

HEALTH AND SAFETY GUIDELINES ON THE CLEANUP OF CONTAMINATED SITES

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1. Introduction

There is increasing concern about the effects of chemical contamination of sites formerly used for manufacturing or processing products where hazardous substances were used. Many existing sites may be contaminated by virtue of the activity being carried out. The hazards can be environmental or they may present a danger to human health and safety.

This document is about the occupational health aspects of site decontamination and pays attention to the procedures and methods necessary to protect workers involved. This guide should be read in conjunction with other OSH publications and the *Health and Environmental Guidelines for Selected Timber Treatment Chemicals* published by the Ministry for the Environment (see section 9 — References).

Contaminated sites will be of variable size and complexity in respect to the cleanup process. The occupational health hazards will be different for each site and this guideline is intended to cover the basic management, assessment, and evaluation techniques required for the successful and safe remediation process.

A factor which distinguishes the contaminated site from other occupational situations involving hazardous substances is the uncontrolled condition of the site and, in some cases, the lack of information on the substances present. Improper control of these substances can result in a threat to health.

Preventing exposure to toxic chemicals or hazardous substances is the primary concern. The exposure can be either chronic or acute and this has to be fully assessed. Symptoms resulting from acute exposures will usually occur during or shortly after contact with a substance, and these vary greatly from substance to substance. Chronic effects may occur after exposure to very low concentrations, usually over a longer time, and the symptoms may be completely different from those experienced through acute exposure.

Appropriate means for the protection of workers should be made with an understanding of the way that the substances may be absorbed and the possible acute and long-term health effects. Health effects such as cancer, respiratory disease, or skin conditions may not become manifest for many years or even decades after exposure. It is essential, therefore, that exposure is very strictly controlled.

Application of these Guidelines

Employers, contractors, local authorities, and others involved in the process of cleaning up contaminated sites should find this document useful as a framework for controlling exposure to hazardous substances which may be present at contaminated sites. It should be noted that it is not the intention of this guide to provide complete occupational health advice on any particular situation, but rather give general advice

on the topic which can be used to develop the appropriate safety procedures. Operators may wish to develop a series of Standard Operating Procedures (SOPs) for some activities which can be standardised for use at each site.

It is standard practice in many industries now to adopt a “permit entry”, or other similar system as the most appropriate method of controlling access to hazardous situations. The “trigger’ for this procedure is not stated in this document but is left for the operator to decide, based on information considered during the site assessment phase discussed later.

While this guideline has no legal standing such as an “approved” code of practice under the HSE Act, compliance with the provisions contained herein may be taken into account in deciding if all practicable steps have been taken to ensure that employees at work, or others are not harmed.

2. Hazards

Under the Health and Safety in Employment Act 1992 (HSE Act), sections 7 to 10, employers are required to identify significant hazards and to manage and control them in the workplace. This guide will assist with the orderly and safe management of a potentially hazardous place of work.

Exposure to Chemicals

The hazards associated with site cleanup will be many and knowledge of how these hazards affect workers is very important. Generally, the most important exposure route is inhalation. The respiratory system is vulnerable to chemicals and many substances pass through the lungs into the bloodstream, where they are transported to other vital organs of the body. Some toxic substances may not be easily detected by the senses, often being colourless and/or odourless, and their toxic effects may not produce immediate symptoms.

Direct contact with the skin or eyes by a chemical provides another important route of entry. Some chemicals directly damage the skin while others do not exhibit obvious outward signs. Skin absorption (particularly when sweating) or entry through the eyes will allow chemicals into the bloodstream and into vulnerable organs in the body. A less common form of occupational poisoning is ingestion. However, it is important to acknowledge it as a possible route of entry. Deliberate ingestion is not likely to occur on a contaminated site but incidental exposure can occur through personal habits such as smoking, chewing, drinking, or eating on the site.

Abrasions and cuts on the skin will allow chemicals to enter the body more readily.

Other Hazards

In many cases, contaminated site cleanup will also include the demolition and dismantling of buildings and equipment which may expose workers to other significant hazards. Readers may wish to consult the *OSH Code of Practice on Demolition*.

Classification of Sites

In New Zealand we are fortunate that there are a relatively small number of classes of contaminated sites. These sites may have involved:

- Timber treatment chemicals;
- Pesticides or agrichemicals;
- Disused gas works;
- Storage of waste materials;
- Leaking underground fuel of chemical tanks; and
- Other industrial processes.

