

## EPA Guidelines for Environmental management of on-site remediation





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# Environmental management of on-site remediation

March 2006

*EPA 623/06: This guideline provides advice on the environmental management of on-site (site contamination) remediation activities so as to minimise any actual or potential adverse impacts and to provide adequate protection to the community.*

## 1. Introduction

The Environment Protection Authority (EPA) recommends and encourages that remediation be undertaken wherever site contamination has occurred. Remediation is considered to be the treatment, containment, removal or management of chemical substances or wastes so that they no longer represent an actual or potential risk to human health or the environment, taking into account the current and intended use of the site.

The *National Environment Protection (Assessment of Site Contamination) Measure 1999* (NEPM) defines contamination as ‘the condition of land or water where any chemical substance or waste has been added at above background level and represents, or potentially represents, an adverse health or environmental impact’.

Methods and processes used in remediation, which can range from relatively straightforward earthmoving operations to complex technological treatment processes, may cause adverse impacts if not properly managed. The majority of remediation methods involve some on-site activities, even when the treatment and disposal of materials may occur elsewhere. It is not unusual for several methods to be used on a site, particularly where remediation of contaminated groundwater is necessary.

This guideline describes the EPA’s expectations for those who undertake remediation projects. It describes, in detail, the environmental aspects that must be considered, and planned for, before starting a remediation project. It is anticipated that careful planning, prior to remediation, will result in the control of both predictable and preventable environmental impacts.

A summary of the approvals process for a remediation project is provided in **Figure 1, Appendix A**.

## 2. Application of this guideline

Any remediation proposals forwarded to the EPA for direction, advice or assistance, either by a relevant planning authority or by any other agent, are expected to have addressed the components of this guideline. The role of the EPA is further described in **Appendix A**.

Not all elements of the guideline will be relevant to every project—its application is expected on a site-specific basis. However, if the project is large or complex in nature, or involves complex chemicals, it is likely that most elements of the guideline will need to be addressed.

Whilst it is primarily aimed at environmental consultants and remediation contractors, the guideline also provides information to the general public, site owners, developers and other authorities who may have an interest in site contamination and remediation.

This guideline is not intended to prescribe technologies, goals or precise rules for the environmental management of on-site remediation. Rather it provides a framework for the key issues that need to be considered throughout remediation programs, and aims to ensure that every effort is made to protect human health, property and the environment.

Remediation works involving hazardous materials, biological hazards or radionuclides will necessitate additional measures that are not discussed in this guideline.

## 3. Regulatory framework

The primary regulatory requirements in relation to remediation and the environment in South Australia are the:

- *Environment Protection Act 1993* (the Act), Regulations and Environment Protection Policies (EPPs)
- National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM)

In seeking to comply with the Act, those undertaking remediation activities are expected to implement the measures described in this guideline, or be able to demonstrate that any alternative approach achieves an equivalent or higher level of environmental performance. Such alternatives should be discussed and agreed with the EPA on a site-specific basis.

### *General environmental duty*

Section 25 of the Act requires 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 environmental harm’.

Non-compliance with this guideline is not, in itself, an offence. However, a person is still required by law to ensure that their activity complies with the Act and relevant Environment Protection Policies (EPPs).

Failure to implement the measures described in this guideline may result in the issuing of an Environment Protection Order (EPO). EPOs typically require a person to take specified action within a certain period of time. Failure to comply with an EPO can lead to prosecution.

Equally, compliance with this guideline indicates that a person has taken reasonable and practicable measures to prevent or minimise environmental harm. Adopting the practices identified by this guideline will be deemed as compliance with a person’s general environmental duty in accordance with section 25 of the Act.

For further legislative information see the section titled **Further information**.

### *Penalty for environmental harm*

Under the Act, 'A person who by polluting the environment causes serious environmental harm is guilty of an offence'. The maximum penalty for serious environmental harm for a corporation is a fine up to \$2,000,000, and for a person, a fine up to \$500,000.

### *Compliance and enforcement*

Further information on compliance and enforcement is in the EPA document *EPA Guidelines for Compliance and Enforcement (2005)*, available from the EPA (tel. 8204 2004) or from the website at <[www.epa.sa.gov.au/pdfs/guide\\_compliance.pdf](http://www.epa.sa.gov.au/pdfs/guide_compliance.pdf)>.

## **4. EPA expectations**

The EPA expects all persons who undertake remediation to comply with the regulatory framework described above.

### *Sensitive land use*

When a 'sensitive land use' is proposed where a contaminating activity has occurred, the EPA expects the use of an independent Environmental Auditor (Contaminated Land), appointed by the Victorian EPA, to assess and provide an expert opinion on the suitability of the site for its intended use. A 'sensitive land use', in relation to site contamination, is defined as any of the following:

- a residence
- a child-care centre
- a pre-school
- a primary school.

The EPA expects planning authorities, developers and landowners to accept and implement the opinion of an auditor as provided in a site audit report (SAR) and throughout the remediation process. The EPA endorses the opinion and/or recommendations of an auditor, and this provides assurance that a site is suitable for its intended use. The role of the auditor is further described in **Appendix A**.

### *Non-sensitive land use*

For the development or continuation of an existing commercial, industrial or similar use, assessment by an experienced environmental consultant should generally be acceptable. The consultant's report should state that the site assessment has been completed taking into account the Assessment of Site Contamination NEPM. The report must also provide definitive statements that the site, following remediation, does not pose unacceptable risks to human health or the environment, taking into account the intended uses(s).

When the consultant's report does not satisfy this, and/or the site has significant site contamination issues, taking into account technical, logistical and financial considerations—then the EPA expects that an auditor be engaged to issue an SAR for the site.

## **5. Remediation management plans**

Remediation should start with the preparation of a remediation action plan (RAP) and an environmental management plan (EMP). The RAP should detail the methods, processes and controls of the remediation activities. The EMP should address all environmental management issues. These two plans may be combined to form a remediation management plan (RMP).

*This guideline is intended to assist in the preparation of the environmental management plan—that is, the plan that will specifically address potential environmental impacts.*

The findings of a site-specific environmental assessment should determine the most appropriate remediation or management measure, taking into account the specific needs and circumstances of the project. It is important to recognise that the conditions and issues associated with site contamination are different for each site, and should be assessed on a site-specific basis.

Careful planning, if completed thoroughly, can result in considerable benefits including financial savings, accurate project schedules, excellent environmental outcomes and achievement of the desired project outcomes.

*All plans are expected to provide sufficient detail to demonstrate that the person undertaking the remediation has clearly identified and considered the issues that are likely to occur during the project and how they will manage or mitigate these issues.*

Such plans should be concise, definite and readily implemented. They should not contain, unless appropriate, words such as ‘should’, ‘could’ and ‘will consider’. Plans must also take into account the level of understanding of those working with the document on site.

