

HEALTH AND SAFETY IN EMPLOYMENT ACT 1992

APPROVED CODE OF PRACTICE FOR
THE SAFE USE OF

TIMBER PRESERVATIVES AND ANTISAPSTAIN CHEMICALS



DEPARTMENT OF
LABOUR
TE TARI MAHI

ISSUED AND APPROVED
BY THE MINISTER
OF LABOUR
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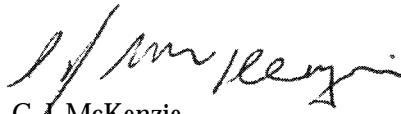
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NOTICE OF ISSUE

I have issued this *Approved Code of Practice for the Safe Use of Timber Preservatives and Antisapstain Chemicals*, being a statement of preferred work practices or arrangements, for the purpose of ensuring the health and safety of persons to which this code applies and persons who may be affected by the activities covered by the code.



C J McKenzie

Secretary of Labour

June 1993

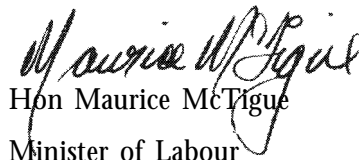
ACKNOWLEDGEMENT

This code has been developed in consultation with representatives of the timber treatment industry, unions, manufacturers of timber preservatives, members of the Technical Committee of the New Zealand Timber Industry Federation (Inc.), Regional Councils, and other Government agencies.

Occupational Safety and Health, a Service of the Department of Labour and the Ministry for the Environment gratefully acknowledge the assistance of all contributors.

FOREWORDS

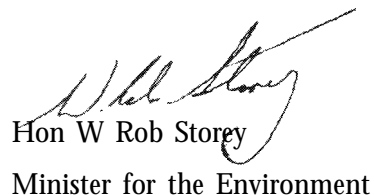
I have approved this statement of preferred work practices, which is an *Approved Code of Practice for the Safe Use of Timber Preservatives and Antisapstain Chemicals* under section 20 of the Health and Safety in Employment Act 1992. When a code is approved a Court may have regard to it in relation to compliance with the relevant sections of the Health and Safety in Employment Act. This means that if an employer in an industry, or using a process to which an approved code applies, can show compliance with that code in all matters it covers, a Court may consider this to be compliance with the provisions of the Act to which the code relates.



Hon Maurice McTigue
Minister of Labour

June 1993

The environmental provisions of this code of practice are consistent with the purpose and principles of the Resource Management Act 1991. I expect the code to be a key reference document to guide regional councils and territorial authorities when preparing policy statements and plans and when considering consents under the Act.



Hon W Rob Storey
Minister for the Environment

June 1993

A SUMMARY OF THE HEALTH AND SAFETY IN EMPLOYMENT ACT 1992

The principal object of the Health and Safety in Employment Act 1992 is to prevent harm to employees at work. To do this it imposes duties on, and promotes excellent health and safety management by, employers. It also provides for the making of regulations and codes of practice.

The following information is a brief outline of provisions of the HSE Act. Copies of the Act and associated regulations may be purchased from any GP Books shop or Occupational Safety and Health Service branch offices.

APPROVED CODES OF PRACTICE

The Act allows for the development and approval of statement of preferred work practice, known as “approved codes of practice”. These are recommended means of compliance with provisions of the Act and may include procedures which could be taken into account when deciding on the practicable steps to be taken. Compliance with codes of practice will not be mandatory. However, they may be used as evidence of good practice in Court.

EMPLOYERS’ DUTIES

Employers have the most duties to perform to ensure the health and safety of employees.

If you are an employer then you have a general duty to take all practicable steps to ensure the safety of employees while at work. (This is set out in section 6.) In particular, you are required to take all practicable steps to:

- Provide and maintain a safe working environment;
- Provide and maintain facilities for the safety and health of employees at work;
- Ensure that machinery and equipment in the place of work is designed, made, set up, and maintained to be safe for employees;
- Ensure that employees are not exposed to hazards in the course of their work; and
- Develop procedures for dealing with emergencies that may arise while employees are at work.

HAZARD MANAGEMENT

Employers must identify hazards in the place of work (previously existing, new and potential) and regularly review them to determine whether they are significant hazards and require further action. Where there occurs any accident or harm in respect of which an employer is required to record particulars, the Act, section 7 (2), requires the employer to take all practicable steps to ensure that the occurrence is so investigated as to determine whether it was caused by or arose from a significant hazard.

“Significant hazard” means a hazard that is an actual or potential cause or source of:

- (a) Serious harm; or
- (b) Harm (being more than trivial) the severity of whose effects on any person depend (entirely or among other things) on the extent or frequency of the person’s exposure to the hazard; or
- (c) Harm that does not usually occur, or usually is not easily detectable, until a significant time after exposure to the hazard.

Where the hazard is significant the Act sets out the steps an employer must take.

- Where practicable, the hazard must be eliminated;
- If elimination is not practicable, the hazard must be isolated;
- If it is impracticable to eliminate or isolate the hazard completely, then the employer must minimise the hazard to employees. In addition, the employer must, where appropriate:
 - Ensure that protective clothing and equipment is provided, accessible and used;
 - Monitor employees’ exposure to the hazard;
 - Seek the consent of employees to monitor their health; and
 - With informed consent, monitor employees’ health.

INFORMATION FOR EMPLOYEES

Before an employee begins work their employer must inform them of:

- Emergency procedures;
- Hazards the employee may be exposed to while at work;
- Hazards the employee may create while at work which could harm other people;
- How to minimise the likelihood of these hazards becoming a source of harm to others; and
- The location of safety equipment.

The employer is also required to inform employees of the results of any health and safety monitoring. In doing so, the privacy of individual employees must be protected.

EMPLOYERS TO INVOLVE EMPLOYEES IN THE DEVELOPMENT OF HEALTH AND SAFETY PROCEDURES

Employers need to ensure that all employees have the opportunity to be fully involved in the development of procedures for the purpose of identifying hazards and dealing with significant hazards or dealing with or reacting to emergencies and imminent dangers (section 14).

TRAINING OF EMPLOYEES AND THE SAFETY OF OTHERS

The employer must ensure employees are either sufficiently experienced to do their work safely or supervised by an experienced person. In addition, the employee must be adequately trained in the safe use of equipment in the place of work, including protective clothing and equipment (section 13).

An employer is also responsible for the health and safety of people who are not employees. An employer must take all practicable steps to ensure that an employee does not harm any other person while at work, including members of the public or visitors to the place of work (section 15).

EMPLOYEES' DUTIES

If you are an employee, the Act gives you responsibility for your own safety and health while at work. You must also ensure that your actions do not harm anyone else.

ACCIDENTS AND SERIOUS HARM (RECORDS AND NOTIFICATION)

The Act defines:

“Accident” means an event that:

- (a) Causes any person to be harmed; or
- (b) In different circumstances, might have caused any person to be harmed:

This means that “accident” includes both near misses and accidents that result in harm to a person or might have caused any person to be harmed.

