Environment Protection Authority

Guidelines for the assessment and remediation of site contamination

EPA South Australia

Guidelines for the assessment and remediation of site contamination

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ISBN 978-1-921495-55-7

February 2014

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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Contents

List of figures

List of tables

Abbreviations

(The) Act	Environment Protection Act 1993
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999, as ammended in 2013
CSM	conceptual site model
DQO(s)	data quality objective(s)
DSI	detailed site investigation
EPA	(South Australian) Environment Protection Authority
EIL	ecological investigation level (for information on limitations and application refer to Schedule B1 of the ASC NEPM)
EPP	environment protection policy
ESL	ecological screening level (for information on limitations and application refer to Schedule B1 of the ASC NEPM)
EV	environmental value
FAQs	frequently asked questions
GIL	groundwater investigation level (for information on limitations and application refer to Schedule B1 of the ASC NEPM)
HIL	health investigation level (for information on limitations and application refer to Schedule B1 of the ASC NEPM)
HSL	health screening level (for information on limitations and application refer to Schedule B1 of the ASC NEPM)
LOR	limit of reporting
LBSC Act	Land and Business (Sale and Conveyancing) Act 1994
ML	management limit (for information on limitations and application refer to Schedule B1 of the ASC NEPM)
NAPL	non-aqueous phase liquid
PCA	potentially contaminating activity
PAN20	Planning Advisory Notice 20 (Site contamination)
PSI	preliminary site investigation
(The) Regulations	Environment Protection Regulations 2009
SCAO	site contamination assessment order
SCAR	site contamination audit report
SCAS	site contamination audit statement
SRO	site remediation order
SSRA	site specific risk assessment
VOC(s)	volatile organic compound(s)
VOCCs	volatile organic chlorinated compounds
VSCAP	voluntary site contamination assessment proposal
VSRP	voluntary site remediation proposal

Summary

The South Australian 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. This guideline outlines the mandatory requirements and the EPA's expectations regarding the assessment and remediation of site contamination in South Australia; to ensure the protection of human health and the environment and to enable consistency and compliance with relevant legislation, policy and guidance.

This guideline has primarily been developed for site owners, persons identified as responsible (or liable) for site contamination, site contamination auditors[1] (auditors), site contamination consultants[2] (consultants) and persons with an interest in the assessment and remediation of site contamination.

This guideline describes in detail the following:

- the purpose of the guidance and related national and EPA guidance
- the legislative framework and how to determine whether site contamination exists
- liability for site contamination
- likely triggers for auditing, assessment and remediation
- EPA regulation and administration of site contamination
- roles of key parties in assessment and remediation processes
- notification and reporting requirements for land owners, occupiers, consultants and auditors
- guidance on notification of hazardous circumstances by consultants and auditors
- summary of the tiered risk based assessment process described in the ASC NEPM
- guidance on aspects of site characterisation including conceptual site models, soil, asbestos, groundwater, non aqueous phase liquids, marine and surface water bodies and vapour assessment
- guidance on remediation as defined in the legislation, the likely triggers for remediation, defining remediation goals, objectives and endpoints and the implementation of remediation
- a framework for the expected reporting of remediation including site remediation plans, remediation and validation reporting and site management plans including ongoing site remediation (management) and monitoring
- guidance on the principles and process for how community engagement and risk communication in relation to site contamination should be addressed as well as the role of the EPA in community engagement
- information on site contamination held by the EPA and how to access this information.

1 Defined in section 3(1) of the Act

2 Defined in section 3(1) of the Act

Part 1

Legislative and policy framework

1 Introduction

1.1 Purpose

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 on the EPA's expectations regarding the assessment and remediation of site contamination to protect human health and the environment, and to ensure consistency and compliance with relevant legislation, policy and guidance. It also 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 guidance is intended to protect human health and the environment in a manner consistent with the objects as defined in Section 10 of the *Environment Protection Act 1993* and 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*, as amended in 2013 (ASC NEPM).

This guideline has primarily been developed as guidance for site owners and persons identified as responsible (or liable) for site contamination, site contamination auditors[3] (auditors), site contamination consultants[4] (consultants), and persons with an interest in the determination, assessment and remediation of site contamination.

The guideline is structured into the following parts to assist readers and users of this document and describes the following:

Part 1 Legislative and policy framework

- Purpose of the guidance and related national and EPA guidance
- Legislative framework and how to determine whether site contamination exists
- Liability for site contamination
- Likely triggers for assessment, remediation and auditing

Part 2 Roles and responsibilities

- EPA regulation and administration of site contamination
- Roles of key parties in assessment and remediation processes
- Notification and reporting requirements for land owners, occupiers, consultants and auditors
- Guidance on notification of hazardous circumstances by consultants and auditors

Part 3A Assessment: Overview and framework

- Summary of the tiered risk-based assessment process described in the ASC NEPM

Part 3B Assessment: Elements of the environment

- Guidance on technical aspects of the assessment of groundwater, environmental values and background concentrations

[3] Defined in section 3(1) of the Act

[4] Defined in section 3(1) of the Act

- Guidance on technical aspects of the assessment of vapour intrusion for petroleum hydrocarbons, chlorinated hydrocarbons, and triggers for vapour remediation

Part 4 Remediation of site contamination

- Guidance on remediation as defined in the legislation, the likely triggers for remediation, defining remediation goals, objectives and endpoints and the implementation of remediation
- Guidance on remediation options and key considerations for the protection of the environment during remediation
- Framework for the expected reporting of remediation including site remediation plans, remediation and validation reporting and site management plans including ongoing site remediation (management) and monitoring

Part 5 Community engagement and information

- Guidance on the principles and process for how community engagement and risk communication in relation to site contamination should be addressed as well as the role of the EPA in community engagement
- Information on site contamination held by the EPA and how to access this information.

The guideline has a glossary of key terms and appendices which provide additional information including a summary of related EPA guidance, legislative penalties, criteria for the determination of harm to water, a summary of reporting requirements, key aspects of the environment when undertaking assessment and remediation, and the electronic format of documents required by the EPA.

1.2 EPA site contamination guidance

This guideline describes the legislative and policy framework for the risk-based assessment and remediation of site contamination in South Australia. It acts as a parent document for a supporting series of guidelines and information sheets. A list of EPA and other publications relevant to the assessment, remediation and auditing of site contamination is included in Appendix 1.

1.3 National guidance

The ASC NEPM is the principle guidance document for the assessment of site contamination in Australia.

The purpose is to establish a nationally consistent approach for the assessment of site contamination to ensure sound environmental management practices are adopted by the community, including regulators, site assessors, site contamination consultants, site contamination 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 environmental site assessment.

This guideline and other documents in the site contamination series are intended to be consistent with the national framework and guidance provided in the ASC NEPM.

The ASC NEPM (amended) is available for download from the ComLaw website.

1.4 Application of this guideline

This guideline is primarily intended for persons with an interest or obligation in the determination, assessment and remediation of site contamination in South Australia.

The Act and *Environment Protection Regulations 2008* (the Regulations) include a range of different requirements for auditors, consultants, land owners and occupiers. Key legislative provisions have been highlighted throughout the guideline in text boxes where appropriate. Legislative requirements have also been identified in this guideline with the

use of the word ‘must’. Where ‘must’ or ‘must not’ 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 Act, the Regulations or relevant guidelines issued by the EPA.

The legislation provides significant penalties for offences and breaches, including expiations, fines and/or imprisonment. Relevant fines and penalties are identified throughout this document[5].

This guideline is not intended to provide details of all relevant legislative provisions. Persons should to seek their own legal advice and interpretation where needed.

1.5 Currency of this guideline

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

- What is site contamination? (2009)
- Determination of background concentrations (2008)
- How to determine actual or potential harm to water that is not trivial resulting from site contamination (2008)
- Guidelines for the assessment and remediation of groundwater (2009)
- Responsibility for assessment and remediation of site contamination (2009)
- Environmental management of on-site remediation (2006)
- Soil bioremediation (2005)
- Honesty in reporting (2008).

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

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 publications related to site contamination.

1.6 Site contamination

1.7 Definition and framework

In South Australia, the Act and Environment Protection Regulations (the Regulations establish the legislative framework for managing site contamination.

The legislation defines key terms relating to the assessment, remediation and auditing of site contamination. The EPA considers the following to be the most relevant sections and parts of the Act that are associated with this guideline:

- Section 5 environmental harm definition
- Section 5B site contamination definition
- Section 10 objects of Act
- Section 25 general environmental duty
- Part 5 environment protection policies
- Section 83 notification where serious or material environmental harm caused or threatened (mandatory notification)

[5] Refer to Appendix 3 for further information

- Section 83A notification of site contamination of underground water (mandatory notification)
- Part 10A special provisions and enforcement powers for site contamination
- Section 109 Public register

The objects of the Act promote the principles of ecologically sustainable development and to ensure that all reasonable and practicable measures are taken to protect, restore and enhance the quality of the environment[6]. The Act also establishes a general environmental duty[7] which creates an obligation for persons to avoid causing environmental harm[8].

Copies of the legislation are available from the South Australian legislation website.

Selected key legislative provisions of the Act relating to site contamination and relevant EPA guidance, where published, is identified in the table contained in Appendix 1.

The EPA encourages consultants and auditors to refer to the relevant sections in the Act for the assessment, remediation and auditing of site contamination in South Australia.

Site contamination is defined in the Act as follows:

Section 5B—Site contamination

(1) For the purposes of this Act, site contamination exists at a site if—

(a) chemical substances are present on or below the surface of the site in concentrations above the background concentrations (if any); and

(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

(c) the presence of the chemical substances in those concentrations has resulted in—

(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

(ii) actual or potential harm to water that is not trivial; or

(iii) other actual or potential environmental harm that is not trivial, taking into account current or proposed land uses.

(2) For the purposes of this Act, environmental harm is caused by the presence of chemical substances—

(a) whether the harm is a direct or indirect result of the presence of the chemical substances; and

(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.

(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[9].

Section 3 of this guideline considers the key components of the definition of site contamination.

The glossary of 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 Defined in section 3(1) of the Act, refer also to the Glossary

7 Refer to section 25 of the Act. Further recommendations for one's general environmental duty are provided in Part 4, section 17.1 of this guideline.

8 Defined in section 5 of the Act.

9 Subsection 3 enables the Regulations under the Act 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.

If site contamination is determined to exist, it is necessary to determine whether it triggers mandatory notification requirements pursuant to sections 83 and 83A of the Act (refer to Part 2, section 9 of this guideline) or represents potentially hazardous circumstances (refer to Part 2, section 10 of this guideline).

2 Defining site contamination

2.1 Chemical substances and waste

A chemical substance is defined in section 3(1) of the Act to mean:

Section 3(1) – Interpretation, chemical substance
any organic or inorganic substance, whether a solid, liquid or gas (or combination thereof), and includes waste.

Waste is also defined in section 3(1) of the Act. Refer to the Environment Protection (Waste to Resources) Policy 2010.

2.2 Background concentrations

To determine whether or not site contamination exists, it is essential to assess whether chemical substances are present above background concentrations.

The term 'background concentrations' is defined in section 3(1) of the Act to mean:

Section 3(1) – Interpretation, 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

By definition, site contamination cannot be determined to exist unless background concentrations of the chemical substances have been established; thus, contamination is only present if the concentrations (obtained during the assessment) exceed background concentrations.

Chemical substances may be found in soils, groundwater and soil gases at varying naturally occurring background concentrations. The source of naturally occurring chemical substances is typically from processes such as erosion and dissolution of mineral deposits. These concentrations will be dependent on and are influenced by topography, geology, geography and the physical, biological and chemical properties of the soil and groundwater. Certain regions of South Australia are known to have elevated levels of naturally occurring metals and metalloids in soil, surface water or groundwater.

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

2.2.1 Soil

Consideration of background soil quality should be in accordance with the guidance provided in Schedules B1, B2 and B5 of the ASC NEPM.

Specific determination of the ambient background concentration is required for derivation of some of the ecological investigation levels (refer to Schedule B1 of the ASC NEPM). The methodology for the collection of data to assess soil quality should be conducted in accordance with Schedule B2 of the ASC NEPM.

2.2.2 Groundwater

The assessment of background groundwater quality should be conducted in accordance with Schedule B6, Section 3.3 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.

The EPA considers where information has been sourced during the preliminary stages of assessment that the following may be considered to demonstrate background concentrations of the groundwater:

- a desktop review of available local and regional hydrogeological and geologic conditions, and
- suitable information be considered as part of the conceptual site model (CSM), to demonstrate up-gradient groundwater quality (refer to Schedule B2, Section 8.1.2 of the ASC NEPM).

In some circumstances, the EPA considers intrusive investigations to demonstrate background concentrations may not be necessary.

For further guidance on defining background concentrations for groundwater, refer to Part 3B, Section 13.3 of this guideline.

2.2.3 Soil vapour

If petroleum and chlorinated hydrocarbons are detected in soil vapour, they are not considered to be naturally occurring. As such, these substances cannot be attributed as background concentrations.

Some bulk ground gases (also referred to as hazardous ground gases) that may be associated with landfill gas generated from a landfill (for example methane), may also be present due to naturally occurring processes. In these circumstances, the naturally occurring concentrations would be considered to represent background concentrations and the contribution associated with a specific potentially contaminating activity (refer to section 3.4 of this guideline) would need to be considered separately.

2.2.4 Naturally occurring chemical substances

If disturbed as the result of an activity, naturally occurring chemical substances may result in site contamination.

The EPA considers that early identification of naturally occurring chemical substances will assist consultants and auditors when defining site contamination (related to any element of the environment). The EPA recommends this be undertaken during the preliminary stages of the assessment of site contamination.

Examples of chemical substances naturally occurring in South Australia may be specific to the geological and hydrogeological formations that are subject to investigation. In particular, identifying at the preliminary stage of assessment whether potential acid sulfate soils exist, is important to determine appropriate techniques and approaches to assess and/or remediate site contamination. Further guidance on acid sulfate soils is provided in the EPA Guideline, *Site contamination: Acid sulfate soil materials (2007)*.

Where there are naturally occurring chemical substances in soils, surface water and groundwater that may impact or potentially impact on current or proposed land use(s), advice may be sought from the EPA in developing appropriate management measures for the protection of human health and the environment.

2.3 Activity

An activity is defined in section 3(1) of the Act as:

Section 3(1) – Interpretation, activity
activity includes the storage or possession of a pollutant

A pollutant is defined in section 3(1) of the Act as:

Section 3(1) – Interpretation, pollutant
(a) any solid, liquid or gas (or combination thereof) including waste, smoke, dust, fumes and odour; or (b) noise; or (c) heat; or (d) anything declared by regulation (after consultation under section 5A) or by an environment protection policy to be a pollutant, but does not include anything declared by regulation or by an environment protection policy not to be a pollutant.

2.4 Prescribed potentially contaminating activities

A potentially contaminating activity (PCA) is an activity prescribed in regulation 50 of the Regulations. The identification of whether a PCA has occurred at a site is relevant in determining whether site contamination is suspected to exist for the purposes of issuing a site contamination assessment order (103H of the Act). The undertaking of a PCA may also be relevant in determining the person with liability to be issued with an Order in accordance with section 103C of the Act (refer to section 5 of this guideline).

The following activities are prescribed by regulation 50 of the Regulations for the purposes of sections 103C and 103H of the Act:

Regulation 50 – Potentially contaminating activities (sections 103C and 103H)
(a) an activity of a kind set out in Schedule 3 clause 2 of the Regulations, undertaken in the course of a business; (b) any other activity (other than an activity of a kind excluded under Schedule 3 clause 2 of the Regulations from the ambit of potentially contaminating activities) undertaken in the course of a business involving— (i) the manufacture, production (including as a by-product or waste) or recycling of a listed substance or a product containing a listed substance; or (ii) the storage at a discrete premises of the business of— (A) 500 litres or more of a liquid listed substance; or (B) 500 kilograms or more of a listed substance other than a liquid; (C) a domestic activity of a kind set out in Schedule 3 clause 3.

A reproduction of Schedule 3, Parts 1 and 2 of the Regulations, current at the time of publication, is included in Appendix 7.

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 may occur.

During the preliminary stages of assessment, it is essential that consultants and auditors determine whether a potentially contaminating activity or land use has occurred on a site to be able to identify the relevant chemicals of interest related to the activity.

2.5 Site and land

Site is defined in section 3(1) of the Act as meaning:

Section 3(1) – Interpretation, site
an area of land (whether or not in the same ownership or occupation)

Land is defined in section 3(1) of the Act as meaning:

Section 3(1) – Interpretation, land
a physical entity, including land covered with water

A site which is the subject of assessment and remediation would normally be land legally defined by, for example one or more relevant certificates of title. Site contamination may extend outside the physical boundaries of the portion of a site under investigation and/or the legally defined boundaries of the property. This may occur as a result of the migration of chemical substances in groundwater, or may also exist as a result of previous subdivisions of land. When this is identified, the contamination is typically referred to as 'off-site' contamination.

2.6 Land use

Current or proposed land uses for a site are relevant to determine whether there is actual or potential harm to human health and safety or the environment as part of determining whether site contamination exists (refer to sections 4 and 2.12 respectively). The Act does not require consideration of land use in determining whether there is actual or potential harm to water.

The determination of whether site contamination exists, based on actual or potential harm to water is not dependent on land use considerations.

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 land use. This is an important concept. For example, the presence of a chemical substance in soils on an industrial site may not be determined to be site contamination. However the same quantity and concentration of this substance may be assessed to be site contamination, if the land use was changed to a sensitive use.

2.7 Sensitive use

Land use descriptions used in providing opinions on the existence of site contamination, in site contamination audit reports, should be consistent as far as possible with:

- the definition of sensitive use in the Act, and
- land use descriptions given in the *Development Act 1993* and relevant Development Plans.

The EPA considers auditors to be the only persons qualified to provide statements in relation to the suitability of sensitive use sites. For the roles and responsibilities of site contamination auditors, refer to the *EPA Guidelines: Site contamination audit system (Draft 2014)*.

Sensitive use is defined in the Act to mean:

Section 3(1) – Interpretation, sensitive use
(a) use for residential purposes; or (b) use for a pre-school[10] within the meaning of the Development Regulations 1993; or (c) use for a primary school; or (d) use of a kind prescribed by regulation[11].