All project plans must be achievable and, once work has commenced, fully implemented. The plans should assign responsibility and are to be signed off by the site manager to demonstrate that he or she understands the content and responsibilities of their role as detailed in the plans.

Detail of the expected content of the management plan is provided in **Appendix B**.

## **6. Environmental management aspects**

The following sections provide information on the types of environmental aspects that are generally applicable to remediation projects, these being:

- air quality (odour and gaseous emissions, dust, noise)
- surface water
- soil quality
- groundwater quality
- flora, fauna and heritage
- consultation and involvement
- occupational health and safety
- security and visitors
- dangerous substances.

The environmental aspects considered in the following sections are not exhaustive and the need for additional measures should be considered on a site-by-site basis. Each aspect is discussed in detail in the **appendices C–L**.

## Appendices

- Appendix A**      **Roles and responsibilities** (EPA, planning authority, independent auditor, Department of Health, contractor)
- Appendix B**      **Management plans** (overview, remediation management plan, remediation action plan, bioremediation management plan, environmental management plan)
- Appendix C**      **Environmental aspect—air quality (volatiles, particulate, asbestos)**
- Appendix D**      **Environmental aspect—noise**
- Appendix E**      **Environmental aspect—surface water**
- Appendix F**      **Environmental aspect—soil quality**
- Appendix G**      **Environmental aspect—groundwater management**
- Appendix H**      **Environmental aspect—flora and fauna**
- Appendix I**      **Environmental aspect—heritage**
- Appendix J**      **Social aspect—consultation and involvement**
- Appendix K**      **Structural aspects—vibration, dewatering and groundwater pumping**
- Appendix L**      **Safety aspect—occupational health and safety** (OHS, security, visitors, dangerous/hazardous substances)



## Appendix A Roles and responsibilities

### The role of the Environment Protection Authority

The Environment Protection Authority is responsible for administering the *Environment Protection Act 1993* (the Act). The EPA is South Australia's primary environmental regulator, with responsibility for the protection and enhancement of the environment, including air and water quality, and control of pollution, waste and noise.

South Australia is preparing specific legislation to deal with site contamination. The Government, through the EPA, has prepared an Environment Protection (Site Contamination) Amendment Bill. The EPA Board has, in the interim, reaffirmed the use of Environmental Auditors (Contaminated Land), appointed by the Victorian EPA. The EPA administers the audit system in South Australia.

Under the *Development Act 1993*, the EPA may be requested to provide advice and guidance to a relevant authority on remediation activities. Throughout any remediation work the EPA will use the provisions of the Act to control activities causing offsite environmental impacts; due consideration should therefore be given to this guideline to avoid unnecessary project delays and possible enforcement action by the EPA under the Act and EPPs.

### The role of a relevant planning authority

All development, as defined by the Development Act and Regulations, requires development authorisation. Proponents are encouraged to seek further information about remediation from the relevant local council or Planning SA to identify whether the proposed activities require development approval.

The EPA recommends that planning authorities take this guideline into account wherever site contamination is suspected or has occurred, and remediation is necessary to ensure that the land is fit for the intended use.

### The role of an independent environmental auditor

The EPA endorses the use of independent Environmental Auditors (Contaminated Land)—appointed by the Victorian Environment Protection Authority—as appropriate persons to assess the suitability of a site for the intended use, particularly where a more sensitive land use is proposed. The role of an auditor<sup>1</sup> is to evaluate the environmental condition of a site at the date of signing a site audit report (SAR). The auditor documents an opinion, on which others can rely, regarding the suitability of the site for future use. In doing so, the auditor is expected to:

- review any assessment or remediation undertaken by others
- evaluate the adequacy of the available information about the condition of the site
- if necessary, seek further information about the condition of the site
- make an independent assessment and provide an opinion of the condition of the site and its suitability for the proposed use.

Therefore, when an auditor has been engaged to undertake an audit, the auditor should:

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<sup>1</sup> refer to Planning SA's Advisory Notice 20—Site Contamination 20/02

- review and endorse the RMP (or the RAP and EMP) where prepared for the remediation activities
- confirm that the proposed remediation should achieve an acceptable outcome that will enable completion of the audit
- confirm that the proposed strategies for environmental management of any on-site remediation, taking into account this guideline, adequately protect human health, property and the environment during the remediation activities.

## **The role of the Department of Health**

The Department of Health aims to achieve sustainable and continuous improvement in the health of all South Australians.

The Environmental Health Service (EHS) of the Department of Health plays an integral part in the department's public health activities, as well as the health system as a whole, by addressing environmental determinants of health.

The EHS has played a major national role in assessing and managing site contamination since 1990, and has recently focused on issues associated with the off-site migration of site contaminants and their potential effects on human health; it collaborates closely with key stakeholders, particularly the EPA.

## **The role of the contractor**

The contractor plays a pivotal role in the success of a remediation project. The contractor is ultimately responsible for implementing the remediation management plan. An experienced remediation contractor can provide excellent practical information on how to mitigate offsite environmental impacts that might arise throughout the remediation process.