Every employer is required to maintain a register of accidents and serious harm; and record particulars relating to:

- (a) Every accident that harmed (or, as the case may be, might have harmed)—
 - (i) Any employee at work; or
 - (ii) Any person in a place of work controlled by the employer; and
- (b) Every occurrence of serious harm to an employee at work, or as a result of any hazard to which the employee was exposed while at work, in the employment of the employer.

Where there occurs any serious harm or accident an employer must:

- (a) As soon as possible after its occurrence, notify the Secretary of the occurrence, and
- (b) Within 7 days of the occurrence, give the Secretary written notice, in the prescribed form, of the circumstances of the occurrence.

The notification to the Secretary applies to:

- (a) Every occurrence of serious harm to an employee at work, or the occurrence of serious harm as a result of any hazard to which the employee was exposed while at work, in the employment of the employer; and
- (b) Accidents of a kind or description required by regulations.

1. INTRODUCTION

1.1 PURPOSE

- 1.1.1 The purpose of this revised code of practice is to set minimum standards that will protect the safety and health of employees and others from the hazards associated with handling timber preservative and antisapstain chemicals, and the plant used to apply them. Some safety and health requirements also provide protection for the environment. The code therefore was further developed to provide guidance consistent with the Resource Management Act, on the measures required to protect the environment from preservative and antisapstain chemicals.

1.2 APPLICATION OF THIS CODE

- 1.2.1 The appropriate sections of the code apply to any plant used for impregnation and/or immersion of timber with antisapstain agents, water-borne preservatives, organic solvent-based preservatives, and creosote. The document does not cover in-situ methods of timber treatment.
- 1.2.2 The purpose of the code is to establish:
- (a) Safe work practices that will reduce the potential for exposure and contamination of personnel engaged in the operation of timber preservative and antisapstain plants; and
 - (b) The design, and operation of the plant and treatment site that will prevent or, if this is not practical, minimise the potential impact on the environment.
- 1.2.3 Much of section 2 (Design and Operational Requirements for All Treatment Plants), a little of sections 4, 5, and 6, and most of section 8 (Disposal of Wastes) establish the precautions necessary to protect the natural environment from treatment chemicals.
- 1.2.4 The remainder of sections 2 and 8, and nearly all of sections 3 to 7 and 9 of this code set out the safety procedures required by the principal types of plant and processes in use. Section 3 contains detailed information on safety and health matters, and also management and employee responsibilities. Section 4 relates to plant safety, sections 5 and 6 consider preservative and antisapstain chemicals, and section 7, chemical mixing. The various appendices contain toxicological and other information on the principal chemicals and antisapstain formulations used.
- 1.2.5 The code does not endeavour to cover the mechanical safety of plant and equipment, but all machinery must comply with the requirements of the law.

- 1.2.6 By complying with the code employers and managers shall be deemed to have met their principal safety, health and welfare obligations under the Health and Safety in Employment Act 1992. This legislation is administered by the Occupational Safety and Health Service of the Department of Labour.
- 1.2.7 Regional councils are required to set consent conditions that will prevent water, soil and air pollution. While all sites will need to meet a minimum standard, the conditions placed on the resource consents for some sites may be more restrictive if classified receiving environments require a higher standard. City and district councils are to ensure that land use planning and hazardous substances control requirements are met.
- 1.2.8 While the code sets out the details and methods that will enable employers to comply with the pertinent legal requirements (sections 1.2.6 and 1.2.7), employers are not constrained to use only these methods. An employer who can prove that another method and/or design achieves the same or better standard of safety and environmental protection may use it in place of that specified in the code.

1.3 INTERPRETATION

- 1.3.1 “**Shall**” and “**must**” imply the instruction is mandatory for compliance with the code.
- 1.3.2 “**Should**” and “**may**” imply that the recommendation be adopted where practicable.

1.4 DEFINITIONS

- 1.4.1 **Treatment chemicals** means preservative and antisapstain chemicals collectively.
- 1.4.2 **Preservative chemicals** are chemicals used for the long-term protection of timber.
- 1.4.3 **Antisapstain chemicals** are chemicals used to control the growth of fungi and moulds.
- 1.4.4 A **holding pad** is a sealed area set aside to collect drips from freshly treated timber. The duration that timber is held in this area is defined in 2.2.2.1 and 2.2.2.2.
- 1.4.5 **Drip free** means that the timbers shall have ceased to drip on the holding pad and that no further drippage shall occur when the timber is moved, tilted, or exposed to heat or sunlight.
- 1.4.6 **Substantially drip free** means drippage equal or less than one drip per second per cubic metre from freshly dipped or sprayed timber (but subject to any conditions set by the regional council for the site specific resource consent).

1.5 ENFORCEMENT

- 1.5.1** Where an existing plant and site may not meet all the requirements of the code, employers shall be allowed reasonable time to bring existing plant and premises up to the requisite standard. However, the Occupational Safety and Health Service expects that full compliance with all occupational safety and health matters covered by the code will be achieved within 3 years of the code's approval by the Minister. The Ministry for the Environment similarly expects the achievement of the code's environmental objectives within 3 years.
- 1.5.2** Environmental enforcement and compliance provisions are contained in the Resource Management Act 1991. This law requires employers of new and existing sites to apply for a resource consent from the regional council. Accordingly, the code sets out criteria to prevent water, soil and air pollution to assist regional councils in the determination of resource consents. Employers will also require a land use consent from the city or district council for all new developments on both existing and new sites where the scope of the activity is changed, otherwise existing rights apply.
- 1.5.3** Appendix 1 provides information on the agency, i.e. the regional council, or OSH (or the Public Health Unit, Crown Health Enterprises) responsible for enforcement of the mandatory provisions of the code.
- 1.5.4** Employers, who experience any difficulty in applying the safety and health requirements of the code or implementing equal or better safety measures, must notify and discuss the problem with the Occupational Safety and Health Service of the Department of Labour within 2 years of the code's approval. Similarly, employers must contact the regional council on environmental matters. Dispensations from the time requirement in section 1.4.1 may be granted in certain circumstances.

