

**Schedule B (9)**  
**Guideline on Protection of Health and the  
Environment During the Assessment of  
Site Contamination**

NEPC



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



The following Guideline provides general guidance in relation to Protection of Health and the Environment During the Assessment of Site Contamination.

This Guideline forms part of the National Environment Protection (Assessment of Site Contamination) Measure 1999 and should be read in conjunction with that document, which includes a Policy Framework and Assessment of Site Contamination flowchart.

The National Environment Protection Council acknowledges the contribution of the National Health and Medical Research Council to the development of this Measure.

**CONTENTS**

**PROTECTION OF HEALTH AND THE ENVIRONMENT DURING THE  
ASSESSMENT OF SITE CONTAMINATION**

	<i>Page</i>
<b>1 GLOSSARY.....</b>	<b>3</b>
<b>2 ABBREVIATIONS .....</b>	<b>4</b>
<b>3 INTRODUCTION .....</b>	<b>4</b>
<b>4 PURPOSE OF THIS GUIDELINE .....</b>	<b>5</b>
<b>5 SCOPE OF THIS GUIDELINE .....</b>	<b>5</b>
5.1 Definition of Potential Site Contamination	6
<b>6 SITE ASSESSMENTS.....</b>	<b>7</b>
6.1 General	7
6.2 The Site Investigation Professional	7
6.3 The Preliminary Site Investigation	8
6.4 The Detailed Site Investigation	8
<b>7 HEALTH AND SAFETY REQUIREMENTS FOR ALL SITES.....</b>	<b>9</b>
<b>8 SITE SAFETY PLAN.....</b>	<b>10</b>
8.1 Introduction	10
8.2 General	11
8.3 Earthworks Hazard	15
8.4 Physical Hazards	18
8.5 Chemical Hazards	22
<b>9 ENVIRONMENTAL RISKS.....</b>	<b>24</b>
9.1 General	24
9.2 Preservation of Groundwater Resources	25
9.3 Contaminant Migration Within a Site or to Adjacent Sites	25
9.4 Run-off Water	25
9.5 Underground Fire	25
9.6 Collection and Disposal of Excavation Spoil	25
9.7 Collection and Disposal of contaminated water	26

9.8	Acid Sulfate Soils	26
9.9	Heritage Sites	27
9.10	Rare Habitats or Endangered Species	27
<b>10</b>	<b>DISPOSAL OF WASTE .....</b>	<b>27</b>
10.1	General	27
10.2	Spoil from Excavations	27
10.3	Water From Excavations, Washing of Equipment	28
10.4	Personnel Decontamination	28
<b>11</b>	<b>SUB-CONSULTANTS AND SUB-CONTRACTORS .....</b>	<b>29</b>
<b>12</b>	<b>ACCIDENT/INCIDENT INVESTIGATION AND REPORT .....</b>	<b>29</b>
<b>13</b>	<b>HEALTH SURVEILLANCE FOR SITE STAFF.....</b>	<b>30</b>
<b>14</b>	<b>REFERENCES.....</b>	<b>31</b>
<b>APPENDIX 1 RELEVANT LEGISLATION AND GUIDELINES FOR WORK ON CONTAMINATED SITES .....</b>		<b>32</b>
	Commonwealth	32
	State by State	34
<b>APPENDIX 2 APPROVED SAFETY EQUIPMENT .....</b>		<b>40</b>
	Safety Glasses	40
	Respirators	40
	Helmets/Hard Hat	40
	Gloves	40
	Safety Boots/Shoes	41
	Occupational Monitoring	41
<b>APPENDIX 3 EQUIPMENT LIST FOR ASSESSMENT OF SITE CONTAMINATION .....</b>		<b>42</b>
<b>APPENDIX 4 ADOPTED NATIONAL EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATION ENVIRONMENT (NOHSC:1003 (1995)) .....</b>		<b>43</b>

# 1 GLOSSARY

**Contamination** means 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.

**Decontamination Zone** is an area where removal of contaminated field clothing and washing of field equipment and plant takes place.

**Detailed Site Investigation Report** means a report on an investigation of a site – includes detailed information on the nature and distribution of contaminants on a contaminated, or potentially contaminated, site.

**Exclusion Zone** is an area where work is being carried out and access is limited to essential persons.

**Hazard** is the intrinsic capacity of a chemical, biological, physical or social agent to produce a particular type of adverse health or ecological effect, eg one hazard affecting human health associated with benzene is that it can cause leukemia, one hazard associated with DDT is that it can cause the thinning of egg shells of some predatory birds.

**Health** means freedom from disease or ailment.

**Preliminary Site Investigation Report** means a report for a phase 1 investigation of a site – includes information on the potential risks posed by the site

**Risk** means the probability in a certain timeframe that an adverse outcome will occur in a person, a group of people, plants, animals and/or the ecology of a specified area that is exposed to a particular dose or concentration of a hazardous agent, ie. it depends on both the level of toxicity of hazardous agent and the level of exposure.

**Safety** means freedom from injury or danger.

**Site** means the parcel of land being assessed for contamination.

**Site Safety Assessor** is a professionally qualified and experienced person who has specific responsibility for assessment of the risks and hazards associated with the investigation of any site and for the preparation of a site safety plan.

**Site Specific Safety Plan** is a plan to remove or appropriately mitigate the identified risks that is produced prior to the intrusive investigation of a potentially contaminated site.

**Support Zone** means an area where field support activities are carried out.

**Work Area** is an area affected by the site investigation activities. Includes the exclusion zone, decontamination zone and support zone.

## 2 ABBREVIATIONS

<b>ANZECC</b>	Australia and New Zealand Environment and Conservation Council
<b>AS</b>	Australian Standard
<b>DSI</b>	Detailed Site Investigation
<b>EPA</b>	Environment Protection Authority
<b>MSDS</b>	Materials Safety Data Sheet
<b>NHMRC</b>	National Health and Medical Research Council
<b>NIOSH</b>	National Institute for Occupational Safety and Health (USA)
<b>NOHSC</b>	National Occupational Health and Safety Commission
<b>PID</b>	Photo-Ionisation Detector
<b>PSI</b>	Preliminary Site Investigation
<b>SSA</b>	Site Safety Assessor
<b>SSSP</b>	Site Specific Safety Plan
<b>USEPA</b>	United States Environment Protection Agency

## 3 INTRODUCTION

Human activity and natural occurrence have resulted in sporadic pollution and contamination of land in many areas of Australia. The identification of such contamination requires vigilance on the part of owners, developers, potential purchasers and regulators to identify potential risks to human health and the environment. A considered appraisal of identified risks is required for each individual circumstance. While this document provides information on a wide range of potential hazards to health and the environment that may be present during a site assessment, the protection measures chosen and adopted should be commensurate with the perceived level of risk to potential receptors.

During the assessment of contaminated or potentially contaminated sites the protection of the health and safety of site assessment personnel, workers involved in site clean up and any residents or site users is paramount. Protection of the health and safety of third party stake-holders such as other persons employed on the site, users of adjoining land, local residents, passers by or sight-seers is also important. Closely associated with the above is the requirement that the action of site

assessment must not have an adverse impact upon the environment by introduction of contaminants to the ecosystem, migration of contaminants between eco-sub-systems or intra-site or off-site migration of contaminants.

In preparation of this guideline, account has been taken of the different approaches to this issue taken by different jurisdictions within the Commonwealth of Australia

This document is aimed at providing practitioners involved in the assessment of site contamination with a general guide on the potential risks to health and the environment that may be encountered when conducting a site assessment.

## **4 PURPOSE OF THIS GUIDELINE**

The purpose of this guideline is to present guidance on the protection of health and the environment during the assessment of site contamination so that the safety and risk of adverse health effects to the site workers, residents and nearby populations and the environment generally can be appropriately addressed.

## **5 SCOPE OF THIS GUIDELINE**

This guideline addresses aspects of the assessment of site contamination. It has been based upon published information and consultation with medical and health professionals, supplemented by input from specialist environmental scientists and engineers. Due regard has been given to the proceedings of the National Contaminated Sites Workshops and to guidance given by the Australian and New Zealand Environment and Conservation Council (ANZECC) and the National Health and Medical Research Council (NHMRC) and others (refer Appendix 1).

This guideline covers:

- the duties and responsibilities of the site safety assessor;
- access to the site;
- signage;
- dust generation from the site;
- contaminant spread both on-site and off-site;
- odour;
- noise and vibration;
- drainage;
- sediment control;
- storage and handling of wastes;
- storage of dangerous goods;
- appropriate assessment and classification of soils for disposal;
- protection of groundwater;
- contaminated groundwater (including disposal issues);
- earthworks; and

- site-specific conditions requiring variations from generic guidelines.

Every contaminated or potentially contaminated site is different. It is not the intention of this guideline to prescribe precise safety rules for site assessment, but rather to provide a guideline framework of the issues to be considered when preparing a site specific safety plan. Specific advice should be sought from the relevant authorities responsible for occupational health and safety and environmental protection to ensure work practices also conform to jurisdictional requirements.

## 5.1 DEFINITION OF POTENTIAL SITE CONTAMINATION

For the purposes of this guideline, potential site contamination refers to the condition of land or water where it is suspected that any chemical substance or waste has been added at above background level or the bioavailability of a chemical substance has increased and represents, or potentially represents, an adverse health or environmental impact. This does not apply where materials are added in accordance with relevant government approvals or endorsements such as to improve its suitability for agriculture.

