potential harm to water</td>
<td>GAR Part 2</td>
<td>Based on field sampling or laboratory analysis</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Details of s 83A notification</td>
<td>EPA s 83A Info Sheet</td>
<td>If applicable</td>
<td>If applicable</td>
<td>If applicable</td>
</tr>
<tr>
<td><strong>Conceptual site model (CSM)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Known and potential sources of contamination</td>
<td>NEPM B2, section 4.3 and 8.1.2</td>
<td>Preliminary CSM</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>GAR Part 3A and 3B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potentially affected element of environment</td>
<td>NEPM B2, section 4.3</td>
<td>Preliminary CSM</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>GAR Part 3A and 3B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human and ecological receptors</td>
<td></td>
<td>Preliminary CSM</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Potential and complete exposure pathways</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemicals of concern / interest</td>
<td></td>
<td>Preliminary CSM</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Nature of chemical substances (mobility, toxicity, volatility etc.)</td>
<td>NEPM B2, section 4.8.1.2 and 9.2.3</td>
<td>Preliminary CSM</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>GAR Part 3A and 3B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identifying and assessing data gaps for CSM refinement</td>
<td>NEPM B2, section 4.4</td>
<td>Preliminary CSM</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>GAR Part 3A and 3B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Written presentation of CSM (illustration to support if required)</td>
<td>NEPM B2, section 4.1</td>
<td>Preliminary CSM</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>GAR Part 3A and 3B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sampling plan methodology</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Define data quality objectives (DQO)</td>
<td>NEPM B2, section 5 and Appendix B</td>
<td>If intrusive investigations are required</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Number, locations, depth, frequency and patterns of sampling points</td>
<td>NEPM B2 section 5.3 and 6.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Report section and information to be included where relevant</td>
<td>Reference: guideline, NEPM Schedule</td>
<td>Preliminary site investigation (PSI)</td>
<td>Detailed site investigation (DSI)</td>
<td>Site specific risk assessment (SSRA)</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>----------------------------------------</td>
<td>--------------------------------------</td>
<td>----------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Sampling and analysis quality plans (SAQP)</td>
<td>NEPM B2, section 5.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elements of environment to be sampled (soil, groundwater, vapour, NAPL etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyte selection and analysis methods</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sampling methods and procedures</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment and interpretation of field data</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Soil assessment and results</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil sampling technique</td>
<td>NEPM B2, section 7.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field description of soils (with logs)</td>
<td>NEPM B2, section 7.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field testing</td>
<td>NEPM B2, section 7.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stockpile sampling</td>
<td>NEPM B2, section 7.5</td>
<td>If applicable</td>
<td></td>
<td>Summary or refer to DSI</td>
</tr>
<tr>
<td>Stockpile sampling</td>
<td>GAR Appendix 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil leachability to groundwater and surface water</td>
<td>NEPM B2, section 7.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comparison of results with appropriate criteria</td>
<td>NEPM B1 and B2</td>
<td></td>
<td></td>
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<tr>
<td>Comparison of results with appropriate criteria</td>
<td>GAR Part 3A</td>
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<tr>
<td><strong>Groundwater assessment and results</strong></td>
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<tr>
<td>Monitoring well establishment (including screen length and depth, bore logs etc.)</td>
<td>NEPM B2, section 8.2.1</td>
<td>If applicable</td>
<td></td>
<td>Summary or refer to DSI</td>
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<tr>
<td>Monitoring well establishment (including screen length and depth, bore logs etc.)</td>
<td>EPA guidelines; Regulatory monitoring and testing; Groundwater sampling (2007)</td>
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<tr>
<td>Groundwater sampling methods (consideration of sample methods, field filtration, sample bottles etc.)</td>
<td>NEPM B2, section 8.2.3.1</td>
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<tr>
<td>Groundwater parameters measured in field</td>
<td>NEPM B2, section 8.2.5</td>
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<td>Report section and information to be included where relevant</td>
<td>Reference: guideline, NEPM Schedule</td>
<td>Preliminary site investigation (PSI)</td>
<td>Detailed site investigation (DSI)</td>
<td>Site specific risk assessment (SSRA)</td>
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<tr>
<td>Aquifer properties (groundwater depth, flow direction, velocity, hydraulic conductivity etc.)</td>
<td>NEPM B2, sections 8.2.6, 8.2.7</td>
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<td>Delineation of contamination (lateral and vertical)</td>
<td>NEPM B2, section 8.3.1, 8.3.2</td>
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<tr>
<td>Potential for attenuation of contaminants</td>
<td>NEPM B2, section 8.3.4</td>
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<tr>
<td>Comparison of results with appropriate environmental values</td>
<td>GAR Part 1 and 3B</td>
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## Vapour assessment and results

### Preliminary and screening VI assessment

| Soil vapour probe installation (including depth, bore logs) | NEPM B2 section 9 and B7 Appendix A6 | | | |
| Soil vapour sampling methods (including leak testing) | | | | |
| Ambient air / geotechnical parameters | CRCCARE TR23 | | | Summary or refer to DSI |
| Comparison of results with appropriate assessment criteria | GAR Part 3B | | | |

### Detailed VI assessment

| Soil vapour probe installation (including depth, bore logs) | NEPM B2 section 9 and B7 Appendix A6 | | | |
| Delineation (lateral and vertical) | | | | Summary or refer to DSI |
| Potential for attenuation of contaminants | CRCCARE TR23 | | | |
| Assessment of preferential pathways | GAR Part 3B | | | |
| Comparison of results with appropriate assessment criteria | | | | |

## Field QA/QC

| Field quality assurance and quality control (including sampling methods, storage, preservation, handling of samples, decontamination of equipment, calibration of instruments etc.)—include documentation | NEPM B2, section 5.4, Appendix C | If required | | Summary or refer to DSI |
| Completed chain of custody (COC) documentation and information | NEPM B2, section 5.4.5 | | | |
## Assessment and remediation of site contamination