[10] Under the *Development Regulations 1993*, the definition of pre-school includes a nursery, kindergarten or childcare centre

[11] Currently, there is nothing prescribed for this purpose

The EPA considers the following generic land use settings[12] (as defined in the ASC NEPM) to be appropriate for describing the residential component of sensitive land use:

- residential with garden/accessible soil; home grown produce <10% fruit and vegetable intake, no poultry (eg this may include low density residential developments)
- residential with minimal opportunities for soil access; includes dwellings with fully and permanently paved yard space such as high rise buildings and apartments (eg this may include medium and high density residential developments).

Other typical land use descriptions include:

- recreational including public open space such as parks, playgrounds, playing field (eg ovals), secondary schools and footpaths
- commercial/industrial including premises such as shops, offices, factories and industrial sites.

Refer to section 6 of this guideline for information on the triggers for the assessment, remediation and auditing of site contamination relating to changes to land use in planning and development processes.

In reports, consultants and auditors are required to make qualified statements regarding whether site contamination exists for specified land uses under section 103ZA of the Act. Refer to section 8.3 for further information on reporting requirements.

2.8 Water

Water is defined in the Act to mean:

Section 3(1) – Interpretation, water
(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.

In South Australia, water quality is protected by the 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 sources. 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 the purpose of this guideline, water occurring naturally or introduced under the ground will be referred to as groundwater.

2.9 Environmental values (EV)

Environmental values (EV) of water bodies are considered to be the qualities of those water bodies (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 water bodies in the South Australia Environment Protection (Water Quality) Policy (WQEPP) as updated from time to time.

[12] Refer to Schedule B7, Section 3 ASC NEPM

2.9.1 EV for groundwater

For the purpose of determining whether site contamination of groundwater exists, the EPA considers it essential that the appropriate EV for groundwater be determined. In the absence of specific guidance in the WQEPP, refer to Table 1 for the determination of the appropriate EV for groundwater.

The EPA considers this determination should occur at the preliminary stages of the assessment. Thus, the groundwater EV will form part of the preliminary conceptual site model (CSM). It is essential to determine if the groundwater at a site may be connected to an adjacent ecosystem (fresh or marine).

In the absence of this determination, it should be assumed that both fresh and marine ecosystems must be protected.

Where the identification of an appropriate EV requires the collection of site specific groundwater quality data (ie salinity cannot be determined from a desktop or background assessment), the sampling and methodology should be consistent with Schedule B6 of the ASC NEPM and Part 3B, section 13.2 of this guideline.

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 to the values provided in Table 1.

If salinity concentrations are measured in alternative units, conversion to mg/L TDS is required to compare the data to the values provided in Table 1.

Table 1 Identification of environmental values (EV) for groundwater based on measured salinity concentrations

Environmental value (EV) for groundwater	Salinity (mg/L TDS)				
	<1,000	1,000–3,000	3,000–7,000	7,000–14,000	>14,000
Ecosystems (fresh)	✓	✓	✓	✓	✓
Ecosystems (marine)				✓	✓
Drinking water	✓				
Recreational water	✓	✓	✓	✓	✓
Irrigation	✓	✓	✓		
Stock watering	✓	✓	✓	✓ (sheep)	
Aquaculture	✓	✓	✓	✓	✓

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.

3 Actual or potential harm

3.1 Actual or potential harm to the health or safety of human beings that is not trivial, taking into account 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 in South Australia. The EPA recommends consultants and auditors 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 the human health investigation and screening levels (HILs, HSLs, interim HILs for soil vapour, and asbestos screening levels) described in the ASC NEPM. Selection of appropriate land use 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.

3.2 Actual or potential harm to water that is not trivial

It is essential that appropriate EVs for groundwater are assessed and defined prior to making the determination of actual or potential harm to water that is not trivial (refer to section 3.9 of this guideline).

In particular, the EPA considers that actual or potential harm to groundwater, that is not trivial, exists if chemical substances are:

a present in (or within close proximity to) the water in the form of a non-aqueous phase liquid (NAPL, refer to section 10.6), or

b detected in the water at a concentration above the harm to water criteria (see below) for the appropriate environmental value/s, or

c detected in the water at concentrations above the laboratory limit of reporting (LOR) for where there is no specified harm to water criteria, or

d detected in soil in a form or concentration which has the potential to result in one or more of (a), (b) or (c) above.

Harm to water criteria for each of the EV for groundwater (identified in Table 1), have been defined by the EPA and are provided in Appendix 2. Where there is more than one EV, the most conservative criteria should be selected to provide the highest level of protection. Where there are no criteria listed for a chemical, then the appropriate criteria (regardless of EV) is the laboratory limit of reporting (LOR).

Chemicals analysed for the purpose of determining groundwater hydro-geochemical properties (eg cations and anions) should not be considered in the determination of harm to water **unless** they have been identified as a potential contaminant of concern (or chemical of interest), i.e. associated with a PCA and/or land use.

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

Environmental harm is defined in the Act to mean:

Section 5 – Environmental harm

(1) For the purposes of this Act, environmental harm is any harm, or potential harm, to the environment (of whatever degree or duration) and includes—

(a) an environmental nuisance; and

(b) anything declared by regulation (after consultation under section 5A) or by an environment protection policy to be environmental harm.

(2) For the purposes of this Act, potential harm includes risk of harm and future harm.

(3) For the purposes of this Act, the following provisions are to be applied in determining whether environmental harm is material environmental harm or serious environmental harm:

(a) environmental harm is to be treated as material environmental harm if—

(i) it consists of an environmental nuisance of a high impact or on a wide scale; or

(ii) it involves actual or potential harm to the health or safety of human beings that is not trivial, or other actual or potential environmental harm (not being merely an environmental nuisance) that is not trivial; or

(iii) it results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding $5 000;

(b) environmental harm is to be treated as serious environmental harm if—

(i) it involves actual or potential harm to the health or safety of human beings that is of a high impact or on a wide scale, or other actual or potential environmental harm (not being merely an environmental nuisance) that is of a high impact or on a wide scale; or

(ii) it results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding $50 000.

(4) For the purposes of subsection (3), loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent or mitigate the environmental harm and to make good resulting environmental damage.

(5) For the purposes of this Act, environmental harm is caused by pollution—

(a) whether the harm is a direct or indirect result of the pollution; and

(b) whether the harm results from the pollution alone or from the combined effects of the pollution and other factors.

Determining whether the conditions for environmental harm have been met may be based on the findings of preliminary and/or detailed[13] (where appropriate) ecological risk assessments. Ecological risk assessment should be undertaken in accordance with the guidance provided in Schedule B of the ASC NEPM.

Consideration must be given to appropriate application of the ecological investigation and screening levels (EILs and ESLs) as provided in the ASC NEPM.

[13] Prior to conducting a detailed ecological risk assessment it is recommended consultants and auditors discuss the issues with the EPA

On selection of appropriate land use scenarios[14] and potential exposure pathways in the context of the CSM and DQO, the EPA recommends consultants and auditors consider whether actual or potential environmental harm that is not trivial, taking into account the land uses has occurred. Refer to Part 2, section 9 of this guideline for further information on environmental harm notification requirements.

[14] Consult with the EPA for guidance on areas of high ecological value

4 Liability for site contamination

4.1 Appropriate persons

The EPA can issue a site contamination assessment order or a site remediation order to an 'appropriate person' in accordance with sections 103H or 103J of the Act, respectively. The 'appropriate person' is determined by the EPA in accordance with sections 103C to 103F of the Act.

Section 103B of the Act assigns liability retrospectively:

Section 103B – Application of this Part to site contamination

This Part applies to site contamination at a site whether the chemical substances were first present there, or the environmental harm resulted, before or after the commencement of this Part or this Act.

Where the EPA is satisfied[15] 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. However, the Act sets out some circumstances where it is not considered practicable[16] 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, assuming that the owner meets the definition of an appropriate person for the purposes of section 103C of the Act.

If the EPA suspects that site contamination exists because a potentially contaminating activity of a kind prescribed by regulation has occurred at the site[17], the EPA can only issue a site contamination assessment order to the owner of the site. Where an order is issued against an owner as opposed to the person who caused site contamination, 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 103C of the Act provides:

Section 103C – General provisions as to appropriate persons

(1) Subject to this Part, the appropriate person to be issued with a site contamination assessment order or a site remediation order in respect of a site under Division 3 is—

(a) the person who caused the site contamination at the site; or

(b) if it is not practicable to issue the order to that person, the owner of the site provided that—

i before the person acquired the site, the person knew, or ought reasonably to have been aware, that chemical substances were present, or likely to be present, on or below the surface of the site such as to require, or be likely to require, remediation; or

ii —

(A) before the person acquired the site, the person knew, or ought reasonably to have been aware, that the activity that caused the site contamination at the site had been carried on at the site, or while the person was the owner, the person knew, or ought reasonably to have been aware, that the

15 Refer to section 103J(1)(a) of the Act

16 Refer to section 103C(3) of the Act.

17 Refer to section 3.4 of this guideline

activity that caused the site contamination at the site was being carried on at the site; and

(B) the activity is an activity of a kind prescribed by the regulations as a potentially contaminating activity.

(2) However, if the basis for issuing a site contamination assessment order is only the Authority's suspicion under section 103H(1)(b) as to the existence of site contamination at the site, subsection (1) of this section does not apply and the appropriate person to be issued with the order is the owner of the site.

(3) For the purposes of subsection (1), it is not practicable to issue a site contamination assessment order or a site remediation order to a person if the person—

(a) has died or, in the case of a body corporate, ceased to exist; or

(b) cannot, after reasonable inquiry, be identified or located; or

(c) would, in the opinion of the Authority, for any reason, be unable to carry out, or meet the costs and expenses of, the action required or authorised under the order.

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

4.2 More than one appropriate person

Section 103F of the Act states the following:

Section 103F – Order may be issued to one or more appropriate persons

If, in the application of this Division, there are 2 or more persons to whom it is practicable to issue an order under Division 3 as appropriate persons, the Authority may determine that—

(a) any 1 of the persons is the appropriate person to be issued with the order; or

(b) 2 or more of the persons are the appropriate persons to be issued with the order (with the effect that the persons are jointly and severally liable to comply with the requirements of the order).

4.3 Causing site contamination by changing site use

Section 103D of the Act states the following:

Section 103D – Causing site contamination

(1) For the purposes of this Act, a person is to be taken to have caused site contamination if the person was the occupier of land when there was an activity at the land that caused or contributed to the site contamination.

(2) If site contamination would not have resulted at a site but for a change of use of a kind prescribed by regulation (whether the change occurred before or after the commencement of this Part or this Act), 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 this Act.

(3) The operation of subsection (2) in a particular case is not to be taken to exclude the possibility of another person or persons also having caused the site contamination under subsection (1).

(4) For the purposes of subsection (2), a person does not bring about a change of use of a site because the person was a relevant authority that granted a consent or approval in respect of the site under the Development Act 1993.

4.4 Refusal of entry onto land

Section 103L of the Act states the following:

Section 103L— Entry onto land by person to whom order is issued

(1) A site contamination assessment order or a site remediation order does not confer on the person to whom it is issued a power to enter land of which that person is not an occupier, to remain on such land or to do anything on such land, without the permission of—

(a) the occupier of the land; and

(b) the owner of the land (unless the order has been issued to the owner or the occupier is the owner).

(2) However—

(a) if permission is withheld or withdrawn by the owner, the Authority may—

(i) revoke, suspend or vary the order; and

(ii) if the owner has been warned of the possible consequences of withholding or withdrawing permission, issue a site contamination assessment order or a site remediation order in respect of the land to the owner as if the owner were the appropriate person;

(b) if permission is withheld or withdrawn by the occupier, the Authority may—

(i) revoke, suspend or vary the order; and

(ii) if the occupier has been warned of the possible consequences of withholding or withdrawing permission, issue a site contamination assessment order or a site remediation order in respect of the land to the occupier as if the occupier were the appropriate person.

(3) If a site remediation order is issued under subsection (2), this Act applies as if no person other than the person issued with the order has liability for site contamination described in the order in respect of the land.

The EPAs preference is to avoid access to other person's land unless such access is essential. If it becomes necessary to gain access to another person's land and that person is withholding permission, then the matter should be discussed with the EPA.

4.5 Transfer of liability

Section 103(E) of the 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 *Transfer of liability*.

5 Process and triggers for assessment, remediation and auditing

5.1 Overall process

A general overview of the triggers for the assessment, remediation and auditing of site contamination is shown in Figure 1. The extent and duration of the process may vary, depending on the level and the 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 on the risk based assessment process and to Part 4 for guidance on remediation.

5.2 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 activity or use of at the site.

Remediation should be implemented where measures are required to address the identified risk resulting from the site contamination.

In some instances, a site contamination audit may be required.

The specific triggers for site contamination assessment, remediation and auditing at a site may be statutory or regulatory requirements, or they may be triggered by non-statutory voluntary mechanisms. The nature of the trigger will determine the extent of the investigation work that is necessary.

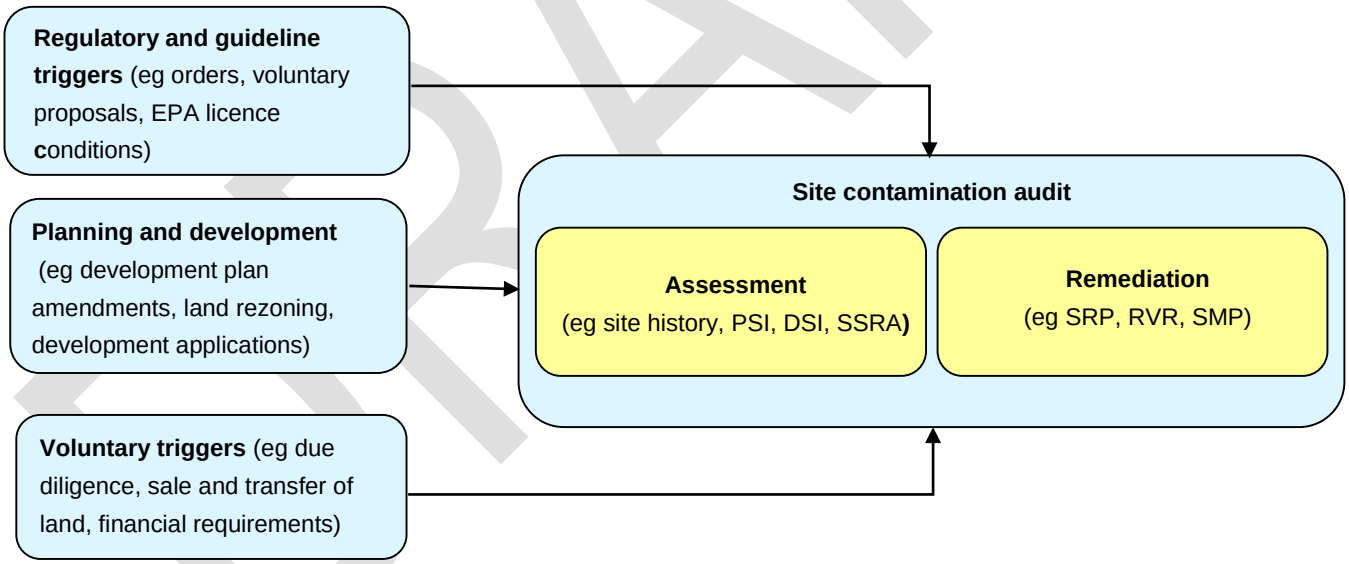

Figure 1 Triggers for the assessment, remediation and auditing of site contamination

5.3 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 6.4.1)
- part of an agreement based on a voluntary proposal (section 6.4.2)
- a condition of an environmental authorisation, environment improvement program, environmental performance agreement or works approval issued under the Act [18]

[18] Refer to the EPA publication *Information for licensees*

- part of the agreement(s) or arrangement(s) of a special management area declared by the EPA[19] (refer to Part 4, section 18.6 of this guideline).

Further information on compliance and enforcement tools available under the Act are provided in the EPA publication *Compliance and Enforcement regulatory tools and options*

5.4 Orders and voluntary proposals

The EPA may issue site contamination assessment order (SCAO) and site remediation order (SRO) under the Act to an appropriate person (refer to section 5.1 of this guideline)[20].

It is an offence to not comply with a SCAO or SRO and the penalties for non-compliance are substantial[21].

In addition, if the requirements of a 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.

Further information on the EPA issuing SCAO's and SRO's is provided in sections 6.4.1 and 6.4.2, respectively.

5.4.1 Site contamination assessment orders (section 103H)

A SCAO may be issued by the EPA under section 103H of the 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 having taken place there (refer to section 3.4 of this guideline). A 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.

5.4.2 Site remediation orders (section 103J)

A SRO may be issued by the EPA under section 103J of the 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 Act.

Persons issued with a SCAO or SRO may appeal (under section 106 of the Act) to the Environment, Resources and Development 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.

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19 Section 103N of the Act

20 The EPA can also issue environment protection and clean-up orders (refer to Part 10, Divisions 2 and 4 of the Act) for environmental harm which may include requirements in relation to site contamination.

21 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.

5.4.3 Voluntary proposals

Sections 103I and 103K of the Act allow the EPA to agree not to issue a site contamination assessment and/or remediation orders 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 Act set out the requirements for voluntary site contamination assessment proposal (VSCAP) and/or voluntary site remediation proposal (VSRP). Should a person not comply with an EPA approved proposal, it is likely that regulatory action will occur.

5.5 Planning and development

The *Development Act 1993* is the legislation that provides for planning and regulates 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.

The guidance to planning authorities on how to appropriately consider and address site contamination issues is currently provided in Planning Advisory Notice 20 Site Contamination (PAN20). This is issued by the Department of Planning and Local Government to assist in the interpretation of the *Development Act 1993*. This document sets out responsibilities of planning authorities in relation to addressing site contamination through the Development Plan Amendment (DPA) process and when assessing development applications and establishes a framework for how this should occur[22].

PAN20 advises that, where there is a potential for the land to be contaminated (or where contamination is known to exist) an applicant should demonstrate to a planning authority that the site is suitable for its intended use. PAN20 also advises that planning authorities should defer granting consent until appropriate information is provided. In relation to land where a change to a sensitive use is proposed, this information should be in the form of an audit report (and audit statement) prepared by an auditor which confirms the suitability of the land for its intended use.