The problems caused by site contamination can be substantial, affecting human health, plant and animal health, the integrity of building structures and services, utilities and the quality of water resources, soil, or the atmosphere. Some contaminants can migrate laterally and/or vertically from a contaminated site and affect adjacent ground, surface water or groundwater and the air.

During assessment of site contamination people may be exposed to contaminants through inhalation, ingestion or skin absorption. The local ecosystem and general environment may be affected by the release and migration of contaminants previously contained upon the site due to the physical disturbance of the site during the sampling procedure.

Materials that can present a physical, chemical and/or biological risk include some forms of: metals (such as lead, cadmium and mercury), toxic elements and compounds; hydrocarbons and chlorinated hydrocarbons; pesticides; toxic, explosive and asphyxiant gases; combustible substances; biologically active substances and micro-organisms; hazardous wastes; radioactive wastes and other materials such as asbestos, synthetic mineral fibre and silica dust.

When contamination, or potential contamination, is adjacent to public premises or public areas, there is often considerable public concern. It is, therefore, recommended that residents in the local area are kept informed about work being carried out and any potential or actual risks to the community are clearly communicated. Consultation with the community is more fully covered in [Schedule B\(8\)](#).



## 6 SITE ASSESSMENTS

### 6.1 GENERAL

The procedures for the assessment of sites are more fully explored in [Schedule B\(2\)](#). The following comments may, therefore, be read in conjunction with that Guideline.

### 6.2 THE SITE INVESTIGATION PROFESSIONAL

Management of the assessment of any potential risks to people or the environment during a site assessment should be vested in a designated site safety assessor (SSA). The site safety assessor will generally be a professionally qualified engineer, occupational hygienist or scientist with recognised experience in the field of contaminated land assessment and a working knowledge of appropriate federal, State and Territory regulations, Codes of Practice and guidelines. Where the SSA's knowledge is not sufficient, advice should be sought from relevant experts such as OH&S and environmental professionals and occupational health physicians to ensure risks to health and the environment are appropriately addressed.

Where significant risks to health or the environment have occurred, or are considered likely, the site safety assessor will find it useful to collaborate with relevant State or Territory governments and authorities. This can help provide additional resources to address the concerns of impacted residents or site users, where necessary.

The requirements for the position of site safety assessor should, in addition to professional qualifications and experience, include a specific requirement to have at least a working knowledge and understanding of the relevant federal legislation and applicable State or Territory legislation. This legislation would cover the following topics:

- contaminated site assessment guidelines and codes of practice;
- environmental legislation;
- public and occupational health legislation;
- ground and surface water protection legislation;
- planning/land management/leasing legislation;
- waste and disposal legislation;
- dangerous goods legislation
- construction/demolition regulations;
- heritage protection legislation; and
- native title legislation.

It will be the specific responsibility of the site safety assessor to ensure the risks to human health and the environment posed by the current site condition and of any impact which might be expected to arise from physical disturbance of the site during assessment are adequately and appropriately addressed. Risks to health and the environment can be expected to increase as more physical disturbance occurs.

Following identification of these risks the site safety assessor would devise and implement a site specific safety plan (SSSP) to remove or appropriately mitigate the identified risks. The aim of the SSSP is to provide as safe a working environment as is practicable. In many cases site safety assessors may already have generic SSSPs to deal with straightforward assessments. The role of the site safety assessor will vary depending upon the progress of any assessment.

The information upon which the site safety assessor makes his/her judgement will be:

- prior to the intrusive assessment of potential site contamination, the Preliminary Site Investigation (PSI) reports and supporting data, site history and a site inspection visit;
- all new or fresh information as it becomes available, including information gained through relevant interested agencies and through the community consultation process.

### **6.3 THE PRELIMINARY SITE INVESTIGATION**

The Preliminary Site Investigation (PSI) often referred to as a Phase/Stage One (desktop) Investigation of any site is crucial to the assessment of potential risk posed by physical disturbance of a site and should be completed before any fieldwork is undertaken. All areas of the site should be examined to establish whether there are any items that could be fire, explosion or physical hazards could lead to chemical exposure or, if there was any other previously unrecognised use of the site, could cause risk from the materials or their breakdown products.

### **6.4 THE DETAILED SITE INVESTIGATION**

A Detailed Site Investigation (DSI) often referred to as a Phase/Stage Two Investigation of any site is an intrusive assessment targeted at obtaining detailed information on the nature and distribution of contaminants on a potentially contaminated site to enable qualification and quantification of the risk posed by any identified contamination and a remediation plan to be designed, if required. The level of detail in the SSSP should reflect the complexity of the site assessment expected, and be updated as and when necessary.

Care should be taken to ensure that items or structures of architectural, indigenous or heritage value present on the site are not damaged or destroyed and that no rare natural habitats or habitats of endangered species of flora or fauna are adversely impacted on during assessment or excavation works.

Prior to engaging any laboratory to provide analytical support to the DSI, agreement should be reached on disposal protocols for contaminated or potentially contaminated samples.

A guide to the field equipment needed for a DSI is presented in Appendix 3.

## 7 HEALTH AND SAFETY REQUIREMENTS FOR ALL SITES

Before undertaking fieldwork it is essential to consider the risks to health and safety of all persons who may be affected by the assessment and the potential impact of the assessment on the surrounding environment.

Broadly, this encompasses:

- site users and occupants (if any)
- personnel conducting the assessment, including sub-contract workers;
- other persons working on the site;
- visitors to the site (for example, couriers)
- people traversing the site;
- site neighbours (as appropriate); and
- analysts at laboratories.

The surrounding environment (air, groundwater, surface water, soil, flora and fauna) should also be assessed.

Appropriate assessment of the levels of exposure of workers on site should be undertaken. All hazards on site should be identified and the severity of risk assessed so that priorities in risk control can be determined. The *Worksafe Guidance Note for the Assessment of Health Risks Arising from the Use of Hazardous Substances in the Workplace* provides information on assessing workplace risks and Appendix 4 provides information on National Exposure Standards. Where risks are identified, work practices and conditions on the site should be evaluated and preventative and control measures should be identified in the SSSP and put in place to eliminate or minimise the risk to an acceptable level.

Control measures include, but are not limited to:

- elimination/substitution and process modification;
- engineering controls;
- administrative controls; and
- use of personal protective equipment.

If, during the site assessment, the hazards encountered are greater than anticipated, workers exposed to the hazard(s) should stop work immediately until the associated risks have been assessed and the appropriate control measures put into place.

Hazards, which give rise to risk, may be broadly characterised as:

- physical hazards largely common to construction and related sites and site assessment activities;
- chemical, biological and radiological hazards which may arise due to potential contamination of the ground, air or water under investigation; and
- environmental hazards which may arise due to impacts from investigative works.

## 8 SITE SAFETY PLAN

### 8.1 INTRODUCTION

The site should be assessed by the site safety assessor in terms of site-specific hazards, risks and level of personal protective equipment required. Safe working procedures should be identified and a SSSP should be written for all assessments of more than one working day's duration or where, due to specific contaminants or site concerns, it is considered necessary by the site safety assessor. The SSSP should address the topics highlighted in Sections 8 and 9.

For minor works, and in the absence of a SSSP, a generic site safety plan should be made available. All workers on and regular visitors to the project should be familiar with this plan via a formal site induction. For a generic plan the SSA should consider following general parameters and site personnel briefed accordingly:

- scope of work;
- relevant legislation, guidelines and standards;
- key personnel, their roles and responsibilities;
- adverse weather conditions;
- site security, classification and personal protective equipment;
- physical and chemical hazards and environmental risks;
- earthworks (including location of site services or utilities, both above and below ground);
- risks associated with each operation;
- training requirements before commencement of work;
- manual handling;
- management of plant and equipment on the site, including traffic management;
- replacement requirements for mandatory use and replacement of personal protective equipment;
- calibration of monitoring equipment;
- any site-specific exposure monitoring (environmental or occupational) or medical surveillance required;
- heat stress monitoring, where applicable;
- actions to be taken to mitigate existing hazards;
- decontamination procedures;
- waste disposal procedures;
- relevant standard operating procedures; and
- location of nearest hospital and medical centre, emergency contact numbers for fire brigade, police etc, transport routes;
- a contingency plan for emergencies, spills etc; and
- emergency evacuation procedures.

The occupational health and safety requirements of the relevant jurisdiction should also be complied with. A useful source of information is the National Occupational Health and Safety Commission's *Hazardous Substances Regulatory Framework*, adopted by most jurisdictions. This consists of national standards and codes of practice dealing with the management of chemicals, which can cause harm, in all workplaces.

## **8.2 GENERAL**

### **8.2.1 Relevant Legislation and Guidelines**

In all cases strict observance must be made of all current relevant Federal, State or Territorial legislation, regulations or codes of practice as may apply from time to time in the fields of contaminated land or groundwater assessment; the environment; public and worker health and safety; the transport and storage of dangerous goods; ground and surface water protection; waste haulage and disposal, indigenous and heritage protection, rare and endangered species protection. (Refer to State by State listing in Appendix 1.)