<table>
<thead>
<tr>
<th>Report section and information to be included where relevant</th>
<th>Reference: guideline, NEPM Schedule</th>
<th>Preliminary site investigation (PSI)</th>
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<th>Site specific risk assessment (SSRA)</th>
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<tr>
<td>Comparison of field screening methods with laboratory results</td>
<td>NEPM B2, Appendix C</td>
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<td>Appropriate QA/QC samples (blanks, duplicates etc.)</td>
<td>NEPM B2, Appendix C</td>
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<td><strong>Laboratory QA/QC</strong></td>
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<td>Comparison of QA/QC information with DQO’s</td>
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<td></td>
<td>Summary or refer to DSI</td>
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<tr>
<td>Copies of completed COC documentation from laboratory</td>
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<tr>
<td>Laboratory method accreditation and holding times for analyses</td>
<td>NEPM B2, Appendix C</td>
<td>If required</td>
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<tr>
<td>Summary of QA/QC</td>
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<td>Appropriate limits of reporting (LOR) for analytes</td>
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<td>Laboratory QC (relative percentage difference, recoveries, spikes)</td>
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<td><strong>Data presentation</strong></td>
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<tr>
<td>Results table of all chemicals of interest (include sample numbers, assessment criteria and highlighted results above criteria)</td>
<td>NEPM B2, section 14.5, 14.6</td>
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<tr>
<td>Summary of all previous results</td>
<td></td>
<td></td>
<td>If required</td>
<td>Summary or refer to DSI</td>
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<tr>
<td>Site plan with sample locations and results (include highlighting results above criteria)</td>
<td>NEPM B2, section 14.5</td>
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<tr>
<td>Concentration contours, cross sections, statistical diagrams</td>
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<tr>
<td><strong>Contaminant fate and transport modelling</strong></td>
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<tr>
<td>Select appropriate model and define objectives of modelling</td>
<td>NEPM B2, section 10</td>
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<td>Summary or refer to DSI</td>
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<td>Validate model</td>
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<td>Sensitivity analysis</td>
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<tr>
<td>Limitations, assumptions and uncertainties of model</td>
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<td>Assessment of results and reporting</td>
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<td>Report section and information to be included where relevant</td>
<td>Reference: guideline, NEPM Schedule</td>
<td>Preliminary site investigation (PSI)</td>
<td>Detailed site investigation (DSI)</td>
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<td>Data collection and evaluation</td>
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<td>Tier 1—comparison of results with appropriate screening criteria</td>
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<td>Tier 2—inclusion of site-specific data</td>
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<td>Tier 3—inclusion of more detailed site specific data</td>
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<tr>
<td>Sensitivity analysis</td>
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<tr>
<td>Limitations, assumptions and uncertainties</td>
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</tbody>
</table>

### Health risk assessment

| Details of stakeholders consulted / engaged | NEPM B8, section 4.1.3 | | | |
| Summary of information provided to stakeholders (correspondence, informed consent etc.) | GAR Part 5 | | | |

### Community engagement and risk communication

| Signed hard copy of reports | | | | |
| Appendices may be provided in electronic format | | | | |
| Searchable Adobe®PDF file of report (must be an accurate copy of the original) | GAR Appendix 10 | | | |
| Electronic files unlocked | | | | |
| Related documents may be included as an electronic appendix | | | | |
| Where available, laboratory analytical data to be provided in an electronic format acceptable by the EPA. | | | | |
### Table 4—Summary of SRP, RVR and SMP reporting

<table>
<thead>
<tr>
<th>Report section and information to be included where relevant</th>
<th>Reference: guideline, ASC NEPM Schedule</th>
<th>Remediation options assessment (ROA)</th>
<th>Remediation and validation reporting (RVR)</th>
<th>Site management plan (SMP)</th>
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<tr>
<td><strong>Executive summary</strong></td>
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<td>Summary or refer to ROA</td>
<td>Summary or refer to ROA</td>
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<td>Background</td>
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<td>Summary of risk conclusions (from DSI / SSRA)</td>
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<td>Scope of work</td>
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<tr>
<td>Environmental value (EV)</td>
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<td>Determination of harm to human health, water or the environment</td>
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<td>Remediation goals and objectives</td>
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<tr>
<td>Summary of remediation conclusions and recommendations</td>
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<td><strong>Site information</strong></td>
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<td>Site identification (include address, allotments and plans, certificate(s) of title, coordinates, maps etc)</td>
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<td>Site plan (layout, scale, north arrow, other site features)</td>
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<td>Current and proposed site use and identification of site users</td>
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<tr>
<td><strong>General information</strong></td>
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<tr>
<td>Name of person requesting work</td>
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<tr>
<td>Summary of previous works undertaken (include triggers for remediation, risk conclusions from DSI or SSRA)</td>
<td>GAR Part 3A and 3B</td>
<td>✓</td>
<td>Summary or refer to ROA</td>
<td>✓</td>
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<tr>
<td>Site contamination audit details (if site contamination auditor engaged)</td>
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<tr>
<td><strong>Remediation options and issues</strong></td>
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<tr>
<td>Define remediation approaches (technical, logistical, financial, value)</td>
<td>GAR Part 4, section 16.2</td>
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<td>Remediation options assessment (ROA)</td>
<td>Remediation and validation reporting (RVR)</td>
<td>Site management plan (SMP)</td>
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<tr>
<td>or water resource and ability to restore, threat to human health or environment)</td>
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<tr>
<td>Discuss impracticability considerations</td>
<td>GAR Part 4, section 16.3.2</td>
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<td>Summary or refer to ROA</td>
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<tr>
<td>Evaluate available and viable remediation options to achieve goals</td>
<td>GAR Part 4, sections 16 and 17</td>
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<tr>
<td>Document rationale for selected remediation option</td>
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<tr>
<td>Document management measures to prevent / reduce additional harm to human health, water or environment</td>
<td>GAR Part 4, section 16 and Appendix 5</td>
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<tr>
<td>Determine time frame for remediation completion</td>
<td>GAR Part 4, section 16</td>
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<tr>
<td>Review by EPA or site contamination auditor</td>
<td>GAR Part 4, Figure 7</td>
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<tr>
<td>Evaluate remediation completion (validation sampling may be required)</td>
<td>GAR Part 4, section 17</td>
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<tr>
<td>Update CSM with validation / additional data</td>
<td>GAR Part 3A</td>
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<tr>
<td>Update SSRA (human health risk assessment or environmental risk assessment) with validation / additional data</td>
<td>GAR Part 3A</td>
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<tr>
<td>Determine whether remediation goals, objectives, endpoints have been met</td>
<td>GAR Part 4, section 15.3</td>
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<tr>
<td>Stakeholder engagement</td>
<td>GAR Part 5</td>
<td></td>
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<tr>
<td>Determine whether post-remediation work is required (SMP, water restriction or prohibition area, special management area)</td>
<td>GAR Part 4, section 18</td>
<td>N/A</td>
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</table>