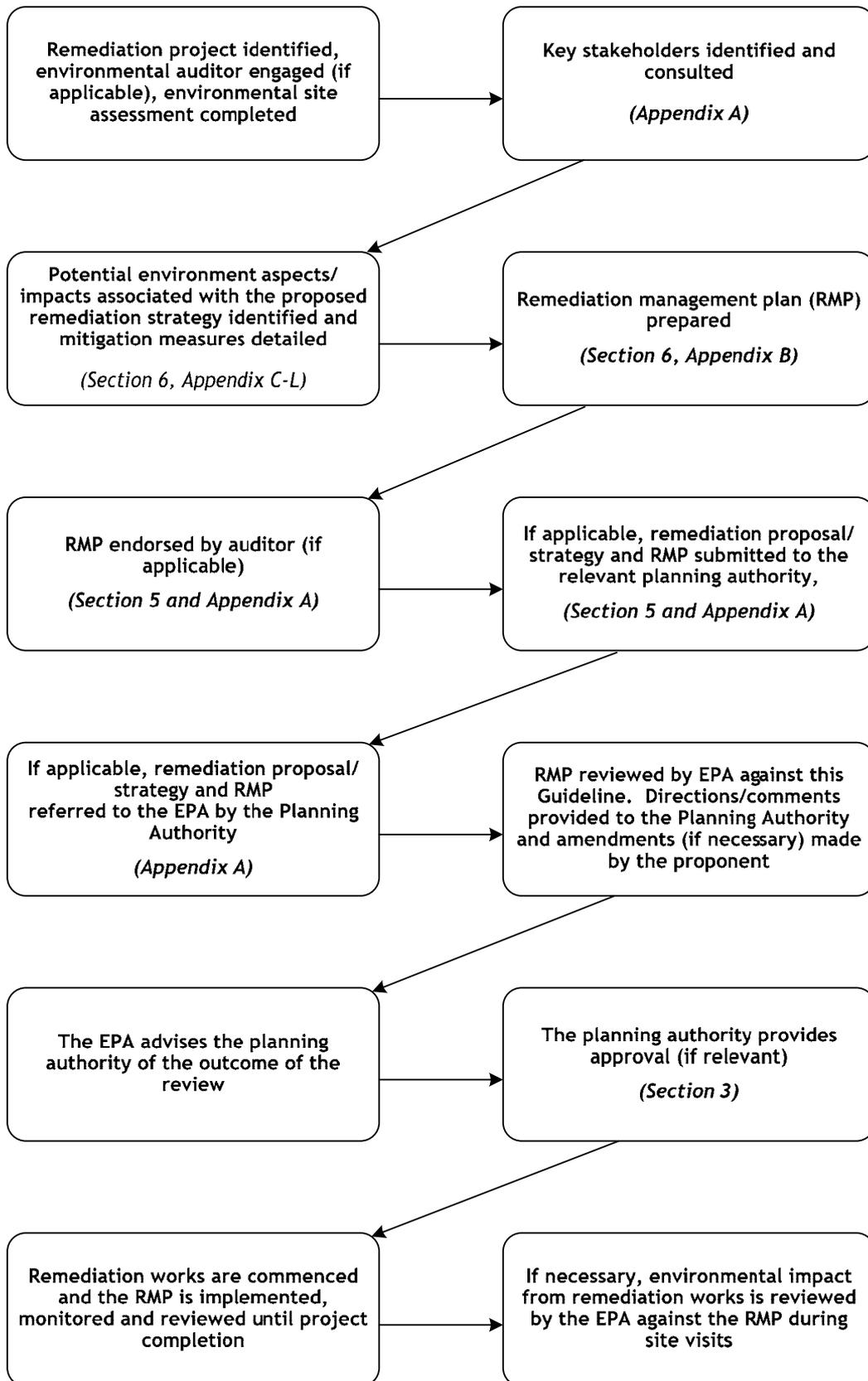


Figure 1 Remediation project approvals process

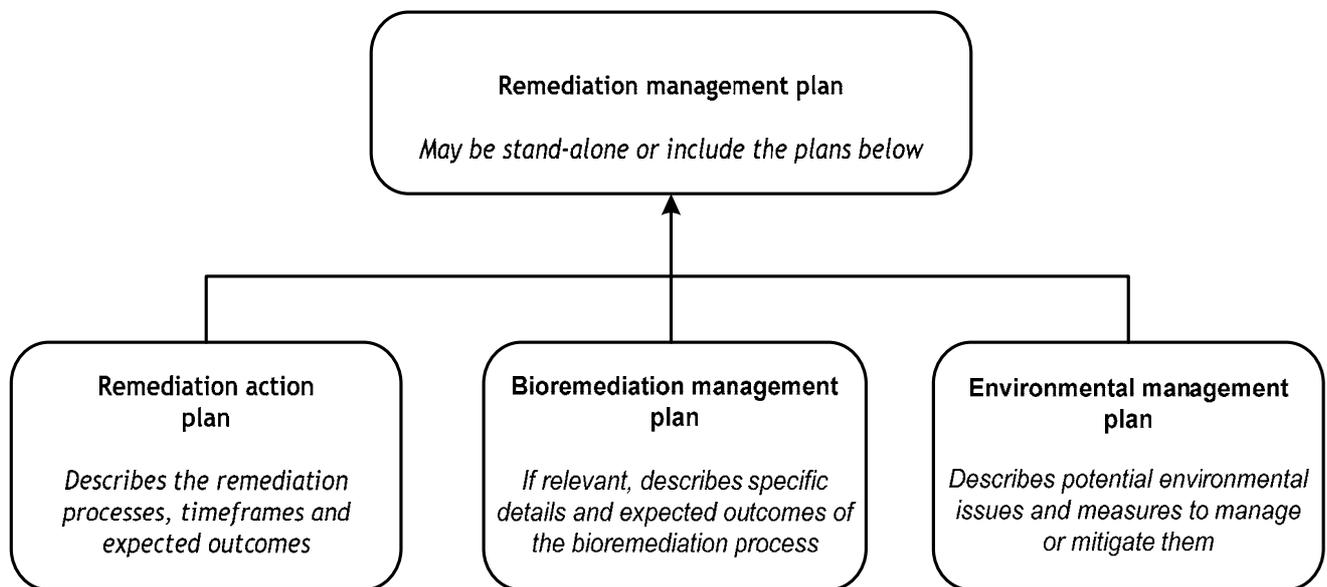
## Appendix B Remediation management plans

### Overview

This section is intended to assist in the preparation of the environmental management plan—the plan that will specifically address potential offsite environmental impact.

All plans are expected to provide sufficient detail to demonstrate that the person undertaking the remediation has clearly identified and considered the issues that are likely to occur throughout the duration of the project and how they will manage or mitigate these issues.

There are essentially four types of plans that need to be considered; they are shown in **Figure 2** and described in the following sections.



**Figure 2 Management plans**

### Remediation management plan (RMP)

An RMP is a detailed document. It can incorporate the EMP and RAP and, if relevant, the bioremediation management plan (BMP). The preparation of an RMP avoids the need to produce numerous documents and provides sections on remediation management, environmental management and, if applicable, bioremediation management.

An RMP is useful on both small and large projects because it can save cost and time in document preparation and avoid duplication. It is not a summary document and in no way diminishes a person’s responsibility to prepare a well constructed, detailed and clear plan for the entire remediation project.

### Remediation action plan (RAP)

The preparation of a detailed RAP, or components of it on smaller projects, is expected for all remediation projects.

The RAP should:

- set remediation goals that ensure that, on completion of the remediation and validation, the site will be suitable for the proposed use and will provide adequate protection of human health, property and the environment. The RAP author should note the auditor's role as outlined in **Appendix A** of this guideline.
- document the nature and extent of remediation necessary (for soils and groundwater) and describe the rationale for the recommended remedial option or combination of options
- detail all procedures and plans to reduce human health and/or environmental risks to acceptable levels for the proposed site use
- establish the environmental safeguards required to complete the remediation in an environmentally acceptable manner
- identify and include proof of the necessary approvals and licences required by regulatory authorities.

An RAP should focus on the remediation technology and its expected effectiveness, especially with respect to the remediation goals.

An RAP should detail the following information:

- the technology to be used
- the expected by-products, wastes, discharges and outputs (including the management of these substances)
- timelines for on-site and off-site activities
- the expected endpoints and outcomes
- results of trials on similar sites or the same site
- how the technology will be implemented
- contingency plans for equipment failure.

### **Bioremediation management plan (BMP)**

A BMP is a specific document forming part of a bioremediation process. Bioremediation is a unique type of remediation that generally requires considerable time and careful planning to achieve successful outcomes. Details for preparing a BMP are provided in the EPA Guideline *Soil Bioremediation*. The BMP can stand-alone or form part of an RMP or RAP.