### **8.2.2 Local Requirements**

Where site specific conditions or limitations apply, as may be the case when assessment work is being carried out in areas where site occupants are in proximity or other works are progressing, it is essential that all stakeholders are aware of the intended operations and that a permit-to-work is obtained, if such a system is in place. In operational environments there may already be a local site safety policy that will need to be followed. Unless the two documents come into direct conflict, an appropriately drafted local site safety policy will generally take priority over the SSSP. In instances where conflicts arise it will be the responsibility of the site safety assessor to liaise with the person assigned responsibility for the implementation of the local site safety policy to arrive at a safe and mutually acceptable working procedure.

### **8.2.3 Site Security, Exclusion Zones and Signage**

The security of any site under assessment is important:

- to ensure the safety of the site staff;
- to prevent, where possible, unauthorised persons or members of the public from entering the site and placing workers at risk or their own health and safety; and
- to prevent unauthorised removal of materials or equipment from the site.

This is particularly important at times where the site may be otherwise unoccupied. The details of security will be site specific. However, it is normal practice to set up an exclusion zone around areas where work is being carried out and to limit access to this area to essential personnel. The exclusion zone may be marked in many ways

ranging from portable signs or bunting to full barriers and fencing. On smaller sites the entire site itself may be considered an exclusion zone. Appropriate signage warning of works in progress and the hazards present should always be deployed at any point where unauthorised access to the site from outside is considered likely.

Temporary relocation of site occupants may also need to be considered to diminish the potential for interference. Consideration should be given to timing assessment activities to coincide with periods when site occupants are absent (for example, with school sites, scheduling activities to coincide with holiday periods may be preferable, if practicable).

Support zones for the temporary location of field support activities should be identified and decontamination zones set aside where necessary for the removal of contaminated field clothing and washing of field equipment and plant.

#### **8.2.4 Emergency Procedures**

All field staff (including sub-consultants and sub-contractors) should be trained with regard to emergency procedures and be familiar with a pre-determined set of signals to signify emergency. Marshals should be appointed and site assembly points (marshalling areas) should be nominated in advance.

At operating facilities, staff should familiarise themselves with the layout of the site, restricted access areas, location of emergency facilities, first aid facilities and marshalling areas. A safety plan should be available, explicitly stating the circumstances and procedures for handing over control of the site during emergency situations, including the transfer of critical information. The safety plan should be approved by personnel with relevant experience and the plan should include reference to the particular site(s) under assessment. On large or complex sites a layout map of the site showing these areas should be available to all staff. Staff should be instructed on and abide by any safety policy, rules and procedures for the site.

#### **8.2.5 Site Specific Restrictions**

Restrictions of access to certain areas of the site to certain specifically trained or equipped personnel may be required. For example certain sites may, due to explosive vapour hazard, require restriction of vehicles to suitable vehicles and electrical equipment to intrinsically safe types. Where it is not practicable to have such equipment, the equipment should be used under a safe system of work providing equal or higher levels of safety than intrinsic safe equipment.

#### **8.2.6 Personal Protective Clothing and Equipment**

Unless otherwise indicated by the SSSP, the minimum requirement for any site assessment should include the standards set for any construction site, ie, hard hat, protective (steel cap) boots, long-sleeved shirt, long pants and safety spectacles.

Other safety clothing or equipment will be site specific and as determined by the site safety assessor. The choice should be appropriate to the level of expected hazards likely to be encountered by site assessment staff. Selection of appropriate equipment is important as safety equipment that overstates the likely risk will result in increased body burden without any improvement in protection and may unduly alarm other personnel on the site and or passers-by and neighbours. Similarly, selection of safety equipment that understates the likely risk will not provide adequate protection.

As a general principle, Personal Protection Equipment (PPE) must be suitable for the type of substance, fitted to the worker, and comply with the relevant Australian Standards. PPE should not be regarded as a substitute for other control measures. Process modification and engineering controls should be instigated first to minimise the PPE necessary. If respirators are used, training in their use and maintenance should be given.

### **8.2.7 Communication**

A system for communication between site staff, the site safety assessor and others with responsibility for site health and safety and emergency service providers, appropriate to the site and scale of the operations, should be established.

Good communication of the hazards, risks and work practices is of key importance to a successful site assessment. Problems at sites may arise if communication of the hazards and risks is poor resulting in a high outrage factor either from site workers or the community.

### **8.2.8 Personnel Training**

Employers have a “duty of care” to provide workers with information, instruction, training and supervision to ensure workers are safe from injury and risks to health. All staff involved in site assessment should be provided with appropriate health and safety training and briefed on expected local site conditions. This may involve site health and safety induction training for those on site as well as personnel assisting in the clean-up such as truck drivers and visiting technical experts and managers. This training should include information on the primary routes of exposure and health effects of contaminants on the site that are likely to cause risk to human health. It is also important that detailed information is given on suitable actions if unacceptable exposure to a contaminant on site occurs (ie provide information and the necessary equipment to allow workers to minimise the effects of direct contact – eye wash, neutralising chemicals, information on nearest wash/first aid facilities etc.).

Competency training, appropriate to the person’s responsibility should also be provided. The *National Guidelines for Integrating Occupational Health and Safety Competencies into National Industry Competency Standards* (NOHSC: 7025, 1995), provides information on the required competencies.

The site safety assessor should ensure all personnel are competent for their tasks and understand the instructions, especially new or temporary workers and those with English language difficulties.

### **8.2.9 Remote Sites**

Special precautions should be observed when working on remote or isolated sites. These include:

- having at least two people at the site at all times when the site is operational;
- having at least one first aider as well as fulfilling any State or Territory requirement for the presence of a trained first-aider;
- studying weather forecasts to ensure adequate field clothing is available for anticipated weather conditions, and that spare clothing is available where extremes of weather or climate are predicted;
- having constant access to a 2-way radio or telephone in case of emergencies;
- ensuring all equipment, machinery and vehicles are fully operational and have undergone a recent maintenance check;
- having emergency and contingency plans and supplies of food and water should workers become isolated; and
- preparation of a work plan prior to the start of on-site activities so that the schedule of expected events is known by a responsible liaison contact at a base station/office, and with whom telephone contact or radio contact is made at the start and end of each working shift and at other agreed times if necessary.

### **8.2.10 Site Hygiene**

On contaminated sites, personal hygiene should be considered a priority matter to mitigate possible exposure to contaminants. Workers should have ready access to appropriate personal hygiene facilities such as clean work clothes, protective clothing, showers and adequate washing and laundry facilities. A separate support facility in a clean area sufficiently remote from the operations should be set aside for use during meal or rest breaks. A decontamination zone for the prior removal of contaminated field clothing should be delineated, particularly for asbestos contamination. Washing facilities, either mains supplied or temporary, should be available. In the absence of immediate access to a water supply, wet-wipes may be useful in some circumstances, but are less effective at removing contaminants or microbial hazards (for example, from underneath fingernails). Many wet wipes also contain alcohol which could enhance skin absorption of some substances. Eating, smoking and chewing gum should not be allowed in the exclusion zone.

The availability of toilet facilities will be dependent upon the location and nature of the site under assessment, and any decision on whether a temporary local facility is required will form part of the SSSP. As a minimum, temporary toilet facilities should be provided at all sites.



### **8.2.11 Macrofauna, Insects and Arachnids**

On many sites there may be a very real risk posed by the presence of animals such as dogs, cattle, venomous snakes or other potentially threatening species. In such instances prior awareness of the risks is required and, where necessary, access to the site should be delayed until risks are mitigated to an acceptable extent. It is advisable to have more than one person present on such sites.

Biting or bothersome insects such as mosquitos, ticks and flies and venomous spiders can present both a risk to health, and a distraction from other dangers. Control measures including the use of insect repellent and suitable clothing may assist.

### **8.2.12 Outdoor Exposure**

Overexposure to ultraviolet radiation is an established cause of skin cancer. The minimum control measure for a reduction of exposure to harmful UV rays should be achieved by wearing appropriate clothing, including long-sleeved shirts, long trousers and hats and by the judicious application of sunscreen creams. The use of UV protective eyewear is also recommended.

Extended work in hot climates may result in heat stress. Personnel may need to acclimatise to extreme weather conditions and, where appropriate, heat stress monitoring should be conducted. It is essential to ensure appropriate work breaks to enable workers to replace body fluids and salts (electrolytes) if necessary. Also, labouring and strenuous tasks should be scheduled during the coolest periods of the day. If heat stress is an issue this should be included in the training and workers should be aware of the symptoms. Appropriate winter clothing should be provided for extended work in cold climates

## **8.3 EARTHWORKS HAZARD**

Consideration should be given to the timing of earthworks in relation to weather conditions as a measure to mitigate their impacts on human health and the environment. Extensive earthworks should not be conducted during dry and windy conditions when excessive dust nuisance to both workers and nearby residents may occur. In areas of Australia exposed to monsoonal climates it may be necessary to undertake earthworks only in the dry season.

### **8.3.1 Dust Generation and Control**

One of the hazards most regularly encountered on site assessments is that of dust. Dust may be wind-blown and aggravated by the actions of trucks or other plant on the site. Monitoring should, as applicable, include personal exposures and area/boundary monitoring for inspirable and respirable dust and respective contaminants. For occupational monitoring, dust and contaminant levels should be below the NOHSC *Exposure Standards for Atmospheric Contaminants in the Occupational*

*Environment.* It should be noted that monitoring for occupational exposure should be carried out according to the Australian Standards, where applicable.