The types of occupational hazards associated with the cleanup of these sites can be of a wide variety and could include the following. (This list is in no order of importance and is not definitive):

- Fire and explosion;
 - Hazardous substances exposure;
 - Safety issues;
 - Heat stress;
 - Confined spaces;
 - Biological;
 - Electrical and mechanical.
-

3. Planning and Organisation

Adequate and appropriate planning is the essential element of site decontamination procedures. By anticipating and taking steps to prevent potential health and safety problems, cleaning up the site can proceed with a minimum of risk to workers involved. To assist with this, a model site health and safety plan is included as appendix 1, which can be modified to suit each location and site.

In addition, other people likely to be visiting or entering the site need to be identified. The extent to which the following procedures are implemented will depend on the circumstances.

There are three important aspects to planning:

- Developing an overall organisational structure;
- Establishing a comprehensive work plan; and
- Establishing a site health and safety plan.

Organisational structure

Under the HSE Act, the person (or body corporate) who engages any person (other than as an employee) to carry out the work is defined as the “principal”. When engaging a contractor to undertake work on a contaminated site, the principal has a duty to take all practicable steps to ensure that:

- No employee of a contractor or subcontractor; and
- If an individual, no contractor or subcontractor —

is harmed while doing any work that the contractor was engaged to do. Contractor(s) engaged to carry out this type of work must have in place suitable management systems to identify and control health and safety.

The following paragraphs provide some guidance for principals and contractors on some of the considerations that need to be taken into account. In the development of an organisational structure, the essential and skilled personnel needed for the operation must be clearly identified right from the start. Establishing a chain of command, accountabilities, and responsibilities for the key personnel is an early requirement.

A structure that supports the overall objectives of the cleanup should be formed and this should include the following components:

- The appointment of a leader who has the authority to direct activities;
- Identification of the other key personnel for the project and confirming their functions and responsibilities;
- Establishment of clear lines of authority, responsibility, and communication; and
- Development of an interface with the appropriate control or regulatory authorities.

As the project progresses, it may be necessary to modify the organisational aspects to recognise changes that take place in each phase. These changes may include downgrading the requirements which experience shows are not necessary, or upgrading the health and safety requirements to take account of new information. It is essential that any changes made are communicated to all key staff and others involved to ensure control is maintained.

Regardless of the size of the project, a specific person should be appointed to oversee and take responsibility for implementing health and safety requirements, with authority to change procedures if necessary. This person will need to network with the authorities and occupational health and safety professionals such as an occupational medicine specialist or occupational hygienist.

One of the most critical factors in worker health and safety is attitude at all levels of the project management. A strong and visible commitment to worker safety must be present right from the start and this must be maintained throughout. Senior-level management support and commitment towards safety for the length of the project can not be overemphasised, and site personnel are more likely to co-operate with safety programmes and directives if they sense a genuine concern at the top.

Establishing a Work Plan

To ensure a safe response, a work plan should be developed for each site which will include health and safety considerations. This plan is likely to vary according to the conditions and complexity of the job and the type of contamination. The plan should describe the anticipated cleanup activities and be managed in conjunction with the environmental assessment programme. A thorough field investigation programme and a review of all available information will provide the detail necessary to make the initial decisions on how the work should proceed.

The preparation of a work plan will be more successful if it involves all appropriate disciplines and input from on-site and off-site personnel. It may be necessary to use occupational health consultants and agencies such as OSH and local authorities in this process.

Establishment of Health and Safety Plans

A comprehensive site health and safety plan for all workers should be prepared and implemented. This should establish policies and procedures designed to protect workers from the potential hazards at the site. The operator should produce a written health and safety plan (see appendix 1) to ensure that all personnel can be adequately informed of policies and decisions.

Under the HSE Act, general duties for health and safety require the identification of hazards and, once identified, all practicable steps must be taken to isolate, eliminate, or minimise exposure to that hazard.

As required by the HSE Act, employees shall be involved in the development of procedures for identifying hazards and dealing with emergencies. Regulatory agencies will also be able to assess the effectiveness of the plan. More detailed discussion of this aspect is in the following chapters of this guide, and assistance can be obtained from OSH.

