CRC for Contamination Assessment and Remediation of the Environment

National Remediation Framework

Guideline on health and safety

Version 0.1: August 2018

National Remediation Framework

The following guideline is one component of the National Remediation Framework (NRF). The NRF was developed by the Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) to enable a nationally consistent approach to the remediation and management of contaminated sites. The NRF is compatible with the *National Environment Protection (Assessment of Site Contamination) Measure* (ASC NEPM).

The NRF has been designed to assist the contaminated land practitioner undertaking a remediation project, and assumes the reader has a basic understanding of site contamination assessment and remediation principles. The NRF provides the underlying context, philosophy and principles for the remediation and management of contaminated sites in Australia. Importantly it provides general guidance based on best practice, as well as links to further information to assist with remediation planning, implementation, review, and long-term management.

This guidance is intended to be utilised by stakeholders within the contaminated sites industry, including site owners, proponents of works, contaminated land professionals, local councils, regulators, and the community.

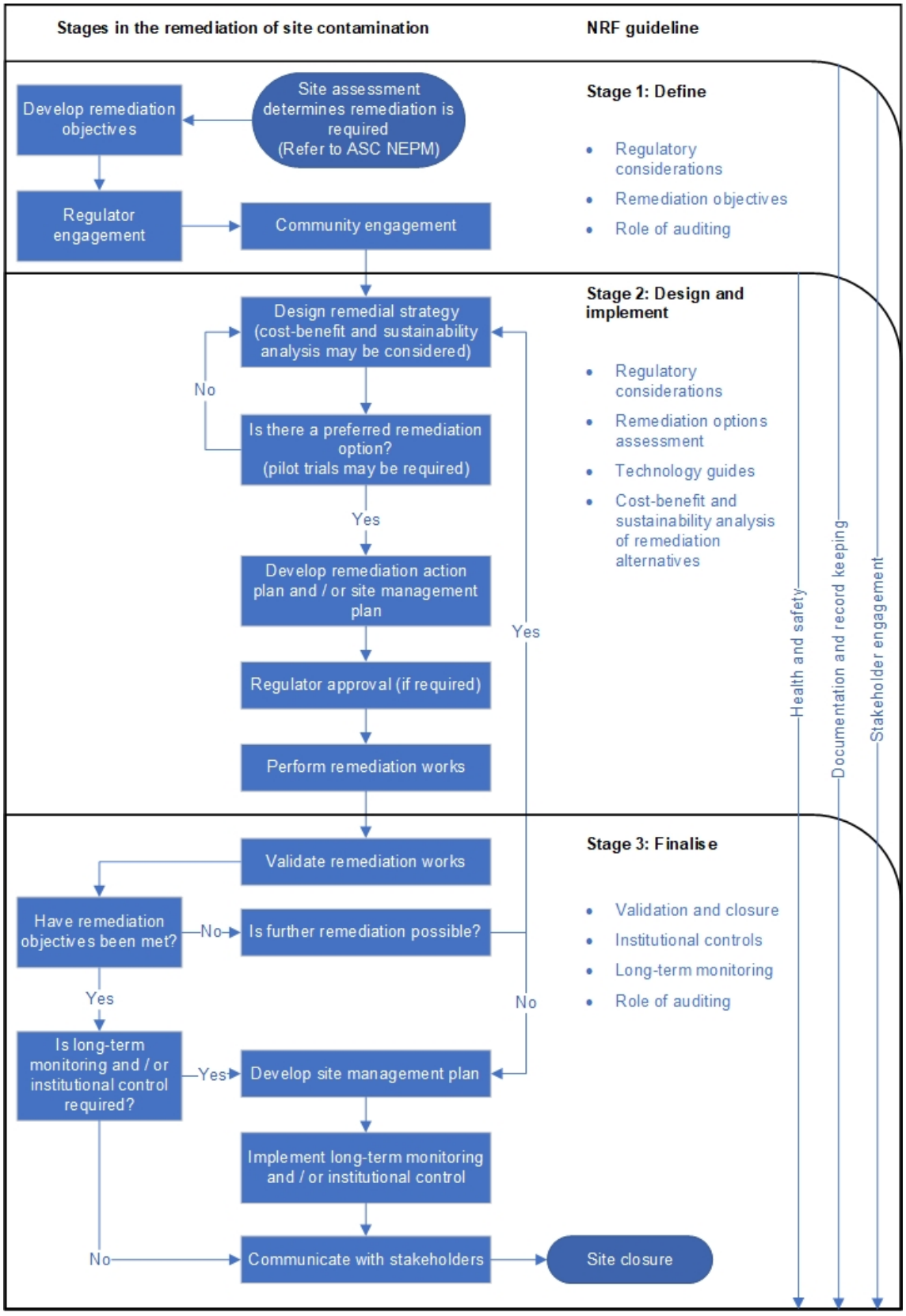
The NRF is intended to be consistent with local jurisdictional requirements, including State, Territory and Commonwealth legislation and existing guidance. To this end, the NRF is not prescriptive. It is important that practitioners are familiar with local legislation and regulations and note that **the NRF does not supersede regulatory requirements**.

The NRF has three main components that represent the general stages of a remediation project, noting that the remediation steps may often require an iterative approach. The stages are:

- Define;
- Design and implement; and
- Finalise.

The flowchart overleaf provides an indication of how the various NRF guidelines fit within the stages outlined above, and also indicates that some guidelines are relevant throughout the remediation and management process.

It is assumed that the reader is familiar with the ASC NEPM and will consult other CRC CARE guidelines included within the NRF. This guideline is not intended to provide the sole or primary source of information.


Stages in the remediation of site contamination
NRF guideline
Site assessment determines remediation is required (Refer to ASC NEPM)
Develop remediation objectives
Regulator engagement
Community engagement
Stage 1: Define
Regulatory considerations
Remediation objectives
Role of auditing
Design remedial strategy (cost-benefit and sustainability analysis may be considered)
No
Is there a preferred remediation option? (pilot trials may be required)
Yes
Develop remediation action plan and / or site management plan
Regulator approval (if required)
Perform remediation works
Stage 2: Design and implement
Regulatory considerations
Remediation options assessment
Technology guides
Cost-benefit and sustainability analysis of remediation alternatives
Yes
Validate remediation works
Have remediation objectives been met?
No
Is further remediation possible?
Yes
No
Is long-term monitoring and / or institutional control required?
Yes
Develop site management plan
Implement long-term monitoring and / or institutional control
No
Communicate with stakeholders
Site closure
Stage 3: Finalise
Validation and closure
Institutional controls
Long-term monitoring
Role of auditing
Health and safety
Documentation and record keeping
Stakeholder engagement

Executive summary

During the remediation and management of contaminated sites, the protection of the health and safety of all people working at, or otherwise involved with, the site is paramount. This includes workers at the site, visitors to the site and third parties such as users of adjoining land, residents, passers-by and sight-seers.

Remediation of contamination presents risks to health and safety that are unique, and which go beyond those associated with a standard construction site. Many of hazards will be known and predictable, but some will be unknown; health and safety systems must be designed to handle both situations. Specific hazards arise from the presence of contamination in a site. Materials that can present a physical, chemical and/or biological risk may be in solid, liquid, gas or dust form. They may be in the soil or groundwater. General hazards might include fires, explosions, confined spaces, underground and above-ground services (e.g. gas lines and electricity), plant, manual handling and slips, trips and falls.

The objective of this guideline is to provide guidance on specific health and safety issues that should be considered during remediation and management of site contamination. This guideline assumes that the contamination status of the site has already been established during prior investigation works, and the likely contaminants are known.

This guideline provides information on the risk management process, documentation, and specific and general hazards and their controls relevant to any remediation site. For health and safety hazards specific to the implementation of a technology readers are directed to the NRF *Technology guides*.

Abbreviations

EPA	Environmental Protection Agency / Authority
GHS	Globally Harmonised System of Classification and Labelling of Chemicals
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
NEPC	National Environment Protection Council
NEPM	National Environment Protection (Assessment of Site contamination) Measure 1999 (amended 2013)
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NOHSC	National Occupational Health And Safety Commission (Now Safe Work Australia)
PPE	Personal Protective Equipment
SA EPA	South Australian Environment Protection Authority
SDS	Safety Data Sheet
SSSP	Site-Specific Safety Plan
SWA	Safe Work Australia
WA	Western Australia
WES	Workplace Exposure Standards for

Glossary

Concentration	The amount of material or agent dissolved or contained in unit quantity in a given medium or system.
Conceptual site model	A representation of site-related information including the environmental setting, geological, hydrogeological and soil characteristics together with the nature and distribution of contaminants. Contamination sources, exposure pathways and potentially affected receptors are identified. Presentation is usually graphical or tabular with accompanying explanatory text.
Contaminant	Any chemical existing in the environment above background levels and representing, or potentially representing, an adverse health or environment risk.
Contaminated site	A site that is affected by substances that occur at concentrations above background or local levels and which are likely to pose an immediate or long-term risk to human health and/or the environment. It is not necessary for the boundaries of the contaminated site to correspond to the legal ownership boundaries.
Contamination	The presence of a substance at a concentration above background or local levels that represents, or potentially represents, a risk to human health and/or the environment.
Decontamination zone	An area where removal of contaminated field clothing and washing of field equipment and plant takes place.
Environment(al) protection authority / agency	The government agency in each state or territory that has responsibility for the enforcement of various jurisdictional environmental legislation, including some regulation of contaminated land.
Exclusion zone	An area where all people are prevented from accessing.
Hazard	The inherent property of a contaminant or situation having the potential to cause adverse effects when a receptor may be exposed to that contaminant.
Health and safety representative	A worker who has been elected by a work group under a Work Health and Safety Act to represent them on health and safety issues.
Plant	Machinery, equipment, appliance, container, implement or tool, including a component or anything fitted or connected to any of those things. Plant includes items as diverse as lifts, cranes, computers, machinery, conveyors, forklifts, vehicles, power tools and amusement devices.