Protection measures are important to ensure that dust inhalation is not a health risk for site operatives, nor a health risk or nuisance to local residents or passers-by. The traditional methods of dust control include:

- light application of a water spray with the objective to dampen the soil and not to saturate it, as potentially contaminated run-off from saturated soils entering adjacent sites, stormwater systems, or local waterways must be avoided (n.b. care should be taken when applying water onto soil that has recently been contaminated with volatiles or semi-volatiles as this can result in a large increase in contaminant emissions from the soil);
- minimising traffic and its speed on exposed contaminated soils;
- the use of groundcovers;
- limitations on the speed of vehicle movements on site; and
- installation of screens to act as windbreaks.

### **8.3.2 Dust in Vehicle Cabs**

An often overlooked hazard in contaminated site assessment is the potential for dust build-up within the cabs of site vehicles, excavation plant and haulage trucks. Cabs should be inspected daily for dust build-up, and if necessary vacuumed clean (preferably using a HEPA filter-equipped machine), or the dust wiped off using wet-wipes or similar. Rubber door-seals should be inspected periodically for wear or damage. In exceptional circumstances, air-filtered cabins on vehicles may be required.

### **8.3.3 Contamination Carryover to Public Roads and Highways**

Potential carryover of contamination to public roads and highways is an issue where excavation plant is operating on a site. Care must be taken to ensure that potentially contaminated material is not transported off-site. Vehicle washing systems with facilities for handling the wash water and the installation of 'rumble strips' to help dislodge dust and mud, should be considered for installation at exits from sites where potential carry-over is perceived to be a problem. Procedures should be set in place for the handling and disposal of potentially contaminated water arising from wheel-wash operations.

### **8.3.4 Road Spillages from Haulage Trucks**

Transport of contaminated soil should always be carried out in accordance with the relevant State or Territory guidelines.

### **8.3.5 Site Run-off, Drainage and Sedimentation**

Site drainage should be given adequate consideration. Run-off water arising from rainfall and natural site drainage may carry with it significant leachate or suspended solids containing contaminants. The topography of the site, the expected direction of run-off flow and any on-site or off site areas susceptible to adverse impact should be assessed. Stockpiled, pre-excavated materials awaiting removal from site may create a particular risk to health.

Mitigation measures may include the use of temporary rainproof covers, excavation of drainage or run-off water diversion trenches, collection or absorption pits or installation of temporary barriers in the form of hay bales, geofabric or similar. Temporary bunding around stockpiles, or location of stockpiles on waterproof surfaces such as asphalt or concrete, or under cover where available, should be considered. Designation of an area within which all run-off and infiltration is to be controlled in accordance with strict performance objectives (for example, zero uncontrolled run-off) should also be considered. Disposal of any run-off should be carried out in accordance with relevant State or Territory legislation.

Following cessation of rainfall it may be necessary to retrieve any sediment which has been carried in run-off or drainage water and manage this material appropriately. Respraying contaminated water onto stockpiles of contaminated soil as a means of effectively managing the water is also a possibility.

Treatment and disposal of collected contaminated run-off water should be appropriate to the contamination expected. If water treatment facilities are not immediately available, following consultation with local waste water authorities, diversion to sewer should be considered. Removal to landfill (not permitted in certain States) or treatment facility by means of road-tanker is an expensive final option.

### **8.3.6 Odours and Vapours**

Many sites, particularly those with TPH (total petroleum hydrocarbons) or organic contamination or putrescible wastes, may generate offensive odours or noxious vapours. In such cases odour control measures should be considered including minimising the exposed surface of the odorous materials at all times, timing excavation activities to minimise off-site nuisance, and by re-covering exposed faces overnight or during periods of low excavation activity. Such odorous materials should not be stockpiled unless closely contained or covered.

When dealing with volatile pollutants an assessment should be made of the need for the regular analysis of atmospheric levels of pollutants on-site and at site boundaries to ensure that workers and residents are not being exposed to excessive levels of substances (eg volatile hydrocarbons) that may give rise to adverse health effects. Monitoring of airborne contaminants in the breathing zone of the worker may need to be carried out where the risk to health is not certain and adequate control measures need to be put in place. In such circumstances, consultation with an

occupational hygienist is recommended. The social impact from the excavation of odorous or noxious materials can often be mitigated by excavating only when the wind direction is such that there will be the minimum possible effect upon neighbouring populations.

Where excavation of odorous or noxious material is expected or planned as part of an assessment process the local population and other stakeholders should:

- be advised of the expected duration of the operation;
- be advised that the operation will last for a limited time only;
- be advised whether or not the odours may pose any potential health risk; and
- be given reassurance with regard to mitigation measures being undertaken.

The appointment of a person to provide public liaison is advised and staff should be instructed to direct all enquiries via the nominated individual. A contact address and/or telephone number for the appointed liaison officer should appear on all signage. All complaints or requests for information should be logged and responded to. More information on effective community consultation is provided in [Schedule B\(8\)](#).

## **8.4 PHYSICAL HAZARDS**

### **8.4.1 Excavations**

Excavations can pose a high risk at the site and workers have been killed where poor work practices and standards have occurred. Work activities should be designed to avoid workers having to enter excavations, trenches and confined spaces where possible. The site safety assessor should check State/Territory health and safety regulations carefully and ensure compliance.

Excavations deeper than 1.2 metres are considered to be a confined space (refer to Section 8.4.2).

Exposure to the atmosphere can quite rapidly release and change the characteristics of contaminants in the soil sampling pits, and open pits can release contaminants. Samples and photographs should, therefore, be taken as soon as possible after opening sampling pits. Unless there is some specific reason to keep pits open, they should then be backfilled, either with clean material or by replacing the excavated soil. If the excavated soil is to be replaced into the pit it should be done stratum by stratum to minimise the potential for vertical spreading of contaminants.

Unsupervised excavations (including boreholes) should never be left open or unfenced such that they present a hazard to site personnel or to livestock. All test pits and boreholes should be backfilled or capped, or be appropriately fenced or barriered (temporary fencing, soil mounding etc) and clearly marked with warning signs and tape.

Unsupported excavations greater than waist-depth should not generally be entered. The National Occupational Health and Safety Commission (NOHSC) demands shoring or battering back of excavation walls to a natural angle of repose for entry to excavations at depths of greater than 1.2 m. Entry into shored trenches should be carried out using a ladder and not travelling in the bucket of an excavator.

Spoil should not be placed adjacent to the pit where entry is planned due to the potential for creation of unstable conditions by overloading the crest of the excavation. Excavations where seepage is occurring should not be entered and caution should be exercised if highly structured/fissured clays are present. The advice of a geotechnical engineer should be sought where deep excavations are being considered adjacent to buildings, roadways and services.

Suitable clearance of excavations from foundations or footings of nearby structures must be provided to avoid damage or destabilisation.

#### **8.4.2 Confined or Enclosed Spaces**

Working in confined spaces can result in injury or death if precautions taken are inadequate. Confined or enclosed spaces are fully or partially enclosed areas which are not designed to be normal places of work, and where entry and exit are restricted. These should be identified and classified prior to site work. Entry into confined or enclosed spaces, such as underground ducts, voids, trenches or channels must not be undertaken until the requirements of AS 2865 - 1995, Safe Working in a Confined Space and State occupational and health safety legislation is met. This will require permission in writing from the site safety assessor. Precautions must be taken to avoid exposure to all potential hazards including harmful substances or oxygen deficient atmospheres. Entry into confined spaces should only be undertaken by appropriately trained personnel, with appropriate aptitude and physical competence, using appropriate safety equipment (eg air-supplied respirator, personal gas monitor, spark-free electrical equipment). The site safety assessor should also ensure that appropriate rescue and first aid procedures are planned, established and rehearsed before work is undertaken.

#### **8.4.3 Vehicles and Equipment**

General physical hazards, which may be encountered during the assessment of potential site contamination, include:

- vehicle and equipment clearance under low bridges, overhead pipes and power lines;
- risk of being struck by vehicles moving around the site; and
- hazards from being close to or beneath operating plant or equipment.

#### **8.4.4 Underground Services or Utilities**

Some of the major hazards associated with excavation or drilling for assessment are underground services, utilities or structures. These include amongst other things:

- electricity cables;
- gas pipelines;
- water or sewerage pipelines;
- communications cables;
- underground storage tanks;
- basement voids; and
- mine shafts.

The location and depth of underground services or utilities, tanks, basements, shafts, sinkholes or similar should be ascertained as far as is possible prior to commencement of excavation works. Information can often be obtained from the site owners or from local utility companies. Anecdotal evidence from site workers or local residents may be valuable. Details of all known utilities on site, and contact numbers for the service providers should be included in the SSSP.

In certain cases excavation by hand or use of hand augers prior to the use of mechanical excavators and/or drilling equipment may be required where the exact location or depth of a service pipe or line, tank or other structure is uncertain. Ground penetrating radar or soil probing may also provide useful information. In the event of uncertainty, underground electrical cables and certain types of metal pipe can often be located using specialist detection equipment.

If any suspect or unexpected structures are unearthed the excavation should be halted until inspection is made by the site safety assessor or representative, and until the item has been identified and isolated from the works if necessary.

If damage to a service occurs, the appropriate utility company or service provider must be advised as soon as possible, the excavation left open, suitably fenced and appropriate warning notices posted.