### **Environmental management plan (EMP)**

An EMP must detail how the proposed remediation activities will affect the environment and the nearby receptors, and how these effects will be managed or mitigated. The EMP should demonstrate to all stakeholders that all of the potential environmental impacts from the proposed remediation activities have been considered, and that the recommended control measures take into account site-specific conditions. The document must be clearly articulated and not vague when discussing aspects, impacts and management measures.

The following appendices provide guidance on the components that should form part of an EMP.

## Appendix C Environmental aspect—air quality

### *Odour and gaseous (volatile) emissions*

**Significance:** 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.

Odours may also cause community concern because the public is likely to perceive odours as posing a health risk to the potentially affected community.

**Goal:** Protection of health and the environment and compliance with the *National Environment (Ambient Air Quality) Protection Measure 1998* (Air Quality NEPM)

**Items that must be considered:**

- ♦ volatility of the chemical substance(s)
- ♦ toxicity of the chemical substance(s)
- ♦ typical and expected atmospheric and weather conditions
- ♦ naturally occurring volatiles (for example, hydrogen sulfide)
- ♦ odour thresholds and modelling
- ♦ location and extent of potentially affected areas
- ♦ distance to nearest sensitive receptor
- ♦ determination of acceptable off-site concentrations
- ♦ duration of potential exposure
- ♦ potential subsurface migration of volatile sources during remediation
- ♦ environmental and occupational health requirements
- ♦ contingency planning for unexpected volatile emissions.

Where there may be a potential risk to health:

- ♦ monitoring of airborne chemical substances in the working zone of the worker may be necessary
- ♦ consultation with an occupational hygienist is recommended (this may be an air quality risk assessor for off-site impacts).

If gaseous emissions are a possible concern on a remediation project, an assessment should be undertaken during the planning stage to determine the need for special measures to prevent and control the emissions. Air quality monitoring programs should be designed to include the regular measurement and testing of odours or atmospheric concentrations of pollutants, on-site and at site boundaries, to ensure that workers and the community are not at risk of adverse health effects.

*Odour and gaseous (volatile) emissions***Potential mitigation measures**

The preferred strategy for protecting air quality during remediation of site contamination is prevention, minimisation, followed by environmental controls. Potential mitigation measures may include:

- ◆ minimising the exposed surface area of odorous/noxious materials (eg use a staged remediation strategy rather than a broad-scale approach)
- ◆ timing excavation activities to minimise off-site nuisance
- ◆ undertaking work in favourable weather conditions (eg lower temperatures, favourable winds)
- ◆ covering exposed surfaces overnight or during periods of low excavation activity
- ◆ not stockpiling odorous materials unless closely contained or covered
- ◆ completely covering the area of excavation (eg with a large tent) during all activities
- ◆ treating (eg using adsorption, thermal or filtration methods) all controlled emissions (eg during bioremediation, air sparging or product recovery)
- ◆ immediately and completely removing offensive odorous material offsite.

In all cases, it is important that an appropriate level of community consultation is undertaken at all stages of the project, particularly before starting any activities. Local residents and stakeholders should be consulted in advance about the likely duration, impacts, potential health risks and mitigation measures to be undertaken, followed by updates during the remediation period.

**Further information**

- ◆ *Air quality impact assessment using design level pollutant concentrations*, September 2003, EPA Guideline 386/06
- ◆ NEPM (1999), *Schedule B(9) Guideline on Protection of Health and the Environment during the Assessment of Site Contamination*
- ◆ *National Environment (Ambient Air Quality) Protection Measure 1998*
- ◆ enHealth (2002), *Environmental Health Risk Assessment—Guidelines for assessing human health risks from environmental hazards*

*Dust (particulate) emissions*

**Significance:** 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.

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.

**Stockpiles:** 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.

## *Dust (particulate) emissions*

**Goal:** Protection of health and the environment and compliance with the *National Environment (Ambient Air Quality) Protection Measure 1998*.

### **Items that must be considered:**

- ◆ likely sources of dust generation
- ◆ toxicity of dust (eg silica, asbestos, and characteristics of the chemical substances within particulate matter)
- ◆ extent of the remediation area
- ◆ timing of remediation works—remediation undertaken at the end of the rainfall season is likely to minimise dust exposure because of soil moisture content
- ◆ choice of remediation technique/s
- ◆ remediation work methods and staging of works
- ◆ impact of dust generation
- ◆ distance to nearest sensitive receptors
- ◆ dust monitoring—appropriate methodologies/protocols
- ◆ background measurements (before and during remediation)
- ◆ methods used to minimise or eliminate dust generation, including management practices
- ◆ weather station monitoring (before and during remediation). For large projects it is important to understand local conditions well before starting work.

### **Potential dust mitigation measures:**

- ◆ good housekeeping—minimising traffic and its speed on exposed soils, minimising exposed working areas during remediation, and minimising loose soil
- ◆ light application of a water spray to dampen the soil but not saturate it. Potentially polluted run-off from saturated soils entering adjacent sites, stormwater systems, or local waterways must be avoided. Water application needs to be periodic to provide persistent effects, although in clayey soils a crust may form which will reduce dust generation. Water conservation measures (or restrictions) must be considered.
- ◆ spraying binders and a hydro-mulch
- ◆ a continuous cover of mulch, coarse sand and dolomite (effective even if used very thinly)
- ◆ rolling the site, particularly when the soil is moist, to compact the surface
- ◆ vegetative cover—grassing (with native or introduced species) to effectively stop dust generation, but this will incur costs for maintenance. However, even if the grass is allowed to die, the dust reduction effect will persist for some time.
- ◆ the use of groundcovers, such as tarps or geo-fabrics
- ◆ installation of screens to act as windbreaks
- ◆ fencing—solid fencing may have a limited effect on wind patterns and may also contain some of the dust that is generated

undertaking dust generating tasks during favourable meteorological conditions, eg low wind currents, rainfall, favourable wind directions.

*Dust (particulate) emissions***Stockpiles:**

- ◆ 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.

**Asbestos fibres**

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.

For information relating to asbestos, contact Workplace Services or the EPA.

**Further information**

- ◆ *Wastes containing asbestos—removal, transport and disposal*, September 2004, EPA Guideline 414/04
- ◆ *Code Of Practice for the Safe Removal of Asbestos* (Second edition), National Occupational Health and Safety Council, 2005 [NOHSC:2002(2005)]
- ◆ *Management of asbestos in the non-occupational environment*, enHealth Council, 2005
- ◆ enHealth, <[www.enhealth.nphp.gov.au/](http://www.enhealth.nphp.gov.au/)>
- ◆ NEPM (1999), *Schedule B(9) Guideline on Protection of Health and the Environment during the Assessment of Site Contamination*.