2. DESIGN AND OPERATIONAL REQUIREMENTS FOR ALL TIMBER PRESERVATION AND ANTISAPSTAIN TREATMENT PLANTS

2.1 GENERAL

2.1.1 SITING AND LAYOUT OF TREATMENT PLANTS

- 2.1.1.1 The most important safety feature in the plant and equipment layout is the containment of the chemical solutions and any associated vapours or mists within the perimeter of the plant.
- 2.1.1.2 All plants shall be laid out so that any discharge of treatment chemicals to the soil, surface water or ground water systems, or the atmosphere shall be avoided or, if this is not practical, minimised. In all cases the discharge limits set by the regional council shall not be exceeded. The holding pads (section 2.2.2) shall be roofed over unless the employer can demonstrate an acceptable alternative. Spouting and culverts shall prevent excess rain water overloading the collection sump and recycling plant during periods of heavy rainfall.
- 2.1.1.3 New sites shall be chosen with due regard to the presence of surface and underground water, and soil type. It is recommended that advice on the siting of plants is sought from the regional and city/district councils which will require resource consents.
- 2.1.1.4 New sites should not be subject to surface flooding, or other known hazards. Before development, drainage plans showing the isolation of treatment, dripping and storage areas from overland storm water flows shall be submitted to the regional council for approval.
- 2.1.1.5 In addition, consideration shall be given to the problem of air emissions in relation to actual or planned centres of habitation, and the direction of prevailing winds.
- 2.1.1.6 Where the regional council is satisfied that the risk of chemical contamination is negligible, areas may be drained so that rain water falling thereon enters storm water drains. Such discharges shall be subject to obtaining a discharge permit from the regional council which may contain conditions that limit the concentration of suspended solids and/or other contaminants.

2.1.2 STORMWATER DISCHARGE OUTLETS

- 2.1.2.1 Stormwater discharge outlets from the treatment plant site shall be provided with a sediment trap or sump of sufficient capacity, and maintained, to comply with the conditions of the discharge permit granted by the regional council with respect to discharge water and sediment.

2.2 STORAGE AREAS FOR PRESERVATIVES, ANTISAPSTAIN CHEMICALS, AND FRESHLY TREATED TIMBER

2.2.1 BANDED STORAGE AREAS

- 2.2.1.1 All deliveries of treatment chemicals shall be made into the banded area (section 2.6). For bulk tanker deliveries the transfer hose connection must be within the bund, but the vehicle itself may be stationed outside the bund. Such areas may be in the open or under cover in secure, well ventilated enclosures or buildings.

2.2.2 HOLDING PADS

- 2.2.2.1 All freshly pressure-treated timber which may drip shall be held on a holding pad that is roofed over for 48 hours or until the timber is drip free whichever is the shorter.
- 2.2.2.2 Dip or spray-treated timber shall be held on the holding pad until substantially drip-free (section 1.4.6). This is expected to be in the order of 30 minutes.
- 2.2.2.3 The holding pad should be sufficiently large so that the timber need not be removed during the dripping process. When the conditions set out in sections 2.2.2.1 or 2.2.2.2 have been met timber may be relocated to the treated stock storage area.
- 2.2.2.4 Holding pads shall be sealed to the requirements of the regional council. The areas shall be laid out so that drips from timber, bogies and loading equipment can be drained to a sump for either recycling or waste disposal.
- 2.2.2.5 To reduce the possibility of the formation of contaminated yard dust, the holding pads also shall be designed to be hosed down and the washings collected, (see also section 3.4).

2.2.3 TIMBER STACKING

- 2.2.3.1 To ensure that timber stacks are safe, this code recommends that stacking procedures comply with the guidelines contained in the booklet *Safety Code for Forestry Operations, Part 5: Timber Stacking, Packaging and Transportation*, published by the Occupational Safety and Health Service of the Department of Labour.

2.2.4 STORAGE AREAS FOR FLAMMABLE MATERIALS

- 2.2.4.1 Storage areas for flammable materials shall comply with the Dangerous Goods (Class 3 - Flammable Liquid) Regulations 1985.

2.3 HAZARDOUS AREAS FOR FLAMMABLE SOLVENTS ELECTRICAL REQUIREMENTS

- 2.3.1 The hazardous areas for LOSP plants and drying sheds depends on many factors including the amount, type and properties of the solvent used, type of equipment and its reliability, and the amount of ventilation provided.
- 2.3.2 Where LOSP plants and buildings meet all the requirements of sections 2.6, 4.2.8.2, 5.4.2.1, 5.4.2.2 and 5.4.4.2, the following guidelines for the hazardous area classification can be applied:
- Zone 1:** The treatment cylinder and 2 m in all directions from the vessel door.
 - Zone 2:** All other areas within the bund and extending to 2 m above the highest point.
 - Non-hazardous:** The drying shed; all areas used by unmodified types of forklift trucks to move timber on and off bogies during normal plant operations.
- 2.3.3 In the case of vapour boron plants complying in full with the bunding requirements of section 2.6, the following guidelines for the hazardous areas can be applied:
- Zone 1:** The interior of the treatment vessel.
 - Zone 2:** The whole banded area extending 2 m above the highest point.
- 2.3.4 The Dangerous Goods Inspector shall have final jurisdiction on the type and extent of the hazardous area.
- 2.3.5 Employers of plants that may not comply in full with the requirements of sections 2.6, 5.4.2.1 and 5.4.2.2, for LOSP, and section 2.6 in the case of vapour boron preservatives shall observe the following procedures:
- (a) The requirements of section 1.5.4.
 - (b) Obtain the hazardous area classification from the Dangerous Goods Inspector.
- 2.3.6 All electrical equipment shall be of a design compatible with the hazardous area classification in which it is used, and comply with the current Electrical Wiring Regulations.
- 2.3.7 Other sources of ignition such as flames, sparks or hot surfaces shall not be permitted within the hazardous area.

2.4 WARNING SIGNS

- 2.4.1 Hazchem labels for each hazardous chemical present on site shall be displayed on all storage tanks and buildings in which the chemicals are either used or stored, and at the site entrance. The code of practice *Warning Signs for Premises Storing Hazardous Substances* contains further information on the Hazchem system and includes a comprehensive list of hazardous substances. It is available from the New Zealand Chemical Industry Council Inc.
- 2.4.2 Warning notices stating FLAMMABLE LIQUIDS AREA—NO SMOKING shall be prominently displayed in easily read capital lettering at all places of work where flammable liquids are stored or used.

2.5 TANKS AND FITTINGS

- 2.5.1 All tanks and fittings shall be fabricated from materials compatible with the stored treatment chemicals. For example, corrosive preservatives such as copper-chrome-arsenic concentrates must be stored in tanks constructed from stainless steel with stainless steel fittings, or similar inert materials such as polyethylene.
- 2.5.2 Tanks with a capacity of 250 litres or greater, and used to contain chemicals classified as toxic or corrosive substances under the Toxic Substances Regulations or NZS 5433: *Transport of hazardous substances on land* shall meet the requirements for fixed bulk containers set out in Regulation 17A of the Toxic Substances Regulations as amended in Amendment No. 1.
- 2.5.3 Underground storage tanks shall comply with the requirements of the regional council and, for flammable liquids, the Dangerous Goods (Class 3 - Flammable Liquids) Regulations, 1985. Where appropriate, reference should be made to the *Code of Practice for the Design, Installation and Operation of Underground Petroleum Storage Systems*, published by OSH.
- 2.5.4 All other tanks, valves, and ancillary equipment used in Light Organic Solvent Preservative (LOSP) and vapour boron installations shall comply with the provisions of the Dangerous Goods (Class 3 - Flammable Liquids) Regulations, 1985.
- 2.5.5 **Level Indicators.** Storage tanks used for preservative concentrates or working strength solutions shall be fitted with level indicators. These should be designed to minimise the possibility of accidental damage resulting in leaks or spills.
- 2.5.6 All valves, gauges and level indicators shall be readily accessible, legibly labelled and located in positions that do not pose a hazard.
- 2.5.7 **Labelling.** In addition to the Hazchem label, every storage tank, or in the case of enclosed or below ground tanks, the riser pipe shall display a separate label clearly stating the common, chemical and/or trade name of the treatment chemical(s) it contains. The latter also shall state the approximate concentration, or range of concentrations of the treatment chemical(s) present using units such as % w/v or % w/w.