As a minimum the plan should:

- Describe the health and safety risks associated with each phase of the task;
 - Confirm the training and supervision regime for personnel required to handle specific hazardous situations;
 - Describe the safe work practices and policies to be employed on the site;
 - Outline the minimum protective equipment to be used by personnel during the various site operations, including training in its proper use;
 - Describe the decontamination procedures for personnel and equipment (see section 8 for further discussion);
 - Set out the minimum requirements for monitoring personnel, and the work environment;
 - Describe any site-specific medical surveillance procedures; and
 - Describe a contingency plan for safe and effective response to emergencies.
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4. Site Assessment

A comprehensive site hazard assessment will identify the issues and enable proper selection of work procedures and safe work methods. Ideally, this assessment should be done by the person appointed as the project leader to enable familiarisation with the site and its hazards.

Appropriate use of experts will greatly assist in getting an accurate and fair assessment. The site assessment should involve close co-operation with the environmental programme, and any testing done for that purpose will be invaluable. It is most likely that the reason for site remediation will be triggered by other than worker health and safety considerations, so all information available should be used.

The extent to which a contaminated site is cleaned up has a significant bearing on the potential exposure of those doing the work. The environmental assessment of a site provides information from which an environmentally acceptable residual level of contamination can be determined. In arriving at this figure, the benefit to the environment of any further cleanup has to be weighed up against the unnecessary exposure of the workforce to a significant health risk. The HSE Act requires that, as part of taking all practicable steps, this conflict must be balanced.

The assessment should clearly highlight the worker health and safety issues, and these could include the following:

- Enclosed spaces that must be entered;
- Potential exposure to chemicals and other contaminants;
- Adverse physical working conditions; and
- The level of skill and knowledge of the workforce.

As much data as possible should be collected about the site, the likely contaminants, and the activities that occurred at the site. Additional features and information will also be available from the environmental assessment. Toxicological advice about the possible health hazards of the contaminants will be required. Much of this assessment can be done off-site prior to starting the job and may already be available as part of the tendering process.

Once the job has been secured, the operator will need to undertake on-site investigations to verify and supplement much of the information already obtained. This initial work may involve testing to confirm the nature and extent of the hazards.

Because the workers may initially be entering a largely unknown environment, caution and conservative actions are appropriate in the first instance. Procedures can be changed in light of experience and knowledge as the job proceeds.

Early work at any site will usually involve tests to determine the nature of the contaminant and its concentration in soil, dust or other materials. As the job proceeds, monitoring the workers exposure may be more appropriate by carrying out biological and environmental monitoring. These procedures are discussed in a later section.

Workplace Exposure Levels

Once the job is under way, confirmation of the hazards can be determined and the work procedures confirmed. To assist in this process reference to a range of documents will be necessary. The *Workplace Exposure Standards* (WES) issued by OSH should be used as a guide on the acceptable worker exposure levels for various chemicals.

Protection measures can be assessed based on the categories of exposure, i.e. short-term (STEL), ceiling (C) or time-weighted average (TWA). The Immediately Dangerous to Life or Health (IDLH) category, used as a guide to respiratory protection requirements, is a useful measure of those conditions that pose a severe threat. Various American authorities set IDLH exposure concentrations which may be useful in some situations.

The WES booklet provides some general information on skin absorption for those chemicals that may pose a dermal hazard. Biological indices for a range of chemicals is also provided in the WES booklet and should be referred to and, in particular, the sampling regime.

It is stressed that workplace exposure levels should be kept to the lowest level possible by using all practicable steps.

Explosion and flammability ranges known as Lower Explosive Limit (LEL) and Upper Explosive Limit (UEL) are measures used to describe the minimum and maximum concentration levels that a mixture of air and a substance will burn or explode. These levels are available in MSDS sheets or chemical information references and will assume some importance when assessing the need to have all electrical or electronic equipment intrinsically safe.

Physical Working Conditions

The problems of working in confined or enclosed spaces must be fully assessed and appropriate measures taken to ensure that the hazards associated with work in these situations do not cause problems.

Oxygen deficiency is a major concern and also the flammability of substances in confined or enclosed areas. Enclosing a workspace to control environmental contamination may concentrate chemicals to a higher level and therefore cause additional problems for workers.

Physical working conditions will need to be assessed in relation to the health parameters of heat stress. The physical nature of the work may lead to severe heat stress problems because of the need to kit out in complete protective clothing. Heat stress requires special management and professional advice may be necessary. The alternative to working in the cool at night may be an option worth exploring, however, artificial light may produce additional safety hazards.