The site contamination audit system provides a mechanism by which planning authorities can satisfy themselves of the suitability of a site for an intended use. The audit system subsequently also provides a mechanism by which land owners, occupiers and others in the community can be assured that land is suitable for its intended use. The audit process should be triggered within the planning system when a development application involves a change to a sensitive use on land and where site contamination is known[23] or suspected[24] to exist.

The EPA recommends that for non-sensitive land use (for example commercial or industrial use)where it is known that significant or complex site contamination issues or off-site contamination issues exist, planning authorities consult with, and refer the matter to, the EPA[25]. In such circumstances the EPA may recommend that an audit be required. Refer to section 6.7 of this guideline for off-site contamination issues.

5.6 Other 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 investigations for purposes including due diligence, transfer of liability, insurance or financial purposes for land acquisition or divestment and corporate requirements.

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22 All references within PAN20 to ‘environmental auditors (contaminated land) appointed by the Victorian EPA’ and ‘Site Audit Report’ should be read as references to ‘site contamination auditors accredited by the SA EPA’ and ‘site contamination audit report’, respectively.

23 For example through the results of previous investigations or because certain information has been notated or registered against land relating to the existence of site contamination pursuant to section 103O or 103P of the Act

24 For example, because a potentially contaminating activity has previously been undertaken (refer Appendix 2 of PAN20)

25 These matters may be identified by planning authorities as part of the consideration of development applications, through the desktop review or initial evaluation of information held by councils, or recorded on the EPA Public Register.

5.7 Off-site contamination and audits

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.

Table 2 summarises the circumstances which the EPA considers are 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. It is assumed that the liability for on and off-site contamination has been determined (refer to section 5 of this guideline).

Table 2 Trigger for audits in managing off-site contamination issues

Assessment site land use	Extent of site contamination	Audit triggered
Sensitive use[1]	Delineated on-site	Yes
	Extending off-site	Yes Auditor to discuss with EPA prior to audit completion
Non-sensitive use	Delineated on-site	No, unless advised or required by the EPA
	Extending off-site to sensitive use	Yes, when an unacceptable risk to human health has been identified. Prior to engaging auditor, discuss issues with EPA (alternative risk based management options may be considered appropriate)
	Extending off-site to non-sensitive use	No, unless advised or required by the EPA. Discuss with EPA prior to completion of final reports to identify appropriate risk based management options

[1] This would include commercial/industrial sites being redeveloped for sensitive use which may be subject to planning and development processes/approvals/consents or land which is currently being used for sensitive use (where historically a potentially contaminating activity has been carried out). Where commercial/industrial land is being redeveloped for a sensitive use it is generally expected that an audit report would be required by the planning authority prior to granting development consent.

Part 2

Roles and responsibilities

6 EPA regulation and administration of site contamination

6.1 The role of the EPA

The EPA is the statutory body responsible for administering the Act and the Regulations[26]. The 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 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 Act, works approvals and exemptions
- providing responses to development applications referred to it through the *Development Act 1993*
- regulatory and administrative tools to achieve compliance
- recording information on the Public Register and contributing to Form 1 statements under the *Land and Business (Sale and Conveyancing) Act 1994*
- environmental offences (eg causing serious or material environmental harm, or causing an environmental nuisance).

The Act also provides for the specific provisions in relation to site contamination:

- site contamination orders and voluntary proposals
- the site contamination audit system
- water restriction or prohibition areas (Part 4, section 18.5 of this guideline)
- special management areas (Part 4, section 18.6 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 7.2 of this guideline).

6.2 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 identifiable who has liability for site contamination.

This will typically be in situations when site contamination has been identified (often groundwater contamination) which extends outside the boundaries of a site being assessed and affecting number of adjacent land parcels. The EPA will actively engage with all affected owners and occupiers of land in accordance with the EPA Community Engagement Framework.

The site contamination assessment work the EPA undertakes at a site forms part of a report that describes 'an assessment area', as provided in section 16 of the Regulations. In accordance with section 109 of the Act, the EPA is required to maintain an EPA Public Register, and record details of other information as is prescribed by the Regulations; thus, EPA assessment areas are recorded and made available in the EPA Public Register.

Information on established assessment areas is also available from the EPA website.

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

[26] Refer to section 18 of the Act

6.3 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 according to the relevant legislation and guidelines issued by the EPA. The role of the EPA is to ensure that an acceptable quality of auditing is maintained.

In order to administer and ensure a quality audit system, 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 Part 5, section 19 of this guideline)
- regulating audit conditions where appropriate, such as notation of conditions on Certificate of Titles for individual land parcels.

For general information on the audit system refer to the EPA publications:

- *Overview of the site contamination audit system*
- *Site contamination auditors*
- *Site contamination audit reports and audit statements*.

For detailed information refer to the Guidelines for the site contamination audit system.

7 Auditors, consultants and other persons

7.1 Site contamination auditors

Site contamination auditors (auditors) are expert professionals accredited by the EPA who undertake the independent review of assessment and/or remediation work carried out by site contamination consultants (consultants). Only a natural person may be granted accreditation[27] and only an individual accredited by the EPA can carry out a site contamination audit (audit) for the purposes of the Act. For further information on auditors and audits, refer to the Guidelines for the site contamination audit system.

A site contamination auditor is defined in section 3(1) of the Act as meaning:

Section 3(1)—Interpretation, site contamination auditor
a person accredited under Division 4 of Part 10A of the Act as a site contamination auditor

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

In exercising their functions and duties under the 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 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 Act. Auditors must be able to demonstrate that in conducting audits they are not subject to a conflict of interest, they have exercised their own professional judgment, and the opinions they express in the audit documentation have been reached independently.

For general information on auditors refer to Site contamination auditors.

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

7.2 Site contamination consultants

A site contamination consultant is defined in section 3(1) of the Act as:

Section 3(1) – Interpretation, 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

The EPA considers that only suitability qualified and experienced consultants should be engaged to carry out the assessment of site contamination. **The EPA will not accept work prepared by consultants or persons that are not suitably qualified or experienced to undertake the assessment and remediation of site contamination.**

[27] Refer to section 103V of the Act

Schedule B9 of the ASC NEPM provides information on the experience, qualification and competency requirements of professionals undertaking the assessment of site contamination. The EPA expects that a consultant who prepares a report, and any specialist who may have reviewed the report will be named and will sign the report.

There is a clear distinction between the roles of the consultant and the auditor. The rigour of the audit system depends on the independence and integrity of the auditor. A consultant may be a company that employs a range of professional and technical staff or may be an individual person. The terms of engagement of a consultant will be agreed between the parties. By contrast, an auditor is required to carry out audits in accordance with the Act, the Regulations and relevant guidelines issued by the EPA.

For further information on the level of experience, qualifications and competency of site contamination professionals refer to the EPA publication *Site contamination consultant (draft 2014).*

7.3 Land owners, occupiers and developers

Land owners and occupiers may have liability for site contamination in certain conditions and have specific notification and reporting obligations under the Act. Refer to sections 3 and 8 for further information.

Under the Act, owner of land means:

Section 3(1) – Interpretation, owner

(a) if the land is unalienated from the Crown—the Crown; or

(b) if the land is alienated from the Crown by grant in fee simple—the owner (at law or in equity) of the estate in fee simple; or

(c) if the land is held from the Crown by lease or licence—the lessee or licensee; or

(d) if the land is held from the Crown under an agreement to purchase—the person who has the right to purchase.

Occupier is defined in the Act as:

Section 3(1) – Interpretation, occupier

in relation to a place, includes a person with a right to occupy the place or a licensee or any holder of a right to use or carry on operations at the place, but does not include a mortgagee in possession unless the mortgagee assumes active management of the place.

Occupier is further specifically defined for the purposes of the site contamination provisions of the Act and the Regulations:

Section 103A – Application

In this Part—***occupier***, in relation to land—

(a) has the meaning assigned to the term by section 3 of the Act; and

(b) if, in accordance with the regulations, a person of a particular kind is to be taken to be an occupier of the land in the circumstances of the case—includes a person of that kind,

and ***occupy*** land has a corresponding meaning.

Regulation 49 – Occupier (section 103A)

(2) For the purposes of the definition of occupier in section 103A of the Act, a person is to be taken to be an occupier of land if the person owns, or has operational control of, a tank or pipeline, or any works or structure, that—

(a) is installed on or traverses the land, whether below or above the ground; and

(b) is used to store or convey chemical substances or for some process employing chemical substances.

1 For the purposes of sub-regulation (1), a person has operational control over a tank, pipeline, works or a structure if the person has the authority to introduce and implement environmental or health and safety policies or any other operating policies for the tank, pipeline, works or structure.

7.4 Developers

Developers or persons bringing about the change in the use of land may have liability for site contamination in certain conditions. Refer to section 103D of the Act and Part 1, section 5.3 of this guideline for further information.

Developers also have responsibilities for considering the potential for site contamination when submitting applications for rezoning or development. Refer to Part 1, section 6 of this guideline for further information on planning and development triggers for assessment, remediation and auditing.

7.5 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 made 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 to ensure that a site, which is 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 Part 1, section 6 of this guideline for further information on planning and development triggers for assessment, remediation and auditing.

8 Notification, honesty and reporting requirements

8.1 Section 83A notification

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

8.2 Section 83 notification

Section 83 of the Act requires a person to notify the Authority if serious or material environmental harm from pollution is caused or threatened in the course of an activity undertaken by that person, as soon as reasonably practicable after becoming aware of the harm or threatened harm.

If you are unsure whether a notification under section 83A or section 83 of the Act is required, you are advised to contact the EPA (refer to Part 5, section 20.6 of this guideline).

8.3 Reports by auditors and consultants

Section 103ZA of the Act states:

Section 103ZA – Reports by site contamination auditors and consultants
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. **Penalty: Division 5 fine**

Refer to Part 1, section 3.6 of this guideline for information on land use descriptions.

Refer to Appendix 3 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 will be engaged to carry out a site contamination audit and prepare a site contamination audit report.

8.4 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 on risk to the health and safety of human beings and the environment.

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

Section 103ZB of the Act places requirements on people providing information to auditors and consultants:

Section 103ZB – Provision of false or misleading information

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).

Penalty: If the offender is a body corporate—Division 1 fine
If the offender is a natural person—Division 3 fine

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.

Additionally, section 119 of the Act requires that:

Section 119 – False or misleading information

A person must not make a statement that is false or misleading in a material particular (whether by reason of the inclusion or omission of any particular) in any information furnished, or record kept, under this Act.

Penalty: If the offender is a body corporate—Division 1 fine
If the offender is a natural person—Division 3 fine

Section 120A(1) of the Act also requires that:

Section 120A(1) – False or misleading reports

A person who makes a false or misleading report to the Authority, another administering agency or a person engaged in the administration of this Act is guilty of an offence if—

(a) the person knows the report is false or misleading; and

(b) the report is of a kind that would reasonably call for investigation or action by the Authority or another administering agency.

Penalty: Division 4 fine

Further information on compliance and enforcement is provided in the EPA publication *Compliance and Enforcement regulatory tools and options*.

9 Hazardous circumstances

Hazardous circumstances include those which 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.

9.1 Human health

Hazards to human health may be acute (imminent exposure) or chronic (threshold and non-threshold[28]).

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 Act), and
- 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 on the identification of an acute and chronic exposure risk from vapour, refer to Section 4 – Risk Assessment Framework, *Guidelines for the assessment and management of sites impacted by hazardous ground gases* (NSW EPA 2012).

9.2 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 by an auditor or a consultant undertaking work at a site, the EPA should 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 Part 5, section 19 of this guideline for information on community engagement. Specific requirements for auditors in relation to notifications of hazardous circumstances are described in the Guidelines for the site contamination audit system.

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 (eg an immediate, uncontrolled explosion hazard), advice should also be provided to the:

- police, fire or ambulance (000); and/or
- EPA Pollution and Environmental Incident Reporting Line (08) 8204 2004 or 1800 623 445 (country).

[28] For detailed guidance refer to the enHealth publication *Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards* (2012)

Part 3A Assessment

Overview and framework

10 Risk assessment framework

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 guidance and expectations of the EPA in relation to the assessment of risks to 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 assessment. This guidance is not exhaustive as each site contamination assessment will present different issues in relation to the site, physical characteristics, chemicals of interest and risk receptors. It is expected where there is additional specific assessment factors that they are addressed and included in reports.

Assessment should be carried out by a suitably experienced and qualified site contamination consultant (refer to Part 2, section 8.2 of this guideline).

10.2 Tiered risk assessment process

A Tier 1 qualitative risk assessment (Figure 2), conducted as part of the first stage of the assessment process, 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 investigation and screening levels, and management levels. An initial screen of the data is required by consultants and auditors to determine whether further assessment is required or whether sufficient information is held to inform risk management decisions.

Tier 2 and Tier 3 quantitative risk assessments, which involve site specific risk assessments (SSRA), may be needed when the results of Tier 1 investigations are not sufficient to inform risk management decisions. A Tier 2 SSRA includes the consideration of site-specific conditions and may involve the modification of Tier 1 generic criteria to the site conditions to create modified Tier 2 site-specific criteria.

Where Tier 1 criteria are unable to be modified, the assessment may proceed directly to a Tier 3 SSRA. A Tier 3 SSRA may also be required where any exceedances of the Tier 2 modified criteria are judged to represent a potentially unacceptable risk to human health and/or the environment.

In making determinations about whether or not site contamination exists, it is critical that an adequate body of assessment and reporting has been prepared by appropriately qualified and experienced consultants, which documents the results of a tiered risk-based assessment carried out in accordance with the ASC NEPM and relevant EPA guidance[29]. The EPA will not accept determinations about site contamination unless it is satisfied that an adequate risk-based assessment has been undertaken in accordance with the ASC NEPM.

[29] Refer to the Selecting a site contamination consultant and Site contamination auditors.

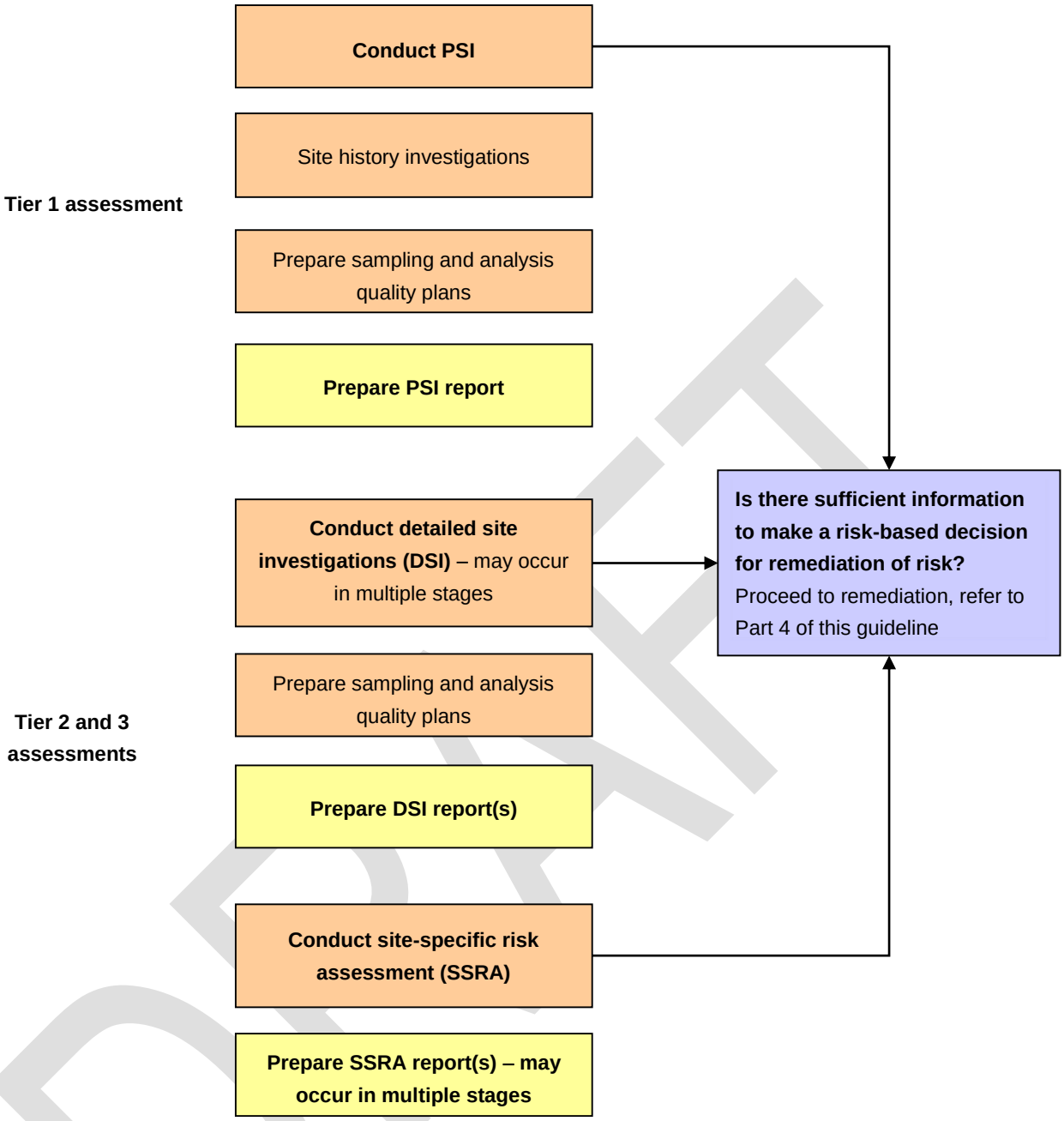

Figure 2 Summary of the site contamination tired-risk assessment process

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 which are applicable to generic land use 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)
- petroleum hydrocarbon management limits (MLs).

Each Tier 1 level has specific application considerations (including land use scenarios, depth, soil type and properties) and limitations which are required to be considered on a site specific basis. They are used to determine whether they are appropriate to be used and how to apply them.

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. As a minimum, the maximum and 95% UCL of the arithmetic mean should be compared to 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 6 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 6 of this guideline.

11 Reporting framework for the assessment of site contamination

11.1 Overview and key components

The EPA expects the assessment of site contamination to be undertaken in accordance with the framework and guidance provided in Schedule A and Schedule B2 of the ASC NEPM.

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 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 guidance on site characterisation contained in Schedule B2 of the ASC NEPM.

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 Part 3B, section 13.3 of this guideline).