## Appendix D Environmental aspect—noise

<i>Noise</i>
<p><b>Significance:</b> 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).</p>
<p><b>Goal:</b> Compliance with the EPPS—Industrial Noise and Machine Noise</p>
<p><b>Items that must be considered:</b></p> <ul style="list-style-type: none"> <li>◆ likely sources of noise</li> <li>◆ distance to nearest sensitive receptors</li> <li>◆ noise modelling and monitoring</li> <li>◆ obligations under the <i>Occupational Health, Safety and Welfare Regulations 1996</i></li> <li>◆ obligations under the <i>Environment Protection (Industrial Noise) Policy 1994 (Schedule 2)</i></li> <li>◆ obligations under the <i>Environment Protection (Machine Noise) Policy 1994</i>.</li> </ul>
<p><b>Potential mitigation measures</b></p> <p>The potential for noise from remediation activities should be evaluated and appropriate control measures put in place if possible to reduce noise. Measures may include the following:</p> <ul style="list-style-type: none"> <li>◆ When close to residential areas, restrict hours of operation to meet the requirements of EPA Information sheets for Environmental Noise and Construction Noise (see below).</li> <li>◆ Noisy machines should preferably not be operated before 9 am.</li> <li>◆ Use noise suppression on machinery or equipment with low sound outputs.</li> <li>◆ Properly maintain all equipment, with special attention to mufflers and other noise control devices.</li> <li>◆ Provide hearing protection for workers.</li> <li>◆ Do not use loud radios where neighbours can be disturbed.</li> <li>◆ Install screens or noise baffles.</li> <li>◆ Between work periods, workers should shut down, or throttle to a minimum, machines such as backhoes, cranes, bobcats, loaders and generators.</li> <li>◆ Place noisy equipment on the site at maximum distance from neighbouring houses.</li> </ul>
<p><b>Further information</b></p> <ul style="list-style-type: none"> <li>◆ <i>Environmental Noise</i> (October 2004), EPA Information Sheet 424/04</li> <li>◆ <i>Environment Protection (Industrial Noise) Policy 1994</i></li> <li>◆ <i>Environment Protection (Machine Noise) Policy 1994</i></li> <li>◆ <i>Construction Noise</i> (March 2005), EPA Information Sheet</li> <li>◆ <i>Handbook for Pollution Avoidance on Building Sites</i> (2nd ed. June 2004), EPA</li> </ul>

## Appendix E Environmental aspect—surface water

### *Surface water protection*

#### **Significance**

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.

**Goal:** Compliance with the *Environment Protection (Water Quality) Policy 2003*

#### **Items that must be considered:**

- ◆ topography of the site
- ◆ local weather patterns and expected direction and pathways of run-off flow
- ◆ location and extent of the affected area
- ◆ sensitivity of surrounding environments and proximity of nearby watercourses
- ◆ remediation work methods and staging of works
- ◆ likely sources of surface water pollution—for example, stockpiled, pre-excavated materials awaiting removal from site may create a particular risk to health and waters
- ◆ any on-site or off-site areas susceptible to adverse impacts
- ◆ requirements under the Water Quality Policy. In accordance with Section 13 of the Policy, a person must not, by discharging any pollutant into any waters, cause any of the water quality criteria applicable to those waters to be exceeded or, if already exceeded, to be further exceeded. Section 17 of the Policy states that a person must not discharge or deposit a pollutant into any waters or onto any land from which it is reasonably likely to enter any waters.

#### **Potential mitigation measures**

The choice of an appropriate mitigation measure for managing surface water run-off should be made with reference to the waste hierarchy (avoid, reduce, recycle, dispose of).

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* generation and run-off of polluted stormwater to waterways 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)

### *Surface water protection*

- ♦ designation of an area within which all run-off and infiltration is to be controlled with strict performance objectives (eg no uncontrolled run-off).

Measures to *recycle* surface water run-off may be undertaken in conjunction with other management options. Potential recycling measures include:

- ♦ respraying polluted water onto stockpiles of excavated soil as a means of effectively managing the water and suppressing dust, although this may not be acceptable if the water contains volatile substance
- ♦ use of collected surface water to stabilise dry soil and avoid dust
- ♦ directing stormwater to landscaped areas
- ♦ use of collected surface water at nearby processing industries.

*Treatment and disposal* of collected polluted run-off should be considered as a final option. The measure selected must be appropriate to the site and the level of pollution expected in the run-off. Potential treatment and disposal options to consider include:

- ♦ treatment on site to appropriate criteria
- ♦ diversion to sewer (requires a Trade Waste Permit; contact the SA Water Trade Waste Unit)
- ♦ removal to a treatment facility by means of road-tanker (this is likely to be an expensive option).

The ability to discharge segregated water from a defined clean area to an off-site stormwater network during rainfall is critical, and probably unavoidable on most sites during high rainfall.

#### **Further information**

- ♦ *Environment Protection (Water Quality) Policy 2003*
- ♦ Code of Practice—Industrial, Retail and Commercial Stormwater Management (in draft at date of publication)

## Appendix F Environmental aspect—soil quality

### *Soils management*

**Significance:** 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.

**Goal:** Protection of health and the environment

**Items that must be considered:**

- ◆ likely sources of cross-contamination
- ◆ types and concentrations of chemical substances and by-products of decomposition
- ◆ extent of the remediation area
- ◆ duration and timing of the remediation works
- ◆ selection of appropriate sampling methods and protocols
- ◆ choice of remediation technique
- ◆ remediation work methods and staging of the works
- ◆ proper classification of waste material for off-site disposal
- ◆ material tracking
- ◆ aesthetics
- ◆ sensitivity of surrounding environments and proximity of nearby watercourses
- ◆ contaminated soil landfill licensing requirements.

Note that when unexpected waste or contamination sources (for example, drums containing hazardous substances, underground storage systems) are uncovered during remediation activities, more stringent controls are likely to be necessary to protect surrounding soils (see also **Appendix L—Dangerous/Hazardous Substances**, and EPA Guidelines *Assessment of Underground Storage Systems*).

**Potential mitigation measures:**

- ◆ Establish a material tracking system that tracks materials from ‘cradle to grave’.
- ◆ Obtain all waste disposal approvals before starting remediation work.
- ◆ Tracking of mud on vehicle tyres is both an on-site and off-site cause of contaminant transport, so tyre washing facilities may be appropriate. Procedures should be set in place for handling and disposing of potentially polluted water from wheel-wash operations.
- ◆ Cover exposed soil to prevent losses from wind or water erosion and vertical migration of chemical substances in the soil from rainfall events.
- ◆ Locate and manage stockpiles appropriately.
- ◆ Provide an impermeable groundcover to protect clean or sensitive areas.
- ◆ Carefully delineate areas on site and manage contaminated soils.
- ◆ Design and operate effective surface water control measures.
- ◆ Isolate treated and validated areas and ensure they are not re-contaminated by site works.
- ◆ Dispose of contaminated soil to an appropriately licensed facility. This will require analysis of the soil to determine which landfill can accept the contaminated waste.