5. Monitoring

Monitoring of exposure of those involved in site cleanup activities is essential. This is required by section 10 (2) of the HSE Act. There are two main areas involved in this procedure:

- Workplace air monitoring; and
- Health surveillance monitoring.

Workplace Air Monitoring

Identification and quantification of contaminants through the use of appropriate air-monitoring strategies will be an essential component of the health and safety programme at a contaminated site. Reliable measurements of airborne contaminants will be useful for:

- Selecting personal protective equipment;
- Selection of areas where protection is needed;

- Assessing the potential effects of exposure; and
- Determining the need for specific health monitoring.

There must be full consideration of the various factors involved with air monitoring and, in particular, the methods available and the types of instruments. Whether or not monitoring is necessary will need to be determined after consideration of all the information. Small or short-duration jobs and those involving low levels of airborne contaminants may not require ongoing monitoring.

The collection and analysis of air samples should be performed by competent persons. Generally, all procedures that are likely to be used to determine the level of airborne contaminant at a worksite would require input from a laboratory with experience in occupational or environmental assays.

Two principle approaches to the monitoring of sites are available:

- On-site direct reading instruments;
- Off-site analysis of samples collected from the site.

Selection of the most appropriate method of sampling and testing should be done in consultation with the analysing laboratory. The extremely low levels of contaminants at many sites will mean that off-site testing is the only option. The length of time for results to be obtained is an important factor to be considered.

Biological monitoring of workers will require analytical services of a similar type and this can be arranged at the same time. The physical aspects of the work environment such as heat or cold may need to be assessed, and instruments are available for this.

Health Surveillance Monitoring

The requirement for health surveillance of people working on a contaminated site will vary according to each circumstance. In most cases, there will be a requirement for a pre-employment medical examination by an occupational health nurse or occupational physician to determine fitness to undertake the cleanup work with particular reference to the wearing of respirators and exposure to the substances involved. Ongoing medical examinations for a specified period of time after the job has been completed may be considered necessary.

For some substances, biological monitoring may be used to estimate the workers' exposure. It may be necessary to carry out initial tests to determine base levels of contaminants in the workforce and from then on only selective monitoring may be necessary. Often the level of exposure to a chemical will be reflected in the level of the substance in a worker's blood or urine.

An important issue is the collection of specimens for biological assessment. These must be taken at the appropriate time in the work cycle and great care must be exercised to ensure that specimens are not contaminated. It is desirable to collect samples off site to prevent this

problem. Reference should be made to the section 10 of the HSE Act and to the OSH publication *Workplace Exposure Standards and Biological Exposure Indices 1992* for further information on this subject. Results of monitoring must be made available to employees under the HSE Act 1992.

6. Information, Training and Supervision

Section 13 of the Health and Safety in Employment Act 1992 places clear requirements on employers in respect to training and supervision of employees. In addition to other responsibilities under the HSE Act, the employer must take all practicable steps to ensure that those involved at contaminated sites are:

- Trained for the task or is supervised by a person who has knowledge and experience in the tasks to be performed;
- Ensure that in carrying out this task the worker is not likely to cause harm to themselves or others and understands the hazards and risks associated with the cleanup of the contaminated site; and
- Adequately trained in the safe use of equipment.

Because of the nature of the job, an unskilled workforce will often be employed. Therefore, considerable effort should be made to inform them of the hazards to which they may be exposed. The training will need to be done in such a manner that they will understand and appreciate the significance of correct work methods. Discussing the results of monitoring undertaken provides an opportunity to reinforce the need to follow procedures and review methods.

All workers should have access to copies of the site health and safety plan, any standard operating procedures, and information on emergency response and symptoms of exposure. (See sections 6,12 and 14 of the HSE Act on information to employees, emergencies and employee involvement.) The work shifts to be operated and other details about employment conditions can also be provided with these documents.

7. Personal Protection

Work on contaminated sites may involve the use of a range of personal protective equipment (PPE) including respirators, hearing and eye protection, and clothing (including hands and feet). The purpose of this equipment is to isolate or shield the worker from the effects of the chemical, physical or biological hazards at the site.