Preliminary investigations usually include:

- a desktop study to identify site characteristics – site location, site layout, building construction, geological and the 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, the elements of the environment that are potentially affected by those contaminants; thus 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 (or not) site contamination exists.

If the preliminary investigations show a history of non-contaminating activities and there is no other evidence or suspicion of contamination, further investigation is not required.

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 4 provides a checklist of information that should be included in a PSI.

Limited sampling may be undertaken in a PSI. It is not necessary to delineate contamination at the PSI stage, however 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 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 4 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, eg 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, a SSRA should be conducted in accordance with the Tier 2 and 3 framework and guidance provided in Schedule A and Schedule B2 of the NEPM.

Appendix 4 provides a checklist of information that should be included in a SSRA which may be presented as part of the DSI reporting or may be prepared as a standalone 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 in identifying the key sources, 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, or
- 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 in 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 to known or potential primary and secondary sources of contamination, and potential preferential pathways will better assist in the determining what further assessment and/or remediation 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 4 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

Elements of the environment

12 Assessment of groundwater

12.1 Groundwater

The potential for site contamination of groundwater (groundwater contamination) to exist as a result of site activities is expected to be assessed as part of preliminary and detailed site investigations. The potential for groundwater contamination originating from other sites, and to impact on the site being assessed, must also be considered.

Further information on undertaking PSI and DSI investigations is provided in Part 3A, section 12 of this guideline.

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

An initial hydrogeological assessment, based on readily available information, should be incorporated into the PSI to determine whether the potential for groundwater contamination exists. This desktop assessment should be undertaken before the development of an intrusive sampling program.

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:

- harm to water criteria (refer Appendix 2) for the determination of harm to water; and
- the relevant groundwater investigation levels (GILs) (refer 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 as a result of a potentially contaminating activity. An example is elevated concentrations of metals in groundwater due to changes in water acidity (pH).

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 what remediation[30] is needed 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, land owners, occupiers, auditors and consultants have a duty to notify the EPA as described in section 83A of the Act (refer to Part 2, section 9.1 of this guideline).

[30] Remediation is defined in section 3(1) of the Act and includes the treatment, containment, removal or management of chemical substances.

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 Act (refer to Part 4, section 18.5 of this guideline).

The EPA has developed a reporting format for how groundwater monitoring results should be provided 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 Notification of site contamination that affects or threatens underground water.

12.2 Groundwater environmental values

As discussed in Part 1, Section 3.9 of this guideline, 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.

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 (eg regional hydrological and geological information obtained as part of desktop site history investigations).

12.3 Background concentrations in groundwater

Background concentrations are defined in the ASC NEPM as being the naturally occurring, ambient concentrations of substances in the local area of a site.

The EPA considers that background concentrations of chemical substances on a site or below its surface are the sum of the naturally occurring background level and the ambient levels that have been introduced from diffuse or non-point sources by general anthropogenic activities not attributed to industrial, commercial, or agricultural activities. Ambient contributions to background concentrations are expected to form widespread, diffuse sources not including industrial, commercial or agricultural activities.

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

1 the information has been sourced during a preliminary site investigation (PSI), and

2 the PSI comprises of a desktop review that includes information suitable when considered as part of the CSM to demonstrate up-gradient groundwater quality.

Guidance on the determination of background concentrations is provided in Schedule B2 Section 8.1.2 of the ASC NEPM.

12.4 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 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.

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

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 containing 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 section 14 of this guideline.

12.5 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 which lines of evidence should be pursued.

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

Similar to LNAPL, a site-specific assessment of vapour risk may be necessary where DNAPL is present containing VOCs. Further information is available in section 14 of this guideline on the assessment of vapour intrusion.

13 Framework for the assessment of vapour intrusion

13.1 Overview and objectives

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.

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.

As identified in Figure 3, for the purpose of undertaking VI assessment, the EPA assumes that a PSI (as a minimum) has been completed; identifying the presence chemical substances, that presents a risk to the health or safety of human beings that is not trivial.

The ASC NEPM provides a framework for vapour assessment which must be considered by consultants and auditors. Further technical guidance on vapour intrusion assessment is provided in section 15 of this guideline. The EPA expects consultants and auditors to be understand the limitations presented in the ASC NEPM and technical guidance documents when undertaking vapour assessments. In order to demonstrate that the vapour intrusion/emission pathways are unlikely to be active or to present a significant risk, multiple lines of evidence are required to be documented in a weight-of-evidence approach.

For further information on 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[31]. 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[32]:

- petroleum hydrocarbon
- chlorinated hydrocarbon, and
- bulk ground gases[33].

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.

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

32 Definition of hazardous ground gases: chemical substances present in either a gaseous or volatile phase. NSW 2010. CIRA doc – also presents definition of hazardous ground gases as ‘gases generated below ground causing adverse impact to human health, environment or building structures’.

33 Definition of bulk ground gases provided in section 1.3.1, Guidelines for the assessment and management of sites impacted by hazardous ground gases (NSW EPA 2012)

The EPA expects consultants and auditors to undertake vapour assessments in accordance with the tired risk-based assessment and reporting framework outlined in Part 3A, section 12 of this guideline. Further guidance on components of a vapour assessment that should be incorporated into the tiered risk assessment are outlined in Figure 4.

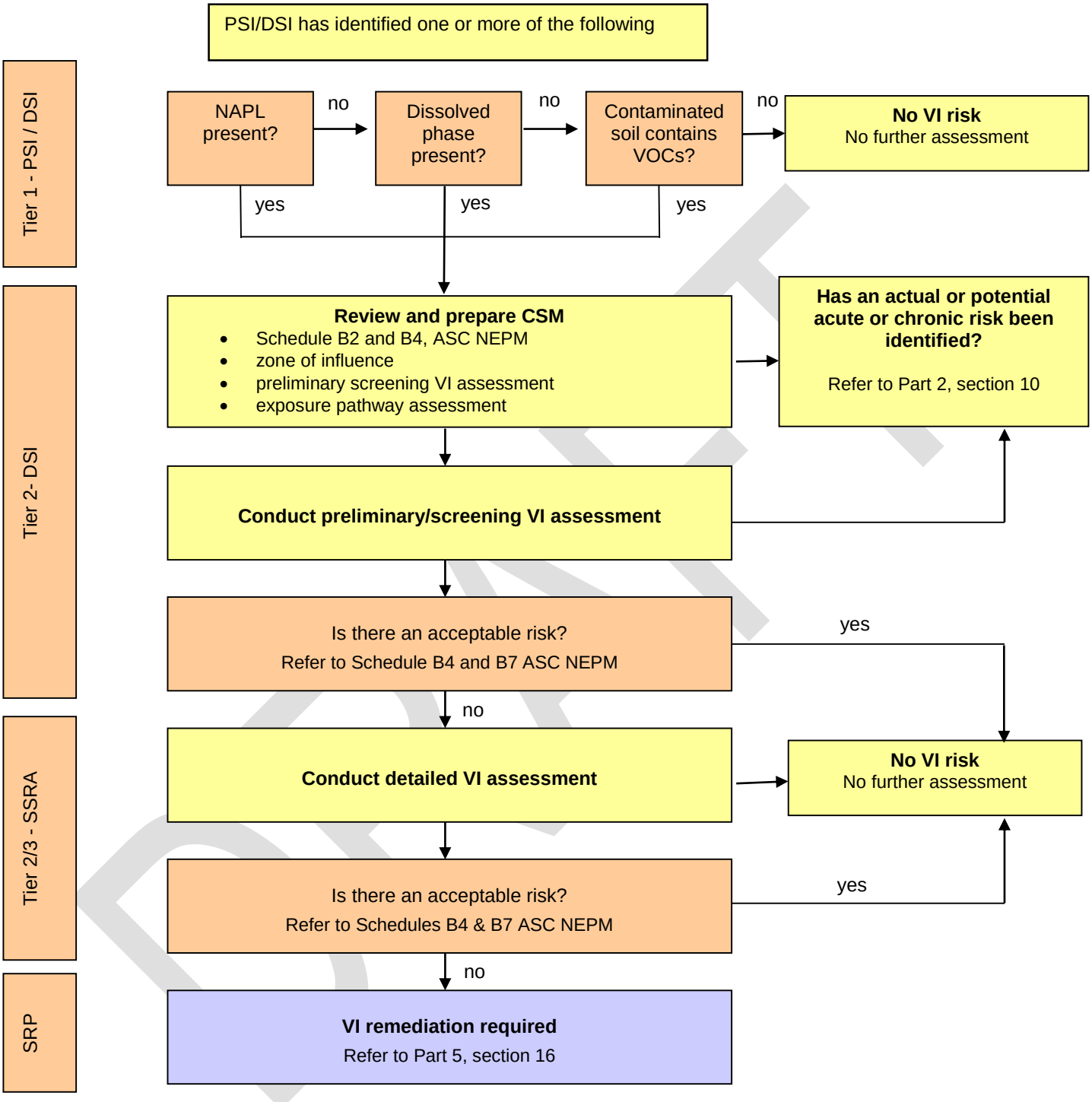

Figure 3 Framework for the assessment of vapour intrusion

It at any stage during the screening VI assessment, consultants and auditors identify an actual or potential hazardous circumstance exists either on or off the site, the EPA expects to be notified in accordance with Part 2, section 10 of this guideline.

13.2 Preliminary vapour intrusion assessment

The EPA considers that once a well-characterised CSM has been established (refer to Part 3A, Section 12.5) key findings for the completion of a preliminary VI assessment are most likely to be addressed.

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

As outlined in the framework for the assessment of VI identified in Figure 4, the EPA considers the main triggers for VI assessment to include the following:

- observation of measurable NAPL (undertaken during field investigations)
- determination of saturated soil contamination within the vadose zone (saturated NAPL)
- determination of dissolved phase hydrocarbons, and
- 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.

For further information on the preparation of a preliminary VI assessment, the EPA expects consultants and auditors to refer to the following guidance:

- Section 3 of the CRC CARE Technical Report 23
- Schedule B2, Section 9.2.2 of the ASC NEPM

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 Part 3A, section 12.5 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 that are 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 or commonly known as “contaminant sources” refer to the contaminated element of the environment, and the phase of the chemical substances causing the contamination.

This information should be incorporated in 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 on the preparation of the CSM and multiple lines of evidence refer to Section 12.5 of this guideline.

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

For further information on site characterisation and preparing a conceptual site model, refer to Schedule B2, Section 9.2.3 of the ASC NEPM.

13.3 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.

Screening distances in the context of vapour intrusion assessment, considers 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 what appropriate screening measures 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 section 15.1 of this guideline.

Soil vapour data obtained from preliminary 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.

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 section 15.1 and section 15.2 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 mobbing 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 (ie site specific data is required to understand the zone of influence).

This approach considers the weighted-lines of evidence approach to determine what further site investigation work may be necessary.

13.4 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, section12.5 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.

A SSRA should be undertaken where non-slab building foundations or future buildings do not exist. Guidance on undertaking a SSRA is provided in Part 3A, section 12.4 of this guideline.

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

- DQO
- CSM
- application of the ASC NEPM interim HILs for VOCCs and appropriate data evaluation
- derivation of site-specific screening data
- site-specific geological, hydrogeological and geochemistry information
- mass balance of the secondary sources (ie compounding of chemicals 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 gas assessment (lateral extent of the soil vapour plume) and/or
  - active sampling techniques to define the lateral and vertical dimensions of the soil vapour plume for quantitative soil gas assessment; and
- point-in-time sampling vs seasonal variability.

Guidance on the methodology and types of intrusive CVI 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 has sampling, refer to Schedule B2, Section 9.5 of the ASC NEPM.

The following as key information should be considered (but not limited to), when undertaking a detailed VI assessment (site-specific risk assessment):

- continuity and permeability of preferential pathways
- limitations and effects of sampling, in particular weather conditions (variability of soil moisture), temperature, barometric pressure
- confounding factors with multiple ground gases ie chemical substances that act as potential inhibitors of chlorinated hydrocarbon degradation)
- anaerobic or aerobic condition of the site specific geology, and
- depth to groundwater and variability (characterisation of site specific hydrogeology).

At the completion of the detailed VI assessment, consultants and auditors should have adequately characterised and understand the risks posed by vapour contamination; understand what remediation is 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).

13.5 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, and
- inconvenience normally associated with site accessibility.

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

- Appendix D Installation of Soil Vapour Probes/Wells of the CRC CARE Technical Report 23
- Appendix F Soil Vapour Sample Collection of the CRC CARE Technical Report 23
- Schedule B2, Sections 9.4.2 and 9.4.3 of the ASC NEPM

The EPA's preferred approach for the collection of soil gas and vapour data is from a subsurface medium, such as sub-slab and/or soil gas data collection from depth.

If available, crawl spaces (the space between the floor of the building and ground surface) provide an alternate vapour sampling medium. Crawl spaces allow for an alternative sample collection to indoor air, 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 expresses 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 apply. Schedule B2, Section 9.3.1 of the ASC NEPM also provides additional information on common confounding sources when undertaking indoor air sampling.

The EPA strongly advises consultants and auditors to only obtain indoor air samples when absolutely necessary.

The EPA expects to be advised prior to contacting a person to seek permission to enter their home. Such entry may require engagement with the local community or other stakeholders. Part 5, Section 19 of this guideline provides guidance to consultants and auditors when 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 petroleum hydrocarbon vapour intrusion assessment is outlined in section 14 of this guideline. The following provides further clarity on specific technical aspects of undertaking a VI assessment for petroleum hydrocarbons.

The CRC CARE Technical Report 23 provides further 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 ie describes the appropriate timeframes when remediation may be required.

Consultants and auditors need to undertake a PVI assessment in accordance with the principles and guidance outlined in the ASC NEPM and the CRC CARE Technical Report 23.

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.

As an overview, CRC CARE Technical Report 23 also provides a literature review and summarises guidance available to auditors and consultants for the purpose of undertaking a PVI assessment. The review provides examples of conditions specific to the Australian climate, and demonstrates the importance of site specific characterisation for the affected media being assessed.

The literature review presented in Appendix A of the CRC CARE Technical Report 23, provides additional information on the derivation of the assessment methodologies and health screening/investigation criteria. The EPA recommends auditors and consultants consider this information when adopting 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

Section 4 of the CRC CARE Technical Report 23 identifies two approaches to undertaking a screening VI assessment, which is presented in Decision Diagram 2. The EPA recommends the screening considerations presented in Schedule B2, Section 9.2.2 of the ASC NEPM are also considered by consultants and auditors when undertaking screening VI assessments for petroleum hydrocarbons.

The application of screening distances at the 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[34]’. 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 on 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 understand the limitations and use when doing so.

For the definition and application of screening distances, refer to Appendix B of the CRC CARE Technical Report 23.

[34] Appendix B Determination of screening distances and slab size, CRC CARE Technical Report 23

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

Source identification is critical to the assessment of VI.

If a preliminary/screening VI assessment identifies the secondary source (or contaminant source) is in direct contact with the building foundations or proposed future building foundations, it is recommended that auditors and consultants follow the process outlined in Decision Diagram 335.

If the secondary source is not identified as being in direct contact with the building foundations, consultants and auditors should follow the steps outlined in Decision Diagram 436.

For further information, refer to Decision Diagrams 3 and 4, Section 5 of the CRC CARE Technical Report 23.

14.1.3 Application of investigation and screening levels

As discussed in section 14.3 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 should be applied specifically for the assessment of petroleum hydrocarbon VI. 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' be included in any report. Completion of the checklist will assist in identifying when site circumstances require a site-specific approach, thus, undertaking a site-specific risk assessment. When comparing results with historical data, consultants and auditors should consider any implications associated with the changes in reporting of total petroleum hydrocarbon (TPH) and total recoverable hydrocarbon (TRH) fractions.

For information on the limitations of the HSLs, refer to Appendix A HSL checklist, Part 2: Application Document, Health screening levels for petroleum hydrocarbons in soil and groundwater of the CRC CARE Technical Report 13.

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 more substantial understanding in comparison to other Tier 1 or PSI assessments of other elements of the environment. For this reason, the EPA considers that the assessment of vapour be undertaken by suitably qualified and experienced persons. The EPA considers the assessment of petroleum hydrocarbon VI to be incorporated as part of the DSI or SSRA assessment.

14.1.4 Supporting information for sampling elements of the environment

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

However, if it is necessary to undertake indoor air sampling, a summary of the key petroleum hydrocarbon compounds that should be considered for a site-specific risk assessment, are provided in Table C1. Schedule B2, Section 9.3.1 of the ASC NEPM also provides additional information on common confounding sources when undertaking indoor air sampling.

Guidance on the acute and chronic indoor air exposure criteria is provided in Table C1, Appendix C Key Chemicals and Assessment Criteria, CRC CARE Technical Report 23. Consultants and auditors must understand the limitations of the application of this section, which are described in the footnotes of the table.

[35] Refer to Decision Diagram 3, Section 5 Detailed PVI Assessment, CRC CARE Technical Report 23

[36] Refer to Decision Diagram 4, Section 5 Detailed PVI Assessment, CRC CARE Technical Report 23

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 section 14 of this guideline. The following provides further clarity on specific technical aspects of undertaking a VI assessment for chlorinated hydrocarbons.

Schedules B2, B4 and B7 of the ASC NEPM provide an outline of the framework for undertaking VI assessment in Australia. However, additional supporting national guidance on specific process for carrying out chlorinated hydrocarbon VI assessment is currently not available. Consultants and auditors should apply the tired risk-based approach (outlined in Part 3A, sections 11 and 12 of this guideline) using multiple lines of evidence for the assessment of chlorinated hydrocarbon VI.

14.2.2 Application of screening distances

In comparison to 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.

It should be noted that other factors that apply during the screening CVI assessment stage are provided in Schedule B2, Sections 9.2 and 9.3 of the ASC NEPM. Consideration of these factors as multiple lines of evidence are crucial to the application of the screening assessment for chlorinated hydrocarbon VI, and the iterative approach to the development of the final CSM and risk assessment.

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*[37] (Schedule B7[37] of the ASC NEPM). The investigation criteria have been developed are for soil vapour data rather than for soil data assessment.

Further information on 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 investigation levels have been developed are for soil vapour data rather than for soil data assessment.

The interim soil vapour HILs for VOCCs have been derived by applying a conservative attenuation factor to published indoor air criteria[38] 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 further consideration of building types with crawl spaces or no slab structures require a site specific assessment for non-slab based foundations. Refer to section 14.4 of this guideline for further information on undertaking SSRAs for VI assessment.