*Soils management*

**Further information**

- ◆ Site Contamination NEPM (1999), *Schedule B(9) Guideline on Protection of Health and the Environment during the Assessment of Site Contamination*

## Appendix G Environmental aspect—groundwater management

### *Groundwater protection*

**Significance:** 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 Policy 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 an Environment Protection Order (EPO) or an Environment Cleanup Order to gain compliance with the Policy. Fines may 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.

**Goal:** Compliance with the *Environment Protection (Water Quality) Policy 2003* and the auditor's remediation criteria.

#### **Items that must be considered:**

- ◆ geology
- ◆ hydrogeology (type and number of aquifer systems, depth to groundwater, hydraulic pressures, flow directions and velocities)
- ◆ type of soil (eg less leaching of metals will occur in clayey soils because of greater adsorption of metals than in sandy soils) and organic content (eg metals will adsorb to organic matter, reducing leaching)
- ◆ amount of water percolation (this will depend on factors such as rainfall, standing water on a site, and nature of the soil)
- ◆ background conditions and location of potential off-site pollution sources
- ◆ horizontal and vertical distribution of chemical substances and by-products of decomposition
- ◆ physical properties of chemical substances (eg density, viscosity, solubility)
- ◆ potential for changes in chemical fate and transport throughout the remediation process
- ◆ size and static pressure of the contamination source (eg underground storage system)
- ◆ pumping zone of influence
- ◆ dewatering

### *Groundwater protection*

- ♦ treatment, reuse or disposal of pumped water
- ♦ the presence of existing on-site disposal bores or wells (can assist the spread of chemical substances)
- ♦ potential for chemical substances to be spread due to groundwater used off-site by nearby premises.

Assessment of groundwater will require knowledge of the groundwater flow (rate and direction) and background concentrations of the substances of concern arising from natural or anthropogenic sources elsewhere.

#### **Potential mitigation measures:**

- ♦ Ensure tanks, pipes, bunds, dams and leachate ponds are all constructed so as not to affect groundwater.
- ♦ Use contaminant fate and transport modelling to understand the likely movement of, and potential changes to, groundwater contamination.
- ♦ Ensure correct management of contaminated soil.
- ♦ Implement groundwater remediation plan(s) appropriately and properly.
- ♦ Identify potential off-site sources of contamination and manage on-site impacts.
- ♦ Carry out the design, construction, installation and decommissioning of groundwater monitoring bores in accordance with LWBC (2003) *Minimum construction requirements for water bores in Australia*.

Bores identified that will be affected by remediation activities *must* be properly decommissioned before starting work.

On completion of groundwater remediation, any bores not required for on-going monitoring should be properly decommissioned (refer to DWLBC for decommissioning).

#### **Further information**

- ♦ *Environment Protection (Water Quality) Policy 2003*
- ♦ Land and Water Biodiversity Committee (2003) *Minimum construction requirements for water bores in Australia*
- ♦ EPA Guideline for Remediation of Groundwater Contamination (in preparation at time of publication)

## Appendix H Environmental aspect—flora and fauna

<i>Flora</i>
<p><b>Significance:</b> 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 <i>Development Act 1993</i>. 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.</p>
<p><b>Goal:</b> Compliance with all legislation covering sensitive or threatened species of flora and fauna.</p>
<p><b>Items that must be considered:</b></p> <ul style="list-style-type: none"> <li>◆ Identify areas of high environmental value on site and in surrounding areas.</li> <li>◆ Identify significant trees on site (regulation 6A(1) of the <i>Development Regulations 1993</i> defines a significant tree).</li> <li>◆ Identify populations of possible threatened species.</li> <li>◆ Assess the likely impacts on flora and fauna from alternative remediation strategies and select the method that is most appropriate for managing these risks.</li> </ul>
<p><b>Potential mitigation measures:</b></p> <ul style="list-style-type: none"> <li>◆ Dedicate or zone areas of high environmental value as part of the master plan for the site.</li> <li>◆ Restrict or alter access to areas of high environmental value.</li> <li>◆ Use alternative remediation methods that minimise the impacts from the remediation work on high-value or threatened species (see above; eg natural attenuation may be an acceptable approach in certain circumstances in preference to methods involving excavation and habitat destruction).</li> </ul>
<p><b>Further information</b></p> <ul style="list-style-type: none"> <li>◆ <i>Development Act 1993</i> and the relevant development plan for the location</li> <li>◆ <i>National Parks and Wildlife Act 1972</i>; see also <a href="http://www.environment.sa.gov.au/biodiversity/threatened.html">www.environment.sa.gov.au/biodiversity/threatened.html</a></li> <li>◆ <i>Native Vegetation Act 1991</i>; (see also <a href="http://www.dwlbc.sa.gov.au/biodiversity/vegetation/index.html">www.dwlbc.sa.gov.au/biodiversity/vegetation/index.html</a>)</li> <li>◆ Federal legislation—<i>Environment Protection and Biodiversity Conservation Act 1999</i>; see also <a href="http://www.deh.gov.au/epbc/">www.deh.gov.au/epbc/</a></li> </ul> <p>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.</p>

## Appendix I Environmental aspect—heritage

<i>Heritage</i>
<p><b>Significance:</b> 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.</p>
<p><b>Goals:</b> Compliance with all legislation covering items of cultural or heritage significance.</p>
<p><b>Items that must be considered:</b></p> <ul style="list-style-type: none"> <li>♦ the heritage significance of structures, landscape elements, archaeological deposits, vegetation or artefacts that may be present at a site</li> <li>♦ training and awareness of workers in relation to heritage issues</li> <li>♦ the presence of site contamination within the fabric of the heritage structures/artefacts, or in the land supporting or surrounding them</li> <li>♦ assessment of the health risks posed by site contamination at a heritage site</li> <li>♦ the type of remediation activities to be undertaken</li> <li>♦ procedures to be taken following discovery of any heritage item.</li> </ul>
<p><b>Potential mitigation measures:</b></p> <p>For heritage structures that may themselves be contaminated, potential mitigation measures and responses include:</p> <ul style="list-style-type: none"> <li>♦ engagement of a heritage consultant or heritage architect to assess the heritage significance of a structure or artefact</li> <li>♦ decontamination of the structure</li> <li>♦ containment or encapsulation of the contaminated materials</li> <li>♦ preparation of a detailed historical record of the structure before its complete or partial demolition.</li> </ul> <p>An appropriate procedure should be implemented on finding a potentially significant artefact. As a minimum, steps taken should include the following:</p> <ul style="list-style-type: none"> <li>♦ Work should be halted and the site manager and DEH<sup>2</sup> Heritage Branch notified.</li> <li>♦ Advice should be sought from an appropriately qualified heritage consultant.</li> <li>♦ Work should resume only under direction of the heritage consultant and/or Heritage Branch.</li> <li>♦ Appropriate studies should be undertaken before work resumes if items of significance are likely to exist on the site.</li> </ul>

<sup>2</sup> Department for Environment and Heritage

## *Heritage*

### **Further information**

- ♦ *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 for Environment and Heritage or Department of Water, Land and Biodiversity Conservation (responsible for the Native Vegetation Act) be contacted if additional information/advice is required.