Practitioner	Those in the private sector professionally engaged in the assessment, remediation or management of site contamination.
Principle contractor	A legal term that means that contractor has control over the construction phase of a project involving more than one contractor. They are appointed in writing by the proponent to plan, manage, monitor and co-ordinate the remediation.
Proponent	A person who is legally authorised to make decisions about a site. The proponent may be a site owner or occupier or their representative.
Remediation	An action designed to deliberately break the source-pathway-receptor linkage in order to reduce the risk to human health and/or the environment to an acceptable level.
Restricted zone	An area where hazard(s) exist, and access is restricted to essential persons as one control for the hazard.
Risk	The probability that in a certain timeframe 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 specified substance, i.e. it depends on both the level of toxicity of the substance and the level of exposure. 'Risk' differs from 'hazard' primarily because risk considers probability.
Risk assessment	A process intended to calculate or estimate the risk to a given target organism, system, or sub-population, including the identification of attendant uncertainties, following exposure to a particular contaminant, taking into account the inherent characteristics of the agent of concern as well as the characteristics of the specific target system (ASC NEPM 1999, Sch B6).
Safe work agency	the state or territory government body responsible for the enforcement (regulation) of work health and safety laws within that particular state or territory.
Site	A parcel of land (including ground and surface water) being assessed for contamination, as identified on a map by parameters including Lot and Plan number(s) and street address. It is not necessary for the site boundary to correspond to the Lot and Plan boundary, however it commonly does.
Site-specific safety plan	A plan to address identified risks and hazards on a potentially contaminated or contaminated site. The aim of a site-specific safety plan is to provide as safe an environment as is practicable.

Work area	An area affected by site activities. Includes the exclusion zone, decontamination zone and support zone.
Work group	A group of workers represented by a health and safety representative who, in many cases, share similar work conditions.
Worker	Any person who carries out work for a person conducting a business or undertaking, including work as an employee, contractor, subcontractor, self-employed person, outworker, apprentice or trainee, work experience student, employee of a labour hire company placed with a 'host employer', or volunteer.

Table of contents

1. Introduction

During the remediation and management of contaminated sites, the protection of the health and safety of all people working at, or otherwise involved with, the site is paramount. This includes workers at the site, visitors to the site and third parties such as users of adjoining land, residents, passers-by and sight-seers. The objective of this guideline is to provide guidance on specific health and safety issues that should be considered during remediation and management of site contamination. This guideline assumes that the contamination status of the site has already been established during prior investigation works, and the likely contaminants are known.

Remediation of contamination presents risks to health and safety that are unique, and which go beyond those associated with a standard construction site. Many of hazards will be known and predictable, but some will be unknown; health and safety systems must be designed to handle both situations. Specific hazards arise from the presence of contamination in a site. Materials that can present a physical, chemical and/or biological risk may be in solid, liquid, gas or dust form. They may be in the soil or groundwater. General hazards might include fires, explosions, confined spaces, underground and above-ground services (e.g. gas lines and electricity), plant, manual handling and slips, trips and falls.

While it is intended to be a stand-alone document, this guideline does not prescribe precise safety rules or cover every single aspect of workplace health and safety. Rather, it provides information on the aspects of health and safety specifically regarding remediation of site contamination. It is anticipated that readers will integrate the information within this guideline with information from other sources to form a complete H&S strategy for their remediation project. Local safe work agencies each hold a substantial amount of guidance relating to work health and safety issues that must be addressed in all workplaces regardless of contamination status. As new guidance in work health and safety is being developed on an ongoing basis by relevant authorities, readers should make regular contact with local safe work agencies to ensure they have access to the most up-to-date and useful information to support their work. To aid the reader in accessing complementary information, a list of safe work agencies is provided in **Appendix A**.

1.1 Health and safety stakeholders

There are often several parties involved in the remediation of site contamination, and they are all involved in creating a safe environment for the remediation works. These parties must work together to provide a holistic view of the planned works, to identify potential hazards and to identify when one party's works may create an unexpected hazard for another party.

1.1.1 *Proponent*

The proponent is the person who is legally authorised to make decisions about a site. The proponent may be a site owner or occupier or their representative. They are generally the person who commissions the remediation work, and they may or may not engage the contractors to complete the work.

Proponents have certain health and safety duties under law, such as provision of a safe work environment.

1.1.2 *Environmental practitioner*

The environmental practitioner is the company engaged by the proponent to plan and supervise the remediation of the site contamination.

They may be one of many contractors all engaged separately, or they may be the only contractor and then subcontract the specialised portions of the work.

The environmental practitioner will be essential in identifying hazards associated with the contamination status of the site.

1.1.3 *Contractors*

Remedial works themselves are usually carried out by a contractor. These are specialist companies that provide services such as:

- Earthworks;
- Specialist groundwater remediation such as thermal or pump-and-treat;
- Vapour or indoor air monitoring;
- Occupational hygienist (typically for particulate monitoring during earthworks);
- Heritage or wildlife experts;
- Arborist;
- Asbestos removal; or
- Installation of vapour barriers, geotextiles or PRBs.

The contractor(s) may be engaged by the environmental practitioner on behalf of the proponent or directly by the proponent.

The contractors will be essential in identifying hazards associated with the specific work methods or equipment.

Often, one of these contractors will act in the role of Principal Contractor. This is a legal term that means that contractor has control over the construction phase of a project involving more than one contractor. They are appointed in writing by the proponent to plan, manage, monitor and co-ordinate the remediation, including health and safety.

1.1.4 *Jurisdictional work safe office*

Every Australian state or territory has a government office dedicated to work health and safety. They are responsible for regulating the implementation of that jurisdictions' health and safety legislation, performing site inspections, and assisting with understanding responsibilities or interpreting guidelines.

The work safe office will be essential in providing further information and advising on recommended controls, standards and guidelines.

The work safe office for each jurisdiction is provided in Appendix A.

2. The risk management process

A risk management process provides a framework to assist in decision-making relating to all aspects of work health and safety. Risk management is a process and involves four steps (see Figure 1 below):

- Step 1 - Identify hazards;
- Step 2 - Assess risks;
- Step 3 - Control risks; and
- Step 4 - Review control measures.

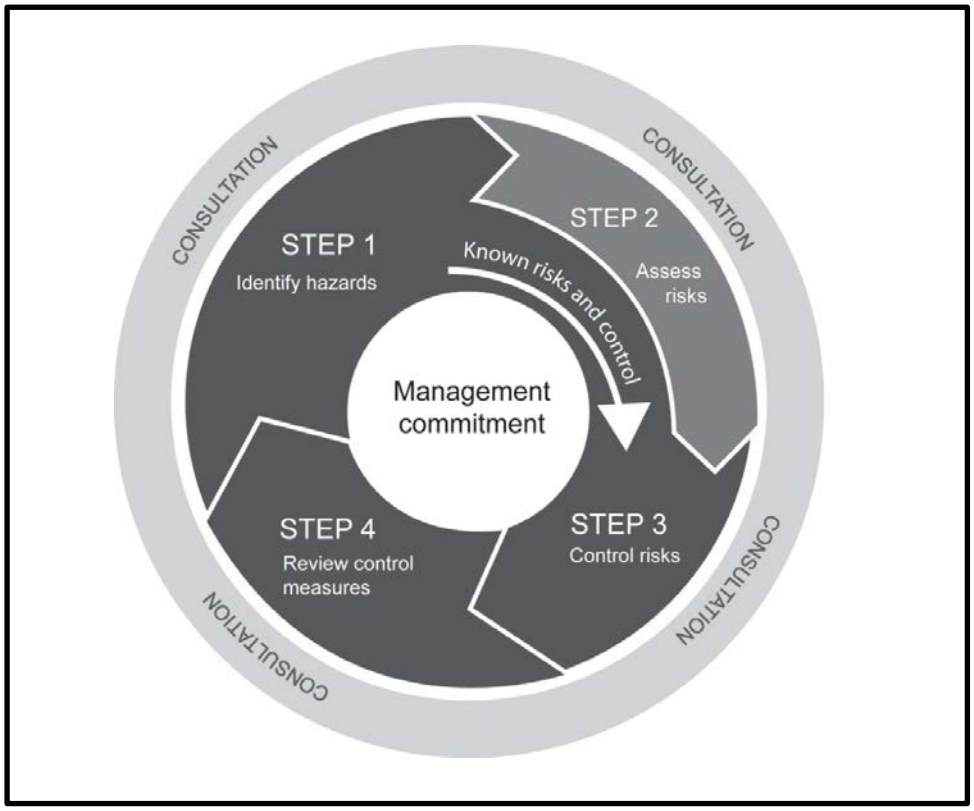


Figure 1: The risk management process, from SafeWork Australia (2011).

Consultation with workers and their health and safety representatives is required at each step, providing the opportunity to share experience, knowledge and ideas before decisions are made.

2.1 Identifying hazards

There are two main categories of hazard that are present on a contaminated remediation site; those associated with the contamination and those associated with general construction work.

The practitioner's investigation reports will contain information regarding the nature and extent of the contamination, including:

- The type of contamination;
- Where on site it exists;

- What it looks like;
- What hazard it presents.

When identifying hazards, it is also necessary to consider the changing physical nature of the site during remediation works. Some chemicals behave differently in different circumstances. For example:

- Are the chemicals safe while in-situ but hazardous when disturbed or exposed to air?
- Are any chemicals safe in small amounts but hazardous in the volumes expected during remediation?
- Is there an explosion risk?
- Is there a risk of workers being exposed to vapours while they excavate?
- Will contamination make ground more susceptible to collapse than usual?
- Will works on other parts of the site disturb contaminated areas?
- Are any chemicals toxic to the environment and require special handling or disposal?

When identifying hazards, it is important to consider that different users of the site may experience a hazard differently, particularly on sites where remediation is occurring in conjunction with normal activities. For example the hazard of

2.2 Assessing risks

A risk assessment involves considering what could happen if someone is exposed to a hazard and the likelihood of it happening. A risk assessment can help determine:

- The nature of the harm that could be caused by the hazard;
- The severity of the risk;
- The likelihood of exposure to the hazard happening;
- Whether any existing control measures are effective;
- What action should be taken to control the risk; and
- How urgently the action needs to be taken.

Typically, a risk assessment for health and safety hazards is conducted using a risk matrix, which combines the severity of the risk with the likelihood of exposure to the hazard. Each activity has a separate row, and scores are given for risk both before and after control measures. If risk cannot be reduced below a certain threshold even with control measures the activity is deemed too risky, and it must be eliminated by finding a different way.

It may not be clear from the investigation report what the risks of acute exposure may be, so research may be needed to find out.

2.3 Controlling risks

The most important step in managing risks involves eliminating them so far as is reasonably practicable, or if that is not possible, minimising the risks so far as is reasonably practicable.

Work health and safety laws include a hierarchy of risk control, which ranks ways of controlling risks from the highest level of protection and reliability to the lowest.

As shown in Figure 2 below.