Electronic and hard copy reporting

<p>| Signed hard copy of reports | | | | ✔ |
| Appendices may be provided in electronic format | GAR Appendix 10 | ✔ | ✔ | ✔ |</p>
<table>
<thead>
<tr>
<th>Report section and information to be included where relevant</th>
<th>Reference: guideline, ASC NEPM Schedule</th>
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<th>Remediation and validation reporting (RVR)</th>
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<td>Related documents may be included as an electronic appendix</td>
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<tr>
<td>Where available, laboratory analytical data to be provided in an electronic format acceptable by the EPA.</td>
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## Appendix 5—Environmental aspects for consideration

<table>
<thead>
<tr>
<th>Environmental aspect</th>
<th>Significance</th>
<th>Guidance and references</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air quality</strong></td>
<td>Many chemical substances, particularly those associated with petroleum hydrocarbons, gasworks wastes, organic solvents or putrescible wastes, may generate offensive odours or noxious vapours. The release of these to the air can cause varying types and degrees of impact, such as explosive conditions, toxic environments, unacceptable health risks (either acute or chronic) and objectionable odours.</td>
<td>ASC NEPM B2, section 15.2.1 National Environment (Ambient Air Quality) Protection Measure (Air Quality NEPM) EPA Guideline: <em>Air quality impact assessment using design ground level pollutant concentrations</em> (2006), 386/06</td>
</tr>
<tr>
<td><strong>Odour and gases (volatile emissions)</strong></td>
<td>Odours may also cause community concern because the public is likely to perceive odours as posing a health risk to the potentially affected community.</td>
<td>enHealth: <em>Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards</em>, 2002 GAR, Part 2, section 7.2: ‘Hazardous circumstances’</td>
</tr>
<tr>
<td><strong>Dust (particulate) emissions</strong></td>
<td>Dust may cause concerns about potential health and environmental impacts if generated at unacceptable levels near sensitive receptors (eg, remediation workers, surrounding community). Meteorological conditions (eg, wind currents) or human activities (eg, traffic, earth moving during site clearing or remediation) may generate dust and result in dust emissions travelling off site. Dust can also be a cause for community concern due to impacts on lifestyle and amenity of the area, and potential health risks posed by chemicals within the dust. Small particles can travel much greater distances than larger particles. Small particles can cause health problems by entering the lungs, whilst larger particle sizes are generally caught in the respiratory tract and might result in sinus congestion, sneezing or coughing.</td>
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<tr>
<td>Environmental aspect</td>
<td>Significance</td>
<td>Guidance and references</td>
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<tr>
<td>Dust (stockpile management)</td>
<td><strong>Stockpiles</strong>&lt;br&gt;Stockpiles, if not correctly managed, can represent a considerable source of dust due to their height, uncompacted nature and (frequently) close proximity to sensitive receptors.&lt;br&gt;Stockpiles should have a maximum height of about 3 m, or equal to or lower than the average height of surrounding structures.&lt;br&gt;Stockpile height should reduce as it approaches the site boundary. Stockpile heights should be below fence lines when within about 5 m of the boundary.&lt;br&gt;Stockpiles should be covered with an effective covering. The contents of the stockpile will dictate the level of cover, i.e., complete enclosure or the formation of a crust layer.&lt;br&gt;Stockpiles should have sufficient moisture content before being handled. Water can be applied the night before and allowed to infiltrate the stockpile. Applying water to a stockpile during handling has little effect on reducing dust emissions. Using water jets or sprays has minimal effect in capturing airborne dust, especially when out in the open.&lt;br&gt;In all cases, it is important that an appropriate level of community consultation is undertaken at all stages of the project. Local residents and stakeholders should be advised in advance about the likely duration, impacts, potential health risks and mitigation measures to be undertaken, followed by updates during the remediation period.</td>
<td>GAR Part 4, section 16.4.2 and 16.4.3</td>
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<tr>
<td>Environmental aspect</td>
<td>Significance</td>
<td>Guidance and references</td>
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<tr>
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</table>
| **Dust (asbestos management)** | **Asbestos** | ASC NEPM, B2, section 11  
Government of Western Australia, Department of Health: *Guidelines for the assessment, remediation and management of asbestos-contaminated sites in Western Australia* (2009)  
GAR, Part 4, section 16.4.5  
| **Noise** | Noise from earthmoving, compaction activities, pumps, blowers, machinery, sirens and vehicles can be a health risk to workers and a nuisance for neighbouring properties.  
Failure to adequately address noise issues associated with remediation activities may also have legislative implications under specific legislation and policies. | ASC NEPM B2, section 15.2.7  
EPA Information Sheet: *Environmental Noise* (2013), 424/13  
*Environment Protection (Industrial Noise) Policy 1994*  
*Environment Protection (Machine Noise) Policy 1994*  
| **Surface water** | Surface waterbodies receive stormwater, which runs directly into waterways, lakes and, ultimately, oceans. Runoff from rainfall and natural site drainage may carry with it leachate or suspended solids containing chemical substances. | GAR Part 4, section 16.6  
ASC NEPM B2, section 15.2.3  
*Environment Protection (Water Quality) Policy 2003*  
Code of practice for: *Industrial, retail and commercial stormwater management* (in draft at date of publication) |
Management of surface waters during remediation activities is an important part of protecting the health of our waterways and preventing the spread of pollution. The *Environment Protection (Water Quality) Policy 2003* (Water Quality Policy) contains stringent controls for the management of water quality.

Taking care to prevent cross-contamination of nearby clean soils is important so as to avoid the spread of chemical substances, and to minimise the amount of soil needing to be treated and the resources required to undertake the project. Similarly, care should be exercised so that polluted surface water does not affect clean soils.

The *Water Quality Policy* imposes stringent obligations to not pollute groundwater and to take all reasonable and practical measures to prevent or minimise environmental harm. When undertaking remediation, specific obligations must be complied with to ensure that water quality is not degraded.