If a gas pipe has been damaged immediately restrict any activity which might provide a source of ignition, and place an exclusion zone around the area until the utility company's representatives arrive on site.

#### **8.4.5 Ground Stability**

The potential for subsidence should be addressed before allowing heavy plant on site. The presence of underground voids created by previous mining activity, excavation of pits or cellars, sub-surface combustion, corrosion of underground storage tanks or similar should be considered. Any such voids may also accumulate flammable or toxic gases or liquids.

Similarly, any areas previously occupied by lagoons, slurry pits, settling ponds or other potentially saturated areas may not provide good geotechnical support. Unsupported unconsolidated soil, sand or gravel walls or embankments may not be stable. The use of geofabrics may be of use for supporting equipment and reducing dust. The design and use of geofabrics for supporting equipment should be approved by a suitably qualified geotechnical engineer.

Excavations should be secured by fencing and personnel should not stand close to the edge of any excavation, and for viewing or down-pit photography the end of a test pit is generally more stable than the side wall.

#### **8.4.6 Noise**

Noise can be a health risk to workers and often a nuisance to those in the vicinity of a site. The potential for noise arising from site assessment activities should be evaluated and appropriate control measures put in place to, where possible, reduce noise (for example, by installing screens or noise baffles). Noise should not be a nuisance to people living or working around the site. At no time should workers (unprotected ear) be exposed to a sound pressure level of more than LAeq 8 hour of 85 dB(A) or a peak of 140 dB(lin). Jurisdictional requirements relating to noise levels should also be met.

Personnel regularly subjected to loud machinery noise, ie. from a concrete breaker, may be subject to hearing impairment if suitable hearing protection is not worn. Hearing protection should be kept appropriately clean and not contaminated. Where ear-plugs are used, spare sets should be carried by field staff and ear plugs replaced regularly ensuring good hygiene when rolling and replacing earplugs.

#### **8.4.7 Equipment and Machinery**

Only persons trained and licensed to do so should operate site machinery. Caution must be observed when working close to equipment or machinery. Particular hazards include:

- reversing equipment or plant motor vehicles;
- extension of hydraulic arms on a back-hoe or excavator;
- rotating equipment, particularly on drilling rigs;
- auger equipment being used as part of the drilling process;
- any compressed air equipment operating above 50 p.s.i.;
- circumference of bodyswing of a tracked excavator;
- suspended loads;
- tall machinery and surveyor's poles making contact with overhead power lines;
- blow-back from pressurised drilling equipment; and
- air blast from compressed air equipment.

Tools, equipment and machinery must be safe and kept in safe working order according to the relevant Australian Standard, Worksafe and State/Territory Guidelines.

#### **8.4.8 Vibration**

Vibration from excavation and drilling, from plant or from the movement of heavily laden trucks can sometimes result in damage to foundations of adjacent structures or to underground services or utilities. This possibility should be addressed and any risks assessed prior to choice of excavation or drilling method.

#### **8.4.9 Flammable or Explosive Materials**

If the presence of flammable or explosive materials is expected on the site, the site history and chemical analyses should be assessed. Advice and supervision from a competent person will be required. Workers in these situations should also be experienced and appropriately trained in all equipment used and safe methods. Danger can arise during excavation of soils containing high concentrations of volatile, flammable hydrocarbons. Sparks generated by plant hitting rocks may ignite volatile vapours in excavation holes which may pose a risk to personnel nearby.

In the case of contamination with flammable substances, a reliable and calibrated flammable gas detector should be regularly used to determine that the flammable vapours are, as a minimum, always below 10% of the Lower Explosive Limit (LEL) during activities on site. Appropriate legislation or standards may require lower levels.

On some sites, flameproof or intrinsically safe electrical equipment and special operating procedures may be required. Where that equipment is unavailable, continuous LEL testing and appropriate safety precautions should be used to allow that equipment to be used safely. Where the presence of explosives is suspected, specialist advice should be sought from the relevant occupational health authority

### **8.5 CHEMICAL HAZARDS**

#### **8.5.1 Protective Clothing**

The selection of clothing to protect against chemical, biological or radiological hazards will be site specific for any assessment, and selection should be made after assessment of risk (refer to Section 8.2.6 and Appendix 2).

#### **8.5.2 Chemical Hazards**

This is the term applied to those materials that can cause adverse health effects in individuals or which, through their physical and chemical properties, are considered to be an immediate hazard (ie reactive, ignitable or corrosive). All available sources of information should be used in order to identify potential contaminants which



might reasonably be expected to be present giving historical activities on the site and neighbouring ground. Site workers should also be provided with information about how to minimise the effects of unacceptable exposure to known chemical pollutants (eg acids splashed into the eyes). Material Safety Data Sheets (MSDS) should be the minimum source of information.

### **8.5.3 Asbestos**

Until the mid 1970s asbestos was a commonly used construction and insulation material in buildings. Asbestos may be present as 'bonded' material such as asbestos bearing cement or linoleum or as friable fibrous lagging on pipe work and boilers. No site work should commence on any site where asbestos is suspected until suitable precautions have been taken to deal with the health risks associated with respirable asbestos fibre. An experienced and qualified asbestos specialist should be consulted. Removal of asbestos should be in accordance with the *Worksafe National Code of Practice and Guidance Note on Asbestos and Disposal* in accordance with the requirements of relevant State/Territory authorities.

### **8.5.4 Risk Assessment**

Risk assessment is a key aspect of the process to determine the communications, engineering controls, safe work practices and site, atmospheric or biological monitoring and training required. The risk assessment should follow the general rule of identification of:

- the contaminant source, nature (chemical, physical, biological or radiological), form or species (chemical species, biological type or radioisotope) and concentration;
- the pathway or exposure route which it might follow; and
- the receptor, either human or ecological upon which it might impact.

From this identification the exposure of the receptors to the contaminants can be estimated and an assessment made of potential risks.

The likelihood or risk that an adverse effect will occur in a receptor from any given hazard is determined by the physicochemical and toxicological properties of the substance, the potential exposure pathways and the level of exposure.

It is important to observe whether any risk will arise from acute (short-term) or chronic (long-term) exposure, and to assess the risk by consideration of potential exposure concentration. The assessment of human health and ecological risks should be taken into account and, where practicable, known or potentially significant, additive, synergistic and antagonistic effects of chemical mixtures addressed.

The assessment of occupational risks to human health should be undertaken by making comparisons with the appropriate occupational exposure standards of relevant jurisdictions and those published and updated periodically by NOHSC.

Where no relevant standards exist, the methodology described in [Schedule B\(4\)](#), could be used even though this methodology is intended primarily to derive HILs for the protection of public health and is based on an undisturbed site scenario. Therefore, when assessing risks to workers during a site assessment, allowance should be made for possible disturbance to the site (intrusive assessments) and different exposure durations for workers. Such risk assessments should be scenario-specific rather than site specific as workers undertaking different activities may experience different exposure scenarios.

When assessing risks to the environment, the appropriate regulatory agencies should be consulted to ensure relevant ecological/environmental values are identified and adequately protected.

## 9 ENVIRONMENTAL RISKS

### 9.1 GENERAL

Assessment of site contamination, or potential contamination, presents risks to the environment as well as to the site personnel and local residents. The measures adopted to ensure protection of the environment form an integral part of any site assessment program. The protection of the environment is required under legislation in each State or Territory (Appendix 1). Breaches of these laws may carry severe penalties.

Items to be addressed include:

- protection of groundwater resources;
- prevention of migration of contamination to adjacent sites or uncontaminated areas within the site;
- prevention of contaminated run-off water reaching stormwater systems or local surface water environments;
- prevention of initiation or spread of fire, either underground or above ground;
- prevention of the deposition of dust off-site;
- collection and disposal of excavation spoil; and
- collection and disposal of contaminated groundwater.

Environmental risks specific to the site should be included in the site-specific SSSP. Risks which can be commonly overlooked include:

- extending contamination or assisting contaminant migration during site investigation works by, for example, drilling through a contaminated aquifer into an uncontaminated lower aquifer thereby creating a conduit through which contamination may migrate;
- introducing contamination to an otherwise clean soil stratum by backfilling a test pit found to be contaminated at surface level but clean at depth using the contaminated soil. It is always preferable to temporarily stockpile test pit spoil in

excavation sequence so that it may be returned to the pit to roughly the same depth from which it was excavated;

- initiating or extending underground fire by the introduction of oxygen;
- enhancing acid run-off by enabling oxidation of *in-situ* materials through exposure to atmosphere; or
- destabilising an otherwise stable embankment by introducing water.

## **9.2 PRESERVATION OF GROUNDWATER RESOURCES**

Before commencement of any drilling work sufficient research should be undertaken to establish how much information is available regarding the geology and hydrogeology of the area to be investigated. If groundwater contamination is suspected there should be an audit of local bores and advice given to users. If more than one aquifer is expected, care should be taken to ensure that the potential for cross contamination is minimised. Bores should be constructed so that different aquifers are isolated.

Licensing of monitoring bores is a statutory requirement in most States and Territories. There may also be State or Territory guidelines that apply to minimum bore requirements and their decommissioning.