Under the HSE Act, personal protection can be used to minimise hazards where elimination or isolation is not practicable. In many cases, wearing PPE will be the only option since engineering controls may not be feasible. The use of PPE can lead to other significant hazards such as heat stress and working difficulties such as impaired vision, lack of mobility and communication problems. Proper consideration of all the factors involved will identify the appropriate selection parameters and also guard against over-protection.

A written PPE programme should be established for each site based on the information collected in the site assessment. The objectives of a written programme are to ensure that workers are fully informed of the policies and directives designed to protect them from hazards, and appropriate use of equipment.

The programme should set out the monitoring regime which will be undertaken to confirm its effectiveness. A combination of environmental, biological and health monitoring may be necessary to ensure that procedures are adequate. The programme should be reviewed as necessary during the progress of the work to ensure that it remains relevant.

The selection of appropriate levels of protective equipment can be very difficult due to the variable nature of the work, the validity of actual exposure levels, their route of entry, and the actual performance of protective equipment. A conservative approach may be necessary in the selection of protective equipment to ensure complete worker safety. There must be a fine balance struck between over-protection on the one hand, which can have detrimental effects, i.e. heat stress, and under-protection.

Specific Safety Equipment

Respiratory Protective Devices

Respiratory protection for workers is very important since inhalation is the main route for exposure to chemical contaminants in respirable form. It is not possible to set out precise requirements for each situation in a document such as this because of the variation of conditions likely to be encountered. Both the user and the supplier should be satisfied that any equipment selected is adequate for the purpose.

Where it is considered necessary to use respiratory protection, a formal respiratory protection programme should be established and managed by appropriate staff with knowledge about the conditions and the benefits and limitations of respiratory products available. Classification of the inhalation hazards will assist in selection of the correct equipment by assessing the type of atmospheric contaminant. Once this is known, the best type of respirator can be chosen using appropriate protection factors.

The effects of the contaminant on skin or eye contact will further influence the type of respirator, as will the medical aspects of wearing a

respirator. Proper fit testing and training and instruction in use and care of respirators is essential, together with a cleaning and maintenance programme.

Correct storage of respirators will prolong the life of filters and ensure that they continue to function correctly.

Further detailed information is available on this subject in the NZS/AS 1715: 1991 *Selection, use and maintenance of respiratory protection devices* or *A Guide to Respiratory Protection*, published by OSH and NZ Safety.

Protective Clothing and Accessories

The most appropriate protective clothing and accessories will once again be determined after assessing the overall hazard at the site. The type of contaminant and its severity as a hazard to the health of workers will dictate the protective measures necessary.

Selection of this equipment is complex and may require expert assistance. Safety equipment firms have a range of products to choose from, and trade literature on their advantages and limitations is usually available. In most situations, outer overall protection will be required using, for example, single-use/disposable type or, in the case of a wet cleanup process, an impervious type garment. Permeation rates for protective clothing and gloves are available for a range of chemicals and these should be referred to before making a final selection.

For further information the reference *Guidelines for the Selection of Chemical Protective Clothing*, 3rd Edition, by Schwoppe, Costas, Jackson and Weitzman should be consulted. Gumboots and gloves will be a general requirement for nearly all situations. If reusable overalls are used, correct laundering procedures will need to be considered, paying particular attention to people required to handle them during laundering.

Eye and Hearing Protection

If the cleanup involves concentrated or corrosive chemicals, eye protection will be necessary. Dusty conditions may also be encountered. Protection can be either goggles or face shields depending on the situation. If large machinery or other noisy equipment such as compressors are used, hearing protection of the appropriate hearing protection grade should be available for all people in the vicinity.

Storage and Maintenance of Equipment

Clothing and equipment must be stored properly to prevent damage and loss of function. Moisture, heat and dust all contribute to a shortened life of this equipment. Washing and cleaning should be a routine practice either by selected staff or as a function of the wearers. Adequate storage facilities should be provided for the equipment.

Heat Stress from Wearing Protective Equipment

Wearing PPE can put workers at risk of developing heat stress. Obviously the weather conditions play an important part in this but the

extent of physical activity and other sources of heat can also contribute. Fully protected staff required to carry out manual tasks will be liable to heat stress which, if not managed properly, can have serious effects on health. It is for this reason that it is desirable that a minimum of protective clothing necessary to safely carry out the job is used, such as not wearing impermeable overalls when cotton would suffice.