Non-compliance with a mandatory provision of the EPP is an offence. Depending on the seriousness of the offence, the EPA may choose to prosecute through the ERD Court or pursue other options, such as issuing relevant orders (Environment Protection Order, Clean-up Order or Site Contamination Order) to gain compliance with the EPP. Fines may apply if a person has been shown to be negligent, even if the offence was accidental.

For some remediation projects, off-site groundwater monitoring may be necessary to assess the effectiveness of remediation activities or the extent of remediation required. It is important to ensure that the community is informed about and understands the purpose of monitoring and is not alarmed by such off-site activity.

<table>
<thead>
<tr>
<th>Environmental aspect</th>
<th>Significance</th>
<th>Guidance and references</th>
</tr>
</thead>
</table>
| **Soil quality (including acid sulfate soils)** | Taking care to prevent cross-contamination of nearby clean soils is important so as to avoid the spread of chemical substances, and to minimise the amount of soil needing to be treated and the resources required to undertake the project. Similarly, care should be exercised so that polluted surface water does not affect clean soils. | GAR—Part 4, section 16.4.6  
ASC NEPM B2, section 15.2.6  
ASC NEPM B2, section 15.2.8  
EPA brochure—*Illegal Dumping: It will cost you* (2012)  
EPA—*Standard for the production and use of waste derived fill*, (2013)  
EPA—*Current criteria for the classification of waste—including industrial and commercial waste (listed) and waste soil* (2010) |
| **Groundwater** | The *Water Quality Policy* imposes stringent obligations to not pollute groundwater and to take all reasonable and practical measures to prevent or minimise environmental harm. When undertaking remediation, specific obligations must be complied with to ensure that water quality is not degraded. Non-compliance with a mandatory provision of the EPP is an offence. Depending on the seriousness of the offence, the EPA may choose to prosecute through the ERD Court or pursue other options, such as issuing relevant orders (Environment Protection Order, Clean-up Order or Site Contamination Order) to gain compliance with the EPP. Fines may apply if a person has been shown to be negligent, even if the offence was accidental. For some remediation projects, off-site groundwater monitoring may be necessary to assess the effectiveness of remediation activities or the extent of remediation required. It is important to ensure that the community is informed about and understands the purpose of monitoring and is not alarmed by such off-site activity. | GAR—Parts 2, 3 and 4, Appendix 6  
ASC NEPM B2, section 15.2.2  
WQ EPP (environmental values) |
### Environmental aspect

<table>
<thead>
<tr>
<th>Flora and fauna</th>
<th>Significance</th>
<th>Guidance and references</th>
</tr>
</thead>
</table>
| Areas of sensitive vegetation and significant trees have substantial environmental value and should be protected, even where site contamination may exist. | ASC NEPM B2, section 15.2.10  
Development Act 1993, and the relevant development plan for the location  
National Parks and Wildlife Act 1972  
Native Vegetation Act 1991  
Federal legislation—Environment Protection and Biodiversity Conservation Act 1999  
It should be noted that this aspect falls outside the EPA's jurisdiction. It is recommended that the relevant authority be contacted if additional information or advice is required. |
| Significant trees are specifically protected from tree-damaging activities under the Development Act 1993. Threatened flora and fauna are also protected under federal environment protection and biodiversity conservation legislation. |  
Threatened species Schedules are found in the National Parks and Wildlife Act and referred to under the Native Vegetation Act.  
Compliance with all legislation covering sensitive or threatened species of flora and fauna is required. |
| The area designated for remediation may have structures, landscape elements, archaeological deposits or vegetation of heritage significance that could, themselves, contain chemical substances or waste, or are located above soils or groundwater that may be contaminated. | ASC NEPM B2, section 15.2.9  
Development Act 1993  
Heritage Places Act 1993  
Federal legislation  
It should be noted that this aspect falls outside the EPA's jurisdiction. It is recommended that the Department of Water, Environment and Natural Resources (responsible for the Native Vegetation Act) be contacted if additional information/advice is required. |
<p>| It is also possible that excavation or earth-moving activities may uncover artefacts of cultural or historical significance. Such artefacts may have substantial heritage value and should be protected. |  |</p>
<table>
<thead>
<tr>
<th>Environmental aspect</th>
<th>Significance</th>
<th>Guidance and references</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>For Aboriginal heritage the appropriate agency is the Department of the Premier and Cabinet.</td>
</tr>
</tbody>
</table>
## Appendix 6—Groundwater environmental values

### Table 5—Environmental values for groundwater based on measured salinity concentrations

<table>
<thead>
<tr>
<th>Environmental value (EV) for groundwater</th>
<th>Salinity (mg/L TDS)</th>
<th>&lt;1,000</th>
<th>1,000</th>
<th>3,000</th>
<th>7,000</th>
<th>14,000</th>
<th>&gt;14,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecosystems (fresh)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Ecosystems (marine)</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinking water</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recreational water</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Irrigation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stock watering (sheep)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aquaculture</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 7—Prescribed potentially contaminating activities

The following activities are prescribed as potentially contaminating activities by clause 50 of the Environment Protection Regulations 2009, for the purposes of sections 103C and 103H of the EP Act. For further information refer to section 6 of this guideline.

Schedule 3 Part 1 of the Regulations—Activities undertaken in course of business

Table 6—Prescribed potentially contaminating activities: Undertaken in the course of business