## **9.3 CONTAMINANT MIGRATION WITHIN A SITE OR TO ADJACENT SITES**

The site safety assessor should be aware of the topography and geology of the site under assessment, and the possibility of migration of contaminants within the site or to adjacent sites, whether windblown, adhering to vehicles, plant and equipment, as free-flowing liquids, as surface run-off or in groundwater flow.

## **9.4 RUN-OFF WATER**

Care must be taken to avoid surface run-off from assessment activity impacting on adjacent sites, wetlands, water courses or stormwater drainage systems. Where this is an issue, mitigation measures such as the use of diversion channels may be required (refer Section 8.3.5).

## **9.5 UNDERGROUND FIRE**

Underground fire may be encountered in coal mining areas or in former landfill sites. In the event of discovery of underground fire all assessment work should cease in that area until full assessment of the situation has been completed. Avoid any action which might enable or encourage the propagation or spread of the fire.

## **9.6 COLLECTION AND DISPOSAL OF EXCAVATION SPOIL**

It is normal practise to return excavation spoil from test pits to the excavation from which it came. Drilling cuttings are seldom returned to the bore. However, care

should be taken to ensure that contaminated materials are not returned to a pit or bore where they could contaminate otherwise uncontaminated strata or groundwater. Due to practical difficulties in compaction of excavation spoil there will inevitably be excess spoil after backfilling of a test pit. Care should be taken to ensure that contaminated spoil does not become spread across an otherwise uncontaminated surface.

Excess spoil should be stored in a lined skip or lined drums brought to site or on an impervious surface such as concrete, asphalt, polyethylene sheeting or similar until analytical results can be assessed to enable cost-effective and safe methods of disposal. Where excess spoil is stored on site, and is not stored within a container, bunding should occur around the area to contain potential run-off. If contaminated materials are to be drummed for disposal or for treatment, the contents should be analysed and management decisions made, based on the analytical results.

Allowances should be made within site assessment budgets for any necessary safe removal of a quantity of soil/fill from site to an appropriate waste disposal or treatment facility. (See Section 10.2)

## **9.7 COLLECTION AND DISPOSAL OF CONTAMINATED WATER**

Sample pits should be backfilled soon after sampling (see section 8.4.5) and sampling should never take place during rain. Contaminated water may be encountered where sample pits have been left open, and in boreholes. Contaminated flush water from borehole purging should not be permitted to seep back into the site, but should be collected in lined drums or tanks for appropriate treatment and/or disposal. (See Section 10.3).

After excavation test pits may fill with rain or groundwater. Care should be taken to ensure that backfilling of the test pit does not rapidly displace this water, causing it to flow over the site. If necessary the test pit should be part-backfilled and then baled out to a suitable storage to enable full backfilling with spoil. Allowances should be made within site assessment budgets for the potential safe removal of contaminated water from site to an appropriate liquid waste disposal or treatment facility. (See Section 10.2)

## **9.8 ACID SULFATE SOILS**

A significant hazard may arise from earthworks when soils containing acid sulfate are exposed. This can lead to the generation of acidic run-off. In some instances, there may be more environmental risk associated with acid generation from digging up anthropogenic contamination during the site assessment than would be caused from leaving the contamination in situ. In these instances, discussions should be held with the relevant regulatory authorities prior to excavation. See section 8.3.5 for possible control measures.

## **9.9 HERITAGE SITES**

Special care should be taken to ensure any assessment works activities of or adjacent to sites of cultural or natural heritage significance will not have an adverse impact. Heritage places may include buildings structures, archaeological remains or landscaped or natural areas of aesthetic, historic, scientific or social value. Where appropriate, advice should be sought from the local representatives of the Aboriginal and Torres Straits Islanders Commission (ATSIC), the Australian Heritage Commission and State or Territory heritage bodies and local Councils.

## **9.10 RARE HABITATS OR ENDANGERED SPECIES**

Special care should be taken to ensure that any assessment works activities will not impact upon rare natural habitats or any endangered species. Advice may be sought from Environment Australia, State or Territory organisations or non-government organisations such as The Australian Conservation Foundation, The Wilderness Society or local ornithological and conservation societies.

# **10 DISPOSAL OF WASTE**

## **10.1 GENERAL**

Waste arising from an assessment of site contamination may take many forms including:

- spoil from excavations;
- cuttings from drilling;
- rinsate;
- water from washing of vehicles or equipment;
- water from purging of bores or naturally arising in test pits and excavations;
- disposable protective equipment or clothing; and
- unwanted or completed analytical samples.

A plan for disposal of contaminated spoil, water, clothing, disposable equipment, water and unwanted or completed samples should be set up for each project.

## **10.2 SPOIL FROM EXCAVATIONS**

Spoil from excavations must be sufficiently analysed to enable:

- adequate assessment and characterisation of contaminants present including environmental mobility considerations (leachability and volatility);
- classification in accordance with the prevailing requirements of the appropriate regulatory authority in the State or Territory in which the work is being carried out;
- choice of an appropriate means of treatment or disposal (removal to another construction site as fill materials, general landfill, secure landfill or other);

- confirmation of compliance with prevailing transportation requirements of the appropriate regulatory authority; and
- confirmation of compliance with licence requirements of any landfill to which the spoil is consigned.

Copies of the analytical data must be made available to all relevant authorised persons or bodies including government authorities and landfill managers.

### **10.2.1 Spoil Records**

Rigorous tracking records of the spoil from point of excavation to point of final disposal must be kept, including location during temporary stockpiling, if conducted.

### **10.2.2 Transportation**

Transportation of the spoil must comply with prevailing transportation requirements of the appropriate regulatory authority in the State or Territory in which the work is being carried out, including the completion and retention of consignment notes, labelling or marking of trucks and trailers, pre-notification of regulatory bodies and the obtaining of confirmation of safe disposal from the landfill or liquid waste disposal or treatment facility. (See also Sections 8.3.3. and 8.3.4.). Communication with the local residents is important about this issue, particularly about transport routes and timing of the activities. All loads carrying contaminated materials off site should be covered, irrespective of whether they pose a potential risk.

## **10.3 WATER FROM EXCAVATIONS, WASHING OF EQUIPMENT**

Contaminated water should be collected for off-site treatment or disposal, or disposal via the sewerage system (refer to section 8.3.5 also). It may be necessary to pre-treat the water by, for example, first passing it through an oil/water separator, siltation/settlement tank or other appropriate method to ensure the effluent meets relevant water quality criteria specified by government agencies. For disposal via sewer, it may also be necessary to obtain prior authorisation from the service supplier.

Care must be taken to ensure that contaminated water is not released to local water courses or to the stormwater system.

## **10.4 PERSONNEL DECONTAMINATION**

All personnel will be equipped with protective clothing as determined appropriate by the site safety assessor. This clothing will be worn at all times within exclusion zones. Whilst in the exclusion zone, all contaminated rubbish generated such as used gloves will be collected in garbage bags or similar for disposal.

## **11 SUB-CONSULTANTS AND SUB-CONTRACTORS**

Each sub-consultant and sub-contractor should be given a copy of the SSSP prior to commencing the job and be required to comply with it. It is the responsibility of the site safety assessor to ensure that all personnel have read and understood the SSSP, are competent for their tasks and have the proper PPE and are familiar with relevant work procedures and safety systems. This may be accomplished at a site induction meeting, at the conclusion of which all attendees should sign a master copy of the SSSP. In the absence of a site-specific SSSP they should comply with the general guidelines set out in Sections 8 and 9 of this document. The training of sub-consultants and sub-contractors should always be carried out in accordance with appropriate State or Territory legislation.

## **12 ACCIDENT/INCIDENT INVESTIGATION AND REPORT**

Any direct contact with a potentially contaminated substance should be reported to the site safety assessor. As the effects of contact with contaminants upon a suspect site may not be immediately apparent any ill effects noted following any site works should also be reported.

The site safety assessor should set up and maintain records of accidents and incidents and to implement and document any actions taken in response to these events. It is recommended that incidents are classified in terms of level of significance (minor ranging to major) and reporting requirements are set out for each level. As a general guide, the reporting of major incidents should include the following information:

- nature and timing of events that occurred;
- materials involved and amounts of each;
- cause of the major accident;
- effects of the major accident on people, property and the built or natural environment;
- clean up methods used;
- effectiveness of emergency plans and procedures; and
- actions taken to prevent similar occurrences.

All injury reporting and recording should comply with AS1885: Workplace injury and disease recording standard. This reporting should include accident/incidents that occur to both employees, workers and contractors working on the site. Where required, accidents to people and the environment must be reported to the relevant authority. In some jurisdictions, penalties exist if an incident and/or breach is not reported within 24 hours. Any other relevant jurisdictional legislation should also be complied with.

## 13 HEALTH SURVEILLANCE FOR SITE STAFF

The purpose of health surveillance is to ensure that control measures are effective and to provide an opportunity to reinforce specific preventative measures and safe work practices. Site assessment staff who may reasonably be expected to be regularly involved in the assessment of site contamination where repeated exposures to hazardous substances are likely should be assessed by an occupational physician as to the need to undergo health surveillance or biological monitoring. This will be specific to the chemical and expected level of exposure and advice from a qualified occupational physician should be sought. The occupational physician should be aware of the jurisdictional requirements regarding biological monitoring. The NOHSC Code of Practice for the Control of Workplace Hazardous Substances provides specific information about requirements for health surveillance. NOHSC has developed Guidelines for Health Surveillance for seventeen substances.