2.6 BUNDING

2.6.1 Construction

New plants, and site expansions at existing plants, shall be designed to contain the maximum total volume of timber preservative or antisapstain solutions present or stored in all vessels, pipes and tanks within the plant area (including the chemical mixing area) by bund(s) in the event of an accident, sabotage or corrosion. The bunds must be capable of holding 120% of the maximum volume [100% if the bund(s) is roofed over] of all preservative or antisapstain solutions that might be present. They shall be constructed with a sealed base surrounded by impermeable levee banks or other means of containment to an engineering design approved by the regional council. The design also shall minimise the possibility of leaking tanks discharging a jet beyond the bund wall.

2.6.2 Isolation Distances

Where flammable liquids may be present, the bund location also must comply with the isolation distances required by the Dangerous Goods (Class 3 - Flammable Liquids) Regulations 1985.

2.6.3 Integrity

The integrity of bonds, in ground tanks and treatment pits shall be maintained so that the unauthorised discharge of contaminants is prevented. Where flammable liquids are stored in ground tanks reference should be made to the *Code of Practice for the Design, Installation and Operation of Underground Petroleum Storage Systems*, published by OSH.

2.6.4 Existing Plants

As far as practical, bunds for existing plants shall meet all the requirements for new plants. Where this may not be possible employers must negotiate an acceptable level of protection with the regional council.

2.6.5 Separate bunds shall be provided to segregate any incompatible treatment chemicals.

2.6.6 Bunds suitable for dip plants may be designed in the shape of a shallow basin to facilitate truck access to and from the dipping tank, (see also section 4.6).

2.6.7 Bunds that may contain water-borne chemicals shall be designed so that they can be hosed down and the washings drained to the recycling sump.

2.6.8 If a collection sump or other open tank can pose a risk to plant employees or other people, employers shall take all reasonable steps to ensure no person falls into it. Such precautions may include covering a sump or open tank with a protective grid, or fencing it off to a height of at least 1.0 m.

2.7 SITE SECURITY

2.7.1 Employers shall establish security precautions appropriate to the site and treatment plant layout to prevent entry by unauthorized persons.

2.7.2 Every manually operated valve controlling the discharge of treatment solutions from storage tanks shall be secured by a locking device when the plant is not in operation. This provision shall not apply if the valves are contained in a secure lock-up building.

2.8 NOISE

2.8.1 All plant shall be designed and operated to comply with the requirements of the Health and Safety in Employment Act 1992.

2.9 SAFEGUARDING THE WATER SUPPLY

2.9.1 All water entry points from external sources to the mixing and storage tanks shall be protected so that treatment solutions cannot flow back into the water supply if there is a fall in supply pressure. Protection must be provided in accordance with Regulation 10 of the Water Supplies Protection Regulations

1961. Prior approval for the system chosen must be obtained from the Water Supply Authority. This requirement also shall apply to any other non-mains supply.

- 2.9.2 There must be a minimum 150 mm clear between the top of the mixing tank and the outlet end of the supply line, which also should incorporate an isolating valve.

2.10 FIRE FIGHTING EQUIPMENT

2.10.1 Fixed Installations

Where sufficient water supplies are available, hose reels conforming to NZS 4504:1981 should be provided and installed throughout the premises in accordance with NZS 4503: 1974 *Code of practice for the distribution, installation and maintenance of hand-operated fire fighting equipment for use in buildings*.

- 2.10.2 The Dangerous Goods (Class 3 - Flammable Liquids) Regulations require that portable fire extinguishers shall be provided and located in easily accessible positions wherever Class 3(a) or 3(b) flammable liquids are present, i.e. for LOSP, creosote and vapour boron installations. The extinguishers shall be selected and positioned according to the recommendations contained in NZS 4503, and the requirements of the Dangerous Goods Inspector.

- 2.10.3 Portable fire extinguishers of the appropriate type should also be provided for all water-borne preservative and antisapstain processes. The extinguishers shall be located in easily accessible positions, and comply with the recommendations contained in NZS 4503.

2.10.4 Automatic Sprinkler Systems

These have been proven over the years to be an effective tool for detecting and controlling fires in the very early stages of development. The Fire Service strongly recommends that employers install automatic fire sprinkler systems in areas where flammable solvents are used. The installation of these systems should comply with NZS 4541, Automatic fire sprinkler systems.

2.10.5 Fire Control Training

Besides providing fire fighting equipment as described above, employers should establish a liaison with the local area commander of the New Zealand Fire Service, and follow his/her recommendations concerning the size and training of fire crews, the provision of emergency evacuation plans, and other related matters.

3. SAFETY AND HEALTH REQUIREMENTS FOR ALL PRESERVATION AND ANTISAPSTAIN PLANTS

3.1 GENERAL

3.1.1 The code requires that good industrial hygiene principles shall apply. Thus, wherever practicable, the exposure of employees to hazardous substances shall be minimised preferably by:

- The substitution of a chemical by one that is less hazardous; or
- Where this is not possible, by the adoption of appropriate technical and engineering methods or improvements; and
- That engineering controls will be applied before relying solely or principally on the provision of protective clothing and equipment.

(The application of these principles is also a requirement of the Resource Management Act.)

3.2 MATERIAL SAFETY DATA SHEETS

3.2.1 Every chemical manufacturer or importer shall produce and make freely available an up-to-date Material Safety Data Sheet (MSDS) for the products it supplies. Appendix 9 provides a sample form. It should be noted that environmental information will be required by the regional council for consents under the Resource Management Act. It is therefore suggested that this should be entered under “Other information” on the MSDS sheet.

3.2.2 Employers shall make the MSDSs readily available to all personnel.

3.3 VENTILATION - GENERAL CONSIDERATIONS

3.3.1 Where employees are likely to be exposed to harmful vapours, fumes, or dusts, which cannot be adequately contained by enclosing the source, suitable mechanical extraction ventilation shall be provided to reduce the concentration to the lowest practical level below the Workplace Exposure Standard (WES), (see appendix 2). Where a Workplace Exposure Standard does not exist, the permitted level of exposure shall comply with the requirements of the Occupational Safety and Health Service (OSH). In

addition, the ventilation system must include any filters or scrubbers necessary to reduce the atmospheric discharge of toxic materials to meet standards set by the regional council.