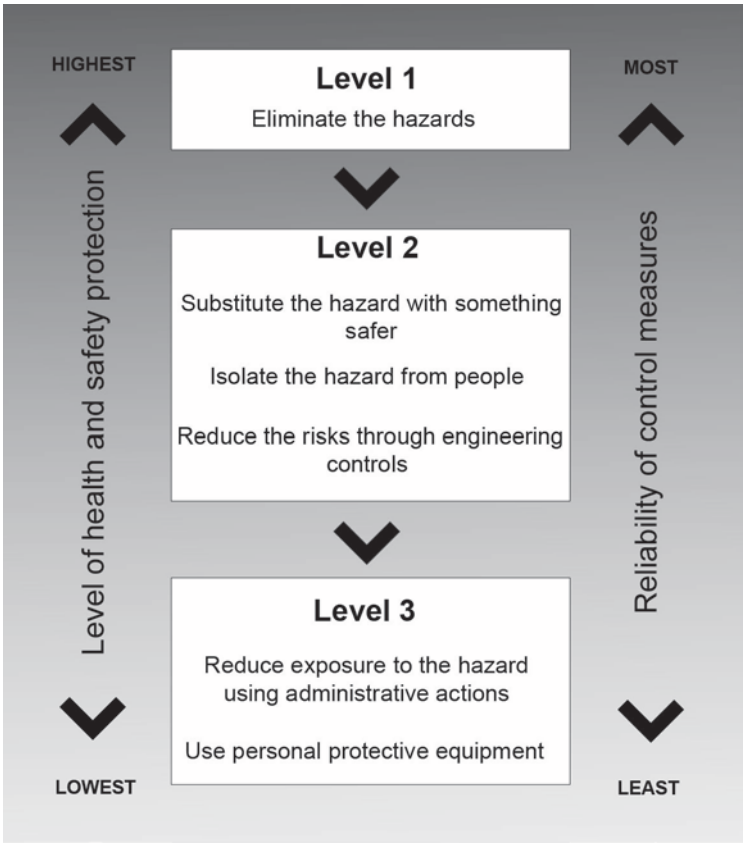


Figure 2: The hierarchy of risk control, from SafeWork Australia (2011).

Level 1

Level 1 control measures involve the **elimination** of the hazard and its associated risk and are the most preferred control measure.

The best way to do this is by not introducing the hazard. For example, the risk of a fall from height can be eliminated by doing the work at ground level.

If it is not possible to eliminate the hazard, then the aim should be to eliminate as many of the risks associated with the hazard as possible.

Level 2

Level 2 control measures involve **minimising** risks and are used if it is not reasonably practicable to eliminate the hazards and associated risks.

This can be done using one or more of the following approaches:

- Substituting the hazard with something safer, e.g. replacing a hazardous reactant with a less hazardous reactant during in-situ chemical oxidation;
- Isolating the hazard from people, e.g. Installing a fence around a pug mill operation to prevent unauthorised access; or
- Implementing engineering controls, e.g. deploying spill matts as standard under plant and equipment during on site refuelling.

If the available information is not relevant to the hazards and risks under consideration, it may be necessary to develop specific control measures. The control option chosen should be:

- One that provides the highest level of protection for people and is the most reliable—that is, a control located towards the top of the hierarchy in Figure 2;
- Available—that is, it can be purchased, made to suit or be put in place, and
- Suitable for the circumstances—that is, will work properly given the conditions, work process and the workers.

Implementing level 2 controls usually requires changes to the way work is carried out due to new or modified equipment or processes, new or different chemicals, or new PPE. It is usually necessary to support the control measures with:

- Work procedures;
- Training, instruction and information, and
- Supervision.

To encourage compliance and individual agency, it is important that all workers on the site understand why the controls are necessary as well as what the controls are. This is particularly important if the controls deviate from the way they normally work on sites that are not subject to remediation.

Level 3

Level 3 control measures involve **managing behaviour** to reduce risk. They do not control the hazard at the source and are the least preferred measure. They rely on human behaviour and supervision and, used on their own, tend to be least effective in minimising risks.

Two approaches to reduce risk in this way are:

- Administrative controls (e.g. work methods or procedures designed to minimise exposure to a hazard, such as a procedure on how to operate machinery safely, or signs to warn people of a hazard); and
- Personal protective equipment (PPE) (e.g. ear muffs, respirators, face masks, hard hats, gloves, aprons and protective eyewear. PPE limits exposure to the harmful effects of a hazard but only if workers wear and use the PPE correctly).

Level 3 controls should only be used:

- When there are no other practical control measures available (as a last resort);
- As an interim measure until a more effective way of controlling the risk can be used; and
- To supplement higher level control measures (as a back-up).

It is important to consider that implementing one control measure may introduce a different hazard, which then also needs to be managed. For example, managing a fall risk by using an elevated platform may introduce a plant and equipment hazard of contact with overhead power lines. Thus hazards cannot be considered in isolation,

rather controlling risks on a remediation project requires a holistic risk assessment, and finding the right combination of controls to maximise safety.

3. Documentation

Documentation is a key component of managing risks to health and safety. Documentation includes the health and safety plans stakeholders will refer to, along with recording of risk assessments, reporting incidents and control reviews.

It is useful to keep information on:

- The identified hazards, assessed risks and chosen control measures, including any hazard checklists, worksheets and assessment tools used in working through the risk management process;
- How and when control measures were implemented, monitored and reviewed;
- Who was consulted;
- Relevant training records; and
- Plans for changes.

There are specific record-keeping requirements for some hazards, such as hazardous chemicals.

Further information on documentation for remediation, including how the health and safety documentation may be included or informed by other documents, is provided in the NRF Guideline on Documentation and Record Keeping.

3.1 Health and safety plan

Every remediation site requires a health hand safety plan. Depending on the jurisdiction, the health and safety plan may be known under a different name (e.g. Site Safety Plan). If the hazards are straightforward it might be that generic plan is suitable, or a site-specific plan may need to be developed. Regardless the plan must include the risk management process steps including the controls. The safety plan should cover all the activities happening at the site, of which the remediation may be only one component. As such the plan will likely include elements that are not discussed in this guideline. Similarly, the plan may be included within as part of a larger remediation-related site plan (e.g. Site Management Plan, Remediation Action Plan

Some sites are ‘high risk construction sites’ and thus require a site-specific plan by law.

As with a more specific plan, the generic site safety plan should be made available to all workers and visitors via a formal site induction.

Templates and other work health and safety planning resources are widely available on both a free and fee-paying basis, but practitioners should always consult first with their state or territory safe work agency and environment protection authority to ensure that their planning and documentation meets local requirements.

An example of layout and content for a health and safety plan is provided as **Appendix B**.

3.2 Reviewing control measures

Control measures should be reviewed regularly to ensure they work as planned. Under work health and safety laws, there are certain situations where control measures must be reviewed and, if necessary, revised. A review is required:

- When the control measure is not effective in controlling the risk;
- Before a change that is likely to give rise to a new or different health and safety risk that the control measure may not effectively control;
- If a new hazard or risk is identified;
- If the results of consultation indicate that a review is necessary; or
- If a health and safety representative requests a review.

Ensuring that controls remain effective may be assisted by the following actions:

- **Accountability** for health and safety—accountability should be clearly allocated to ensure procedures are followed and maintained. Managers and supervisors should be provided with the authority and resources to implement and maintain control measures effectively;
- **Maintenance** of plant and equipment—this will involve regular inspection and testing, repair or replacement of damaged or worn plant and equipment;
- Up-to-date **training** and competency—control measures, particularly lower level controls, depend on all workers and supervisors having the appropriate competencies to do the job safely. Training should be provided to maintain competencies and to ensure new workers can work safely;
- Up-to-date hazard **information**—information about hazards, such as plant and substances, may be updated by manufacturers and suppliers and should be checked to make sure controls are still relevant. New technology may provide more effective solutions than were previously available. Changes to operating conditions or the way activities are carried out may also mean that control measures need to be updated; and
- Regular **review and consultation**—control measures are more effective where there is regular review of work procedures and consultation with workers and their representatives.

3.3 On-site documentation

The following documents should be continuously available on site in a place that can be accessed by everyone including the public:

- Health and safety plan;
- Emergency plan
- Safe work procedures;
- Information about symptoms of exposure to contaminants on the site;
- Information on personal hygiene and managing of tools and equipment to eliminate hazards;
- Information about what to do and who to contact in an emergency, and who to notify about an incident and
- Contacts for emergency response, including medical and incident notification.

4. Specific hazards and their controls

By their very nature remediation works will involve working around contamination. This guideline assumes the nature and extent of the contamination is relatively well understood, however unexpected finds may still occur.

Working around contamination can present other hazards to remediation workers that may not be present for general workers on the site, such as strong localised odours or potentially hazardous specialised remediation equipment.

The sections below detail the identification of hazards and likely controls for hazards specific to contamination and remediation works. It is noted that this list is not exhaustive and site-specific conditions should always be considered when conducting the health and safety risk assessment for remediation projects.

4.1 Chemical contamination

Chemical contaminants may include such things as:

- Heavy metals (such as lead, cadmium and mercury);
- Petroleum hydrocarbons and halogenated hydrocarbons;
- Polycyclic aromatic hydrocarbons;
- Pesticides;
- Herbicides;
- Polychlorinated biphenyls;
- Toxic, explosive and asphyxiant gases;
- Combustible substances; and
- Hazardous wastes.

The type of contamination, nature of the contaminated media (e.g. soil or groundwater) and level of contamination will be detailed in the previous contamination assessment reports or the remediation action plan (if available).

It is important to note that due to the differences in potential exposure times and opportunities, the concentrations of chemicals that pose a risk to ongoing site users (and hence trigger remediation) are often much lower than the concentrations of the same chemicals that pose a risk to remediation workers. As such, media that is contaminated and requires remediation does not automatically pose an immediate health risk to remediation workers. Instead, reference should be made to the occupational national exposure standards for each chemical to determine if concentrations warrant specific controls for remediation workers. It should be noted that there are mandatory requirements for risk control at sites which may be contaminated with **lead.** The national occupational exposure standards can be found through the Safe Work Australia website at <www.safeworkaustralia.gov.au>.

People may be exposed to chemical contaminants through inhalation, ingestion or skin absorption. The body absorbs chemicals mainly by:

- Direct contact with the skin or eyes (including exposure to dust);
- Penetration through the skin (either damaged or intact skin);

- Breathing in particles, dust, fibres or fumes and vapours;
- Swallowing soil particles or contaminated water; and
- Ingesting contaminated food or drinking water.

Following the identification of hazards and the assessment of associated risks, there is a range of control measures that can be considered. Using the hierarchy of controls, potential mitigation measures are presented in Table 1.