Regular physical examination and biological monitoring may enable a potential health problem to be identified early, and may assist in providing a future data bank on health risk or adverse effects to workers employed in this area of environmental science and engineering. Biological monitoring is an adjunct for ensuring that the proper personal hygiene and occupational hygiene precautions are effective. The effectiveness of safety controls must be reviewed if there are abnormal results from physical examination or biological monitoring. Records of any monitoring or health surveillance are confidential and must be kept for the period of time prescribed by legislation.

When selecting team members for any particular site a pre-placement medical examination may need to be performed to ensure the person is fit for work, particularly where the work could involve contaminants which may pose a risk to health, physical issues associated with personal protective equipment, or confined space entry. An occupational physician can provide advice on this matter. It may be appropriate during the pre-placement examination to perform baseline biological monitoring appropriate for the health risk (eg blood lead measurement when dealing with a lead contaminated site). This will assist both the worker and site management in addressing issues about health risks as they occur. Furthermore, the biological monitoring should be performed prior to ending the task or termination of employment as a means of demonstrating that the baseline has not changed since the beginning of employment on the site.

The site safety assessor should also take into account the physical requirements of the work and ensure that they are within the capabilities of the appointed staff. For example, pregnancy may preclude certain activities. This is particularly important where there is potential for use of respiratory protective equipment. Staff should have undergone lung function testing if they will work with respiratory hazards such as irritants, allergens and fibrosing dusts, and if they will be required to work in confined spaces. They also need to confirm they can use respiratory protection equipment. Where there is a need for facial fit respiratory equipment, staff should be



clean shaven or their facial hair should not interfere with the correct operation of the respirator.

Consideration should be given to any pre-existing condition which may lead to an increased risk from exposure to a site contaminant eg asthma and exposure to dust/fungal spores; immunocompromised people and exposure to potentially pathogenic micro-organisms.

Site staff should not work on a site that is contaminated or potentially contaminated when affected by prescribed or non-prescribed drugs, including alcohol, that might reduce alertness or cause drowsiness.

## 14 REFERENCES

A list of Government statutes, regulations, guidelines and Australian Standards, that may be relevant to work in site contamination is included in Appendix 1. This list is not exhaustive and enquiries should be made with the relevant government departments to ascertain the relevant regulations for any particular project. Some further references are as follows:

Environmental Audit Guidebook, Centre of Professional Development, 1993.

Petts, J Cairney T, Smith, M. *Risk Based Contaminated Land Investigation and Assessment*, John Wiley & Sons, 1997.

Montgomery J.H., *Groundwater Chemicals Field Guide*, Lewis Publishers, 1991.

Sax N I., *Dangerous Properties of Industrial Materials* (current edition), Van Nostrand Reinhold Co.

*The Merck Index* (current edition), Merck and Co. USA.

NIOSH, *Pocket Guide to Chemical Hazards*, 1990.

*National Workshop on Health Risk Assessment and Management of Contaminated Land - Contaminated Sites Monograph Series*, South Australian Health Commission.

NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance manual for Hazardous Waste Site Activities*, US Dept. of Health & Human Services, 1985

HSE (UK), *Protection of Workers and the General Public During the Development of Contaminated Land*, HMSO, 1991.

NOHSC, Worksafe Australia website, [www.worksafe.gov.au](http://www.worksafe.gov.au)

**APPENDIX 1**  
**RELEVANT LEGISLATION AND GUIDELINES**  
**FOR WORK ON CONTAMINATED SITES**

The Statutes, Regulations and Standards listed in this Appendix are not necessarily a complete list of such relevant documents. This Appendix is provided for information only and is not intended to be exhaustive.

**COMMONWEALTH**

**Australian Standards**

Particularly standards relating to:

Breathing apparatus	2704, 2705, 2299, 1715, 1716
Chemical analysis and testing	3741, 2830.1, 2850, 2701.10, 2503, 5667
Chemical storage and handling	3780, 2508, 2243.10, 4326, 2507, 4081
Flammable and combustible liquids	2229.1, 2106, 1678.3, 2809.2, 1940, 1692
Confined spaces	2865
Dangerous Goods	1216, 1678, HB95, 2931, HB76, 2400.21, 2809, 2508, 1940 and 3833
Earth moving equipment	2012.1-2012.2, 2952-2952.1, 2952.3-2952.6, 2868, 3868, 4242, 2953-2953.6, 2956-2956.4, 2951-2951.7, 2957-2957.6, 2294-2294.2, 2954-2954.6, 4457, 2958-2958.3, 2264, 2955-2955.10
Emergency procedures	3745, 2293, VID0234, VID024, MP24
Explosive atmospheres	1915, 1828, 2430.1, 1360, 1299, 2275, 1939, 2229, 1039, 2236, 2430.2, 2595.1, MP69, 2381.10, 2431, 2380.2.6.7.9.4, 1482, 1076, 2381, 1826, 2268, 2275, 2290.3
Fire protection	1851, CS-FP-001 & 002, 4078, 1211, 1301, 4077.1&2, HB20, 2419, 3772, 3784.1, 1851.3
First aid kits	3539, 2675

Gas detectors	2275, 2290.3
Hazardous materials	1678, 1940, 2508, 2927, 2714, 2507, VID018, 3780
Hearing Conservation	1269, 1270
Industrial accidents	1885.1, MP58
Intrinsically safe equipment	2380.7, 2381.7
Measuring instruments	3912.1
Protective Clothing	
• Against hazardous chemicals	3765.1, 3765.2
• Against heat and fire	2375
• Industrial	2919
Quality Assurance	HB82, ISO 9001.1, RuQ/1, 3912.1, HB85, ISO 8402
Radiation	2900.6
Respirators	1715
Safety harnesses	1819.1, 2626, 2227, 3989
Safety helmets	4499, 1801, 1800, 2063, 1698, 2512
Sampling methods - contaminated soil	4482
Self-contained breathing apparatus	1716, 1715, 2704
Site Investigations	1726
Test Methods (some)	1635, 1321, 1937, 1141, 1861, 2039, 2891, 1733, 3822
Water testing	35503.3,5,6,2,4, 3506, 2976, 2769, 2031.1, 5667.1-11, 2382, 2723, 2882, 2849, 3896

## Guidelines and Codes of Practice

\*Please check currency of these documents as they are updated from time to time.

“Control of Work Place Hazardous Substances, National Model Regulations and Code of Practice”, 1991, Worksafe Australia.

“Guidance Note for Delivery and Classifying a Hazardous Substance”, Worksafe Australia.

“Guidance Note for the Assessment of Health Risks Arising from the Use of Hazardous Substances in the Workplace”, Worksafe Australia, 1994.

“Exposure Standards for Atmospheric Contaminants in the Occupational Environment. Guidance Note and National Exposure Standards”, 1991, Worksafe Australia.

National Code of Practice and Guidance Note on Asbestos.

National Code of Practice for the Construction Industry. October 1997

“Australian and New Zealand Guidelines for the Assessments and Management of Contaminated Sites”, ANZECC and NHMRC, 1992.

Contaminated Sites Monographs 1 to 4, Proceedings of the National Workshops on the Health Risk Assessment and Management of Contaminated Sites.

AS 4482.1 Australian Standard for Sampling of Soils Part 1: Guide to the sampling and investigation of potentially contaminated soil (1997).

“Financial Liability for Contaminated Site Remediation” ANZECC, June 1993.

Australian Code for the Transport of Dangerous Goods by Road and Rail Regulations Commonwealth of Australia 1997.

Approved criteria for Classification of Hazardous Substances, 1999, Worksafe Australia.

List of Designated Hazardous Substances, 1999, Worksafe Australia.

Guidelines for Health Surveillance, 1995, Worksafe Australia.

Guidelines for Health Assessment for Work, 1998, Australasian Faculty of Occupational Medicine.

The use of personal protective equipment at work, 1996, NSW WorkCover.

## **STATE BY STATE**

### **Australian Capital Territory**

#### **Acts**

Land (Planning and Environment) Act 1991

Health Act 1993

Radiation Act 1983

Public Health Act 1997

Environment Protection Act 1997

Occupational Health and Safety Act 1989

Clinical Waste Act 1990  
Canberra Sewage and Water Supply Regulations  
Dangerous Goods Act 1984  
Radiation act 1983  
Regulations  
Public Health (Infectious and Notifiable Diseases) Regulations  
Environment Protection Regulations 1997  
Guidelines  
Guidance on trenching and excavation work.

## **New South Wales**

Responsibility within NSW lies with the NSW Environment Protection Authority (NSWEPA). NSWEPA issue guidelines for reporting on site contamination, but have no specific requirements for health issues related to investigative works, relying on the responsibility of employers to provide a safe workplace. However, WorkCover NSW administers legislation concerning occupational health and safety at all workplaces.