- 3.3.2 The cleaned air shall be discharged clear of all working, storage and process areas, and is subject to the requirements of the Resource Management Act 1991.
- 3.3.3 Alternatively, any other means of controlling the emission of harmful vapours, fumes or dusts shall be acceptable, provided the standards discussed in section 3.3.1 are met.

3.4 HOUSEKEEPING

- 3.4.1 All holding pads, and other areas subject to the build up of chemical deposits (except creosote and LOSP) must be kept clean by regular hosing down with water into collection sumps for reuse or appropriate treatment and disposal (see section 8). The practice of dry sweeping is not permitted. Creosote and LOSP deposits shall be cleaned up as described in section 8.4 for spillages.

3.5 USE OF CHANGING ROOMS AND SHOWERS

- 3.5.1 Even though the employer shall meet the requirements of this code and provide a safe working environment for employees, there remains the possibility that an employee's protective clothing, skin and hair will become contaminated with traces of highly toxic chemicals. To meet their obligations not to endanger themselves or others (section 19 of the Health and Safety in Employment Act) employees shall:
- Leave all protective equipment and clothing in the lockers provided (section 3.6.2); and
 - Use the washing or showering facilities before eating, smoking or leaving the site.

3.6 PLANT ENTRY, CHANGING AND TOILET FACILITIES

- 3.6.1 To facilitate good hygiene practices, all new plants should be laid out so that personnel working with treatment chemicals and processes can enter and leave the work area via the changing room. (A second exit from the work area also must be available to staff in emergency situations.)
- 3.6.2 The changing room, shower, hand washing and toilet facilities shall meet the requirements of the Building Act and the Health and Safety in Employment Act. They shall be available for the use of persons working with treatment chemicals and processes. Provision shall be made for staff using the toilet facilities to remove protective clothing and wash before using the facilities. The changing room in CCA and creosote treatment plants shall have separate clean area and working area sections, with a clothes locker in each section for every employee.

3.7 EMERGENCY SHOWERS, AND EYE-WASHING FACILITIES

- 3.7.1 Emergency showers, wash basins, and eye-washing facilities that can provide continuous irrigation of the eye for 15 minutes shall be provided at appropriate locations throughout the plant. Access to the emergency facilities must be kept clear of any obstruction and the areas conspicuously marked.

3.8 EATING AND SMOKING FACILITIES

- 3.8.1 Smoking, and the consumption of food and drink shall be permitted only in an administrative or other uncontaminated area specifically set aside for that purpose.

3.9 PROTECTIVE CLOTHING

- 3.9.1 All personnel working with timber preservatives, antisapstains or handling freshly-treated timber shall be provided with and wear the appropriate level of protective clothing and equipment for the operation(s) carried out. It is recommended that the following is supplied:

- (a) Full-length overalls made from cotton, cotton/polyester blends, or other absorbent fabrics. These materials can absorb small splashes of liquids and prevent penetration to underclothes or skin. Two pairs of overalls shall be supplied to each employee.

Full length overalls made from imperious fabrics such as PVC should be specified for non routine or emergency situations, if there are real risks of personal exposure to preservative or antisapstain solutions or their sludges.

Green table employees may be exempted from the requirement to wear full-length overalls provided they comply with the other provisions in this section, and those contained in the manufacturer's Material Safety Data Sheet.

- (b) A waterproof PVC or neoprene apron of the bib type and extending below the knees for operations where contact with treatment solutions or freshly treated timber is likely.
- (c) PVC gloves for all operations that may involve contact with water-borne treatment chemicals and neoprene gloves for LOSP, vapour boron and creosote operations. Elbow length gloves are recommended whenever contact with liquid preservatives or antisapstains is likely. Two pairs of gloves shall be provided for each employee.
- (d) Safety footwear for all employees. Where wet conditions exist the footwear also shall be waterproof. Note, only synthetic rubber or PVC footwear is suitable for use with CCA preservatives.
- (e) Safety glasses or splash-proof goggles to provide protection whenever there is a possibility of exposure to liquid splashes, mists or chemical dusts. This requirement applies to all open situations, also for totally

enclosed plant where the preservatives are under pressure and leaks might occur. A full face shield shall be provided for situations where liquid splashes can be expected.

- (f) A suitable respirator to be worn whenever toxic substances may be inhaled in harmful concentrations. Note, a gas or particulate respirator will only be effective when fitted with the correct filter(s) and the oxygen level is not depressed. Compressed air-fed respirators are recommended for use when confined spaces are entered unless an adequate supply of fresh air can be guaranteed by other means. (The requirement to provide and wear respirators does not reduce the onus on the employer to comply with the provisions of section 3.1.) The publication *A Guide to Respirators and Breathing Apparatus* contains helpful advice on the proper selection and care of respirators, and is available from OSH offices.
- (g) An ultra-block grade of sunscreen to be applied to any skin exposed to creosote splashes and sunlight (section 5.5.2.1).
- (h) Hearing protection devices should be worn whenever noise levels are likely to impair a employee's hearing. They must be of a type approved for the degree of protection required.

3.9.2 All protective clothing and equipment shall be issued for the exclusive use of an individual.

3.10 CARE OF PROTECTIVE CLOTHING

- 3.10.1** Protective clothing shall be laundered by the employer at least weekly and more often if obviously contaminated. Employees should not wash overalls at home. They should preferably be washed at the plant but may be laundered commercially provided personnel are fully aware of the possible hazards. Treatment plant managers are responsible for providing this information. Torn clothing or clothing that contains holes shall be repaired or replaced.
- 3.10.2** Protective gloves should be examined daily for signs of cracking or other deterioration and replaced if found defective. At the end of each day employees should wash the gloves inside and out, and hang them up to dry for 36 hours or longer. Wear the two pairs of gloves provided on alternate days. This procedure will reduce the occurrences of dermatitis.
- 3.10.3** Cartridge filters or canisters used in respirators shall be replaced when:
 - The life of the device has elapsed (as recommended by the supplier);
 - Users have difficulty in breathing;
 - The wearer detects the taste or smell of the contaminant;
 - The cartridges or canisters show any sign of damage.

3.11 FIRST AID

- 3.11.1** If an accident involving timber treatment chemicals occurs, the following emergency procedures are recommended:

- (a) **Inhalation:** Remove the person to fresh air. Clear the air passages. Start artificial respiration if person is not breathing.
- (b) **Skin Contact:** Wash affected area with soap or specialist cleansers, and cold water but do not rub harshly or scrub. Where clothing has been drenched use the emergency showers provided, and remove all contaminated clothing while under the shower. Affected clothing must be laundered or disposed of if severely contaminated.
- (c) **Eye Contact:** Immediately flush with water for at least 15 minutes. Have the patient blink as much as possible while flooding the eye. Seek medical attention for all incidents involving corrosive chemicals, and if pain or discomfort persists following any other chemical contact.