If heat stress is likely to be a problem, regular monitoring of staff will be necessary. Maintenance of body fluids, modification of work schedules to include rest periods, and provision of cooling devices are all measures that can be taken to prevent adverse effects from heat stress.

Training workers to recognise the effects of heat stress should be part of the ongoing evaluation review process.

8. Site Control

The purpose of site control is to minimise the potential contamination of workers, protect the public from the site activities, and prevent vandalism which may have an effect on the surrounding environment. Emergencies may occur at any time and the control process must address this aspect also.

The elements of site control are:

- Site preparation and defining zones;
- Decontamination procedures;
- Site security;
- Communications; and
- Safe work practices and policies.

The degree of site control will depend on the position of the site, its proximity to built up areas, and the type of contaminants present. The site control procedures will be identified at the planning and organisation phase outlined in section 3.

Site Preparation

Some time and effort will be necessary to prepare the site for the cleanup activity to ensure that delays do not occur or shortcuts taken which may compromise workers' health and safety. Hazardous exposures can occur during site preparation and this should not be overlooked.

Work zones should be established on the site with boundaries marked out both on a drawing and physically. These will assist in site security and clearly define zones for worker protection purposes. The site can be

divided into any number of zones, but the less complex the better. The classifying of the zone will specify the minimum health protection measures necessary for staff entering.

The **exclusion zone**, for instance, will be where the major cleanup work is performed into which only essential personnel go and only if appropriately protected. A series of lesser control zones will be provided to enable other staff to carry out essential duties, such as the **decontamination zone** where workers and equipment are decontaminated, and the **support zone** where support services are located and unprotected personnel and visitors can be safely located.

Decontamination Procedures

Decontamination of staff and equipment may be required at various stages of the task. The complexity of this procedure will vary according to the individual circumstances and this should be identified at the site assessment phase.

If it is considered necessary to fully enclose a work area to contain contamination, then a decontamination unit consisting of clean and dirty shower areas, air locks and waste recovery will be required. In some instances, it may be necessary to provide negative-pressure enclosures.

The decontamination unit should be placed at the zone boundary enabling those entering or leaving the zone to go through it. Decontamination and cleaning of equipment must be done in a structured way to ensure worker safety and prevent environmental effects. This is best carried out at the zone boundary.

Before equipment is taken away from the site, it should be thoroughly decontaminated on site, where adequate control of waste water and contaminated residues can be handled together with the site disposal procedures.

Site Security

Site security will be necessary to prevent unauthorised people from entering into a hazardous area and to ensure that only people with the proper knowledge and equipment have access to certain areas.

The maintenance of security may be assisted by the erection of fences or other barriers which will also have the added advantage of reducing vandalism or theft. Signposting of the perimeter and using commercial security firms for after-hours security may also be essential at some sites.

Communications

An effective communication system may be required to ensure that there is good contact between on-site and off-site personnel. The need for this and what form it should take will depend on the complexity of the operation and remoteness of the site.

An adequate communication system will be necessary in case of emergencies and to assist with site control and response. Where total enclosure procedures are being used, good communication is essential to the overall management of the project and its safe operation.

Safe Work Practices and Policies

Each site should have written policies in the form of standard operating procedures (SOP's) which set out the minimum health and safety requirements for workers to observe. These will have been identified — by involving the workers — in the planning and organisation and site assessment phases of the project and should be provided to each staff member. These could include the following considerations:

- Work practices that minimise contact with the contaminant or prevent the formation of dust will assist in maximising worker safety.
 - The actual work methods utilised will have a significant bearing on the extent of exposure.
 - The choice of methods is important, such as wet or dry working, vacuum cleaning or dry sweeping, hand tools or power tools, etc. The options chosen should then be written into operating procedures.
 - The need for staff involved in cleanups to observe strict personal hygiene practices cannot be over-stressed. Keeping hands away from the face, strict no smoking policies on site, and attention to washing and showering before eating or leaving the site are all essential work practices to be enforced.
 - Where heat is a problem and it is necessary to take on fluids during the work, safe methods will have to be devised to do this. Drinking fountains with the water jet coming out at an angle may offer the best solution.
 - All protective clothing and equipment must be cleaned at the end of each shift and stored properly until used again. Disposable clothing should be safely disposed of as waste.
 - Should an emergency occur which requires an immediate evacuation of a worker from the site, emergency decontamination procedures may need to be performed. These procedures will need to be planned in advance and contingencies made to implement them if necessary.
 - The safe storage, transport, and correct labelling of waste pending safe disposal needs special emphasis.
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9. References