Table 1: Chemical contamination potential controls

Hierarchy level	Potential control
Level 1 – Eliminate (most preferred)	• Use of plant and equipment to handle contaminated media;
Level 2 – Minimise	• Use of containment such as barrels with lids, tarpaulins and covered trucks to limit the potential for exposure; • Preventing dust during earthworks, either by using water sprays or limiting work to calm days;
Level 3 – Manage behaviour (least preferred)	• Use of personal protective equipment such as gloves, full length clothing and safety glasses; • Requiring washing of hands prior to smoking, eating or drinking.

There are some contaminants that may be present on a site that are not included within this guideline, including:

- Radioactive material;
- Biological contamination; and
- Unexploded ordinance.

These contaminants are considered to require specialised knowledge and skills to safely assess, manage and remediate and are thus not included within this general guideline. Readers are encouraged to seek specialised advice prior to working on sites that may contain those contaminants.

4.2 Asbestos

Asbestos may be present at the site as ‘bonded’ material such as asbestos containing cement or linoleum, as friable fibrous lagging such as on pipe work and boilers, or as fibres within the soil.

The management and remediation of sites contaminated with asbestos is a specialised task and should only be carried out by specialist contractors. The specialist contractor will advise on the potential hazards, their control measures and the most appropriate remediation strategies.

It should be noted that there are mandatory requirements for risk control at sites which may be contaminated with **asbestos.** Asbestos-contaminated soil is subject to the requirements of several different regulatory agencies such as:

- Work Health and Safety regulators;

- Environmental Protection agencies;
- Public Health; and
- Local governments.

There are often mandatory control measures including reduction of dust during excavation and use of licenced and covered trucks for transport.

Readers should refer to their specialist contractor and jurisdictional work safe office for more information.

4.3 Dust

On contaminated sites, weather conditions and remediation activities may generate dust. This can lead to concerns about potential health impacts for workers as well as for people in the surrounding community. Small particles can travel much greater distances than larger particles. Small particles can cause health problems by entering the lungs, while larger particles are generally caught in the upper respiratory tract and may result in sinus congestion, sneezing or coughing.

Dust can also be a cause for community concern due to impacts on lifestyle and amenity of the area.

Site conditions should be considered when assessing the hazards and risks associated with dust, including the:

- Likely sources of dust generation;
- Potential toxicity of the dust (e.g. silica, asbestos, and characteristics of the chemical substances within particulate matter);
- Extent of the remediation area;
- Timing of the 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 techniques;
- Remediation work methods and staging of works;
- Impact of dust generation;
- Distance to nearest sensitive receptors;
- Weather station monitoring (before and during remediation), and
- Area/boundary monitoring for dust deposition, inhalable and respirable dust and respective contaminants.

Following the identification of hazards and the assessment of associated risks, there is a range of control measures that can be considered. Using the hierarchy of controls, potential mitigation measures are presented in Table 2.

Table 2: Dust potential controls

Hierarchy level	Potential control
Level 1 – Eliminate (most preferred)	• Light application of a water spray to dampen the soil but not saturate it, as potentially contaminated run-off from saturated soils entering adjacent sites, stormwater systems, or local waterways must be avoided (note: 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); • Spraying binders and a hydro-mulch; • A continuous cover of mulch, coarse sand and dolomite (effective even if used very thinly); • Vegetative cover—grassing (with native or introduced species) to effectively stop dust generation; • Use of groundcovers, such as tarps or geofabrics;
Level 2 – Minimise	• Minimising traffic and its speed on exposed soils; • Minimising exposed working areas during remediation, and • Minimising loose soil; • Rolling the site, particularly when the soil is moist, to compact the surface; • Installation of screens to act as windbreaks; • Fencing—solid fencing may have a small effect on wind patterns and may also contain some of the dust that is generated; • Undertaking dust-generating tasks during favourable weather conditions, e.g. low wind currents, favourable wind directions.

Stockpiles can represent a considerable source of dust, due to their height, uncompacted nature and (frequently) proximity to sensitive receptors. Management of stockpiles should include the following considerations:

- 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 effectively. The contents of the stockpile will dictate the level of cover, i.e. complete enclosure or the formation of a crust layer; and

- Stockpiles should have sufficient moisture content before being handled. Water can be applied the night before to allow it to infiltrate the stockpile.

An often-overlooked hazard in contaminated site remediation 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.

4.4 Offensive or noxious odours

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 hazard, such as:

- Explosive conditions;
- Toxic environments;
- Unacceptable health risks (either acute or chronic); and
- Objectionable odours.

Odours may also cause community concern as the public may perceive odours as posing a health risk to the community.

Site conditions should be considered when assessing the hazards and risks associated with offensive or noxious odours, including the:

- Volatility and toxicity of the chemical substance(s);
- Typical and expected atmospheric and weather conditions;
- Naturally occurring volatiles, e.g. hydrogen sulphide;
- Odour thresholds;
- Modelling of potential odour movement and intensity;
- Location and extent of potentially affected areas;
- Distance to nearest sensitive receptors;
- Determination of acceptable off-site concentrations;
- Duration of potential exposure;
- Potential subsurface migration of volatile sources during remediation;
- Contingency planning for unexpected volatile emissions;
- Local regulatory requirements; and
- Whether monitoring airborne chemical substances on the site may be necessary.

When dealing with volatile pollutants, an assessment should be made of the need for the regular analysis of atmospheric levels of pollutants (e.g. benzene) on site and at site boundaries to ensure that workers and residents are not being exposed to unacceptable levels that may give rise to adverse health effects.

Following the identification of hazards and the assessment of associated risks, there is a range of control measures that can be considered. Using the hierarchy of controls, potential mitigation measures are presented in Table 3.

Table 3: Offensive or noxious odours potential controls

Hierarchy level	Potential control
Level 1 – Eliminate (most preferred)	• 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 (e.g. with a large tent) during all activities; • Treating (using adsorption, thermal or filtration methods) all controlled emissions (e.g. during bioremediation, air sparging or product recovery); • Immediately and completely removing offensive odorous material off site.
Level 2 – Minimise	• Minimising the exposed surface area of odorous/noxious material, (e.g. 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, (e.g. in times of lower temperatures or favourable winds);
Level 3 – Manage behaviour (least preferred)	• Personal protective equipment such as respirators.

In addition, site boundary and community monitoring of offensive odours should be regularly undertaken during remediation and management of problematic sites. Site work practices relating to odour-generating activities should be promptly amended or stopped and reassessed in response to the results of boundary and community monitoring.

For further information on communicating with the community readers are directed to the NRF Guideline on stakeholder engagement.

4.5 Contaminated waste

The remediation of site contamination will very often generate contaminated waste. Sources of contaminated waste can include:

- Contaminated soil or groundwater;
- Used PPE such as gloves or coveralls;
- Single-use equipment such as tarpaulins that covered stockpiles; or
- Building rubble.

Site conditions should be considered when assessing the hazards and risks associated with contaminated waste, including the:

- Toxicity of contaminants;
- Life cycle of contaminants, and
- Life cycle of the waste product.

Following the identification of hazards and the assessment of associated risks, there is a range of control measures that can be considered. Using the hierarchy of controls, potential mitigation measures are presented in Table 4.

Table 4: Contaminated waste potential controls

Hierarchy level	Potential control
Level 1 – Eliminate (most preferred)	• Changing work methods avoid generating contaminated waste or reduce/minimise the volume generated;
Level 2 – Minimise	• Selecting different equipment that can be decontaminated on site before reuse or disposal;
Level 3 – Manage behaviour (least preferred)	• Complying with the specific packaging, handling and transport requirements of contaminants; or • Labelling containers with appropriate hazard warnings and waste producer contact details.

Every jurisdiction has regulation and guidance regarding the handling, transport and disposal of contaminated waste, including contaminated soil and groundwater. Readers should refer to their local EPA for details on the local requirements and facilities available.

It should be noted that contaminated waste is usually only allowed to be disposed of to landfill, which is the least preferred method on the waste disposal hierarchy. Thus, minimising contaminated waste can assist with increasing the sustainability of remediation. For more information on sustainability in remediation readers are directed to the NRF *Guideline on performing cost-benefit and sustainability analysis of remediation options*.

4.6 Carryover to public areas

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.

Site conditions should be considered when assessing the hazards and risks associated with carryover to public areas, including the:

- Type of soil on site (e.g. clay may carry over more than sand);
- Type of vehicles operating on site (e.g. heavy or light vehicles, with tracks or tyres);
- Nature and extent of earthworks;
- Anticipated weather conditions; and

- Nature of the public spaces and roadways adjacent to the site.

Following the identification of hazards and the assessment of associated risks, there is a range of control measures that can be considered. Using the hierarchy of controls, potential mitigation measures are presented in Table 5.

Table 5: Carryover into public areas potential controls

Hierarchy level	Potential control
Level 1 – Eliminate (most preferred)	• Selecting different equipment, such as a smaller excavator or a different type of tread or tyre;
Level 2 – Minimise	• Changing work methods to limit soil clinging to vehicles;
Level 3 – Manage behaviour (least preferred)	• Limiting vehicle access to bare soil • Decontaminating mobile plant and equipment prior to leaving site

If decontamination is required, then:

- Contaminated plant and equipment should be thoroughly cleaned by washing wheels, underbody and wheel arches;
- Vehicle washing systems should include facilities for handling and disposing of potentially contaminated wash water;
- Rumble strips should be installed to help dislodge dust and mud:
  - At the ingress to the wash system if washing is required; or
  - Set back from the exit to the site if washing is not required.
- Drivers should stay in the cabs of their plant until washing has been completed to avoid the spread of contaminants; and
- Periodic vacuuming of plant cabs to prevent the build-up of contaminants.

4.7 Remediation equipment

Some remediation equipment is highly specialised and carries hazards during operation. Typically, these systems will be managed and overseen by a specialist contractor who is familiar with the operation, potential hazards and appropriate controls. That contractor will have health and safety information pertinent to that equipment which should be included within the site health and safety plan.

Common controls for applying equipment specific controls to the wider site include:

- Preventing unauthorised people from being exposed to the hazard (e.g. by using physical barriers); and
- Requiring training prior to operation.

Readers should consult the individual contractors or manufacturers for more information on specific hazards posed by remediation equipment.

4.8 Unexpected finds

In addition to the contamination known to be on the site, remediation works may uncover areas of previously unknown to be contaminated, referred to as an

'unexpected find'. These may be new areas of contamination similar in nature to that already at the site, or it may be a new type of contamination not previously identified at the site.