If the patient wears contact lenses, immediately irrigate the eye and contact lens with water for 15 minutes. If the lens does not wash out of the eye as sometimes happens, it must be removed when practicable either by the patient but otherwise only by trained personnel. Note, no additional damage will occur to the eye if the lens is left in it for several hours.

- (d) **Swallowed:** Seek medical assistance immediately. While waiting, give patient approximately 500 ml milk or water unless the person is losing consciousness, unconscious, having convulsions, or cannot swallow. The National Poisons and Hazardous Chemicals Information Centre, phone (03) 474 0999, provides a 24-hour emergency service.

3.12 EMPLOYEE TRAINING

3.12.1 The training of employees in the safe use of timber treatment chemicals is an important safety measure that must be undertaken by every employer. Such training must be completed before the employee undertakes any work unless the employee is to be supervised by an experienced person.

3.12.2 The instruction shall include the following aspects:

- (a) Safe work procedures, methods and practices. Reference should be made to the following information:
 - Material Safety Data Sheets (where available) and technical data sheets or manuals available from the chemical suppliers;
 - Occupational Safety and Health (OSH) booklets: *Safety at Work*, *Safety Code for Forklift Truck Operators - No. 1 Front Loading Forklift Trucks*, *Manual Handling - Guidelines for the Workplace*, *Safety Code for Timber Stacking and Transportation*, and *Safety in Confined Spaces*.
- (b) The correct procedures to be followed if a spillage occurs, (section 8.4).
- (c) The hazards and symptoms of overexposure to the treatment chemicals used (appendix 7). This should cover the possibility of contact with the skin, eyes, and inhalation of dusts, aerosol mists or fumes.

- (d) The necessity for wearing the appropriate protective clothing provided for the task undertaken, and care of the same.
 - (e) First aid procedures, and the location of the emergency showers and eye wash facilities.
 - (f) The importance of good hygiene practices.
 - (g) The reporting of defects in safety devices and equipment.
- 3.12.3** Retraining shall be carried out periodically and whenever significant changes are made to the plant operation.
- 3.12.4** A record shall be kept with dates of the training provided each person employed in the preservative or antisapstain treatment of timber, and be available to the inspector on request.

3.13 MEDICAL SURVEILLANCE

- 3.13.1** Medical surveillance is recommended for employees who have the potential for exposure to timber preservative or antisapstain chemicals. This relates mainly to the employees applying the treatment chemicals and would not normally apply to those working with dry treated timber. Specific advice on the appropriate type of surveillance may be obtained from any Occupational Safety and Health Service office.
- 3.13.2** Treatment plant managers should advise a local doctor(s) of the nature of the treatment chemicals used in the plant so that appropriate medical attention may be readily available if accidents occur.

3.14 MANAGEMENT AND EMPLOYEE RESPONSIBILITIES

- 3.14.1** Employers have a legal responsibility to provide, and maintain safe and healthy working environments, and work practices so that the risks arising from working with timber treatment chemicals and the treated timber are minimised.
- 3.14.2** Employees have a responsibility, while performing their work to:
- Take care of their safety, and that of other persons who may be affected by their acts or omissions;
 - Co-operate with their employer to ensure that the provisions of this code of practice are followed;
 - Comply with instructions and procedures for their safety and health, and those of others;
 - Report immediately to their supervisor any situation that they believe could present a risk, which they cannot themselves correct;
 - Be familiar with the information contained on the labels of all treatment chemicals they use and the Material Safety Data Sheets where available;
 - Wear the appropriate protective equipment for the job, and ensure that it is correctly selected and fitted.

4. TREATMENT PROCESSES AND PLANT

4.1 PRESSURE PLANT, DESCRIPTION OF PROCESS

- 4.1.1 Timber may be conditioned by air-drying, steaming, or kiln-drying before preservative treatment. The untreated timber is placed in a steel vessel of cylindrical or rectangular shape. An initial vacuum may be drawn before the introduction of the relevant water-borne, oil-borne or light organic solvent-based preservative (LOSP) solution. This is followed by the application of pressure until the required uptake of chemicals is achieved. After draining, a final vacuum is normally applied to remove surplus solution and minimise post-treatment drip.

4.2 PRESSURE PLANT, DESIGN AND OPERATION

4.2.1 GENERAL

- 4.2.1.1 The safe operation of treatment plants depends upon sound design, regular maintenance, and correct operation by trained employees. Failure to attend to any of these aspects can lead to accidents. Sections 4.2.2 and 4.2.3 provide information on the mandatory safety precautions required for operating horizontal vessels designed for use under vacuum and pressure.

4.2.2 TREATMENT VESSEL DOOR

- 4.2.2.1 If the treatment vessel door is not closed and locked fully before starting the treatment process, it may be dislodged and blown open, either by internal pressure or by the weight of the preservative solution behind it.
- 4.2.2.2 Before closing the vessel door, employee's must ensure that the liquid seal is in position and wash or wipe the seal clean of any debris.
- 4.2.2.3 Where an overhead crane or davit is used to lift the door into place a safety chain must be attached to prevent the door dropping should the swivel break.
- 4.2.2.4 The door must be equipped with an interlock that prevents the treatment cycle starting unless the door is fully closed and locked.
- 4.2.2.5 A mechanism shall be provided to ensure that only very small amounts of residual liquid remain in the treatment vessel prior to opening the door. This may be accomplished by opening the vessel door by a small amount, provided it is restrained by a stepped locking ring or similar mechanism that will prevent remaining liquid forcing the door open violently. Any other means of achieving the same degree of safety will also be accepted.

- 4.2.2.6 For LOSP treatment vessels only, the vessel door shall also be interlocked with a means for exhausting preservative mists or vapours within the vessel when the door is opened by a small amount following a treatment cycle. This exhaust may be effected by the vacuum pump and a timing mechanism. Full opening of the door shall not occur until the fumes have been removed to below the WES limit for the preservative mist or vapour.
- 4.2.2.7 The door should be kept closed when the treatment plant is not in use.

4.2.3 ADDITIONAL INFORMATION FOR BOLTED DOORS

- 4.2.3.1 While pulling the initial vacuum at the beginning of the treatment cycle all bolts must be fully tightened and remain so until completion of the process. If there is no initial vacuum stage, the bolts must be fully tightened before starting the treatment cycle.
- 4.2.3.2 A device should be fitted that will break the liquid seal before all the bolts are removed. This should be attached to one or more of the bolts, preferably opposite the door hinge, so that the door will remain captive until the seal is broken, generally when the door is opened about 3 mm.