### **Acts**

Contaminated Land Management Act 1997  
Protection of the Environment Operations Act 1997  
Pollution Control Act, 1970  
Environmentally Hazardous Chemicals Act, 1985  
Occupational Health & Safety Act, 1983  
Unhealthy Building Land Act, 1990  
Environmental Offences and Penalties Act, 1989  
Environmental Restoration and Rehabilitation Trust Act, 1990  
Environment Planning and Assessment Act 1979  
National Parks and Wildlife Act 1974  
Wilderness Act 1987  
Clean Waters Act 1990  
Catchment Management Act 1989  
Dangerous Goods Act 1975  
Radiation Control Act 1990  
Public Health Act 1991.  
Construction Safety Act 1912

### **Regulations**

Occupational Health & Safety (Asbestos Removal Contractors) Regulation, 1988  
Occupational Health & Safety (Confined Spaces) Regulation, 1990  
Occupational Health and Safety (Hazardous Substances) Regulation, 1996  
Occupational Health and Safety (Noise) Regulation, 1996  
Occupational Health and Safety (Manual Handling) Regulation 1991

## **Northern Territory**

Contaminated land issues are the responsibility of the Environment and Heritage of the Department of Lands Planning and Environment. The Waste Management and Pollution Control Act is the primary means of managing contaminated land in the Territory.

### **Acts**

Waste Management and Pollution Control Act  
Environmental Assessment Act  
Dangerous Goods Act  
Water Act  
Planning Act  
Public Health Act  
Work Health Act  
Work Health Act (Occupational Health and Safety) Regulations

## **Queensland**

Contaminated land issues are currently the responsibility of the Environmental Protection Agency. Guidelines are currently being formulated but will be subject to modification due to expected changes to the Contaminated Land Act (CLA) (1991). Queensland Department of Natural Resources (DNR) currently runs two-day workshops on working in acid-soil environments.

### **Acts**

Environmental Protection Act 1994 - not fully in operation.  
Environment and Other Legislation Amendment Act 1997 (replacing Contaminated Land Act, 1991)  
Workplace Health and Safety Act 1995  
Radioactive Substances Act 1958  
Health Act, 1937  
Local Government Act 1991  
Sewerage and Water Supply Act 1949

### **Guidelines**

Guidelines for the Assessment of Contaminated Land in Queensland  
Chemical Hazards and Emergency Management Unit, Jan. 1992  
Contaminated Sites Register: Sites are listed as possible, probable, confirmed or restricted.

## **South Australia**

### **Acts**

Environment Protection Act 1993

Water Resources Act 1997

Public and Environmental Health Act 1987

Occupational Health Safety and Welfare Act 1986

Radiation Protection and Control Act 1982.

Further legislation is being developed.

### **Guidelines**

Special Bulletin No.1, The Use of Environmental Auditors. Contaminated Land, 20 October 1995

Practice Circular 2, Land Contamination, September 1997.

Information Sheet No.8, Assessment Procedure for Contaminated Sites, November 1997.

Technical Bulletin No.5, Disposal Criteria for Contaminated Soil.

Stormwater Pollution Prevention, Code of Practice for the Community, September 1997.

## **Tasmania**

No specific site contamination legislation enacted as yet, however a Contaminated Sites Management Task Force has been set up and a position paper has been published. Legislation is expected 1998/9.

### **Acts**

Environment Management and Pollution Control Act 1994.

Land Use Planning and Approvals Act 1993

Health Act 1997 (not yet in force)

Dangerous Goods Act 1976

Radiation Control Act 1977.

### **Guidelines**

Contaminated Sites: Their Identification, Assessment, Management and Remediation in Tasmania, August 1992, DELM.

Off-site Disposal of Contaminated Soil in Tasmania, DELM Information Bulletin, May 1976

## **Victoria**

Responsibility for regulation in Victoria lies with the Environment Protection Authority, Victoria (EPAV). There are no specific health and safety requirements for assessment of sites, but the EPAV Contaminated Land Auditor system provides some degree of comfort in the overseeing of many assessments by an independent EPAV appointed auditor.

## **Acts**

Occupational Health and Safety Act, 1985  
Environment Protection Act, 1970.  
Dangerous Goods Act 1985  
Health Act 1958  
Health (General Amendment) Act, 1988  
Water Act 1989

## **Regulations**

Environment Protection (Prescribed Waste) Regulations 1987 (No. 195)  
Environment Protection (Transport) Regulations 1987

## **Guidelines**

Offsite disposal of Contaminated Soil, WM 91/01, EPAV,  
EPAV Information Bulletin 448 "Classification of Wastes"  
Environmental Auditors, Contaminated Land, 1991 WM 91/05, EPAV  
Guidelines for Environmental Auditors, Contaminated Land, 1991, EPAV  
Minister's Direction No.1. Potentially Contaminated Land, 9th October 1989,  
updated 14 May 1992  
Environmental Guidelines for Major Construction Sites, EPAV Publication 480,  
December 1996.  
State Environment Protection Policies (SEPPs).

## **Western Australia**

No current specific legislation for site contamination, however responsibility currently lies with the Department of Environmental Protection (DEP) and Health Department of Western Australia (HDWA). A discussion paper has been issued.

The DEP have adopted the Dutch criteria as interim guidance pending new Contaminated Sites legislation, planned to be gazetted within the next twelve months. This legislation is intended to include the establishment of a contaminated sites register.

## **Acts**

Environmental Protection Act, 1986.  
Occupational Health, Safety and Welfare Act 1984  
Health Act 1911  
Radiation Safety Act 1975

## **Regulations**

Occupational Safety and Health Regulations 1986  
Environment Protection (Noise) Regulations 1997



## **Commonwealth**

### **Acts**

Occupational Health and Safety (Commonwealth Employment) Act 1991

The Approved Codes of Practice approved by the Minister under Section 70 of the Occupational Health and Safety (Commonwealth Employment) Act 1991

### **Regulations**

Occupational Health and Safety (Commonwealth Employment) Regulations

Occupational Health and Safety (Commonwealth Employment) (National Standards) Regulations, Parts 1 to 7

### **Guidelines**

Guidance material issued by the Safety Rehabilitation and Compensation Commission

## APPENDIX 2 APPROVED SAFETY EQUIPMENT

Equipment should be in accordance with the standards listed. Please check currency of standard:

### **SAFETY GLASSES**

Recommended practices for occupational eye protection	AS 1336:1997
Filters for eye protectors - Filters for protection against radiation generated in welding and allied operations	AS 1338.1:1992
Filters for eye protectors - Filters for protection against ultraviolet radiation	AS 1338.2:1992
Filters for eye protectors - Filters for protection against infra-red radiation	AS 1338.3:1992

### **RESPIRATORS**

Selection, use and maintenance of respiratory protective devices	AS 1715:1994
Respiratory protective devices	AS 1716:1994

### **HELMETS/HARD HAT**

Occupational protective helmets – Selection, care and use	AS 1800:1998
Occupational protective helmets	AS 1801:1997

### **GLOVES**

Occupational protective gloves – General requirements	AS 2151.2:1998
Occupational protective gloves – Protection against mechanical risk	AS 2161.3:1998
Occupational protective gloves – Protection against thermal risks (heat and fire)	AS 2161.4:1999
Occupational protective gloves – Protection against cold	AS 2161.5:1998

## **SAFETY BOOTS/SHOES**

Occupational protective footwear - Guide to selection, care and use	AS 2210.1:1994
Occupational protective footwear - Specification	AS 2210.2:1994
Industrial clothing	AS 2919-1987
The storage and handling of corrosive substances	AS 3780-1994
The storage and handling of oxidizing agents	AS 4326-1995
Storage and handling of LP Gas	AS 1596:1997
The storage and handling of toxic substances	AS 4452:1997

## **OCCUPATIONAL MONITORING**

Workplace atmospheres - Method for sampling and gravimetric determination of respirable dust	AS 2985-1987
Workplace atmospheres - Organic vapours - Sampling by solid adsorption techniques	AS 2986-1987
Workplace atmospheres - Method for sampling and gravimetric determination of inspirable dust	AS 3640-1989

Instruments used in explosive atmospheres should be in accord with AS 2381.7 - 1989.

## APPENDIX 3

### EQUIPMENT LIST FOR ASSESSMENT OF SITE CONTAMINATION

The lists of field equipment presented in this Appendix are a guide to the equipment suggested for a detailed contaminated site assessment.

#### **Health And Safety Equipment - Minimum Requirements**

- First aid kit
- Fire extinguisher - dry chemical type ABC, 1.5 - 1.6 kg
- Portable eye wash
- Inner and outer nitrile gloves
- Disposable oversuit
- Safety helmet
- Ear plugs and/or ear muffs
- Safety glasses
- Safety boots
- Hand wash water container or wet-wipes
- Hand wash soap
- Scrubbing brush
- Stakes and cones for exclusion zone
- Tape or appropriate barrier materials
- Hammer for driving stakes
- Paper towel
- PID
- Explosimeter (where combustible gases may be present)
- Garbage bags
- Site plan

**APPENDIX 4**  
**ADOPTED NATIONAL EXPOSURE STANDARDS FOR ATMOSPHERIC  
CONTAMINANTS IN THE OCCUPATION ENVIRONMENT (NOHSC:1003 (1995))**

The exposure standards referred to in this Appendix are produced by the National Occupational Health and Safety Commission (NOHSC). They provide guidance that may be used to ensure workers are adequately protected from substances that may impair health or cause undue irritation.

The exposure standards listed in this publication represent airborne concentrations of individual chemical substances which, according to current knowledge, should neither impair the health of nor cause undue discomfort to nearly all workers.

The exposure standards only consider absorption via inhalation and are valid only on the condition that significant skin absorption cannot occur.

The exposure standards can also be accessed, via the Internet, on:  
<http://www.worksafe.gov.au>.