Unexpected finds are special cases that need to be addressed on a case by case basis, commencing with stopping work in the area and consulting the environmental practitioner. Once the nature and extent of the unexpected find has been determined the risks and controls can be incorporated into the health and safety plan for the site.

The health and safety plan should have a procedure for handling unexpected finds or refer to the procedure documented elsewhere (e.g. in the remediation action plan).

4.9 Long-term monitoring

In some instances, monitoring of a site long-term is necessary as part of remediation, or validation, or both. The development of long-term monitoring program must include the risk management process to identify the hazards and assess and control the risks for workers carrying out the monitoring as well as members of the public.

The hazards and risks associated with long-term monitoring of a site can be like those associated with 'active' remediation of the same site, however there are additional considerations to be made such as:

- Are inductions and other training still valid?
- Are the monitoring points easily accessible or might they require heavy lifting (e.g. of covers or gates) or maintenance (e.g. mowing of grass);
- Are there biological hazards present (e.g. snakes or spiders) that may not have been present during 'active' remediation;
- Has the weather been accounted for;
- Will the worker be isolated, working alone or travelling long distances between locations;
- Will the worker be using hazardous chemicals that require management;
- Will the monitoring generate contaminated waste or materials hazardous to other site users, the public or the environment;

Further information on long term monitoring requirements is available in the NRF *Guideline on implementing long-term monitoring*.

4.10 Outdoor work

Many remediation projects involve working outdoors for some or most of the working day. Site conditions should be considered when assessing the hazards and risks associated with outdoor work, including:

- Reduced capacity for maintaining personal hygiene;
- Exposure to solar ultraviolet rays;
- Exposure to cold;
- Exposure to wet weather; and
- Biological hazards.

Following the identification of hazards and the assessment of associated risks, there is a range of control measures that can be considered. Using the hierarchy of controls, potential mitigation measures are presented in Table 6.

Table 6: Outdoor work potential controls

Hierarchy level	Potential control
Level 1 – Eliminate (most preferred)	• Changing work practices to avoid adverse weather, particularly hot weather (e.g. starting and finishing earlier in the day); • Rearranging the work schedule to avoid exacerbating adverse weather (e.g. completing work inside or in vehicles on very hot days); • Accounting for 'wet bulb' temperature when assessing the risk of a hot day;
Level 2 – Minimise	• Shelter for eating meals and taking breaks; • Shelter for protection against adverse weather conditions, including either heating or cooling as appropriate for the weather; • Access to hand washing and toilet facilities; • Training workers to recognise and act on the signs of heat strain or hypothermia;
Level 3 – Manage behaviour (least preferred)	• Providing appropriate PPE - Hot weather: wide brim hat, long-sleeved collared shirt, long pants, sunglasses and sunscreen; - Cold weather: windbreaker or warm jacket, gloves, beanie, long pants, wet weather gear.

Environmental work often involves entering parts of sites that are seldom visited or not well maintained. Thus, biological hazards can exist for remediation workers that may not be identified in a site's regular health and safety program.

Biological hazards include such things as dogs, cattle, snakes, spiders, ticks, leeches and mosquitos. These hazards are not limited to remote or rural sites; e.g. snake habitat can include piles of undisturbed timber on a building site and spider habitat can include groundwater monitoring well gatic covers.

Following the identification of hazards and the assessment of associated risks, there is a range of control measures that can be considered. Potential mitigation measures may include:

- Changing work practices to avoid certain times of the day;
- Co-ordinating with the animal owner to remove / restrain the animal for the duration of works;
- Training the worker what snake habitat looks like, including both urban and rural habitat;

- Cutting of long grass, draining of standing water or strategic application of pesticides prior to commencement of works;
- Utilising PPE such as boots above the ankle, gaiters or thick gloves; and
- First aid training in the treatment of biological injuries.

4.11 Remote or isolated work

Some remediation work is carried out in places that are remote or isolated due to the location, time or nature of the work being done. In some situations, a worker may be alone for a short time (e.g. conducting regular boundary monitoring or repairing fences on a large site away from other workers). In other situations, the worker may be on their own for days or weeks in remote locations.

Working alone or remotely increases the risks in any job. Site conditions should be considered when assessing the hazards and risks associated with remote or isolated work, including the:

- Length of time the person may be working alone;
- Time of day when a person may be working alone;
- Access to communication;
- Location of the work;
- Nature of the work; and
- Skills and capabilities of the worker.

Following the identification of hazards and the assessment of associated risks, there is a range of control measures that can be considered. Using the hierarchy of controls, potential mitigation measures are presented in Table 7.

Table 7: Remote or isolated work potential controls.

Hierarchy level	Potential control
Level 1 – Eliminate (most preferred)	• Arranging scheduled welfare checks, where the alarm is raised automatically if a worker fails to check in; • Preparing a work schedule that mitigates fatigue, including when driving; • Arranging regular calls with family, friends or co-workers to relieve loneliness and boredom;
Level 2 – Minimise	• Having at least two people work together to complete jobs away from the rest of the workforce; • Having at least two people at the site at any time the site is operational, including one 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; and • Having emergency and contingency plans and supplies of food and water should workers become isolated.

4.12 Underground services or utilities

One of the major hazards associated with excavation or drilling during remediation activities is potentially striking an underground service, utility or structure, including:

- Electricity cables;
- Gas pipelines;
- Water pipelines;
- Sewerage pipes and systems;
- Communications cables;
- Underground storage tanks;
- Irrigation systems;
- Basement voids; and
- Mine shafts.

Before commencing excavation work, all reasonable steps must be taken to obtain current underground services information that relates to the site and areas adjacent to the site. Every person carrying out the excavation must be given this information and it

must be available for inspection by relevant authorities until the excavation is completed.

Relevant information includes:

- The services that may be affected;
- The location, including depth, of any pipes, cables or other plant associated with the affected services; and
- Any conditions on the proposed excavation work.

General location of underground services or utilities, tanks, basements, shafts, sinkholes or similar can be determined by several different methods, including:

- Contacting organisations that can assist in locating underground services (e.g. Dial Before You Dig—1100);
- Utilising professional service location specialists, including ground penetrating radar;
- Examining the records and other information held by the site owners or from local utility companies;
- Observing signage near the planned excavation location; or
- Anecdotal evidence from site workers or local residents.

Following the identification of hazards and the assessment of associated risks, there is a range of control measures that can be considered. Using the hierarchy of controls, potential mitigation measures are presented in Table 8.

Table 8: Underground services or utilities potential controls.

Hierarchy level	Potential control
Level 1 – Eliminate (most preferred)	• Changing the location of excavations to avoid services; • Temporary or permanent disconnection of the service. •
Level 2 – Minimise	• Utilisation of hand excavation (shovels or hand augers) prior to or instead of the use of mechanical excavators; • Non-destructive drilling to confirm the presence/absence of a suspected service prior to the use of mechanical excavators.

If any suspect or unexpected structures or damage to a service occurs:

- The excavation should be halted;
- Emergency procedures should be enacted if required, such as deploying spill kits, isolating the area or removing sources of ignition;
- If safe, the excavation should be inspected, and the service or structure identified;
- The appropriate utility company or service provider must be advised as soon as possible;

- The excavation must be left open, suitably fenced, with appropriate warning notices posted.

If a gas pipe has been damaged immediate action should include:

Restriction of any activity which might provide a source of ignition,

Placement of an exclusion zone around the area until the utility company's representatives arrive on site.

4.13 Ground stability

The vibration from excavation and drilling, from plant, or from the movement of heavily laden trucks can sometimes result in the collapse of pits, or damage to foundations of adjacent structures or to underground services or utilities.

Site conditions should be considered when assessing the hazards and risks associated with ground stability, including the current or former presence of:

- Mining activity;
- Excavation of pits or cellars;
- Underground storage tanks;
- Slurry pits;
- Settling ponds;
- Lagoons;
- Sub-surface combustion;
- Unconsolidated soil or fill material.

Following the identification of hazards and the assessment of associated risks, there is a range of control measures that can be considered. Using the hierarchy of controls, potential mitigation measures are presented in Table 9.

Table 9: Ground stability potential controls.

Hierarchy level	Potential control
Level 1 – Eliminate (most preferred)	• Geotechnical testing prior to commencing works; • Changing equipment to avoid the use of heavy plant and equipment;
Level 2 – Minimise	• Changing work methods to avoid excessive vibrations; • Using geofabrics to support unstable ground (The design and use of geofabrics for supporting equipment should be approved by a suitably qualified geotechnical engineer). • Securing excavations with fencing a suitable distance from the lip; • Backfilling excavations as soon as practicable.

4.14 Excavations

Excavation work generally means work involving the removal of soil or rock from a site to form an open face, hole or cavity using tools, machinery or explosives. Excavation is very common on remediation sites and includes holes and trenches.

Specific hazards associated with excavations include:

- A person falling into an excavation;
- A person working in an excavation being:
  - Trapped by the failure of excavation wall(s);
  - Struck by a falling thing, or
  - Exposed to an airborne contaminant.
- Instability of an adjoining structure caused by the excavation;
- Hazardous atmosphere in an excavation, particularly is there are volatile contaminants present;
- Plant striking underground services during excavation; and
- Plant striking overhead services (powerlines) during excavation or movement.

Excavation failures are particularly dangerous as they may occur quickly, limiting the ability of workers (and, in some cases, others in the vicinity) to escape, especially if the collapse is extensive. The speed of an excavation collapse increases the risk associated with this type of work and the consequences are significant as the falling earth can bury or crush any person in its path. This can result in death by suffocation or internal crush injuries.

Following the identification of hazards and the assessment of associated risks, there is a range of control measures that can be considered. Using the hierarchy of controls, potential mitigation measures are presented in Table 10 below.

Table 10: Excavations potential controls

Hierarchy level	Potential control
Level 1 – Eliminate (most preferred)	• Seeking the advice of a geotechnical engineer prior to excavations, particularly if they are adjacent to: - Buildings; - Roadways; - Railways; - Footings or foundations; or - Swimming pools. • Installing barricades or fences to prevent accidental ingress into the trench by people or animals; • Not entering excavations: - Unless appropriate controls are in place; - At all if there is seepage occurring; - At all if there is evidence of unstable walls or previous collapse.
Level 2 – Minimise	• Limiting the number and depth of excavations that are open at any one time; • Backfilling excavations as soon as practicable; • Benching or battering the sides of the excavation to reduce the risk of ground collapse; • Installing shoring in trenches to reduce the risk of collapse; • Placing spoil away from the lip of the excavation to reduce load; • Not leaving an excavation open overnight. If it cannot be backfilled, cover with road plates or similar;
Level 3 – Manage behaviour (least preferred)	• Installing warning signs and flagging near excavations; and • Use of PPE such as hard hats and fall arrestors.