4.2.4 TREATMENT VESSEL WORKING PRESSURE

- 4.2.4.1 The treatment vessel shall be equipped with a pressure indicator.
- 4.2.4.2 If the pump can deliver a pressure greater than the safe working pressure of the treatment vessel, two pressure relief valves shall be included in the system. The first, acting as a pressure regulator shall be set just above the normal treatment pressure, while the second is to be set at the designated safe working pressure of the vessel. The total flow from both pressure relief valves shall be at least equal to the volumetric output of the pump.
- 4.2.4.3 Where fitted, the discharge from both pressure regulators shall be to a safe area.

4.2.5 PRESSURE PUMPS

- 4.2.5.1 Pressure pumps associated with the vessels used for water-borne preservatives may develop leaking glands under normal operating conditions (1300 - 1400 kPa). Rotating pump shafts that may generate mists or sprays of preservative solutions shall be provided with appropriate shields to contain the mist and protect employees. Where shields either do not or cannot provide effective protection the pump must be taken out of service for maintenance or replacement.
- 4.2.5.2 In LOSP plants where operating pressures are usually less than 100 kPa, all pumps and valves shall be maintained so that leaks of flammable liquid do not occur.

4.2.6 VACUUM PUMPS

- 4.2.6.1 Where applicable condensing traps shall be fitted to vacuum pump exhausts to remove preservative mists or vapours. The collected contaminants shall be transferred to mixing or waste tanks in the treatment plant for recycling or disposal.

- 4.2.6.2 Any contaminated water discharged from rotary ring pumps shall be collected by the sump or other means for reuse.

4. 2. 7 EMERGENCY REPAIRS

- 4.2.7.1 Where it is essential to effect emergency repairs on items such as leaking pump glands while the plant is operating, employees and maintenance staff shall wear full face shields and respirators in addition to their normal protective clothing to prevent the possible inhalation of mists (section 3.9.1).

4.2.8 LOADING EQUIPMENT

- 4.2.8.1 If a forklift truck, or similar, is used to push the loaded timber bogies into the treatment vessel, the link between the two should be a rigid metal bar. Rolling stock and towing equipment must be maintained in good working condition. This arrangement is acceptable for use with all non-flammable preservative solutions, and the vapour boron process (section 4.3).
- 4.2.8.2 In LOSP plants the hazardous area for forklift trucks powered by fossil fuels may exceed that for the electrical requirements set out in section 2.3.2. This is possible if solvent vapours can enter the air intake of the engine when the treated timber is removed from the treatment vessel. To avoid this hazard the bogies shall be loaded into and removed from the treatment cylinder either manually, or with a winch or an unmodified electric forklift truck provided it remains outside the Class 1, Zone 1 area, as defined in section 2.3.2.
- 4.2.8.3 If the conditions set out in 4.2.8.2 are not practical, modified forklift trucks shall be used of the type DS; ES; GS; or LPS depending on the motive power, (reference NFPA 505: 1987 *Powered industrial trucks including type designations, areas of use, maintenance and operation 1987*, an endorsed Standard).

4.2.9 TREATMENT VESSEL IDENTIFICATION

- 4.2.9.1 Information to be marked on new or reconditioned vessels shall include where possible:
- Design code;
 - Safe working pressure;
 - Name of manufacturer or reconditioner;
 - Drawing number;
 - Date of manufacture;
 - Date of hydraulic test and test pressure; and
 - Vessel manufacturer's unique identification number.

For older installations, the above information may not be readily available. Where possible, the manufacturer should be contacted for assistance.

4.2.10 ENTRY INTO CONFINED SPACES

- 4.2.10.1 Circumstances may arise when entry into treatment vessels or tanks that may contain dangerous fumes or lack of oxygen, is required. Special precautions must be taken in such instances, which include:

- The completion of an ENTRY PERMIT of the type shown in appendix 8 whenever employees are required to carry out maintenance within such spaces, or enter any vessel or tank that has contained organic solvents;
- The provision of an extra person who shall remain outside the chamber to co-ordinate rescue procedures in case of an emergency. This provision applies whenever any confined space is entered, including those situations not requiring an ENTRY PERMIT.

The booklet *Safety in Confined Spaces*, contains additional information on this subject. It is available from any office of the Occupational Safety and Health Service.

4.3 VAPOUR BORON PLANT, DESCRIPTION OF PROCESS

- 4.3.1 The vapour boron process provides a rapid boron treatment of timber that has been previously kiln dried to a low moisture content. It is a non pressure high vacuum process that facilitates the diffusion of boron in the vapour state using trimethyl borate azeotrope. A by-product of the process is the formation of methanol which is removed under vacuum together with any unreacted trimethyl borate. All condensate is collected. After reconditioning the timber using live steam, the treated timber emerges from the process at about 60°C and drip free.

4.4 VAPOUR BORON PLANT, DESIGN AND OPERATION

- 4.4.1 The treatment vessel shall be designed and maintained to operate under vacuum and atmospheric pressure in the presence of highly flammable liquids and vapours, and steam.
- 4.4.2 The specific safety provisions described in sections 4.2.6, 4.2.7, 4.2.8, and 4.2.10 shall also apply.

4.5 DIFFUSION AND ANTISAPSTAIN PLANT, DESCRIPTION OF PROCESS

- 4.5.1 In the diffusion process the timber is treated in the green state. The preservative and/or antisapstain solution, (section 5.2.2) can be either hot or cold depending on the formulation, and may be applied to the timber using any of the following methods:
- (a) Mechanically dipping the timber into an open tank, ensuring immersion, and removing;
 - (b) Spraying the timber by passing it through a spray ring contained in an open ended tunnel; or
 - (c) The chain dip method, which uses moving chains to transport the timber through a tank or tray containing a solution of the treatment chemical(s).

Following immersion boron treated timber may require 6-8 weeks' storage under cover for the diffusion process to reach completion.

4.6 DIFFUSION AND ANTISAPSTAIN PLANT, DESIGN AND OPERATION

4.6.1 OPEN TANK SYSTEMS

- 4.6.1.1 Plants must be designed and operated so that when packets of timber are removed from the dip tank, excess treatment solution is either returned to the tank or collected separately for recycling or waste disposal, (see also sections 2.2.2 and 2.6.6).
- 4.6.1.2 Tanks used for the dipping process must be sufficiently robust to withstand the physical impacts they will be subjected to from time to time, and comply with the requirement of section 2.6.8.
- 4.6.1.3 Tanks installed below ground, or pits may also act as the retaining bund provided the construction of the tank or pit complies with the requirements of section 2.6.3.

4.6.2 SPRAY TUNNEL METHOD

- 4.6.2.1 Spray tunnel plants shall be designed and maintained to contain any chemicals present in the spray to the lowest practicable level below the Workplace Exposure Standard. One way of achieving this is to use a low pressure spray with a wide diameter nozzle that effectively washes rather than sprays the timber.
- 4.6.2.2 The outfeed conveyor shall be built so that surplus treatment solution returns to the working solution tank or sump for recycling or disposal.