For Aboriginal heritage the appropriate agency is the Department for Aboriginal Affairs and Reconciliation (DAARE).

## Appendix J Social aspect—consultation and involvement

### *Consultation and involvement*

**Significance:** The public has a legitimate right to understand and to be involved in decisions that may affect them. It follows that high levels of involvement and communication are important to prevent undue concerns about the risks during remediation or validation (site testing) work. Community involvement and consultation, if required, should begin early in the project.

**Goal:** Timely and clear information to all stakeholders at all stages of the remediation process.

**Items that must be considered:**

Community involvement and consultation is likely to be necessary in the following circumstances:

- ♦ possible nuisance or effects on the amenity of the locality, eg from noise, dust or odour
- ♦ significant site contamination—when the concentrations of certain chemical substances may affect the neighbouring community, or when the characteristics or toxicity of the chemical substance may be controversial
- ♦ sites that are in or close to environmentally sensitive areas
- ♦ controversial sites—when the site has a controversial history that may be linked to the site contamination, or the development of the site is controversial for political, economic or social reasons
- ♦ duration—nuisances for short periods are generally more tolerable, but nuisance over periods of time can result in increased frustration. Hence additional measures to minimise impacts to the community may be required.

At a site where no community groups or individuals are potentially affected or concerned by the remediation activities, public involvement in the decision making process may not be a significant issue. Similarly, the public may not be involved where the nature and extent of remediation (including the nature and characteristics of the chemical substances) may not be a significant issue of concern.

The following items must also be considered:

- ♦ Identify the stages of the project when consultation is required.
- ♦ Establish the project’s area of impact.
- ♦ Identify the various stakeholders who may be affected or would like to be involved and consulted.
- ♦ Consult with the relevant union or worker body group.
- ♦ Identify statutory requirements in relation to consultation (such as required by a development approval or the development process).
- ♦ Determine appropriate notices.
- ♦ Identify potential language barriers—interpreters may be necessary in some instances.

## *Consultation and involvement*

### **Potential mitigation measures:**

When community involvement and consultation is considered necessary, it will also be necessary to prepare a consultation strategy that:

- ◆ defines requirements for community consultation and stakeholder involvement
- ◆ plans for evaluation and feedback from all parties involved on the effectiveness of the consultation and communication so that improvements and modifications can be made
- ◆ documents the goals and objectives, consultation and communication program (when) and action plan (techniques)
- ◆ ensures that the party undertaking the site works is involved so that promises are not made that cannot be kept
- ◆ demonstrates that the community is genuinely involved and consulted and not just advised.

Be aware that it is possible for special interest groups to bias or stack consultation processes. They may not represent the interests of the local communities involved, but serve as a platform for wider political or self-interests. This can lead to poorer outcomes for local communities and for the wider environment. The Site Contamination NEPM (see below) provides detailed guidance for numerous methods of consultation.

A complaints register should also be established for the project. This involves developing a system that effectively receives, records and responds to community complaints, providing staff with training in how to effectively deal with these complaints, and publicising the service to the local community.

An appropriately skilled community consultation consultant or facilitator may be necessary if consultation will be substantial.

### **Further information**

- ◆ *National Environment Protection (Assessment of Site Contamination) Measure 1999, Schedule B(8) Guideline on Community Consultation and Risk Communication*
- ◆ Contaminated Sites Management Series, Community Consultation, Department of Environment, Western Australia (June 2002),  
<[portal.environment.wa.gov.au/portal/page?\\_pageid=53,733059&\\_dad=portal&\\_schema=PORTAL](http://portal.environment.wa.gov.au/portal/page?_pageid=53,733059&_dad=portal&_schema=PORTAL)>

## Appendix K Structural aspects

### *Vibration, dewatering and groundwater pumping*

**Significance:** Vibration from compaction of deep-filled sites, demolition activities or rock excavation may cause structural damage to nearby structures (eg houses, buried pipelines and telecommunication cables) and/or cause a nuisance to nearby residences.

Lowering of the water table can result in the subsidence of buildings and structures—particularly in loose or collapsing soils and uncontrolled fill sites.

**Goal:** No offsite structural impact resulting from remediation.

**Items that must be considered:**

- ◆ zone of impact
- ◆ vibration modelling and monitoring
- ◆ level of compaction required.

**Potential mitigation measures:**

- ◆ use of alternative compaction options to mitigate damage—eg non-vibrating rollers, sheepsfoot roller
- ◆ completion of a suitable geotechnical study before any site works
- ◆ consideration of engineering solutions that require low levels of compaction, taking into account the subsequent land use
- ◆ use of excavation measures that minimise vibration levels
- ◆ use of saw cuts to isolate areas of rock to be broken out

Undertake dilapidation surveys and reports (before and after remediation) to ensure that damage caused by vibration is accurately identified and compensated, if appropriate. This requires that a suitably qualified independent person undertake a review of all properties in the zone of impact, in consultation with the residents, before remediation activities commence, during work and following completion.

## Appendix L Safety aspect

### *Occupational health and safety*

**Significance:** Employers have a statutory and ethical obligation to protect the health and safety of workers at all sites. Consideration must be given to appropriate occupational health and safety measures from the time of the preliminary assessment of a site through to completion of remediation.

Under the South Australian *Occupational Health, Safety and Welfare Act 1986*, provisions have been made to protect the health and safety of persons at work. Section 19 of the OHS&W Act defines the duties of employers, which include:

- ♦ to provide a health and safety policy
- ♦ to provide and maintain a safe working environment and safe systems of work
- ♦ to provide plant and substances in safe condition
- ♦ to provide adequate facilities for the welfare of employees
- ♦ to provide information, instruction, training and supervision necessary to ensure the health and safety of employees
- ♦ to monitor working conditions at any work place.

These requirements are detailed in the OHS&W Regulations.

**Goal:** No adverse impact on human health from remediation activities.

**Items that must be considered:**

The following information is required to enable the employer to undertake a risk assessment of the contaminants, in accordance with the *OHS&W (Hazardous Substances) Regulations 1995*, put appropriate controls in place and develop safe operating procedures:

- ♦ types of chemical substances present, their nature and characteristics and their likely concentrations—should be known from the site environmental assessment report or material safety data sheets (MSDS)
- ♦ the toxicity and volatility of chemical substances (via all exposure routes) as well as other safety hazards (eg explosion from specific gases or vapour); this information can also be found in the MSDS
- ♦ the types of operations to be carried out on site—equipment to be used, the way in which the chemical substances are to be dealt with, specific tasks of workers on site.