4.15 Confined spaces

A confined space is determined by the hazards associated with a set of specific circumstances and not just because work is performed in a small space. A confined space means an enclosed or partially enclosed space that:

- Is not designed or intended primarily to be occupied by a person; and
- Is, or is designed or intended to be, at normal atmospheric pressure while any person is in the space; and
- That person is or is likely to be a risk to health and safety from:

- An atmosphere that does not have a safe oxygen level; or
- Contaminants, including airborne gases, vapours and dusts that may cause injury from fire or explosion; or
- Harmful concentrations of any airborne contaminants; or
- Engulfment.

Confined spaces are commonly found in:

- Vats;
- Tanks;
- Pits;
- Pipes;
- Ducts;
- Flues;
- Chimneys;
- Silos;
- Pressure vessels;
- Sewers or septic tanks;
- Wet or dry wells;
- Trenches or tunnels.

The risks of working in confined spaces include:

- Loss of consciousness, impairment, injury or death due to the immediate effects of airborne contaminants;
- Fire or explosion from the ignition of flammable contaminants;
- Asphyxiation resulting from oxygen deficiency or immersion in a free-flowing material, such as liquids, grain, sand, fertiliser or water; and
- Difficulty rescuing and treating an injured or unconscious person.

There are many specific requirements under work health and safety laws that must be met in relation to work undertaken in confined spaces, including training and licensing of any person that enters a confined space.

It is preferable to alter the work such that entry into the confined space is not required, however if this is not possible then a suitably trained and licenced person should be consulted for site-specific hazard identification, control measures and to undertake the work.

4.16 Hazardous chemicals and dangerous goods

It is common during remediation works that hazardous chemicals or dangerous goods will either be the subject of the remediation or used during the remediation process.

Under work health and safety laws, hazardous chemicals and dangerous goods are covered under a single framework that includes a hazard classification and communication system based on the United Nations' *Globally Harmonised System of*

Classification and Labelling of Chemicals (GHS). Hazardous chemicals are those that, following worker exposure, can have an adverse effect on health. Examples of hazardous chemicals include poisons, chemicals that can cause burns or skin and eye irritation, and chemicals that may cause cancer. Many hazardous chemicals are also classified as dangerous goods. Dangerous goods are chemicals, mixtures or articles that, because of their physical, chemical or acute toxicity properties, present an immediate hazard to people, property or the environment. Types of chemicals classified as dangerous goods include explosives, flammable liquids and gases, corrosives, chemically reactive or highly toxic chemicals. Many dangerous goods are also classed as hazardous chemicals.

Examples of hazardous chemicals or dangerous goods that may be encountered on a remediation site include:

- Petroleum products, including residue in underground storage tanks;
- Chlorinated hydrocarbons;
- Chemical adhesives;
- Solvents for cleaning or calibrating equipment; or
- Chemicals used as additives for in-situ chemical oxidation;

There are two broad types of hazards associated with hazardous chemicals which may present an immediate or long-term injury or illness to people. These are:

- **Health hazards –** These are properties of a chemical that have the potential to cause adverse health effects. Exposure usually occurs through inhalation, skin contact or ingestion. Adverse health effects can be acute (short-term) or chronic (long-term), with some having long latency periods before presenting with effects. Typical acute health effects include headaches, nausea or vomiting and skin corrosion, while chronic health effects include asthma, dermatitis, nerve damage or cancer.
- **Physicochemical hazards** – These are physical or chemical properties of the chemical, mixture or article that pose risks to workers other than health risks, as they do not occur because of the biological interaction of the chemical with people. They arise through inappropriate handling or use and can often result in injury to people and/or damage to property because of the intrinsic physical hazard. Examples of physicochemical hazards include flammable, corrosive, explosive, chemically reactive and oxidising chemicals.

Many chemicals have both health and physicochemical hazards.

Following the identification of hazards and the assessment of associated risks, there is a range of control measures that can be considered. Using the hierarchy of controls, potential mitigation measures are presented in Table 11.

Table 11: Hazardous chemicals and dangerous goods potential controls.

Hierarchy level	Potential control
Level 1 – Eliminate (most preferred)	• Substituting with another method (e.g. using nails instead of chemical-based adhesives); • Substituting with a different form of the product (e.g. using pre-mixed or diluted chemicals instead of manually mixing or diluting chemicals at the site)
Level 2 – Minimise	• Substituting a hazardous chemical with a chemical that is less hazardous and presents lower risks (e.g. using hazardous chemicals with a single hazard class rather than those with multiple hazards); • Substituting with a different form of the product (e.g. using a product in paste or pellet form rather than as a dust or powder). • Enclosing the process involving the hazard (e.g. using a fume cupboard); or • Distancing workers from hazardous chemicals (e.g. restricted zones where only certain personnel are allowed). • Isolating chemicals from other chemicals (e.g. by physically separating incompatible chemicals, achieved by distance, barriers, or a combination of barriers and distance); • Vapour capture systems, particularly on specialised remediation equipment; • Chemical storage cupboards that comply with relevant legislation; • Intrinsically safe electrical equipment in hazardous areas; • Fume hoods; • Fans for local ventilation;

Hierarchy level	Potential control
Level 3 – Manage behaviour (least preferred)	• Requiring doors to be open during certain activities; • Use of portable gas detectors to monitor the local atmosphere. • Appropriate signage; • Training of workers; • Restricting personnel allowed into high risk areas to those who have been trained. • PPE specific to the chemical being used, including: - Gloves; - Aprons; - Coveralls; - Protective eyewear; or - Breathing protection.

Work health and safety laws include specific requirements for the management of risks to health and safety associated with using, handling, generating and storing hazardous chemicals. The reader should consult their relevant work safety office for more information on their legal responsibilities.

4.17 Hazardous manual tasks

Manual work is common during remediation work, and some manual tasks can be hazardous. A hazardous manual task is any task that requires a person to lift, lower, push, pull, carry or otherwise move, hold or restrain any person, animal or thing involving one or more of:

- Repetitive or sustained force;
- High or sudden force;
- Repetitive movement;
- Sustained or awkward posture; or
- Exposure to vibration.

Examples of hazardous manual tasks that may be encountered on a remediation site include:

- Carrying sections of fence;
- Lifting validation sample containers into a car;
- Installing remediation equipment; or
- Using a vibration compactor.

Work health and safety laws consider hazardous manual tasks in the context of their impact on the musculoskeletal system of a worker. Musculoskeletal disorders may include conditions such as:

- Sprains and strains of muscles, ligaments and tendons;
- Back injuries, including damage to the muscles, tendons, ligaments, spinal discs, nerves, joints and bones;
- Joint and bone injuries or degeneration, including injuries to the shoulder, elbow, wrist, hip, knee, ankle, hands and feet;
- Nerve injuries or compression, e.g. carpal tunnel syndrome;
- Muscular and vascular disorders as a result of hand-arm vibration;
- Soft tissue hernias, and
- Chronic pain.

Musculoskeletal disorders occur in three ways:

- Gradual wear and tear to joints, ligaments, muscles and inter-vertebral discs caused by repeated or continuous use of the same body parts, including static body positions;
- Sudden damage caused by strenuous activity, or unexpected movements such as when loads being handled move or change position suddenly; or
- A combination of these mechanisms, for example, body tissue that has been weakened by cumulative damage may be vulnerable to sudden injury by lower forces.

Following the identification of hazards and the assessment of associated risks, there is a range of control measures that can be considered. Using the hierarchy of controls, potential mitigation measures are presented in Table 12.

Table 12: Hazardous manual tasks potential controls

Hierarchy level	Potential control
Level 1 – Eliminate (most preferred)	• Changing work practices to eliminate the hazard (e.g. using equipment that comes in smaller, easier to handle pieces); • Changing work practices to substituting the hazard with something that gives rise to a lesser risk (e.g. replacing hand tools with power tools to reduce the level of force required to do the task); • Isolating the hazard from any person exposed to it (e.g. isolating vibrating machinery from the user providing fully independent seating on mobile plant);
Level 2 – Minimise	• Use of mechanical lifting aids
Level 3 – Manage behaviour (least preferred)	• Implementing administrative controls (e.g. by rotating workers between different tasks to reduce exposure); or • PPE (e.g. gloves).

4.18 Slips, trips and falls

The nature of remediation work often creates fall hazards. Fall hazards are found where work is carried out at height, for example, loading and unloading a large truck. Falls can also occur at ground level into holes, for example trenches or service pits.

Site conditions should be considered when assessing the hazards and risks associated with outdoor work, including:

- Any structure or plant being constructed or installed, demolished or dismantled, inspected, tested, repaired or cleaned;
- Fragile surfaces (e.g. cement sheeting roofs, rusty metal roofs, fibreglass sheeting roofs and skylights);
- Potentially unstable surfaces (e.g. areas where there is potential for ground collapse);
- Using equipment to work at the elevated level (e.g. when using elevating work platforms or portable ladders);
- Sloping or slippery surfaces where it is difficult for people to maintain their balance (e.g. a stockpile);
- Unprotected open edges; and
- Holes, shafts or pits into which a worker could fall (e.g. trenches or service pits).

A checklist may be useful to identify hazards and risks relating to falls. Key things to look for include:

- Surfaces, including the:
  - Stability, fragility or brittleness;
  - Potential to slip;
  - Safe movement of workers where surfaces change;
  - Strength or capability to support loads;
  - Slope of work surfaces, e.g. where they exceed 7 degrees.
- Levels, including:
  - Where levels change, and workers may be exposed to a fall from one level to another;
  - Evenness and stability of the ground for safe support of scaffolding or a work platform;
  - Open edges of floors, working platforms, walkways, walls or roofs;
  - Holes, openings or excavations;
- Structures, including the:
  - Stability of temporary or permanent structures.
- Working area;
  - Whether it is crowded or cluttered and the entry and exit from the area;

- Places where hand grip may be lost.

In some situations, advice may be needed from technical specialists, such as structural engineers, to check the stability of structures or load bearing capacity.

Following the identification of hazards and the assessment of associated risks, there is a range of control measures that can be considered. Using the hierarchy of controls, potential mitigation measures are presented in Table 13.

Table 13: Slips, trips and falls potential controls.