<table>
<thead>
<tr>
<th>Activity</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasive blasting</td>
<td>Operation of works for abrasive blast cleaning or disposal of abrasive blasting material (including mobile abrasive blasting works and abrasive blast cleaning carried out in fully enclosed booths, but excluding abrasive blast cleaning undertaken for residential purposes)</td>
</tr>
<tr>
<td>Acid sulfate soil generation</td>
<td>Oxidation of iron sulfide in potential acid sulfate soil material (sulfidic material) resulting in formation of actual acid sulfate soil material or sulfuric material</td>
</tr>
<tr>
<td>Agricultural activities</td>
<td>Any of the following activities undertaken in the course of agriculture:</td>
</tr>
<tr>
<td></td>
<td>• burial of animals or parts of animals</td>
</tr>
<tr>
<td></td>
<td>• burial of other waste</td>
</tr>
<tr>
<td></td>
<td>• irrigation using wastewater</td>
</tr>
<tr>
<td></td>
<td>• intensive application or administration of a listed substance to animals, plants, land or water (excluding routine spraying, in accordance with manufacturers’ instructions, of pesticides used in broadacre farming)</td>
</tr>
<tr>
<td>Airports, aerodromes or aerospace industry</td>
<td>Operation of premises for commercial or charter aircraft take-off and landing or manufacture, repair or maintenance of commercial or charter aircraft or aircraft equipment</td>
</tr>
<tr>
<td>Animal burial</td>
<td>Burial of animals or parts of animals other than in the course of agriculture</td>
</tr>
<tr>
<td>Animal dips or spray-race facilities</td>
<td>Operation of animal dips or spray-race facilities</td>
</tr>
<tr>
<td>Animal feedlots</td>
<td>Operation of confined yards or areas for holding of animals and feeding of animals principally by mechanical means or by hand</td>
</tr>
<tr>
<td>Animal saleyards</td>
<td>Operation of yards at which cattle, sheep or other animals are gathered and confined for the purpose of their sale, auction or exchange (including associated transport loading facilities and associated wastewater disposal)</td>
</tr>
<tr>
<td>Asbestos disposal</td>
<td>Disposal of asbestos or asbestos products</td>
</tr>
<tr>
<td>Asphalt or bitumen works</td>
<td>Operation of works for manufacture of asphalt or bitumen</td>
</tr>
<tr>
<td>Battery manufacture, recycling or disposal</td>
<td>Assembly, disassembly, manufacture or recycling of batteries (excluding storage of batteries for sale)</td>
</tr>
<tr>
<td>Activity</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Breweries</td>
<td>Production of beer by infusion, boiling or fermentation</td>
</tr>
<tr>
<td>Brickworks</td>
<td>Production of bricks (including glazing of bricks)</td>
</tr>
<tr>
<td>Bulk shipping facilities</td>
<td>Operation of facilities for bulk handling of agricultural crop products, rock, ores, minerals or liquid organic chemical substances to or from wharf or wharfside facility (including seaport grain terminals)</td>
</tr>
<tr>
<td>Cement works</td>
<td>Operation of works for production of cement clinker or grinding of cement clinker using argillaceous and calcareous materials</td>
</tr>
<tr>
<td>Ceramic works</td>
<td>Operation of works for manufacture of tiles, pipes, pottery goods, refractories or other ceramic products</td>
</tr>
<tr>
<td>Charcoal manufacture</td>
<td>Manufacture of charcoal</td>
</tr>
<tr>
<td>Coal handling or storage</td>
<td>Handling of coal, coke or carbonaceous material by any means or storage of coal, coke or carbonaceous reject material</td>
</tr>
<tr>
<td>Coke works</td>
<td>Production, quenching, cutting, crushing or grading of coke</td>
</tr>
<tr>
<td>Compost or mulch production or storage</td>
<td>Production or storage of compost, mulch or garden soils</td>
</tr>
<tr>
<td>Concrete batching works</td>
<td>Operation of works for production of concrete or concrete products manufactured by inclusion of cement, sand, rock, aggregate or similar materials</td>
</tr>
<tr>
<td>Curing or drying works</td>
<td>Operation of works for smoking, drying or curing meat, fish or other edible products by application of heat or smoke</td>
</tr>
<tr>
<td>Defence works</td>
<td>Operation of military defence establishments (including training areas)</td>
</tr>
<tr>
<td>Desalination plants</td>
<td>Operation of desalination plants</td>
</tr>
<tr>
<td>Dredge spoil disposal or storage</td>
<td>Disposal of dredge spoil onto land or storage of dredge spoil</td>
</tr>
<tr>
<td>Drum reconditioning or recycling works</td>
<td>Operation of works for reconditioning or recycling of metal or plastic drums</td>
</tr>
<tr>
<td>Dry cleaning</td>
<td>Operation of premises for dry cleaning</td>
</tr>
<tr>
<td>Electrical or electronics component manufacture</td>
<td>Manufacture of electrical or electronics components</td>
</tr>
<tr>
<td>Electrical substations</td>
<td>Operation of electrical substations</td>
</tr>
<tr>
<td>Electrical transformer or capacitor works</td>
<td>Operation of works for manufacture, repair, storage or disposal of electrical transformers, capacitors or associated equipment or fluids</td>
</tr>
<tr>
<td>Electricity generation or power plants</td>
<td>Operation of electricity generation or power plants</td>
</tr>
<tr>
<td>Explosives or pyrotechnics facilities</td>
<td>Operation of facilities for manufacture of explosives or pyrotechnics</td>
</tr>
<tr>
<td>Fertiliser manufacture</td>
<td>Manufacture of agricultural fertiliser</td>
</tr>
<tr>
<td>Fibreglass manufacture</td>
<td>Manufacture of fibreglass products</td>
</tr>
<tr>
<td>Activity</td>
<td>Definition</td>
</tr>
<tr>
<td>----------</td>
<td>------------</td>
</tr>
<tr>
<td>Fill or soil importation</td>
<td>Importation, to premises of a business, of soil or other fill originating from a site at which another potentially contaminating activity has taken place</td>
</tr>
<tr>
<td>Fire extinguisher or retardant manufacture</td>
<td>Manufacture of fire extinguishers or fire retardants</td>
</tr>
<tr>
<td>Fire stations</td>
<td>Underground storage of fuel at fire stations</td>
</tr>
<tr>
<td>Fire training areas</td>
<td>Operation of premises for fire training involving the use of liquid fuel, fire accelerants, aqueous film forming foam or similar substances</td>
</tr>
<tr>
<td>Foundry</td>
<td>Manufacture of metal products by injecting or pouring molten metal into moulds</td>
</tr>
<tr>
<td>Fuel burning facilities</td>