It is important that auditors and consultants understand the limitations presented in Schedule B7, Appendix A6 – Derivation of interim HILs for volatile organic chlorinated compounds of the ASC NEPM when applying the guidance.

[37] Refer to Schedule B7, Appendix A6 – The derivation of interim HILs for volatile organic chlorinated compounds ASC NEPM

[38] Refer to Table 3, Schedule B7– Health-based investigation levels ASC NEPM

14.2.4 Supporting information sources

Further guidance on understanding the complexities of undertaking a detailed CVI assessment is available from the following international training and guidance sources.

Online training and further guidance available via the Interstate Technology Regulatory Council (ITRC):

- ITRC 2007 – Vapour Intrusion Pathway
- ITRC 2007 – Vapour Intrusion Pathway: Investigate Approaches for Typical Scenarios
- ITRC 2007 – DNAPL: Integrated DNAPL Site Strategy.

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 on the assessment of operating or closed landfill sites in South Australia, refer to the EPA publication, Guidelines for environmental management of landfill facilities (municipal solid waste and commercial and industrial general waste)

The EPA considers bulk ground gases to include:

- methane (CH_4)
- carbon dioxide (CO_2)
- carbon monoxide (CO)
- hydrogen, and
- hydrogen sulfide (H_2S).

The chemical substances grouped as bulk ground gases are potentially explosive, can cause asphyxiation or a potential acute exposure risk.

It should be noted that the NSW EPA 2012 guidance references 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)
- *Assessing risk posed by hazardous ground gases to buildings* CIRIA C665 (2007)

Where a determination of any acute risk associated with bulk ground gasses is identified this should be immediately notified to the EPA as a hazardous circumstance as described in Part 2, section 10 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.

For this reason, the EPA considers that if indoor air or crawl space sampling is necessary, it is important that an assessment of outdoor or ambient air has been completed.

For further information on the assessment of outdoor or ambient air quality, refer to Schedule B2, Section 9.3.1of the ASC NEPM

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

- *National Environmental Protection (Air Toxics) Measure*
- *National Environment Protection (Ambient Air Quality) Measure*
- *Environment Protection (Air Quality) Policy 1994*

as well as, the following guidelines issued by the EPA:

- *Air quality impact assessment using design ground level pollutant concentrations*
- *Odour assessment using odour source modelling*.

Part 4

Remediation

15 Remediation

15.1 Definition

Remediation is defined in the Act as meaning to:

Section 3(1) – Interpretation, remediate/remediation
treat, contain, remove or manage chemical substances on or below the surface of the site so as to— (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 (b) eliminate or prevent, as far as reasonably practicable— (i) actual or potential harm to water that is not trivial; and (ii) any other actual or potential environmental harm that is not trivial, taking into account current or proposed land uses.

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 may be required.

To make this determination it is essential that adequate characterisation of the source(s) and exposure pathways has been completed. That is the 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 which approach to remediation is practical and most 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) and either with the existing or proposed land use, an appropriate timeframe 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 Part 1, Table 1 of this guideline.

15.2 Remediation goals

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

1. prevent or prevent actual or potential harm to health or safety of human beings that is not trivial; and
2. eliminate or prevent, as far as reasonably practicable actual or potential harm to water that is not trivial; and
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 identified above consider the current or proposed land uses for the site.

Additional goals may be based on achieving the objectives of intergenerational equity, protecting the value or amenity or resources as well as business reputation. It is essential that auditors and consultants consider the triggers for remediation (refer to Figure 4).

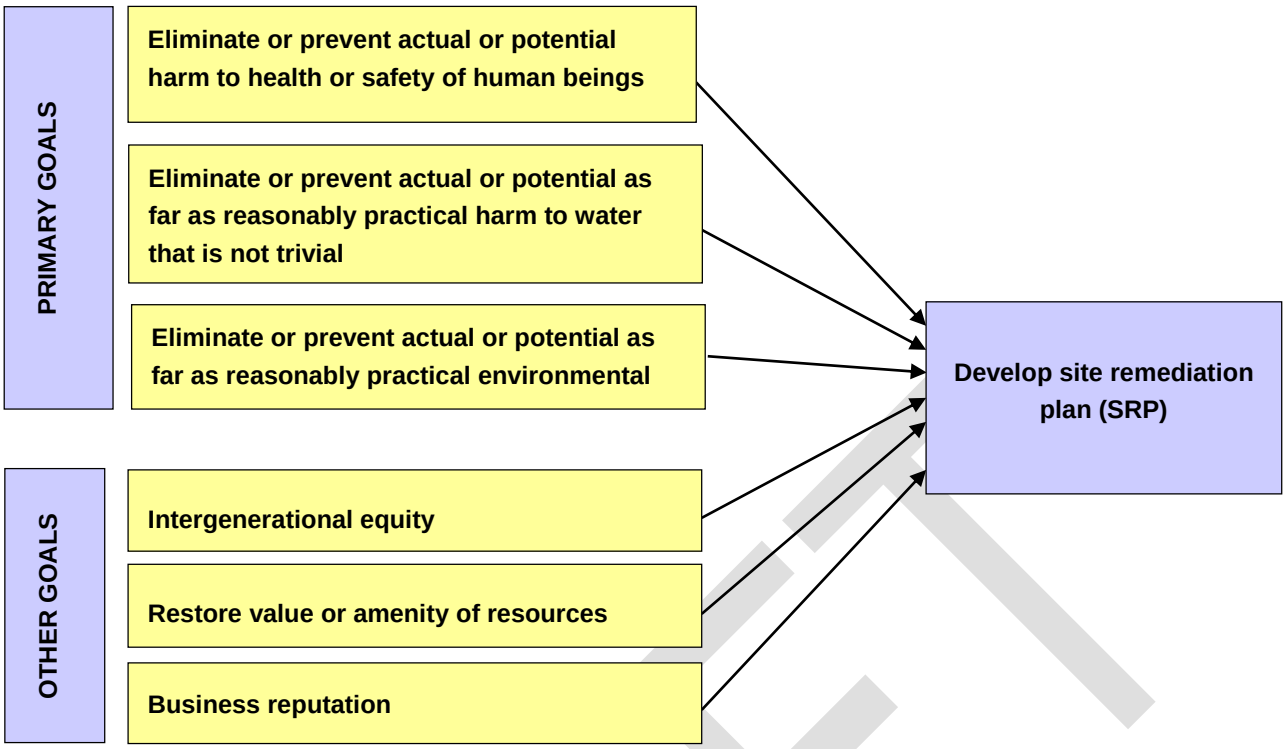

Figure 4 Triggers for undertaking remediation

15.2.1 Setting remediation goals—eliminate or prevent

The Act does not contemplate the extent (endpoint) required for the elimination or prevention of harm nor the timing of when remediation is necessary. Setting remediation goals can only be determined based on site specific considerations and an understanding of the remediation objectives.

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 occur where the exposure pathways to site contamination remaining at a site, are managed in such a way that they are no longer active. For example 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 environmental, the objective must be to prevent as far as reasonably practicable the harm.

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

Further information on remediation management options to prevent actual or potential harm is provided in section 17 of this guideline.

The EPA expects remediation strategies will take into account technical, logistical and financial considerations. Further guidance on determining remediation goals is available in the CRC CARE Technical Report 22: *Developing a national*

guidance framework for Australian remediation and management of site contamination - Review of Australian and international frameworks for remediation (2012) (CRC CARE Technical Report 22) and CRC CARE Technical Report 18: *Selecting and assessing strategies for remediating LNAPL in soils and aquifers (2010)* (CRC CARE Technical Report 18).

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 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 a SRO[39] to the person liable for the site contamination (refer to Part 1, section 5 of this guideline).

15.3 Remediation objectives

Remediation objectives vary greatly with the particular 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 timeframe)
- logistical (site access, availability of materials and infrastructure, and disposal of wastes)
- financial (cost of remediation including waste treatment)
- value of the water resource and ability to restore the appropriately identified environmental value, and
- threat the contamination poses to human health or the environment.

Remediation of site contamination that is actual or potential harm to the health and safety of human beings, taking into consideration the land uses must be eliminated or prevented. It is essential that there is no practicable limitations related to the elimination or prevention of risk to human health in SA.

It is also essential for the consultant or remediation practitioner to consider the endpoint of the remediation objective. From a technical perspective, the reliability and the effectiveness of the remediation to remain protective of human health and the environment (ie longevity and appropriate use of treatment and containment systems) must be considered and reviewed by the EPA or the auditor prior to remediation commencement.

The remediation technology must be realistic, suitable and practicable, where appropriate. It should also reflect the complexities of the site contamination outlined in the CSM, and address the risk outcomes identified in either the PSI, DSI or SSRA.

Action to prevent or eliminate an immediate risk posed to human health must be addressed as soon as reasonably practical, and in these instances consultants and auditors should consider advising the EPA of the issue.

15.4 Remediation endpoint

15.4.1 Eliminate or prevent

The triggers for remediation are determined at varying stages in the risk-based assessment of site contamination. Endpoint determination is often a contentious subject as it has a direct impact on remediation cost. The Act is specific about the endpoints for human health, environment and water.

[39] Refer to section 5.1.2. Site contamination remediation order of this guideline for further information on the legislative requirements of a SRO.

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 end points are clearly determined prior to the commencement of remediation. These need to be agreed with the EPA or auditor. The end points are intended to provide sufficient conditions to ensure that remediation objectives and ultimately the goals of remediation are achieved.

A remediation options assessment is required between desirable endpoints to meet objectives for remediation (eliminate or prevent) and endpoints that are feasible through the application of techniques (ie remediation options).

As well as feasible endpoints, the timeframe, 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 SA, which include:

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

Remediation may include measures which 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 section 17 of this guideline.

15.4.2 Impracticability considerations

While practicable is not defined in the 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 what is possible to the extent reasonable.

Remediation of site contamination, for the elimination or prevention of actual or potential harm to human health and safety, is not subject to what 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 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 to be incorporated to support an argument for impracticability.

15.5 Remediation timeframe

The EPA considers that remediation timeframes 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 the following factors, but not limited to, be taken into consideration when developing the remediation timeframes:

- 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 – refer to the SuRF website
- hydrogeological characteristics
- type, source(s), and extent of contamination
- multiple elements of the environment which are contaminated that also 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 of 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 focussed on one element of the environment. In other cases, remediation may be undertaken as a whole 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 timeframe to achieve that goal should be reasonable and based on site-specific factors. At sites where it is anticipated that the timeframe for achieving the final remediation goal will be lengthy, establishing timeframes for intermediate remediation goals can provide a meaningful measure of progress.

15.6 Implementation and validation

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

- any exemptions pursuant to the Act are obtained prior to implementation
- community communication and engagement has been undertaken (communication plan[40])
- the timeframes are appropriate, and
- adequate assessment quantifies and validates the efficacy of the remediation technology.

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

Consultants and auditors should refer to section 18.2 of this guideline for guidance on the development of a site remediation plan.

[40] Refer to section 9 of this guideline

16 Remediation options and key considerations

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 Act, Regulations and relevant EPPs.

Part 1, section 6 of this guideline describes the regulatory tools available to the EPA to ensure compliance with the Act.

The EPA may use regulatory measures, such as environment protection orders or clean up orders to person's contravening section 25 of the Act. The EPA may also issue site remediation orders to require a person who has liability for site contamination to undertake remediation is a specified approach and timeframe.

Equally, if a person carrying out remediation does so in accordance with this guideline, may indicate that reasonable and practicable measures have been considered 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 the 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 6 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 6 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 in the remediation of site contamination in South Australia.

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

There are two types of bioremediation which include *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:

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 prove 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 determining 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 timeframe and is only successful on 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, and 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, or
- 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, onsite retention of chemical substances in soils may be considered the only appropriate remediation option at a site.

If onsite retention of chemical substances in soils is considered as 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 and SMP 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) (CRC CARE Technical Report 16).The following provides the key steps:

1 Identify the environmental values and receptors that need to be protected (refer to Part 1, section 3.9 of this guideline).

2 Assess the scenarios for risk exposure (CSM).

3 Analyse and evaluate the risk exposure, and determine if remediation goals, objectives and endpoints are likely to be achieved (site remediation plan (SRP) in accordance with section 18.2 of this guideline).

4 Prepare appropriate site management plan (SMP) to manage the risks and achieve the endpoints for remediation (refer to section 18.4 of this guideline).

5 Carry out the remediation in accordance with the SRP (undertake remediation and validation (RVR), as required, in accordance with section 18.3 of this guideline).

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

Further information on the framework for carrying out remediation and reporting is provided in Figure 3 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 onsite retention of chemical substances in soils.

Section 18.4 of this guideline also provides other factors that the EPA considers important when developing the SMP for the retention of onsite 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 6 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 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 the prior to soil excavation or handling activities, allowing sufficient time 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 Part 5, 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 Act to be environmental nuisance. As such failure to control dust is likely to result in the EPA taking regulatory action.

For further information on key considerations for the soil stockpile management during remediation, refer to Appendix 6 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 does not apply to asbestos materials which 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 in legislation including the Act and relevant EPA guidelines[41].

The assessment of asbestos must be undertaken by a competent person[42]. Asbestos found at a site requires specialist skills and care in handling, removal and transportation to prevent the likelihood of asbestos fibres becoming air-borne.

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 Part 2, section 10 of this guideline).

For further information on key considerations for the management of asbestos during assessment and remediation, refer to Appendix 6 of this guideline.

16.4.6 Acid sulfate soils

Acid sulfate soils (ASS) are described in the EPA guideline *Acid sulfate soil materials*. This guideline outlines the requirements related to onsite management of acid sulfate soils, and any off-site disposal or reuse[43]. 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 they 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 LNAPL 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, and
- reducing the concentration of specific compounds present in the NAPL.

41 Refer to the EPA publication *Wastes containing asbestos: Removal, transport and disposal*

42 Guidance on a competent person in the context of asbestos is provided in Schedule B2 of the ASC NEPM

43 Refer prescribed condition of accreditation under regulation 56(2)(c) of the Regulations

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

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 Report18: *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.

For further information for undertaking MNA as a remediation option, refer to CRC CARE Technical Report 15: *A technical guide for demonstrating monitored natural attenuation of petroleum hydrocarbons in groundwater* (2010)

16.6 Surface waters

If a CSM identifies surface water bodies (including fresh and marine) as potential receptors, any EVs of those water bodies described in the WQEPP must be considered (refer to Part 1, section 3.9 of this guideline).

The minimum considerations for the protection of fresh and marine surface water bodies during any remediation activity, is provided in Appendix 6 of this guideline.

The selection of an appropriate mitigation measure for managing surface water run-off 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 in the environment as a result of a selected option.

Mitigation measures to avoid or reduce the generation and run-off of contaminated water to surface water bodies, 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 run-off water diversion trenches
- collection or absorption pits
- ponds to capture and treat the run-off (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 which 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 a residual odour (for example, natural sulphur odour).

General considerations and circumstances which 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 excavated and disposed of.

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 5 addresses specific South Australian regulatory and policy requirements which are not addressed or detailed by the ASC NEPM.

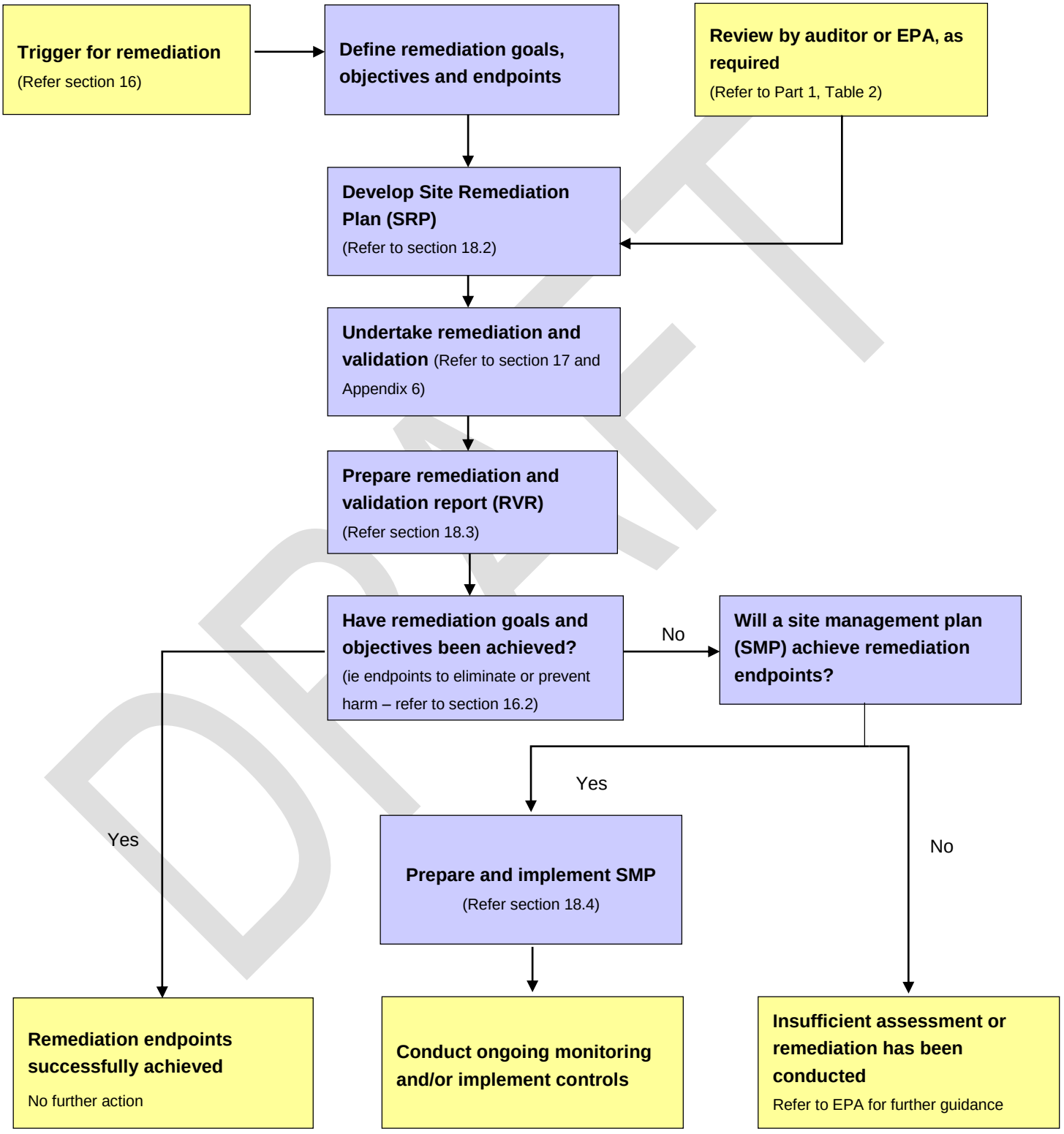

Figure 5 Process for undertaking remediation and reporting framework

17.2 Site remediation plan (SRP)

The site remediation plan (SRP) should define the goals of remediation, and provide the plan of how the remediation objectives will be achieved to meet the definition of remediate in the Act.