Hierarchy level	Potential control
Level 1 – Eliminate (most preferred)	• Carrying out any risk-related work on the ground; • Carrying out work on solid construction; • Backfilling excavations as soon as practicable. •
Level 2 – Minimise	• Battering excavations to lessen the height to fall; or • Providing safe ingress and egress from heights to avoid risky behaviour. • Fences around open excavations and trenches; • Permanently installed guard rails around the edges of a roof;
Level 3 – Manage behaviour (least preferred)	• Signage of open excavations or trenches; • Signage of people working above; and • Training. • PPE such as - A work positioning system (e.g. an industrial rope access system); or - A fall-arrest system.

In some cases, a combination of control measures may be necessary, for example using a safety harness while working from an elevating work platform.

4.19 Plant and equipment

Most remediation projects involve the use of plant and equipment. There are significant risks associated with using plant and severe injuries can result from the unsafe use of plant, including:

- Limbs amputated by unguarded moving parts of machines;
- Being crushed by mobile plant;
- Sustaining fractures from falls while accessing, operating or maintaining plant;
- Electric shock from plant that is not adequately protected or isolated;

- Burns or scalds due to contact with hot surfaces, or exposure to flames or hot fluids;
- Hearing loss due to noisy plant; or
- Musculoskeletal disorders caused by operating plant that is poorly designed.

Examples of plant and equipment hazards that may be encountered on a remediation site include:

- Improper use of equipment, including power tools;
- Pedestrians being struck by vehicles moving around the site;
- Hazards from being close to, on top of, or beneath operating plant or equipment.
- Reversing equipment or plant;
- Extension of hydraulic arms on a backhoe or excavator;
- Rotating equipment, particularly on drilling rigs;
- Compressed air equipment operating above 50 psi;
- Circumference of body-swing of a tracked excavator;
- Suspended loads;
- Tall machinery and surveyors' poles contacting overhead power lines, pipes or bridges;
- Blow-back from pressurised drilling equipment; and
- Air blast from compressed air equipment.

Following the identification of hazards and the assessment of associated risks, there is a range of control measures that can be considered. Using the hierarchy of controls, potential mitigation measures are presented in Table 14.

Table 14: Plant and equipment potential controls.

Hierarchy level	Potential control
Level 1 – Eliminate (most preferred)	• Using machinery designed and built to produce low noise levels; • Reducing the number of plant on site at any one time • Using that is safer in the circumstances (e.g. using a cordless drill instead of an electric drill if the power cord is in danger of being cut); • Constructing a booth from which the plant can be operated remotely.

Hierarchy level	Potential control
Level 2 – Minimise	• Using the smallest plant capable of performing the task • Using barriers to separate plant from pedestrians • Installing guards to prevent contact with moving parts of machinery; or • Installing automatic systems (e.g. automatic tarpaulin activators on haulage trucks).
Level 3 – Manage behaviour (least preferred)	• Implementing a tag-out, lock out system to ensure that workers are aware that the plant is isolated from its power source and must not be operated while maintenance or cleaning work is being done; or • Signage to indicate that plant or equipment is operating. • PPE, including - Heat resistant clothing or material; - Gloves; - Hard hats; - Hearing protectors; and - Protective eyewear.

Specific controls are required by law for certain types of plant, such as:

- Powered mobile plant
- Plant that lifts or suspends loads
- Industrial robots
- Lasers
- Pressure equipment
- Scaffolds.

References to relevant Australian Standards are provided in Appendix C, and readers are encouraged to contact their jurisdictional safe work office for more information.

4.20 Noise

Many remediation projects will be noisy environments for at least some of the time, particularly those involving heavy machinery or specialised remediation equipment. Some noise is hazardous. Hazardous noise affects the functioning of the inner ear, which may cause temporary hearing loss or tinnitus. After a period away from noise, hearing may be restored. With further exposure to hazardous noise, the ear will gradually lose its ability to recover and the hearing loss will become permanent. Permanent hearing loss can also occur suddenly if a person is exposed to very loud impact or explosive sounds. The degree of hearing loss that occurs is dependent on how loud the noise is, how long someone is exposed to it and, to some extent,

individual susceptibility. The frequency or pitch can also have some effect on hearing loss, since high-pitched sounds are more damaging than low-pitched ones.

Noise from remediation activities can also be a nuisance to members of the public near a site. Noise that is a nuisance can occur at decibels below that which is considered unsafe.

Examples of noise hazards that may be encountered on a remediation site include:

- Drilling rigs;
- Heavy machinery;
- Power tools;
- Specialised remediation equipment, such as diesel pumps for groundwater extraction;
- Normal site operations (e.g. if the remediation is occurring inside an operational factory).

Following the identification of hazards and the assessment of associated risks, there is a range of control measures that can be considered. Using the hierarchy of controls, potential mitigation measures are presented in Table 15.

Table 15: Noise potential controls.

Hierarchy level	Potential control
Level 1 – Eliminate (most preferred)	• Ceasing to use • Changing the way work is carried out so hazardous noise is not produced a noisy machine • Substituting the hazard with plant or processes that are quieter
Level 2 – Minimise	• Using engineering controls to modify equipment or processes (such as mufflers); • Isolating the source of noise from people by using distance, barriers, enclosures; • Deploying sound-absorbing surfaces
Level 3 – Manage behaviour (least preferred)	• Reduce the time people are exposed to noise; • Restricting access to noisy areas; or • Appropriate signage. • Appropriate PPE, including: - Ear-muffs; - Ear-plugs.

5. Site-wide controls

As there are several hazards that are unique to contamination remediation sites, so to there are controls that are unique, even when they fall under categories found on many regular construction sites. It may be that these controls can be implemented to control the risks posed by several hazards at once.

5.1 Site access and security

Appropriate on-site security during remediation activities may be necessary to:

- Protect workers and the public from potential risks from earthworks (e.g. trenching, earthmoving operations and traffic),
- Limit exposure from contaminated soil;
- Protect equipment against vandalism and theft.

It is important to ensure that worker and public access to the site is controlled both during and after working hours.

The following topics should be considered when planning appropriate site security;

- Types and concentrations of chemicals on site;
- Toxicity of chemical chemicals;
- Types of operations to be carried out on site—e.g. excavations, use of plant machinery;
- Usual use of the site (e.g. A vacant lot or a school building);
- Ease of public access;
- Public safety (all hours);
- Vehicle access;
- Size of site;
- Fencing, and
- Location of site.

Potential safety measures include:

- Secure fencing to restrict access to the entire site;
- Fencing to provide protection from specific physical hazards. Unsupervised excavations (including boreholes) should never be left open or unfenced as they present a hazard to site personnel, visitors and animals;
- Restriction of access to areas of the site to certain specifically trained or equipped personnel. (e.g. Restriction of vehicles to suitable vehicles and intrinsically safe rated electrical equipment due to explosive vapour hazard.
- A requirement that all visitors report to the site office upon arrival at the site;
- Site induction for all workers and visitors to the site;
- Records kept of all people attending the site, and

- Signage.

The details of security will be site specific. However, it is normal practice to set up a restricted zone around areas where work is being carried out and to limit access to this area to essential personnel. The restricted zone may be marked in many ways ranging from portable signs or bunting to full barriers and fencing. On small sites the entire site may be considered a restricted 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. Signage, while important, is a relatively unsatisfactory way of communicating information to people about the site and should be used to complement other safety measures that are being considered.

Temporary relocation of occupants of the site may also need to be considered to diminish the potential for interference. Consideration should be given to timing remediation and management activities to coincide with periods when site occupants are absent, for example, scheduling activities at a school to coincide with holiday periods.

5.2 Hazard training for workers

Training aims to ensure that workers:

- Understand the hazards and risks associated with work on a contaminated site, particularly their health effects;
- Are not likely to cause harm to themselves or others, and
- Know how to use any mobile plant and equipment and personal protective equipment and clothing.

It is essential that workers who may be exposed to contamination hazards on site are trained in:

- Information on the primary routes of exposure;
- Health effects of contaminants on the site,
- Control measures,
- Correct use of protective clothing and equipment; and
- Details of health monitoring (when it is needed and what it will involve).

General hazard training for all workers should include:

- Information on contaminants and all identified hazards at the site;
- How to identify hazards;
- Procedures for reporting hazards to a supervisor
- Safe procedures, including the use of personal protective clothing and equipment;
- Spill procedure, including clean-up; and
- Emergency evacuation procedures.

5.3 Hygiene facilities

On contaminated sites, personal hygiene is essential for mitigating possible exposure to contaminants.

It is important that workers wash their hands before eating, drinking or smoking. 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 chemicals. A separate support facility in a clean area sufficiently remote from the operations should be set aside for use during meal or rest breaks.

Where there are significant levels of contamination, the risk management process may identify a need for additional hygiene measures and work procedures. Such measures may include a serviced hygiene unit or restricted zones to control exposure.

A serviced hygiene unit should be set up at the most convenient access and egress point to a contaminated area. This reduces the risk of workers coming in contact with contaminants after leaving the work area and prevents others outside the work site being exposed to contaminants.

A recommended layout for a hygiene unit is:

- First stage – after exiting the 'dirty zone', an area for removal and storage of contaminated work wear, such as overalls, footwear and gloves
- Second stage – a washing area equipped with deep sink troughs for hand washing and showers for workers who have been in trenches or in dusty conditions
- Third stage – a clean area used for the storage of normal clothing.

The hygiene unit's toilets should be situated so that workers undergo the hygiene procedure before using these facilities. A boot wash, with a brush to remove soil, should be situated at the entrance to the first stage of the serviced hygiene unit.

On larger sites, zones around contaminated areas may be needed with boundaries clearly marked, signposted and controlled to prevent exposure to unprotected workers. Workers (including sub-contractors) should not enter these zones unless they are equipped with the minimum PPE and trained in its use.

A recommended layout for zones is:

- A restricted zone where the work may involve exposure to contaminants and which is restricted to essential personnel who are trained and appropriately protected;
- A decontamination zone on the boundary containing a serviced hygiene unit and facilities for washing mobile equipment and plant; and
- A support zone where support services are located, and unprotected people can work with minimal exposure risk.

If these additional hygiene measures are required, an occupational hygienist should be consulted for further advice. Specific guidance should also be sought regarding decontamination procedures relating to asbestos.

5.4 Personal protective equipment and clothing

Work on contaminated sites may require the use of a range of personal protective equipment and clothing (PPE). PPE is one of the least effective ways of controlling risks to health and safety and should only be used:

- When there are no other practical control measures available (as a last resort);
- As an interim measure until a more effective way of controlling the risk can be used; or
- To supplement higher-level control measures (as a back-up).

PPE includes a wide range of clothing and safety equipment, such as:

- Safety boots;
- Respirators;
- Hard hats;
- Sunhats or sunscreen;
- Ear plugs;
- Safety glasses;
- Coveralls;
- gloves;
- High visibility clothing; or
- Safety harnesses.