<td>Burning of solid or liquid fuel (including for generation of power or steam at rate of heat release exceeding 1MW)</td>
</tr>
<tr>
<td>Furniture restoration</td>
<td>Restoration of furniture</td>
</tr>
<tr>
<td>Gasworks</td>
<td>Operation of gasworks or gas holders</td>
</tr>
<tr>
<td>Glass works</td>
<td>Operation of works for manufacture of glass products</td>
</tr>
<tr>
<td>Glazing</td>
<td>Glazing of ceramics or pottery</td>
</tr>
<tr>
<td>Hat manufacture or felt processing</td>
<td>Manufacture of hats or processing of felt</td>
</tr>
<tr>
<td>Incineration</td>
<td>Incineration within the meaning of Schedule 1, Part A, clause 3(1) of the EP Act</td>
</tr>
<tr>
<td>Iron or steel works</td>
<td>Operation of works for manufacture of iron or steel</td>
</tr>
<tr>
<td>Laboratories</td>
<td>Operation of laboratories</td>
</tr>
<tr>
<td>Landfill sites</td>
<td>Operation of sites for disposal of waste onto or into land</td>
</tr>
<tr>
<td>Lime burner</td>
<td>Manufacture (by means of kiln) of cement or lime from limestone (including associated storage of waste)</td>
</tr>
<tr>
<td>Metal coating, finishing or spray painting</td>
<td>Finishing, treating or coating of metal (including anodising, galvanising, pickling, electroplating, heat treatment, powder coating, enamelling and spray painting)</td>
</tr>
<tr>
<td>Metal forging</td>
<td>Forging of metal products</td>
</tr>
<tr>
<td>Metal processing, smelting, refining or metallurgical works</td>
<td>Operation of works for melting (by means of furnace) of ferrous or non-ferrous metal or smelting or reduction of ores to produce metal</td>
</tr>
<tr>
<td>Mineral processing, metallurgical laboratories or mining or extractive industries</td>
<td>Chemical or physical extraction or processing of metalliferous ores, storage of mining or exploration waste (for example, in tailings dams, overburden or waste rock dumps) mining or processing of minerals or operation of laboratories or pilot facilities for processing or testing of minerals</td>
</tr>
<tr>
<td>Mirror manufacture</td>
<td>Manufacture of mirrors</td>
</tr>
<tr>
<td>Activity</td>
<td>Definition</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Motor vehicle manufacture</td>
<td>Manufacture of motor vehicles</td>
</tr>
<tr>
<td>Motor vehicle racing or testing venues</td>
<td>Operation of facilities designed and used for motor vehicle competitions or motor vehicle speed or performance trials</td>
</tr>
<tr>
<td>Motor vehicle repair or maintenance</td>
<td>Operation of premises for repair or maintenance of motor vehicles or parts of motor vehicles (including engine reconditioning works)</td>
</tr>
<tr>
<td>Motor vehicle wrecking yards</td>
<td>Operation of yards for wrecking or dismantling of motor vehicles or parts of motor vehicles</td>
</tr>
<tr>
<td>Mushroom farming</td>
<td>Farming of mushrooms</td>
</tr>
<tr>
<td>Oil recycling works</td>
<td>Operation of works for recycling of oil</td>
</tr>
<tr>
<td>Oil refineries</td>
<td>Operation of works for refining of crude petroleum oil or shale</td>
</tr>
<tr>
<td>Paint manufacture</td>
<td>Manufacture (including blending, mixing and formulation) of paint</td>
</tr>
<tr>
<td>Pest control works</td>
<td>Operation of premises for storage of pesticides or filling or washing of tanks used in pest control operations</td>
</tr>
<tr>
<td>Plastics manufacture works</td>
<td>Operation of works for manufacture (including blending, mixing and formulation) of plastics or plastic components (excluding processing</td>
</tr>
<tr>
<td></td>
<td>and moulding of plastics manufactured elsewhere)</td>
</tr>
<tr>
<td>Printing works</td>
<td>Operation of printing works</td>
</tr>
<tr>
<td>Pulp or paper works</td>
<td>Operation of works for manufacture of timber pulp or paper</td>
</tr>
<tr>
<td>Railway operations</td>
<td>Railway operations within the meaning of Schedule 1 Part A clause 7(2) of EP Act</td>
</tr>
<tr>
<td>Rubber manufacture or processing</td>
<td>Manufacture or processing of rubber or rubber products</td>
</tr>
<tr>
<td>Scrap metal recovery</td>
<td>Recovery (including cleaning) of scrap metal</td>
</tr>
<tr>
<td>Service stations</td>
<td>Operation of retail fuel outlets</td>
</tr>
<tr>
<td>Ship breaking</td>
<td>Wrecking or dismantling of ships</td>
</tr>
<tr>
<td>Spray painting</td>
<td>Spray painting other than spray painting of metal</td>
</tr>
<tr>
<td>Tannery, fellmongery or hide curing</td>
<td>Operation of works for preservation or treatment of animal skins or hides</td>
</tr>
<tr>
<td>Textile operations</td>
<td>Manufacture or dyeing of fabrics or materials</td>
</tr>
<tr>
<td>Transport depots or loading sites</td>
<td>Operation of transport depots or loading sites</td>
</tr>
<tr>
<td>Tyre manufacture or retreading</td>
<td>Manufacture or retreading of tyres</td>
</tr>
<tr>
<td>Vermiculture</td>
<td>Cultivation of earthworms for production of earthworm castings</td>
</tr>
<tr>
<td>Vessel construction, repair or maintenance</td>
<td>Operation of works or facilities (whether on water or land) for construction, repair or maintenance of vessels</td>
</tr>
<tr>
<td>Activity</td>
<td>Definition</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Waste depots</td>
<td>Reception, storage or treatment (including recycling) of waste or disposal of waste to land or water</td>
</tr>
<tr>
<td>Wastewater treatment, storage or disposal</td>
<td>Treatment, storage (including in tanks, lagoons and ponds) or disposal (to land or water) of wastewater</td>
</tr>
<tr>
<td>Water discharge to underground aquifer</td>
<td>Direct discharge of water from surface of land to underground aquifer</td>
</tr>
<tr>
<td>Wetlands or detention basins</td>
<td>Operation of bodies of water less than 6 metres deep for collection and management of stormwater or other wastewater for urban amenity, flood mitigation or ecological or other environmental purposes</td>
</tr>
<tr>
<td>Wineries or distilleries</td>
<td>Operation of works for processing grapes or other produce to make wine or spirits</td>
</tr>
<tr>
<td>Wood preservation works</td>
<td>Operation of works involving treatment or preservation of timber using chemicals</td>
</tr>
<tr>
<td>Wool scouring or wool carbonising works</td>
<td>Operation of works involving cleaning or carbonising of wool other than in the course of handicraft business where wool is further processed for retail sale</td>
</tr>
<tr>
<td>Works depots</td>
<td>Operation of works depots by councils or utilities</td>
</tr>
</tbody>
</table>