The SRP should consider all appropriate technologies and include a description of the decision-making process that led to the selection of the preferred remediation method, effectively a remediation options assessment. The SRP 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 SRP is to be submitted to the EPA or auditor for review, in accordance with Table 2, Part 1 of this guideline.

Appendix 6 provides key information as minimum appropriate environmental management measures that should be considered by the consultant, remediation practitioner and/or auditor prior to remediation.

Appendix 5 provides a checklist of information as a minimum requirements that should be included in an SRP.

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 SRP 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 are 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 (GMEs)
- soil vapour monitoring events (SVMEs)
- revisions to the CSM, and
- 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 Table 2, Part 1 of this guideline.

Appendix 6 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.

Appendix 5 provides a checklist of information as a minimum requirements that should be included in an RVR.

Figure 5 provides a flow chart of the remediation and reporting framework, identifying the stages when further validation and/or remediation may be required. It also identifies the process 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) may be required where a site requires some form of post-remediation monitoring, or management (remediation), for example as required in conditions of an audit report.

The EPA considers this approach as 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 onsite within an engineered containment cell (refer to section 17.4.2 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 i.e. technical impracticability been identified (refer to section 16.2.2 of this guideline).

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

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

- groundwater monitoring and management plan (GMMP)
- soil stockpile management plan (SSMP)
- bioremediation management plan (BMP)
- soil vapour monitoring and management plan (SVMMP)
- construction environmental management plan (CEMP)
- site maintenance and inspection.

The development of the SMP is required to ensure the effective management and monitoring of the site contamination.

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

- groundwater monitoring events (GMEs)
- soil vapour monitoring events (SVMEs)
- revisions to the CSM, and
- 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 a SMP or CEMP is required to be implemented these plans 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
- timeframe over which actions specified in the plan will take place
- timeframes for any reporting.

The length and contents of the management plans will depend on the complexity of the site issues.

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 Table 2 in Part 1 of this guideline.

Appendix 6 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 SMP.

Appendix 5 provides a checklist of information that should be included in an SMP.

17.5 Water restriction or prohibition areas

Section 103S of the Act states the following:

Section 103S – Prohibition or restriction on taking water affected by site contamination

(1) It the Authority is satisfied that-

a) there is site contamination that affects or threatens water; and

b) action is necessary under this section to provide actual or potential harm to human health or safety,

the Authority may, by notice in the Gazette, prohibit or restrict the taking of the water.

(2) A notice under this section must-

(a) specify the water to which it relates; and

(b) give particulars of site contamination affecting the water.

(3) A person must not contravene a notice under this section.

Penalty: Division 5 fine.

(4) The Authority may, by notice in the Gazette, vary or revoke a notice under this section.

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 way in which the use of groundwater is prohibited for any purpose, with the exception for groundwater monitoring, and thus eliminates the human exposure to contaminated water.

It is an offence to contravene the requirements of a notice under section 103S of the Act. This is essential to protect 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 19 for further information on community engagement.

Information on 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.

17.6 Special management areas

Section 103N of the 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 the 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 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 are achieved and/or the long-term management of the site contamination.

Part 5

Community engagement and information

18 Community engagement and risk communication

18.1 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. Risk communication and community engagement are key components of the assessment and management of site contamination.

In South Australia, 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 appropriate person responsible for the site contamination.

18.2 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.

18.3 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 a third-party land, the owner/occupier should be made aware of the implications of doing so.

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

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

The EPA advises that where contamination on third party sites is identified the land owners 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 (the LBSC Act) and the Regulations 2010 (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 land owners 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 on any subsequent obligations (for both the EPA and the land owner) that require relevant information to be passed on under the Form 1 statement of the Regulations under the LSBC Act.

18.4 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 which is accessible for community consultation enquiries on 1800 729 175. Further information is also available from the EPA website or by email.

19 Access to site contamination information

19.1 EPA public register

The 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 Act and as prescribed in regulation 16 of the Regulations.

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[44] 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[45]
- 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 on payment of a fee.

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

[44] Environmental assessment, in relation to land, means an assessment of the existence or nature or extent of—(a) site contamination (as defined in the Act) at 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

[45] Pre-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) what remediation is or remains necessary for a particular use, but does not include a site contamination audit (as defined in the 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. People 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 by telephone 08 8204 9128 or email.

19.2 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 which 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 in 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 on payment of a fee. The EPA will then provide a response to these questions as described above where this information is held by the EPA.

To make a Section 7 enquiry contact the EPA 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*.

19.3 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.

19.4 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 which 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 (eg consultant or auditor).

19.5 Currency of reports

Consultant and audit reports provide information useful to and 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.

19.6 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>

20 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 of 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
environmental value	Refer to section 2 of this guideline
groundwater contamination	site contamination of underground water.
groundwater restriction or prohibition of use area	an area declared under section 103S of the 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

occupier*

in relation to land—

1 has the meaning assigned to the term by section 3; and

2 if, in accordance with the regulations, a person of a particular kind is to be taken to be an occupier of the land in the circumstances of the case—

includes a person of that kind

potentially contaminating activity*

means an activity prescribed in regulation 50 of the Regulations

remediate*

to remediate a site means treat, contain, remove or manage **chemical substances** on or below the surface of the site so as to—

1 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

2 eliminate or prevent, as far as reasonably practicable—

Section 1.01	actual or potential harm to water that is not trivial; and
Section 1.02	any other actual or potential environmental harm that is not trivial, taking into account current or proposed land uses

remediation*

has the corresponding meaning to **remediate**

residential purposes

means land currently used or proposed for any form of residential use including single lot, medium density and high density and includes residential portions of mixed use

sensitive use*

means—

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 Act
site contamination audit*	a review carried out by a person that— 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 1 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— (1) sets out the findings of the audit and complies with the guidelines from time to time issued by the EPA; and 7 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*	a site remediation order issued under Part 10A of the Act
special management area*	a declaration under section 103N of the Act
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.
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 Act.
Tier 1 assessment*	Is a risk-based analysis comparing site date with generic published screening criteria (Tier 1 criteria) for various environmental values.
Tier 2 assessment*	Is 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.
water*	(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 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.

Appendix 1 EPA site contamination publications

The principal legislation dealing with site contamination in South Australia is the Act and in particular, Part 10A of the Act deals with site contamination. The relationship of guidance published by the EPA to the legislation relevant to site contamination is summarised below.

Table 3 Links between legislation and EPA guidance relevant to site contamination

Act	Overview	Link to primary EPA guidance document[46]
Section 3	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	Guideline for the assessment and remediation of site contamination Guidelines for the site contamination audit system
Section 5B	Definition of site contamination	Guideline for the assessment and remediation of site contamination
Section 83A	Notification of site contamination of underground water	Site contamination: Section 83A – Notification of site contamination that affects or threatens underground water
Section 103C	General provisions as to 'appropriate persons'	Guideline for the assessment and remediation of site contamination
Section 103H	Site contamination assessment orders (SCAO)	Compliance and enforcement regulatory options and tools
Section 103I	Voluntary site contamination assessment proposals (VSCAP)	Compliance and enforcement regulatory options and tools
Section 103J	Site remediation orders (SRO)	Compliance and enforcement regulatory options and tools
Section 103K	Voluntary site remediation proposals (VSRP)	Compliance and enforcement regulatory options and tools
Section 103S	Prohibition or restriction on taking water affected by site contamination	(not published at date of publication of this guideline)
Sections 103T-Z	Site contamination audit system	Guidelines for the site contamination audit system
Sections 103ZB, 119, 120A	Honesty in reporting	Guideline for the assessment and remediation of site contamination

Additional relevant EPA guidance includes the following:

- Selecting a site contamination consultant
- Overview of the site contamination audit system
- Site contamination auditors

[46] Current at time of publication. Please check the EPA website.

- Site contamination audit reports and audit statements
- Site contamination – information for licensees
- Acid sulfate soil materials.

Appendix 2 Harm to water criteria

Actual or potential harm to water criteria: Adopted from the NEPM Groundwater Investigation Levels or GILs (1999), the *Guidelines for managing risk in recreational water* or GMRRW (NHMRC 2008) and Guidelines for irrigation, stock watering and aquaculture (AQWG 2000).

Table A2–1 Harm to water criteria

Chemical substance	Actual or potential harm to water trigger level for the environmental value to be protected						
	Fresh water (µg/L)	Marine water (µg/L)	Drinking water (µg/L)	Recreation use (µg/L)	Agricultural irrigation (µg/L)	Agriculture stock watering (µg/L)	Agricultural aquaculture (µg/L)
Metals and metalloids							
Aluminium	55	–	–	–	5,000	5,000	100
Antimony	–	–	3,000	30,000	–	–	–
Arsenic (III)	24	–	10	100	100	500	50
Arsenic (v)	13	–	10	100	100	500	50
Barium	–	–	2,000	20,000	–	–	–
Beryllium	–	–	60	600	0.1	–	–
Boron	370	–	4,000	40,000	500	5,000	–
Cadmium	0.2	0.7	2	20	10	10	0.2
Calcium	–	–	–	–	–	1,000	–
Chromium (Cr (III)	–	27	–	–	–	1,000	3
Chromium (Cr (VI)	1	4.4	50	500	100	1,000	3
Cobalt	–	1	–	–	50	1,000	–
Copper	1.4	1.3	2,000	20,000	200	500	5
Iron	–	–	–	–	1,000	–	10
Lead	3.4	4.4	10	100	2,000	100	1
Lithium	–	–	–	–	75	–	–
Magnesium	–	–	–	–	–	–	15,000
Manganese	1,900	–	500	5,000	200	–	10
Mercury (Total)	0.06	0.1	1	10	2	2	1
Molybdenum	–	–	50	500	10	150	–
Nickel	11	7	20	200	200	1,000	100
Selenium (Total)	5	–	10	100	20	20	10

Chemical substance	Actual or potential harm to water trigger level for the environmental value to be protected						
	Fresh water (µg/L)	Marine water (µg/L)	Drinking water (µg/L)	Recreation use (µg/L)	Agricultural irrigation (µg/L)	Agriculture stock watering (µg/L)	Agricultural aquaculture (µg/L)
Silver	0.05	1.4	100	1,000	–	–	3
Sulphate	–	–	–	–	–	1,000,000	-
Tributyl tin (as Sn)	–	0.006	–	–	–	–	0.01
Tributyl tin oxide	–	–	1	10	–	–	0.01
Uranium	–	–	17	170	10	200	–
Vanadium	–	100	–	–	100	–	100
Zinc	8	15	–	–	2,000	20,000	5
Non-metallic Inorganics							
AmmoniaE (as NH3-N at pH 8)	900	910	–	–	–	–	–
Bromate	–	–	20	200	–	–	–
Chloride	–	–	–	–	–	–	–
Chlorine	–	–	–	–	–	–	3
Cyanide (as un-ionised Cn)	7	4	80	800	–	–	5
Fluoride	–	–	1,500	15,000	1,000	1,000	-
Hydrogen sulphide (un-ionised H_2S measured as S)	1	–	–	–	–	–	1
Iodide	–	–	500	5,000	–	–	–
Nitrate (as NO_3)	–	17	50,000	500,000	–	400,000	–
Nitrite (as NO_2)	–	–	3000	30,000	–	30,000	100
Nitrogen	–	–	–	–	–	–	–
Phosphorus	–	–	–	–	–	–	100
Sulphate (as SO_4)	–	–	500,000	5,000,000	–	–	–
Organic alcohols/other organics							
Ethanol	1,400	–	–	–	–	–	–
Ethylenediamine tetra-acetic acid (EDTA)	–	–	250	2,500	–	–	–

Chemical substance	Actual or potential harm to water trigger level for the environmental value to be protected						
	Fresh water (µg/L)	Marine water (µg/L)	Drinking water (µg/L)	Recreation use (µg/L)	Agricultural irrigation (µg/L)	Agriculture stock watering (µg/L)	Agricultural aquaculture (µg/L)
Formaldehyde	–	–	500	5,000	–	–	–
Methane	–	–	–	–	–	–	65,000
Nitrilotriacetic acid	–	–	200	2,000	–	–	–
Petroleum hydrocarbons							
Total petroleum hydrocarbons/total recoverable hydrocarbons	>LOR	>LOR	>LOR	>LOR	>LOR	>LOR	>LOR
Anilines							
Aniline	8	–	–	–	–	–	–
2,4-Dichloroaniline	7	–	–	–	–	–	–
3,4-Dichloroaniline	3	150	–	–	–	–	–
Chlorinated alkanes	–	–	–	–	–	–	–
Dichloromethane	–	–	4	40	–	–	–
Trichloromethane (chloroform)	–	–	3	30	–	–	–
Trihalomethanes (total)	–	–	250	2,500	–	–	–
Tetrachloromethane (carbon tetrachloride)	–	–	3	30	–	–	–
1,2-Dichloroethane	–	–	3	30	–	–	–
1,1,2-Trichloroethane	6,500	1,900	–	–	–	–	–
Hexachloroethane	290	–	–	–	–	–	–
Chlorinated alkenes							
Chloroethene (vinyl chloride)	–	–	0.3	3	–	–	–
1,1-Dichloroethene	–	–	30	300	–	–	–
1,2-Dichloroethene	–	–	60	600	–	–	–
Tetrachloroethene (PCE/Perchloroethene)	–	–	50	500	–	–	–

Chemical substance	Actual or potential harm to water trigger level for the environmental value to be protected						
	Fresh water (µg/L)	Marine water (µg/L)	Drinking water (µg/L)	Recreation use (µg/L)	Agricultural irrigation (µg/L)	Agriculture stock watering (µg/L)	Agricultural aquaculture (µg/L)
Trichloroethylene (TCE)	>LOR	>LOR	>LOR	>LOR	>LOR	>LOR	>LOR
Chlorinated benzenes							
Chlorobenzene	–	–	300	3,000	–	–	–
1,2- Dichlorobenzene	160	–	1,500	15,000	–	–	–
1,3- Dichlorobenzene	260	–	–	–	–	–	–
1,4- Dichlorobenzene	60	–	40	400	–	–	–
1,2,3-Trichlorobenzene	3	–	30	300	–	–	–
1,2,4-Trichlorobenzene	85	20	–	–	–	–	–
1,3,5-Trichlorobenzene	–	–	–	–	–	–	–
Polychlorinated biphenyls (PCBs)							
Aroclor 1242	0.3	–	–	–	–	–	–
Aroclor 1254	0.01	–	–	–	–	–	–
Other chlorinated compounds							
Epichlorohydrin	–	–	100	1,000	–	–	–
Hexachlorobutadiene	–	–	0.7	70	–	–	–
Monochloramine	–	–	3	30	–	–	–
Monocyclic aromatic hydrocarbons							
Benzene	950	500	1	10	–	–	–
Toluene	–	–	800	8,000	–	–	–
Ethylbenzene	–	–	300	3,000	–	–	–
Xylenes	350 (as o-xylene) 200 (as p-xylene)	–	600	6,000	–	–	–

Chemical substance	Actual or potential harm to water trigger level for the environmental value to be protected						
	Fresh water (µg/L)	Marine water (µg/L)	Drinking water (µg/L)	Recreation use (µg/L)	Agricultural irrigation (µg/L)	Agriculture stock watering (µg/L)	Agricultural aquaculture (µg/L)
Styrene (Vinyl benzene)	–	–	30	300	–	–	–
Polycyclic aromatic hydrocarbons (PAHs)							
Naphthalene	16	50C	–	–	–	–	–
Benzo[a]pyrene	–	–	0.01	0.1	–	–	–
Phenols							
Phenol	320	400	–	–	–	–	–
2-Chlorophenol	340	–	300	3,000	–	–	–
4-Chlorophenol	220	–	–	–	–	–	–
2,4-Dichlorophenol	120	–	200	2,000	–	–	–
2,4,6-Trichlorophenol	3	–	20	200	–	–	–
2,3,4,6-Tetrachlorophenol	10	–	–	–	–	–	–
Pentachlorophenol	3.6	11	10	100	–	–	–
2,4-Dinitrophenol	45	–	–	–	–	–	–
Phthalates							
Dimethylphthalate	3,700	–	–	–	–	–	–
Diethylphthalate	1,000	–	–	–	–	–	–
Dibutylphthalate	10	–	–	–	–	–	–
Di(2-ethylhexyl) phthalate	–	–	10	100	–	–	–
Pesticides							
Acephate	–	–	8	80	–	–	–
Aldicarb	–	–	4	40	–	–	–
Aldrin plus Dieldrin	–	–	0.3	3	–	–	–
Ametryn	–	–	70	700	–	–	–
Amitraz	–	–	9	90	–	–	–