Where PPE is provided and used on the site, it is important to remember that:

- Wearing PPE may adversely affect the performance of tasks (e.g. by restricting vision or mobility);
- PPE may be uncomfortable to wear,
- Some workers may require alternatives (e.g. workers who are allergic to latex cannot wear rubber gloves and will require other glove types such as nitrile)
- Ongoing supervision is required to ensure the PPE is being worn and maintained correctly, and
- PPE may create new hazards (e.g. some items of PPE can hinder the body's natural cooling mechanisms by preventing evaporation of perspiration).

Required PPE should be provided in a fully operational condition and stored in clean facilities. Appropriate signs should be used to remind workers where PPE must be worn, and workers must be instructed and trained in how to use, maintain and store the PPE. It is important that PPE does not interfere with any medical conditions of the worker using the PPE.

PPE must be:

- Selected to minimise risk to health and safety;
- Suitable for the nature of the work and any hazard associated with the work;
- A suitable size and fit and reasonably comfortable for the person wearing it;
- Maintained, repaired or replaced so it continues to minimise the risk; and
- Used or worn by the worker, so far as is reasonably practicable.

Selection of the level and type of PPE to be used will depend on the:

- Type and amount of the contaminants on site (including whether the contaminant will interact negatively with the PPE, for example dissolving protective gloves or fogging safety glasses);
- Nature of the work;
- Expected or potential exposure levels;
- Route of entry of the contaminants into the body, and
- Actual performance of the PPE.

The selection of appropriate PPE 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 does not adequately address the likely risk will not provide adequate protection.

When choosing the right PPE for an activity, the selection process must involve consultation with users and health and safety representatives and should include:

- A detailed evaluation of the risk and performance requirements for the PPE;
- Compatibility of PPE items where more than one type of PPE is required (for example, ear muffs with a hard hat);
- Consultation with the supplier to ensure PPE is suitable for the work and conditions, and
- Preference for PPE that complies with the relevant Australian Standard or equivalent standard.

An occupational hygienist may need to be consulted for advice on the selection of specialised PPE, and any specific training and supervision needed for workers using it.

5.5 Health monitoring

Often, the environmental consultant company or remediation specialist will provide ongoing health monitoring for their workers as part of their employment. This helps control the risk of chronic exposure to low concentrations of contaminants over the time of employment.

Health monitoring involves the monitoring of a person to identify changes in the person's health status because of exposure to certain chemicals. There are different types of health monitoring procedures used to assess exposure to hazardous chemicals, including:

- Interview questions—this involves asking the worker questions about previous occupational history, medical history, lifestyle, work practices and symptoms related to exposure.
- Medical examination— this involves the use of standard clinical and medical assessments, tests and techniques to assess the presence of early or long-term health effects, often at set intervals.
- Biological effect monitoring— this is the measurement and assessment of early biological effects before health impairment occurs in exposed workers,

e.g. measurement of reduction of cholinesterase activity levels in workers exposed to organophosphate pesticides

- Biological exposure monitoring—this involves measurement and evaluation of the levels of a hazardous chemical or its metabolites (break-down products) in body tissues, body fluids, or in exhaled breath of an exposed person.

Health monitoring does not include air monitoring or other measures used to assess or control exposure to hazardous chemicals.

Health monitoring must never be used as an alternative to implementing effective control measures. However, it can be used to help identify whether existing control measures are working effectively or whether new or more effective control measures should be implemented. It also provides a valuable opportunity for feedback from workers on the effectiveness of control measures.

Work health and safety laws state that health monitoring is mandatory for a worker if they are carrying out ongoing work using, handling, generating or storing certain hazardous materials and there is a **significant risk** to their health because of exposure to a scheduled material. In addition, health monitoring is mandatory for workers **at risk** of exposure to asbestos.

This means a risk assessment must be conducted to determine the likelihood of exposure in conjunction with the known health effects, to decide if a health monitoring program is necessary. It is recommended that professional advice be sought from an occupational hygienist or medical professional to assist with this risk assessment.

Health monitoring should be provided:

- Before commencing work with the hazardous material. This is known as baseline monitoring and it is done so changes to the worker's health can be identified during periods of potential exposure;
- During periods of exposure to the hazardous material, particularly where excessive exposure occurs, e.g. following spills or loss of containment;
- Where the worker has concerns that may relate to exposure to the hazardous material, e.g. where relevant symptoms are identified, and
- At termination of work with the hazardous material.

Health monitoring must be carried out by or be done under the supervision of a registered medical professional with experience in health monitoring.

During a health monitoring program regular reports on the health status of the workers will be supplied by the medical professional carrying out the monitoring. These reports should be shared with the workers involved in the monitoring, while maintaining the confidentiality of the individual workers. The health monitoring report should only contain information relating to the health monitoring program for the chemical(s) being used. It should not contain other confidential health information about workers.

It is necessary to act on the recommendations of the health monitoring program reports. This step should be included in the risk assessment 'controls' for the hazardous material. Examples of recommendations are:

- Change in methodology to reduce exposure;

- Implementation of engineering controls (e.g extractor fans or watering to prevent dust);
- Individual workers be assigned to alternative work or another location where exposure to the hazardous chemical will not occur; or
- Alteration of work practices and procedures if tasks are not being performed correctly or controls are being bypassed;

If a worker is removed from work with hazardous chemicals, or transferred to other work, they must be kept up to date with information concerning the results of health assessments and their health status.

There are special rules around reporting, storing, securing and keeping health monitoring reports that vary by jurisdiction. Readers are advised to consult their local authorities for local requirements.

5.6 First aid

First aid is a standard requirement at all sites. First aid requirements are site-specific and depend on the:

- Nature of the work;
- Type of hazards;
- Site size and location; and
- Number of people at the site.

A risk assessment will help determine the type of first aid facilities and equipment needed. The risk assessment should consider the resources required if all of the control measures for a hazard fail.

First aid facilities include:

- First aid equipment;
- Personnel trained in administering first aid;
- Space to administer first aid or rest a patient; and
- Method of contacting emergency services.

First aid equipment may include one or more of:

- First aid supplies for treating common injuries;
- First aid supplies for treating injuries specific to the contamination being remediated or the site conditions (e.g. specific eye wash designed to neutralise acid, or snake bite bandages);
- Eye wash stations;
- Emergency shower; or
- Defibrillator.

Personnel trained to administer first aid should nationally recognised Statement/s of Attainment issued by a Registered Training Organisation for the nationally endorsed first aid unit/s of competency. They should attend training on a regular basis to refresh their first aid knowledge and skills and to confirm their competence.

First aid procedures are required so that site users have a clear understanding of the first aid available. The procedure should cover such things as:

- First aid facilities and where they are located;
- Who is responsible for the first aid facilities and how frequently they should be checked and maintained;
- The communication equipment and systems to be used when first aid is required;
- Arrangements for ensuring that workers receive appropriate information, instruction and training in relation to first aid;
- How to report injuries and illnesses;
- Practices to avoid exposure to blood and body fluids;
- What to do when a person is too injured or ill to stay at the site, e.g. if they require assistance with transport to a medical service, home or somewhere else where they can rest and recover, and
- Access to debriefing or counselling services to support first aiders and workers after a serious incident.

A record of any first aid treatment given should be kept by the first aider and reported to managers on a regular basis to assist reviewing first aid arrangements.

Appendix A – Government safe work agencies

Government	Agency	Website
Commonwealth	Safe Work Australia	www.safeworkaustralia.gov.au
	Department of Sustainability, Environment, Water, Population and Communities	www.environment.gov.au
Australian Capital Territory	WorkSafe ACT	www.worksafe.act.gov.au/health_safety
	Environment Protection Authority	www.environment.act.gov.au
New South Wales	WorkCover Authority of NSW	www.workcover.nsw.gov.au
	Environment Protection Authority	www.epa.nsw.gov.au
Northern Territory	NT WorkSafe	www.worksafe.nt.gov.au
	Environment Protection Authority	www.ntepa.nt.gov.au
Queensland	Workplace Health and Safety Queensland	www.deir.qld.gov.au/workplace
	Department of Environment and Heritage Protection	www.ehp.qld.gov.au
South Australia	SafeWork SA	www.safework.sa.gov.au
	Environment Protection Authority	www.epa.sa.gov.au
Tasmania	Workplace Standards Tasmania	www.workplacestandards.tas.gov.au
	Environment Protection Authority	www.epa.tas.gov.au
Victoria	Victorian WorkCover Authority	www.vwa.vic.gov.au
	Environment Protection Authority	www.epa.vic.gov.au
Western Australia	WorkSafe	www.commerce.wa.gov.au/WorkSafe/
	Department of Environment Regulation	www.der.wa.gov.au

Appendix B – Site-specific safety plan

This appendix provides guidance on the recommended contents of a site-specific safety plan.

Section	Recommended Content
Emergency procedure	• Type and location of emergency equipment; • Details of first aid equipment, facilities and procedures; and • Contact details for the nearest medical centre, hospital, and emergency services.
Introduction	• History and previous uses of the site; • Results of any site assessments; • Condition of the site; • Objectives and scope of the remediation work; • Roles, responsibilities and supervision on site; • Name and contact details of a site contact person; • Applicable legislation, guidelines and standards; • Contact details for the local safe work authority and environment protection agency; and • Project arrangements, including plans for continuity of work and revision of safety and health planning when work is delayed.
Risk assessment	• Using the control hierarchy, identify the location, exposure risks and control measures for: - biological hazards; - radiological hazards; - physical hazards; and - environmental hazards;

Section	Recommended Content
Safe work systems	• Prohibited activities on site; • Instructions for adverse weather conditions; • Permits required (e.g. hot work) • Underground and above-ground services clearance and isolation; • Access, security and control of movement and work zones • Procedures for: - Communication; - Use of personal protective equipment and clothing; - Unexpected finds; - Manual handling; - Decontamination of site, equipment and personnel; - Waste management and contamination control. • Safety Data Sheets and Material Safety Data Sheets for any hazardous chemicals used; • Requirements for clean amenities and drinking water facilities; and • Schedule for regular review of systems of work.
Induction, training and supervision	• Induction program; • Training for maintenance and use of personal protective equipment and clothing; • Training for work with hazardous chemicals; and • Training for individual job roles, if required.
Documentation and record keeping	• Reporting and record-keeping required for: - Incident notification; - First aid; - Induction and training; and - Unexpected finds. • Log book for recording work activities, the weather, site monitoring data and notes on problems; • Plans for the maintenance, control and preservation of records.

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