**Schedule 3 Part 1 of the Regulations—Domestic activities**

Table 7—Prescribed potentially contaminating activities: Domestic activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fill or soil importation</td>
<td>Importation, to domestic premises, of soil or other fill originating from a site at which another potentially contaminating activity has taken place</td>
</tr>
<tr>
<td>Liquid organic chemical substances—storage</td>
<td>Storage of more than 500 litres of liquid organic chemical substances in underground or above-ground tanks or vessels at a discrete premises (excluding storage of oil for domestic heating at the premises)</td>
</tr>
</tbody>
</table>

**Schedule 3 Part 1 of the Regulations—Listed substances**

Table 8—Prescribed potentially contaminating activities: Listed substances

| Acidic solutions                              | Copper solutions                                      |
| Acids                                         | Cyanide complexes                                    |
| Adhesives (excluding solid inert polymeric materials) | Cyanides                                             |
| Alkali metals                                 | Cyanide solutions                                     |
| Alkaline earth metals                         | Cytotoxic wastes                                      |

---

63 Intended to capture other business activities that manufacture or store listed substances over a set threshold (500 L/500 kg). If a business has manufactured or stored these chemical substances at a weight or volume exceeding the threshold, then the manufacture or storage will also be deemed as a potentially contaminating activity. The purpose of the storage threshold is to exclude minor storage of the listed substances.
<table>
<thead>
<tr>
<th>Chemical / Substance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaline solutions</td>
<td>Dangerous substances within the meaning of the Dangerous Substances Act 1979</td>
</tr>
<tr>
<td>Alkalis</td>
<td>Distillation residues</td>
</tr>
<tr>
<td>Antimony</td>
<td>Equipment containing mercury</td>
</tr>
<tr>
<td>Antimony compounds</td>
<td>Fluoride compounds</td>
</tr>
<tr>
<td>Antimony solutions</td>
<td>Halogens</td>
</tr>
<tr>
<td>Arsenic</td>
<td>Heterocyclic organic compounds containing oxygen, nitrogen or sulfur</td>
</tr>
<tr>
<td>Arsenic compounds</td>
<td>Isocyanate compounds (excluding solid inert polymeric materials)</td>
</tr>
<tr>
<td>Arsenic solutions</td>
<td>Laboratory chemicals</td>
</tr>
<tr>
<td>Asbestos</td>
<td>Lead compounds</td>
</tr>
<tr>
<td>Barium compounds</td>
<td>Lead solutions</td>
</tr>
<tr>
<td>Barium solutions</td>
<td>Lime sludges or slurries</td>
</tr>
<tr>
<td>Beryllium</td>
<td>Liquid organic chemical substances</td>
</tr>
<tr>
<td>Beryllium compounds</td>
<td>Manganese compounds</td>
</tr>
<tr>
<td>Boron</td>
<td>Medical waste within the meaning of Schedule 1 Part B of the Environment Protection Act 1993</td>
</tr>
<tr>
<td>Boron compounds</td>
<td>Mercaptans</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Mercury compounds</td>
</tr>
<tr>
<td>Cadmium compounds</td>
<td>Mutagens</td>
</tr>
<tr>
<td>Cadmium solutions</td>
<td>Nickel compounds</td>
</tr>
<tr>
<td>Calcium carbide</td>
<td>Nickel solutions</td>
</tr>
<tr>
<td>Carbon disulfide</td>
<td>Nitrates</td>
</tr>
<tr>
<td>Carcinogens</td>
<td>Organic halogen compounds (excluding solid inert polymeric materials)</td>
</tr>
<tr>
<td>Chlorates</td>
<td>Organic phosphates</td>
</tr>
<tr>
<td>Chromium compounds</td>
<td>Solvent recovery residues</td>
</tr>
<tr>
<td>Chromium solutions</td>
<td>Sulphides</td>
</tr>
<tr>
<td>Copper compounds</td>
<td>Sulphide solutions</td>
</tr>
<tr>
<td>Phosphorus compounds</td>
<td>Surfactants</td>
</tr>
<tr>
<td>Polychlorinated biphenyls</td>
<td>Teratogens</td>
</tr>
<tr>
<td>Radionuclides</td>
<td>Thallium</td>
</tr>
<tr>
<td>Reactive chemicals</td>
<td>Thallium compounds</td>
</tr>
<tr>
<td>Reducing agents</td>
<td>Thallium solutions</td>
</tr>
<tr>
<td>Selenium</td>
<td>Vanadium compounds</td>
</tr>
<tr>
<td>Selenium compounds</td>
<td>Zinc compounds</td>
</tr>
<tr>
<td>Selenium solutions</td>
<td>Zinc solutions</td>
</tr>
<tr>
<td>Silver compounds</td>
<td></td>
</tr>
<tr>
<td>Silver solutions</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 8—Honesty in reporting

1 Site contamination consultant/auditor contact details

(this section is to be completed by the consultant or auditor)

Form completed whilst engaged as a consultant [ ] or auditor [ ] (tick only one box)

Consultant/auditor company:

Auditor accreditation number (if applicable):

Postal address:

Telephone: ( ) Facsimile: ( )

Email:

Consultant/auditor reference:

EPA reference number (if applicable):

Declaration:

I understand that it is an offence to provide false or misleading information to the Authority (section 120A of the Environment Protection Act 1993).

I understand that I must clearly qualify any statement of my opinion as to the existence of site contamination at the site by specifying the land uses that were taken into account in forming that opinion (section 103ZA of the Environment Protection Act 1993).

Maximum penalties range from $15 000 for individuals to $60 000 for corporations.

Name:

Signature:

Position of signatory: Date:
## Site information

*(this section is to be completed by the consultant or auditor)*

<table>
<thead>
<tr>
<th>Site name (if applicable):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site address:</td>
</tr>
<tr>
<td>Certificate of Title number(s):</td>
</tr>
<tr>
<td>Date(s) of assessment:</td>
</tr>
<tr>
<td>Site owner and contact details:</td>
</tr>
<tr>
<td>Site occupier and contact details <em>(if applicable):</em></td>
</tr>
<tr>
<td>Name, address and position of person requesting report:</td>
</tr>
<tr>
<td>Existing or proposed land use:</td>
</tr>
<tr>
<td>Consultant/auditor reference:</td>
</tr>
</tbody>
</table>
Section 103ZB of the Environment Protection Act 1993 states that:

A person must not make a statement that the person knows to be false or misleading in a material particular (whether by reason of the inclusion or omission of any particular) in any information furnished to a site contamination auditor or site contamination consultant that might be relied on by the auditor or consultant in preparing a report relating to site contamination (whether or not required under this or any other Act).