Chemical substance	Actual or potential harm to water trigger level for the environmental value to be protected						
	Fresh water (µg/L)	Marine water (µg/L)	Drinking water (µg/L)	Recreation use (µg/L)	Agricultural irrigation (µg/L)	Agriculture stock watering (µg/L)	Agricultural aquaculture (µg/L)
Amitrole	–	–	0.9	9	–	–	–
Asulam	–	–	70	700	–	–	–
Atrazine	13	–	20	200	–	–	–
Azinphos-methyl	–	–	30	300	–	–	–
Benomyl	–	–	90	900	–	–	–
Bentazone	–	–	400	4,000	–	–	–
Bioresmethrin	–	–	100	1,000	–	–	–
Bromacil	–	–	400	4,000	–	–	–
Bromoxynil	–	–	10	100	–	–	–
Captan	–	–	400	4,000	–	–	–
Carbaryl	–	–	30	300	–	–	–
Carbendazim (Thiophanate-methyl)	–	–	90	900	–	–	–
Carbofuran	0.06	–	10	100	–	–	–
Carboxin	–	–	300	3,000	–	–	–
Carfentrazone-ethyl	–	–	100	1,000	–	–	–
Chlorantraniliprole	–	–	6,000	60,000	–	–	–
Chlordane	0.03	–	2	20	–	–	–
Chlorfenvinphos	–	–	2	20	–	–	–
Chlorothalonil	–	–	50	500	–	–	–
Chlorpyrifos	0.01	0.009	10	100	–	–	–
Chlorsulfuron	–	–	200	2,000	–	–	–
Clopyralid	–	–	2,000	20,000	–	–	–
Cyfluthrin, Beta-cyfluthrin	–	–	50	500	–	–	–
Cypermethrin isomers	–	–	200	2,000	–	–	–
Cyprodinil	–	–	90	900	–	–	–
1,3-Dichloropropene	–	–	10	100	–	–	–

Chemical substance	Actual or potential harm to water trigger level for the environmental value to be protected						
	Fresh water (µg/L)	Marine water (µg/L)	Drinking water (µg/L)	Recreation use (µg/L)	Agricultural irrigation (µg/L)	Agriculture stock watering (µg/L)	Agricultural aquaculture (µg/L)
2,2-DPA	–	–	500	5,000	–	–	–
2,4-D [2,4-dich-ophenoxy acetic acid]	280	–	30	300	–	–	–
DDT	0.006	–	9	90	–	–	–
Deltramethrin	–	–	4	40	–	–	–
Diazinon	0.01	–	4	40	–	–	–
Dicamba	–	–	100	1,000	–	–	–
Dichloroprop	–	–	100	1,000	–	–	–
Dichlorvos	–	–	5	50	–	–	–
Dicofol	–	–	4	40	–	–	–
Diclofop-methyl	–	–	5	50	–	–	–
Dieldrin plus Aldrin	–	–	0.3	3	–	–	–
Diflubenzuron	–	–	70	700	–	–	–
Dimethoate	0.15	–	7	70	–	–	–
Diquat	1.4	–	7	70	–	–	–
Disulfoton	-	–	4	40	–	–	–
Diuron	-	–	20	200	–	–	–
Endosulfan	0.03	0.005	20	200	–	–	–
Endothal	-	-	100	1,000	–	–	–
Endrin	0.01	0.004	-	-	–	–	–
EPTC	–	–	300	3,000	–	–	–
Esfenvalerate	–	–	30	300	–	–	–
Ethion	–	–	4	40	–	–	–
Ethoprophos	–	–	1	10	–	–	–
Etridiazole	–	–	100	1,000	–	–	–
Fenamiphos	–	–	0.5	5	–	–	–
Fenarimol	–	–	40	400	–	–	–

Chemical substance	Actual or potential harm to water trigger level for the environmental value to be protected						
	Fresh water (µg/L)	Marine water (µg/L)	Drinking water (µg/L)	Recreation use (µg/L)	Agricultural irrigation (µg/L)	Agriculture stock watering (µg/L)	Agricultural aquaculture (µg/L)
Fenitrothion	0.2	–	7	70	–	–	–
Fenthion	–	–	7	70	–	–	–
Fenvalerate	–	–	60	600	–	–	–
Fipronil	–	–	0.7	7	–	–	–
Flamprop-methyl	–	–	4	40	–	–	–
Fluometuron	–	–	70	700	–	–	–
Fluproponate	–	–	9	90	–	–	–
Glyphosate	370	–	1000	10,000	–	–	–
Haloxyfop	-	–	1	10	–	–	–
Heptachlor	0.01	–	–	–	–	–	–
Heptachlor epoxide	–	–	0.3	3	–	–	–
Hexazinone	–	–	400	4,000	–	–	–
Imazapyr	–	–	9,000	90,000	–	–	–
Iprodione	–	–	1,000	10,000	–	–	–
Lindane (γ-HCH)	0.2	–	10	100	–	–	–
Malathion	0.05	–	70	700	–	–	–
Mancozeb (as ETU, ethylene thiourea)	–	–	9	90	–	–	–
MCPA	–	–	40	400	–	–	–
Metaldehyde	–	–	20	200	–	–	–
Metham (as methylisothiocyanate, MITC)	–	–	1	10	–	–	–
Methidathion	–	–	6	60	–	–	–
Methiocarb	–	–	7	70	–	–	–
Methomyl	3.5	–	20	20	–	–	–
Methyl bromide	-	–	1	10	–	–	–
Metiram (as ETU, ethylene thiourea)	–	–	9	90	–	–	–

Chemical substance	Actual or potential harm to water trigger level for the environmental value to be protected						
	Fresh water (µg/L)	Marine water (µg/L)	Drinking water (µg/L)	Recreation use (µg/L)	Agricultural irrigation (µg/L)	Agriculture stock watering (µg/L)	Agricultural aquaculture (µg/L)
Metolachlor/s–Metolachlor	–	–	300	3,000	–	–	–
Metribuzin	–	–	70	700	–	–	–
Metsulfuron-methyl	–	–	40	400	–	–	–
Mevinphos	–	–	6	60	–	–	–
Molinate	3.4	–	4	40	–	–	–
Napropamide	–	–	400	4,000	–	–	–
Nicarbazin	–	–	1,000	10,000	–	–	–
Norflurazon	–	–	50	500	–	–	–
Omethoate	–	–	1	10	–	–	–
Oryzalin	–	–	400	4,000	–	–	–
Oxamyl	–	–	7	70	–	–	–
Paraquat	–	–	20	200	–	–	–
Parathion	0.004	–	20	200	–	–	–
Parathion methyl	–	–	0.7	7	–	–	–
Pebulate	–	–	30	300	–	–	–
Pendimethalin	–	–	400	4,000	–	–	–
Pentachlorophenol	–	–	10	100	–	–	–
Permethrin	–	–	200	2,000	–	–	–
Pic-am	–	–	300	3,000	–	–	–
Piperonyl butoxide	–	–	600	6,000	–	–	–
Pirimicarb	–	–	7	70	–	–	–
Pirimiphos methyl	–	–	90	900	–	–	–
Polihexanide	–	–	700	7,000	–	–	–
Profenofos	–	–	0.3	3	–	–	–
Propachlor	–	–	70	700	–	–	–
Propanil	–	–	700	7,000	–	–	–

Chemical substance	Actual or potential harm to water trigger level for the environmental value to be protected						
	Fresh water (µg/L)	Marine water (µg/L)	Drinking water (µg/L)	Recreation use (µg/L)	Agricultural irrigation (µg/L)	Agriculture stock watering (µg/L)	Agricultural aquaculture (µg/L)
Propargite	–	–	7	70	–	–	–
Proparzine	–	–	50	500	–	–	–
Propiconazole	–	–	100	1,000	–	–	–
Propyzamide	–	–	70	700	–	–	–
Pyrasulfatole	–	–	40	400	–	–	–
Pyrazophos	–	–	20	200	–	–	–
Pyroxsulam	–	–	4,000	40,000	–	–	–
Quintozene	–	–	30	300	–	–	–
Simazine	3.2	-	20	200	–	–	–
Spirotetramat	–	–	200	2,000	–	–	–
Sulprofos	–	–	10	100	–	–	–
2,4,5-T	36	–	100	1,000	–	–	–
Tebuthiuron	2.2	–	-	-	–	–	–
Temephos	–	0.05	400	4,000	–	–	–
Terbacil	–	–	200	2,000	–	–	–
Terbufos	–	–	0.9	9	–	–	–
Terbuthylazine	–	–	10	100	–	–	–
Terbutryn	–	–	400	4,000	–	–	–
Thiobencarb	2.8	–	40	400	–	–	–
Thiometon	–	–	4	40	–	–	–
Thiram	0.01	–	7	70	–	–	–
Toltrazuril	–	–	4	40	–	–	–
Toxafene	0.1	–	–	–	–	–	–
Triadimefon	–	–	90	900	–	–	–
Trichlorfon	–	–	7	70	–	–	–
Triclropyr	–	–	20	200	–	–	–
Trifluralin	2.6	–	90	900	–	–	–

Chemical substance	Actual or potential harm to water trigger level for the environmental value to be protected						
	Fresh water (µg/L)	Marine water (µg/L)	Drinking water (µg/L)	Recreation use (µg/L)	Agricultural irrigation (µg/L)	Agriculture stock watering (µg/L)	Agricultural aquaculture (µg/L)
Vernolate	–	–	40	400	–	–	–
Surfactants							
Linear alkylbenzene sulfonates (LAS)	280	–	–	–	–	–	–
Alcohol ethoxylated sulfate (AES)	650	–	–	–	–	–	–
Alcohol ethoxylated surfactants (AE)	140	–	–	–	–	–	–

Appendix 3 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 division penalties provided in the 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 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 A3–1 Summary of relevant division penalties

Division	Maximum imprisonment	Maximum fine
1	15 years	$60,000
3	7 years	$30,000
4	4 years	$15,000
5	2 years	$8,000
6	1 year	$4,000

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 4 Assessment reporting checklist

Table A4–1 Summary of PSI, DSI and SSRA reporting

Report section and information to be included where relevant	Reference: Guideline, NEPM Schedule	Preliminary site investigation (PSI)	Detailed site investigation (DSI)	Site-specific risk assessment (SSRA)
Executive summary				
Background		✓	✓	✓
Objectives of investigation		✓	✓	✓
Scope of work		✓	✓	✓
Environmental value (EV)	GAR S2.9	✓	✓	✓
Determination of harm to water	GAR S2.9	✓	✓	✓
Notifications (eg s83A, audit)	GAR S8 Audit guidelines	If applicable	If applicable	If applicable
Risk to human health and/or environment		✓	✓	✓
Summary of conclusions and recommendations		✓	✓	✓
Site information				
Site identification (include address, allotments & plans, certificate(s) of title, coordinates, maps etc)	NEPM B2, Section 3.1	✓	✓	✓
Site owner / site occupier		✓	✓	✓
Site plan (layout, scale, north arrow, other site features)	NEPM B2, Section 3.2	✓	✓	✓
Local government authority and zoning		✓	✓	✓
Current & proposed site use and identification of site users		✓	✓	✓
General Information				
Name of person requesting work		✓	✓	✓
Clear statement of the scope of work	NEPM B2, Section 8.1.2	✓	✓	✓
List of previous reports and brief description of works previously undertaken		If previous works completed	✓	✓
Site contamination audit details (if site contamination auditor engaged)		If applicable	If applicable	If applicable

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

Report section and information to be included where relevant	Reference: Guideline, NEPM Schedule	Preliminary site investigation (PSI)	Detailed site investigation (DSI)	Site-specific risk assessment (SSRA)
Survey of existing groundwater wells and registration details	Water Connect	✓		Summary or refer DSI
Other geological and hydrogeological properties	NEPM B2, Section 3.5	Desktop review, or intrusive if required		Summary
Site Inspection				
Current site use and surrounding site use	NEPM B2, Section 3.6	✓	✓	✓
Visual evidence / other observations of site contamination (discoloured soil, bare soil patches, odours etc.)			✓	✓
Condition of existing groundwater wells (if present)			Summary or refer to PSI	Summary or refer to PSI
Presence and condition of site structure and improvements (roads, buildings, storage tanks etc.)				
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 NEPM B2, Section 8.1.2 GAR Part 3B	Desktop review, or intrusive if required	✓	✓
Investigation levels				
Determine appropriate soil criteria taking into account current or proposed land use	GAR Part 3A	✓	✓	✓
Environmental value assessment	NEPM B1 GAR Part 1	✓	✓	✓

Report section and information to be included where relevant	Reference: Guideline, NEPM Schedule	Preliminary site investigation (PSI)	Detailed site investigation (DSI)	Site-specific risk assessment (SSRA)
Determine existence of actual or potential harm to water (groundwater environmental values)	GAR Part 3B	Based on field sampling or laboratory analysis	✓	✓
Details of S83A notification	EPA S83A Info Sheet	If applicable	If applicable	If applicable
Conceptual site model (CSM)				
Known and potential sources of contamination	NEPM B2, Section 4.3 & 8.1.2 GAR Part 3A & 3B	Preliminary CSM	✓	✓
Potentially affected element of environment	NEPM B2, Section 4.3 GAR Part 3A & 3B	Preliminary CSM	✓	✓
Human and ecological receptors		Preliminary CSM	✓	✓
Potential and complete exposure pathways		Preliminary CSM	✓	✓
Chemicals of concern / interest		Preliminary CSM	✓	✓
Nature of chemical substances (mobility, toxicity, volatility etc.)	NEPM B2, Section 4.8.1.2 & 9.2.3 GAR Part 3A & 3B	Preliminary CSM	✓	✓
Identifying and assessing data gaps for CSM refinement	NEPM B2, Section 4.4 GAR Part 3A & 3B	Preliminary CSM	✓	✓
Written presentation of CSM (illustration to support if required)	NEPM B2, Section 4.1 GAR Part 3A & 3B	Preliminary CSM	✓	✓
Sampling plan methodology				
Define data quality objectives (DQO)	NEPM B2, Section 5 & Appendix B	If intrusive investigations are required	✓	✓
Number, locations, depth, frequency and patterns of sampling points	NEPM B2 Section 5.3 & 6.4			
Sampling and analysis quality plans (SAQP)	NEPM B2, Section 5.3			
Elements of environment to be sampled (soil, groundwater, vapour, NAPL etc.)				
Analyte selection and analysis methods				

Report section and information to be included where relevant	Reference: Guideline, NEPM Schedule	Preliminary site investigation (PSI)	Detailed site investigation (DSI)	Site-specific risk assessment (SSRA)
Sampling methods and procedures				
Assessment and interpretation of field data				
Soil assessment and results				
Soil sampling technique	NEPM B2, Section 7.2	If applicable	✓	Summary or refer to DSI
Field description of soils (with logs)	NEPM B2, Section 7.3			
Field testing	NEPM B2, Section 7.4			
Stockpile sampling	NEPM B2, Section 7.5 GAR Appendix 6			
Soil leachability to groundwater and surface water	NEPM B2, Section 7.6			
Comparison of results to appropriate criteria	NEPM B1 & B2 GAR Part 3A			
Groundwater assessment and results				
Monitoring well establishment (including screen length and depth, bore logs etc.)	NEPM B2, Section 8.2.1 EPA Mon & sampling guidelines (2007)	If applicable	✓	Summary or refer to DSI
Groundwater sampling methods (consideration for sample methods, field filtration, sample bottles etc.)	NEPM B2, Section 8.2.3.1			
Groundwater parameters measured in field	NEPM B2, Section 8.2.5			
Aquifer properties (groundwater depth, flow direction, velocity, hydraulic conductivity etc.)	NEPM B2, Sections 8.2.6, 8.2.7			
Delineation of contamination (lateral and vertical)	NEPM B2, Section 8.3.1, 8.3.2			
Potential for attenuation of contaminants	NEPM B2, Section 8.3.4			

Report section and information to be included where relevant	Reference: Guideline, NEPM Schedule	Preliminary site investigation (PSI)	Detailed site investigation (DSI)	Site-specific risk assessment (SSRA)
Comparison of results to appropriate environmental values	GAR Part 1 & 3B			
Vapour assessment and results				
Preliminary and Screening assessment				
Soil vapour probe installation (including depth, bore logs)	NEPM B2 Section 9 and B7 Appendix A6 CRCCARE TR23 GAR Part 3B	N/A	✓	Summary or refer to DSI
Soil vapour sampling methods (including leak testing)				
Ambient air / geotechnical parameters				
Comparison of results to appropriate assessment criteria				
Detailed assessment				
Soil vapour probe installation (including depth, bore logs)	NEPM B2 Section 9 and B7 Appendix A6 CRCCARE TR23 GAR Part 3B	N/A	✓	Summary or refer to DSI
Delineation (lateral and vertical)				
Potential for attenuation of contaminants				
Assessment of preferential pathways				
Comparison of results to 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			
Comparison of field screening methods to laboratory results	NEPM B2, Appendix C			
Appropriate QA/QC samples (blanks, duplicates etc.)	NEPM B2, Appendix C			
Laboratory QA/QC				
Comparison of QA/QC information with DQO's	NEPM B2, Appendix C	If required	✓	Summary or refer to DSI

Report section and information to be included where relevant	Reference: Guideline, NEPM Schedule	Preliminary site investigation (PSI)	Detailed site investigation (DSI)	Site-specific risk assessment (SSRA)
Copies of completed COC documentation from laboratory				
Laboratory method accreditation and holding times for analyses				
Summary of QA/QC				
Appropriate practical quantitation limits (PQL), limits of reporting (LOR) for analytes				
Laboratory QC (relative percentage difference (RPD), recoveries, spikes)				
Data presentation				
Results table of all chemical of interest (include sample numbers, assessment criteria and highlighted results above criteria)	NEPM B2, Section 14.5, 14.6	If required	✓	Summary or refer to DSI
Summary of all previous results				
Site plan with sample locations and results (include highlighting results above criteria)	NEPM B2, Section 14.5			
Concentration contours, cross sections, statistical diagrams				
Contaminant fate and transport modelling				
Select appropriate model and define objectives of modelling	NEPM B2, Section 10	N/A	✓	Summary or refer to DSI
Validate model				
Sensitivity analysis				
Limitations, assumptions and uncertainties of model				
Assessment of results and reporting				
Health risk assessment				
Identification of chemicals of concern	NEPM B4, Section 9.3.2–9.3.6	N/A	✓	✓
Data collection & evaluation				
Tier 1 – comparison of results with appropriate screening criteria				
Tier 2 – inclusion of site specific data			If required	If required

Report section and information to be included where relevant	Reference: Guideline, NEPM Schedule	Preliminary site investigation (PSI)	Detailed site investigation (DSI)	Site-specific risk assessment (SSRA)
Tier 3 – inclusion of more detailed site specific data				
Exposure assessment			✓	✓
Toxicity assessment				
Sensitivity analysis				
Limitations, assumptions and uncertainties				
Community engagement and risk communication				
Details of stakeholders consulted / engaged	NEPM B8, Section 4.1.3 GAR Part 5	✓	✓	✓
Summary of information provided to stakeholders (correspondence, informed consent etc.)				
Electronic and hard copy reporting				
Signed hard copy of reports	GAR Appendix 9	✓	✓	✓
Appendices may be provided in electronic format				
Searchable Adobe®PDF file of report (must be an accurate copy of the original)				
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 EPA.				