Consideration should also be given to cumulative exposure effects on workers who regularly undertake assessment and remediation works.

## *Occupational health and safety*

### **Potential mitigation measures**

Given this information, a range of measures to minimise workers' exposures may be considered:

- ♦ type of equipment used on site to minimise airborne generation of chemical substances in particulate matter
- ♦ dust suppression techniques
- ♦ personal hygiene requirements
- ♦ worker education and training
- ♦ site-specific safety requirements (eg devices for testing vapours, gases)
- ♦ personal protective equipment (as a least preferred option, but may be necessary in some instances)
- ♦ regular medical surveillance by an occupational physician.

Some occupational health and safety measures may only be necessary for people who may be continually exposed to chemicals in a work place and do not directly relate to the level of protection that would be needed for the community. The community should be informed of these differences during the consultation process so as not to cause unnecessary community concern.

A site safety plan needs to be prepared before remediation activities begin to document health and safety procedures on a site. As a minimum, the plan should define:

- ♦ responsible persons
- ♦ nearest medical facilities
- ♦ risks and the safety and emergency procedures associated with each operation
- ♦ appropriate supervision
- ♦ safe operating procedures
- ♦ controls to be used
- ♦ decontamination procedures (for personnel and equipment)
- ♦ procedures for confined space entry
- ♦ safety equipment and procedures for first aid
- ♦ training and education of employees and supervisors.

### **Further information**

NEPM 1999, *Schedule B(9) Guideline on Protection of Health and the Environment During the Assessment of Site Contamination*, NEPC.

SAHC 1991, El Saadi O, Langley AJ (eds), *Protocol for the Health Risk Assessment and Management of Contaminated Sites*. Summary of a National Workshop on the Health Risk Assessment and Management of Contaminated Sites, South Australian Health Commission: 25-27.

*Internet sites:*

WorkCover Corporation of South Australia <[www.workcover.com.au](http://www.workcover.com.au)>

United Trades and Labor Council (UTLC) <[www.utlc.org.au](http://www.utlc.org.au)>

Department of Health <[www.health.sa.gov.au](http://www.health.sa.gov.au)>

Workplace Services <[www.eric.sa.gov.au](http://www.eric.sa.gov.au)>

*Occupational health and safety**Security and visitors*

**Significance:** Appropriate on-site security may be necessary to protect the public from potential risks from earthworks (eg trenching, earthmoving operations and traffic), to limit exposure from contaminated soil and to protect equipment against vandalism. For these reasons, it is important to ensure that visitor access to the site is controlled during and after working hours.

Remediation activities can be complex, and the safety hazards associated with these activities can prove catastrophic if proper safety measures are not implemented. Natural interest by people of all ages in remediation activities can sometimes have catastrophic results.

Unless site visits are carried out under controlled conditions, members of the public should be prohibited from entering the site.

**Goal:** Prevention of any unauthorised visitors or activities on site throughout remediation.

**Items that must be considered:**

- ◆ types and concentrations of chemical substances
- ◆ toxicity of chemical substances and other safety hazards
- ◆ types of operations to be carried out on site—eg excavations, use of plant machinery
- ◆ ease of public access
- ◆ public safety (all hours)
- ◆ vehicle access
- ◆ size of site
- ◆ fencing
- ◆ location of site.

**Potential mitigation measures**

Signage, whilst important, is a relatively unsatisfactory way of communicating information to people about the site and, in general, its use would appear limited. Potential safety measures include:

- ◆ secure fencing to restrict access to the site and provide protection from physical hazards. In particular, unsupervised excavations (including boreholes) should never be left open or unfenced as they present a hazard to site personnel, visitors and animals.
- ◆ requirement for all visitors to report to the site office to receive further instructions
- ◆ site induction for all workers and visitors to the site
- ◆ records of those who attend site.

*Dangerous/hazardous substances*

**Significance:** Appropriate collection, storage, handling and use of dangerous or hazardous substances during on-site remediation activities is important to protect workers and nearby residents and to ensure that further site contamination does not result.

Dangerous substances may be of concern when:

- ◆ dangerous or hazardous substances are brought to the site and used as part of the remediation process (eg a fuel tank)
- ◆ remediation activities include the storage of recovered dangerous substances.

*Occupational health and safety*

*Dangerous/hazardous substances*

**Goal:** Correct management of all dangerous substances throughout the remediation project.

**Items that must be considered:**

- ◆ the requirements of the SA Dangerous Substance Act and Regulations
- ◆ potential for loss of containment (deliberate and accidental)
- ◆ types and toxicity of chemical substances
- ◆ separation distances for incompatible classes of hazardous substances
- ◆ distance to sensitive structures (should a spill, release or explosion occur)
- ◆ emergency measures and response plans in the event of a spill (contingency planning).

**Potential mitigation measures:**

- ◆ If hazardous substances are to be stored on site, the EPA and Workplace Services may require licensing. For more information contact the EPA and Workplace Services' Hazardous Substances Branch.
- ◆ Ensure adequate on-site security.
- ◆ Ensure safe work practices—in particular that there are no potential ignition sources in the vicinity of flammable or explosive substances (including the use of intrinsically safe machines).
- ◆ Document emergency procedures in the site-specific safety plan.

**Further information**

- ◆ *Bunding and spill management*, EPA Guideline 080/04
- ◆ *AS1940: The storage and handling of flammable and combustible liquids*
- ◆ Workplace Services: <[www.eric.sa.gov.au](http://www.eric.sa.gov.au)>

## Currency of these guidelines

These guidelines offer advice to assist with compliance with the general environmental duty and specific environmental policies. They are subject to amendment and persons relying on the information should check with the EPA to ensure that it is current at any given time.

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## FURTHER INFORMATION

### *Legislation*

Legislation may be viewed on the internet at: <[www.legislation.sa.gov.au](http://www.legislation.sa.gov.au)>

Copies of legislation are available for purchase from:

Service SA Government Legislation Outlet 101 Grenfell Street Adelaide SA 5000	Telephone: Facsimile: Internet:	13 23 24 (08) 8204 1909 < <a href="http://shop.service.sa.gov.au">shop.service.sa.gov.au</a> >
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*For general information please contact:*

Environment Protection Authority GPO Box 2607 Adelaide SA 5001	Telephone: Facsimile: Freecall (country): Internet: Email:	(08) 8204 2004 (08) 8124 4670 1800 623 445 < <a href="http://www.epa.sa.gov.au">www.epa.sa.gov.au</a> > < <a href="mailto:epainfo@epa.sa.gov.au">epainfo@epa.sa.gov.au</a> >
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