Maximum penalties range from $30,000 for individuals to $60,000 for corporations.

Declaration:

I hereby declare I have read and that I understand section 103ZB of the Environment Protection Act 1993 printed above.

Name:

Signature:

Position of signatory: Date:

Name:

Signature:

Position of signatory: Date:

Name:

Signature:

Position of signatory: Date:

Name:

Signature:

Position of signatory: Date:

Name:

Signature:

Position of signatory: Date:
Appendix 9—References for legislation and guidelines

Auditors and consultants should refer to published national and state legislation and guidelines relevant to the assessment, remediation and auditing of site contamination when carrying out audits. A list of publications considered relevant to the assessment and remediation of site contamination is provided below. The list is not exhaustive and auditors and consultants are expected to refer to other published guidelines or standards as appropriate.

This list of guidelines/documents was correct at the time of issue of this guideline.

Legislation

Copies of the EP Act and Regulations, and all other South Australian legislation are available from the South Australian legislation website.

National environment protection measures

National environment protection measures are made under section 14 of the National Environment Protection Council Act 1994 and the equivalent section of the National Environment Protection Council (South Australia) Act 1994. Auditors should have regard to any relevant national environment protection measure, but, in particular, the National Environmental Protection (Assessment of Site Contamination) Measure 1999 (ASC NEPM), amended in 2013.

The purpose of this measure is to establish a nationally consistent approach to the assessment of site contamination. South Australia is a participating state in the Intergovernmental Agreement on the Environment made on 1 May 1992, and is a participating jurisdiction in relation to the ASC NEPM, which was made on 10 December 1999 and amended in 2013. The ASC NEPM is required to be implemented by the state through the National Environment Protection Council (South Australia) Act 1995.

Other NEPMs likely to be relevant include:

- National Environmental Protection (Air Toxics) Measure, prepared in 2011

Refer to the National Environment Protection Council (NEPC) website for details.

Environment Protection Policies

Environment Protection Policies (EPPs) are a second level of environment protection legislation under the EP Act to secure the aims of the Act. EPPs may contain mandatory provisions that are enforceable under the EP Act, either as offences or by the issuing of an EPO. EPPs may also refer to, or require compliance with, codes of practice. EPPs include:

- Environment Protection (Water Quality) Policy 2003
- Environment Protection (Air Quality) Policy 1994

Refer to the EPA website for a listing of all EPPs.

Guidelines issued by the EPA

Guidelines issued by the EPA considered relevant in relation to site contamination in South Australia include this guideline and all publications in the site contamination series. A summary is included in Appendix 1.

Other relevant guidelines issued by the EPA include the following waste guidelines:

- Standard for the production and use of waste derived fill (2013)
- Landfill gas and development near landfills – advice for planning authorities and developers (2012)
Current criteria for the classification of waste – including industrial and commercial waste (listed) and waste soil (2010).

All publications issued by the EPA are available from the EPA website. Hard copies can be obtained by contacting the EPA.

Further reading and reference documents

Other reference guidelines and documents may be relevant to and useful for the assessment and remediation of site contamination assessment and remediation. It is the responsibility of consultants and auditors to identify and utilise such documents where relevant.

The ASC NEPM includes references to documents that provide supporting or further information. Consultants and auditors are expected to have regard to these references as appropriate.

The CRC CARE (Cooperative Research Centre for Contamination Assessment and Remediation of the Environment) has published a series of technical reports. Several of these technical reports are referenced in the ASC NEPM. The technical reports are available through the CRC CARE website.

Other national publications considered relevant are also referenced as appropriate in this and other EPA guidelines.
Appendix 10—Electronic format of notifications and reports

Notifications and reports

File format

Information regarding site contamination is required to be placed on the Public Register by the EPA. Notifications and reports require ongoing preservation by the EPA to support access and use over time.

Electronic versions of notifications and reports are requested to be provided to the EPA as PDF files (Portable Document Format®), which are regarded as suitable for long-term record preservation. The electronic files may be provided to the EPA on CD or DVD or other acceptable digital format.

All pages within the PDF file should be numbered and the page size set to the ISO 216 A–series Standard, for example, A4, A3, A0, and so on. In addition, the resolution of the file should not be any lower than 300 dots per inch. Any attachments, such as photos, figures and maps, should also be included within the PDF, as discussed under: ‘Other issues’ in this appendix. A notification or report may include colour, and black and white information. This information should be appropriately reproduced within the electronic copy.

File naming

File name conventions ensure that notifications and reports can be stored and retrieved in an efficient manner. All notifications recorded and administered by the EPA are assigned a reference number. The reference number is unique and is provided by the EPA following receipt of a notification. All reports subsequently submitted to the EPA should be named using the assigned reference number followed by the report completion date in the format YYYYMMDD, for example: 60000 20143001.

Searchability and copy protection

All submitted PDF files must be text searchable. The EPA will request enabled electronic files of notifications or reports that are not able to be searched or that are copy protected. Appendices provided as PDF files should also support searchable text and copying of text and images.

Encryption, passwords and copy protection

PDF files submitted to the EPA should not be locked with any form of password. The EPA will request electronic copies of reports that are not encrypted or require passwords to access, display, copy, search or print.

Printing options

PDF files should include printing permissions that allow unrestricted printing. The EPA will request enabled electronic copies of reports where these functions are restricted.

Other issues

Any file attachments, sound files, movie files, plug-in extensions or Javascript actions should be removed or disabled. Such features are difficult to preserve in the long term and may alter the way a file is displayed in the future. PDF files should be self-contained. There are several options in the PDF specification that allow components of a PDF document to be external to the PDF file. Such components are most likely to be lost during long-term preservation, so externally linked objects or referenced content should be removed or embedded in the PDF file.

64 Refer to section 109 of the EP Act for requirements of the EPA Public Register.