Appendix 5 Remediation reporting checklist

Table A5-1 Summary of SRP, RVR and SMP reporting

Report section and information to be included where relevant.	Reference: Guideline, NEPM Schedule	Site remediation plan (SRP)	Remediation and validation reporting (RVR)	Site management plan (SMP)
Executive summary				
Background	GAR Part 4, Section 16	✓	Summary or refer to SRP	Summary or refer to SRP
Summary of risk conclusions (from DSI / SSRA)			✓	✓
Scope of work				
Environmental value (EV)				
Determination of harm to human health, water or the environment				
Remediation goals and objectives			✓	✓
Summary of remediation conclusions and recommendations		N/A	✓	✓
Site information				
Site identification (include address, allotments & plans, certificate(s) of title, coordinates, maps etc)	GAR Part 3A, 3B & 4	✓	✓	✓
Site owner / occupier				
Site plan (layout, scale, north arrow, other site features)				
Current & proposed site use and identification of site users				
General information				
Name of person requesting work	GAR Part 3A & 3B	✓	✓	✓
Summary of previous works undertaken (include triggers for remediation, risk conclusions from DSI or SSRA)			Summary or refer to SRP	
Site contamination audit details (if site contamination auditor engaged)			✓	

Report section and information to be included where relevant.	Reference: Guideline, NEPM Schedule	Site remediation plan (SRP)	Remediation and validation reporting (RVR)	Site management plan (SMP)
Remediation options and issues				
Define remediation approaches (technical, logistical, financial, value or water resource and ability to restore, threat to human health or environment)	GAR Part 4, Section 16.2		✓	
Discuss impracticability considerations	GAR Part 4, Section 16.3.2		Summary or refer to SRP	
Evaluate available and viable remediation options to achieve goals	GAR Part 4, Sections 16 & 17	✓		✓
Document rationale for selected remediation option				
Document management measures to prevent / reduce additional harm to human health, water or environment	GAR Part 4, Section 17 & Appendix 6		✓	
Determine timeframe for remediation completion	GAR Part 4, Section 16.4			
Review by EPA or site contamination auditor	GAR Part 2, Section 5			
Evaluate remediation completion (validation sampling may be required)	GAR Part 4, Section 16.5	N/A		If required
Update CSM with validation / additional data	GAR Part 3A			
Update SSRA (human health risk assessment or environmental risk assessment) with validation / additional data	GAR Part 3A		✓	✓
Determine if remediation goals, objectives, end points met	GAR Part 4, Section 16.3			
Stakeholder engagement	GAR Part 5	✓		
Determine if post remediation work is required (SMP, water restriction or prohibition area, special management area)	GAR Part 4, Section 18	N/A		
Electronic and hard copy reporting				
Signed hard copy of reports	GAR Appendix 9	✓	✓	✓
Appendices may be provided in electronic format				

Report section and information to be included where relevant.	Reference: Guideline, NEPM Schedule	Site remediation plan (SRP)	Remediation and validation reporting (RVR)	Site management plan (SMP)
Searchable Adobe®PDF file of report (must be an accurate copy of the original)				
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 EPA.				

Appendix 6 Environmental aspects for consideration

Environmental Aspect	Significance	Guidance and References
Air quality	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.	ASC NEPM B2, Section 15.2.1 *National Environment (Ambient Air Quality) Protection Measure 1998* (Air Quality NEPM) EPA Guideline, *Air quality impact assessment using design level pollutant concentrations*, September 2003, 386/06
Odour and gases (volatile emissions)	Odours may also cause community concern because the public is likely to perceive odours as posing a health risk to the potentially affected community.	enHealth Environmental Health Risk Assessment, *Guidelines for assessing human health risks from environmental hazards,* 2002 GAR, Part 2, Section 10 Hazardous circumstances
Dust (particulate) emissions	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 offsite. Dust can also be a cause for community concern due to impacts on lifestyle and amenity of the area and to the potential health risks posed by dust and chemicals within it.	

Environmental Aspect	Significance	Guidance and References
Dust (stockpile management)	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. **<u>Stockpiles</u>** 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. 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 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 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. 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.	GAR Part 4, Section 17.4.2 and 17.4.3

Environmental Aspect	Significance	Guidance and References
Dust (asbestos management)	**Asbestos** Various forms of asbestos, such as bonded asbestos (fibro-cement products) or free fibres (such as insulation or lagging), may be identified on sites being treated. The greatest risk to human health from asbestos is through inhalation. It should be noted that asbestos products have different physical and chemical properties, resulting in different potential risks to human health, depending on the likelihood of asbestos fibres becoming air-borne. Therefore, asbestos found on a site requires specialist skills and care in handling, removal and transportation to prevent the likelihood of asbestos fibres becoming air-borne. Asbestos-specific communication skills may also be needed to address potential concerns of workers and the community. There are specific legislative requirements relating to the handling of materials containing asbestos.	ASC NEPM, B2, Section 11 Western Australia Departments of Health, *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia,* 2009 (WA DoH 2009a) GAR, Part 4, Section 17.4.4 EPA Guideline, *Waste: Wastes containing asbestos—removal, transport and disposal,* July 2013, 414/13 National Occupational Health and Safety Council, *Code Of Practice for the Safe Removal of Asbestos (Second edition),* 2005 enHealth Council, *Management of asbestos in the non-occupational environment*, 2005
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 (see below).	ASC NEPM B2, Section 15.2.7 EPA Information Sheet, *Environmental Noise* (October 2004), 424/04 *Environment Protection (Industrial Noise) Policy 1994* *Environment Protection (Machine Noise) Policy 1994* EPA Information Sheet, *Construction Noise* (March 2005) EPA Handbook *for Pollution Avoidance on Building Sites* (2nd ed. June 2004)

Environmental Aspect	Significance	Guidance and References
Surface water	Surface water consists of stormwater that runs directly into our waterways, lakes and oceans. Run-off water from rainfall and natural site drainage may carry with it leachate or suspended solids containing chemical substances. 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.	GAR Part 4, Section 17.6 ASC NEPM B2, Section15.2.3 *Environment Protection (Water Quality) Policy 2003* Code of Practice—Industrial, Retail and Commercial Stormwater Management (in draft at date of publication)
Soil quality (incl. acid sulphate 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 17.4.5 ASC NEPM B2, Section15.2.6 ASC NEPM B2, Section 15.2.8 Illegal Dumping Guidelines for the classification of waste derived fill Waste Classification
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 court or take other options such as issuing relevant orders (environment protection order, clean up order or site contamination orders to gain compliance with the Policy. Fines may	GAR, Parts 2, 3 and 4, Appendix B ASC NEPM B2, S.15.2.2 WQ EPP (Environmental Values)

Environmental Aspect	Significance	Guidance and References
	apply if you have 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, understands and is not alarmed by such off-site activity. Some projects may necessitate a substantial amount of groundwater remediation as part of the project. Groundwater remediation is generally complex and time consuming; numerous technologies are available and the effectiveness of the technology will depend on many (generally site-specific) factors. Often trials are necessary to assist in the selection process. Regardless of the selected technology, the requirements of this guideline should be met—that is, project management plans should be prepared and implemented for groundwater remediation projects.	
Flora and fauna	Areas of sensitive vegetation and significant trees have substantial environmental value and should be protected, even where site contamination may exist. 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 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.	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.

Environmental Aspect	Significance	Guidance and References
Heritage	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. It is also possible that excavation or earthmoving activities may uncover artefacts of cultural or historical significance. Such artefacts may have substantial heritage value and should be protected.	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. For Aboriginal heritage the appropriate agency is the Department of the Premier and Cabinet.

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 Act. For further information refer to section 2.4 of this guideline.

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

Activity	Definition
Abrasive blasting	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)
Acid sulphate soil generation	Oxidation of iron sulphide in potential acid sulphate soil material (sulphidic material) resulting in formation of actual acid sulphate soil material or sulphuric material
Agricultural activities	Any of the following activities undertaken in the course of agriculture: • burial of animals or parts of animals; • burial of other waste; • irrigation using wastewater; • 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 broad-acre farming)
Airports, aerodromes or aerospace industry	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
Animal burial	Burial of animals or parts of animals other than in the course of agriculture
Animal dips or spray race facilities	Operation of animal dips or spray race facilities
Animal feedlots	Operation of confined yards or areas for holding of animals and feeding of animals principally by mechanical means or by hand
Animal saleyards	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)
Asbestos disposal	Disposal of asbestos or asbestos products
Asphalt or bitumen works	Operation of works for manufacture of asphalt or bitumen
Battery manufacture, recycling or disposal	Assembly, disassembly, manufacture or recycling of batteries (excluding storage of batteries for sale)
Breweries	Production of beer by infusion, boiling or fermentation

Activity	Definition
Brickworks	Production of bricks (including glazing of bricks)
Bulk shipping facilities	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 sea-port grain terminals)
Cement works	Operation of works for production of cement clinker or grinding of cement clinker using argillaceous and calcareous materials
Ceramic works	Operation of works for manufacture of tiles, pipes, pottery goods, refractories or other ceramic products
Charcoal manufacture	Manufacture of charcoal
Coal handling or storage	Handling of coal, coke or carbonaceous material by any means or storage of coal, coke or carbonaceous reject material
Coke works	Production, quenching, cutting, crushing or grading of coke
Compost or mulch production or storage	Production or storage of compost, mulch or garden soils
Concrete batching works	Operation of works for production of concrete or concrete products manufactured by inclusion of cement, sand, rock, aggregate or similar materials
Curing or drying works	Operation of works for smoking, drying or curing meat, fish or other edible products by application of heat or smoke
Defence works	Operation of military defence establishments (including training areas)
Desalination plants	Operation of desalination plants
Dredge spoil disposal or storage	Disposal of dredge spoil onto land or storage of dredge spoil
Drum reconditioning or recycling works	Operation of works for reconditioning or recycling of metal or plastic drums
Dry cleaning	Operation of premises for dry cleaning
Electrical or electronics component manufacture	Manufacture of electrical or electronics components
Electrical substations	Operation of electrical substations
Electrical transformer or capacitor works	Operation of works for manufacture, repair, storage or disposal of electrical transformers, capacitors or associated equipment or fluids
Electricity generation or power plants	Operation of electricity generation or power plants
Explosives or pyrotechnics facilities	Operation of facilities for manufacture of explosives or pyrotechnics
Fertiliser manufacture	Manufacture of agricultural fertiliser
Fibreglass manufacture	Manufacture of fibreglass products
Fill or soil importation	Importation, to premises of a business, of soil or other fill originating from a site at which another potentially contaminating activity has taken place

Activity	Definition
Fire extinguisher or retardant manufacture	Manufacture of fire extinguishers or fire retardants
Fire stations	Underground storage of fuel at fire stations
Fire training areas	Operation of premises for fire training involving the use of liquid fuel, fire accelerants, aqueous film forming foam or similar substances
Foundry	Manufacture of metal products by injecting or pouring molten metal into moulds
Fuel burning facilities	Burning of solid or liquid fuel (including for generation of power or steam at rate of heat release exceeding 1MW)
Furniture restoration	Restoration of furniture
Gasworks	Operation of gasworks or gas holders
Glass works	Operation of works for manufacture of glass products
Glazing	Glazing of ceramics or pottery
Hat manufacture or felt processing	Manufacture of hats or processing of felt
Incineration	Incineration within the meaning of Schedule 1, Part A, clause 3(1) of the Act
Iron or steel works	Operation of works for manufacture of iron or steel
Laboratories	Operation of laboratories
Landfill sites	Operation of sites for disposal of waste onto or into land
Lime burner	Manufacture (by means of kiln) of cement or lime from limestone (including associated storage of waste)
Metal coating, finishing or spray painting	Finishing, treating or coating of metal (including anodising, galvanising, pickling, electroplating, heat treatment, powder coating, enamelling and spray painting)
Metal forging	Forging of metal products
Metal processing, smelting, refining or metallurgical works	Operation of works for melting (by means of furnace) of ferrous or non-ferrous metal or smelting or reduction of ores to produce metal
Mineral processing, metallurgical laboratories or mining or extractive industries	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
Mirror manufacture	Manufacture of mirrors
Motor vehicle manufacture	Manufacture of motor vehicles
Motor vehicle racing or testing venues	Operation of facilities designed and used for motor vehicle competitions or motor vehicle speed or performance trials

Activity	Definition
Motor vehicle repair or maintenance	Operation of premises for repair or maintenance of motor vehicles or parts of motor vehicles (including engine reconditioning works)
Motor vehicle wrecking yards	Operation of yards for wrecking or dismantling of motor vehicles or parts of motor vehicles
Mushroom farming	Farming of mushrooms
Oil recycling works	Operation of works for recycling of oil
Oil refineries	Operation of works for refining of crude petroleum oil or shale
Paint manufacture	Manufacture (including blending, mixing and formulation) of paint
Pest control works	Operation of premises for storage of pesticides or filling or washing of tanks used in pest control operations
Plastics manufacture works	Operation of works for manufacture (including blending, mixing and formulation) of plastics or plastic components (excluding processing and moulding of plastics manufactured elsewhere)
Printing works	Operation of printing works
Pulp or paper works	Operation of works for manufacture of timber pulp or paper
Railway operations	Railway operations within the meaning of Schedule 1 Part A clause 7(2) of Act
Rubber manufacture or processing	Manufacture or processing of rubber or rubber products
Scrap metal recovery	Recovery (including cleaning) of scrap metal
Service stations	Operation of retail fuel outlets
Ship breaking	Wrecking or dismantling of ships
Spray painting	Spray painting other than spray painting of metal
Tannery, fellmongery or hide curing	Operation of works for preservation or treatment of animal skins or hides
Textile operations	Manufacture or dyeing of fabrics or materials
Transport depots or loading sites	Operation of transport depots or loading sites
Tyre manufacture or retreading	Manufacture or retreading of tyres
Vermiculture	Cultivation of earthworms for production of earthworms or earthworm castings
Vessel construction, repair or maintenance	Operation of works or facilities (whether on water or land) for construction, repair or maintenance of vessels
Waste depots	Reception, storage or treatment (including recycling) of waste or disposal of waste to land or water
Wastewater treatment, storage or disposal	Treatment, storage (including in tanks, lagoons and ponds) or disposal (to land or water) of wastewater

Activity	Definition
Water discharge to underground aquifer	Direct discharge of water from surface of land to underground aquifer
Wetlands or detention basins	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
Wineries or distilleries	Operation of works for processing grapes or other produce to make wine or spirits
Wood preservation works	Operation of works involving treatment or preservation of timber using chemicals
Woolscouring or wool carbonising works	Operation of works involving cleaning or carbonising of wool other than in course of handicraft business where wool is further processed for retail sale
Works depots	Operation of works depots by councils or utilities

Part 2—Domestic activities

Activity	Definition
Fill or soil importation	Importation, to domestic premises, of soil or other fill originating from a site at which another potentially contaminating activity has taken place
Liquid organic chemical substances—storage	Storage of more than 500 litres of liquid organic chemical substances in underground or aboveground tanks or vessels at a discrete premises (excluding storage of oil for domestic heating at the premises)

Part 3—Listed substances[47]

Acidic solutions

Acids

Adhesives (excluding solid inert polymeric materials)

Alkali metals

Alkaline earth metals

Alkaline solutions

Alkalis

Antimony

Antimony compounds

Antimony solutions

Arsenic

Arsenic compounds

Arsenic solutions

Asbestos

Barium compounds

Barium solutions

Beryllium

Beryllium compounds

Boron

Boron compounds

Cadmium

Cadmium compounds

Cadmium solutions

Calcium carbide

Carbon disulphide

Carcinogens

Chlorates

Chromium compounds

Chromium solutions

Copper compounds

Copper solutions

Cyanide complexes

Cyanides

Cyanide solutions

Cytotoxic wastes

Dangerous substances within the meaning of the *Dangerous Substances Act 1979*

Distillation residues

Equipment containing mercury

Fluoride compounds

Halogens

Heterocyclic organic compounds containing oxygen, nitrogen or sulphur

Isocyanate compounds (excluding solid inert polymeric materials)

Laboratory chemicals

Lead compounds

Lead solutions

Lime sludges or slurries

Liquid organic chemical substances

Manganese compounds

Medical waste within the meaning of Schedule 1 Part B of the *Environment Protection Act 1993*

Mercaptans

Mercury compounds

Mutagens

Nickel compounds

Nickel solutions

Nitrates

Organic halogen compounds (excluding solid inert polymeric materials)

Organic phosphates

[47] 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.

Phosphorus compounds

Poisons within the meaning of the *Drugs Act 1908*

Polychlorinated biphenyls

Radionuclides

Reactive chemicals

Reducing agents

Selenium

Selenium compounds

Selenium solutions

Silver compounds

Silver solutions

Solvent recovery residues

Sulphides

Sulphide solutions

Surfactants

Teratogens

Thallium

Thallium compounds

Thallium solutions

Vanadium compounds

Zinc compounds

Zinc solutions

Appendix 8 References and guidance

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 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, National Environment Protection Council, Canberra (the ASC NEPM) as amended in 2013.

The purpose of this measure is to establish a nationally consistent approach to the assessment of site contamination. SA is a participating state to the Intergovernmental Agreement on the Environment made on 1 May 1992, and is a participating jurisdiction 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 2004*, National Environment Protection Council, Australia
- National Environment Protection (Ambient Air Quality) Measure 2003e, National Environment Protection Council, Australia.

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 Act to secure the aims of the Act. EPPs may contain mandatory provisions that are enforceable under the 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*
- *Environment Protection (Waste to Resources) Policy 2010*

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:

- Waste guidelines including
  - *Standard for the production and use of Waste Derived Fill*
  - Landfill gas and development near landfills–advice for planning authorities and developers
  - Current criteria for the classification of waste–including Industrial and Commercial Waste (Listed) and Waste Soil.

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 which 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 9 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[48]. 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 A–series standard eg A4, A3, A0, etc. In addition, the resolution of the file should not be any lower than 300 dots per inch (DPI). Any attachments, such as photos, figures, maps, etc should also be included within the PDF according to the following guidelines. 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 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 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 which are copy protected, updated versions where these functions are restricted. 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 how the 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 included/embedded in the PDF file.

[48] Refer to section 109 of the Act