The following publications may be useful:

- *Workplace Exposure Standards and Biological Exposure Indices for NZ*, published by OSH and available from OSH branch offices.
- *A Guide to Respiratory Protection*, published by OSH and NZ Safety Ltd. and available from OSH branch offices.
- NZS/AS 1715: 1991 *Selection, use and maintenance of respiratory protective devices*, available from Standards NZ.
- *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, NIOSH/OSHA/USCGEPA.
- *Approved Code of Practice for the Safe Use of Timber Preservatives and Antisapstain Chemicals*, published by OSH and available from OSH branch offices.
- *Health and Safety in Employment Act 1992*, available from GP Books and OSH branch offices.
- *Guide to the Health and Safety in Employment Act 1992*, available from OSH branch offices.
- *Health and Environmental Guidelines for Selected Timber Treatment Chemicals*. Ministry for the Environment and the Ministry of Health.
- *Guidelines for the Selection of Chemical Protective Clothing*, 3rd Edition. Schwope, Costas, Jackson and Weitzman, ISBN 036712-73-2.
- *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*, Australia and New Zealand Environment and Conservation Council, National Health and Medical Research Council, 1992.
- *NIOSH Pocket Guide to Chemical Hazards*, DHHS publication No. 90177.

Appendix: MODEL SITE HEALTH AND SAFETY PLAN

This appendix provides a model health and safety plan which can be adapted to suit any situation where contaminated site remediation is required.

1. SITE DESCRIPTION AND DETAIL

Site owner:

Cleanup operator:

Date: Location:

Hazards:
.....
.....

2. ON-SITE ORGANISATION AND KEY PERSONNEL

The following personnel are designated to carry out the stated job function:

Project leader:

Health and safety officer:

Scientific advisor:

Medical advisor:

Security officer:

3. REGULATORY AUTHORITIES: CONTACTS

Ministry for the Environment:

Occupational Safety & Health Service:

Public Health Agency:

Local Authority:

Regional Council:

4. ON-SITE CONTROL

Security officer:

Control zones have been established as follows:

Exclusion zone:

Decontamination zone:

4. ON-SITE CONTROL (Cont)

Support zone:

Control zones are identified by:

.....
(Attach drawing showing control zones)

Hazard evaluation

The following substance(s) are known or suspected to be on site.

The main hazard of each is identified.

Substance	Concentration	Main Occupational Hazard
.....
.....
.....
.....

The following additional hazards are expected on site:

5. PERSONAL PROTECTIVE EQUIPMENT

Based on the site assessment of the potential hazards, the following protection will be used in the designated control zones.

Zone	Job Function	Level of Protection
.....
.....
.....
.....

Protection levels (examples)

- A = Full encapsulating suit, boots, gloves and SCBA or air-supplied full-face piece respirators.
- B = Single-use chemical-resistant overalls, boots, gloves and half-face piece respirator with single/double filter, and eye protection.
- C = Cotton overalls minimal protection. Particulate/dust respirator.
- D = Norma work-type clothing. No respirator.

6. COMMUNICATION PROCEDURES

The following methods of communication will be employed on site:

- (a) Two-way radio
- (b) Cellphone

7. ESSENTIAL AND EMERGENCY TELEPHONE CONTACT NUMBERS

Name	Number	Name	Number
.....
.....
.....

8. DECONTAMINATION PROCEDURES

The following decontamination procedures will be used:

Exclusion zone

All personnel and equipment before leaving the zone will be decontaminated in the following way:

Decontamination zone

As required

9. MEDICAL, HEALTH AND EMERGENCY CARE AND SERVICES

Name of medical officer:

Address:

Phone number:

Emergency health care

Ambulance location:

Phone number:

First aid care

Location of first aid kit(s):

Name(s) of first aider(s):

9 MEDICAL, HEALTH AND EMERGENCY CARE AND SERVICES (CONT)

Emergency services

Agency/facility	Phone	Contact
Police:
Fire:
Hospital:
Local authority:

10. ENVIRONMENTAL AND BIOLOGICAL MONITORING

The following monitoring procedures will be adopted:

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11. ADDITIONAL CONTROL PROCEDURES NOT COVERED IN ABOVE:

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