4.6.3 CHAIN DIP METHOD

- 4.6.3.1 The chain dip plant shall be designed and operated to comply with the general provisions set out in sections 2.1.1.2, 2.6.1, 2.6.4 and 3.1.1 of the code.

4.7 PLANT MAINTENANCE

- 4.7.1 All machinery shall be soundly constructed of proper materials, and shall be maintained in a safe working condition.
- 4.7.2 A thorough examination of the treatment cylinder, and its associated pipework, valves, tanks and pumps shall be carried out at intervals of not more than three years by a technically competent person to ensure the continued safety of the operation. The examination report shall be available for inspection on site.

5. TYPES OF PRESERVATIVES

5.1 WATER-BORNE, PERMANENTLY FIXED TYPE

5.1.1 GENERAL

- 5.1.1.1 A fixed water-borne preservative becomes chemically insoluble and fixed to the wood fibres either during or following the treatment process so that the timber is permanently protected for use in exposed or wet situations. The most common preservatives of this type are copper-chrome-arsenic (CCA) salts. Appendix 3 contains some of their formulations and trade names.

5.1.2 HEALTH HAZARDS OF CCA PRESERVATIVES

- 5.1.2.1 The major risk to employees' health arises from contact with arsenic or chromium compounds. Poisoning may be caused by:
- Swallowing (usually through transfer onto food), chewing gum, or smoking materials from hands or dirty clothing;
 - Inhalation of contaminated dusts or aerosol mists;
 - Direct contact with the skin.

Contamination may arise from poor housekeeping or unsatisfactory work practices, which the code addresses elsewhere. In particular sections 3.5 and 3.9 consider the requirements for washing facilities and protective clothing.

- 5.1.2.2 Copper salts are also toxic but to a much lesser extent than either arsenic or chromium. Provided adequate precautions are taken to prevent arsenic and chromium poisoning, employees should experience no additional risk from exposure to copper salts. Appendix 7 contains specific information on the toxicity of arsenic, chromium, and copper compounds, and explains the mechanism of chemical fixation.
- 5.1.2.3 The potential risk of exposure to employees by CCA chemicals is in direct proportion to the CCA concentration in dusts and solutions. Thus liquid concentrates, e.g. 60% w/v are much more hazardous than working strength solutions, which typically vary from less than 1% w/v to about 6% w/v depending on the process and the degree of protection to be afforded the timber. CCA salts therefore vary from being aggressively to mildly corrosive in contact with skin depending on the solution concentration.
- 5.1.2.4 The process of chemical fixation of CCA salts to wood fibres begins during the treatment process and generally proceeds to completion over a period of approximately 14 days. However, the CCA present on the surface of the timber is essentially completely fixed within 48-72 hours at ambient temperatures. (Future developments in technology may considerably reduce this time.) After that time the timber may be safely handled wearing only

normal protective clothing, i.e. gloves, overalls, and safety footwear (section 3.9). Occasionally a white powder will appear on the surface of CCA treated timber. This is sodium sulphate, a by-product of the fixation process. It is a harmless substance which, if necessary, may be simply brushed or hosed off.

- 5.1.2.5 In certain instances green deposits may appear on the surface of treated timber. These are a form of copper arsenate, which is toxic. If there is a possibility of inhaling hazardous amounts of dust from these deposits, i.e. above the WES Limit (appendices 2 and 7), employees must wear canister-type respirators in addition to their normal protective clothing. The respirators must be fitted with particulate filters appropriate for the removal of arsenic. Chemical sludging causes these deposits, which can be minimised by adopting sound plant management practices (section 5.1.5).

5.1.3 MINIMISATION OF TIMBER DRIPPING

The amount of drip from pressure treated timber needs to be minimised in order to reduce the cost of meeting the requirements set out in sections 2.1.1.2 and 2.2.2. This may be best achieved by using one or more of the following procedures:

- (a) Before removing the treated charge from the treatment vessel, a final vacuum of at least minus 85 kPa should be drawn for not less than 15 minutes and preferably longer.
- (b) Packets of sawn timber should be tilted using suitable bolsters to help the run off of excess solution within the treatment cylinder.
- (c) Use one of the “new technology” proprietary process systems.
- (d) Apply a substantial initial vacuum, where applicable, in addition to the final vacuum.

5.1.4 SLUDGE FORMATION IN CCA PLANTS

- 5.1.4.1 There are at least three sources of suspended solids, known as sludge, in CCA working solutions:
- (a) Impurities present in the preservative concentrate.
 - (b) Foreign matter washed from the wood, such as bark, sawdust, and soil.
 - (c) Insoluble precipitates formed by chemical reactions between CCA components and wood extractives.
- 5.1.4.2 Suppliers of CCA bulk concentrates should take steps to reduce the solids present to very low levels, consistent with good preservation practices, so that the contribution of (a) to the total sludge is unlikely to cause concern.
- 5.1.4.3 Any working solution will contain a certain amount of type (b) sludge, which if not removed can cause significant wear to pumping equipment and increase the possibility of blockages. Thus, timber awaiting treatment should be kept clean, free of dirt and dust, and contact with the ground avoided by using bearers or skids.
- 5.1.4.4 Type (c) sludge is bright green in colour and toxic. Wood that is hot from exposure to the sun or steam seasoning before immersion in the preservative solution may aggravate the formation of chemical sludge.

5.1.5 SLUDGE MINIMISATION

- 5.1.5.1 Significant amounts of CCA sludge will not form on the surface of treated timber provided the concentration of suspended solids is maintained below 2.5 grams per litre in working strength solutions.
- 5.1.5.2 The sludge present in treatment solutions can be reduced by adopting one or more of the following procedures:
- (a) Use a settling tank or sump to separate the solids from the preservative solution.
 - (b) Use a treatment process that has a high solution uptake.
 - (c) Install a properly designed filtering system to remove coarse particles with the filter located so that it is easily accessible for cleaning.

5.1.6 SLUDGE IN OTHER SITUATIONS

- 5.1.6.1 Sludge formation can occur in other treatment solutions. For example, substantial concentrations of solids may accumulate in antisapstain, and boron dip processes. Good operational practice can usually reduce the amount of sludge formed to acceptable levels, although it may still be necessary to dispose of some sludge (section 8.3.2).

5.2 WATER-BORNE, NON-FIXED TYPE

5.2.1 GENERAL

- 5.2.1.1 This group of chemicals is used to preserve timber that is completely protected from the weather, and not in contact with the ground. The most common formulations are of the boron type that contain solutions of boric acid and borate salts normally in concentrations of between 7.5% w/v and 24% w/v boric acid equivalent. Appendix 5 contains trade names of common preservatives in this group.

5.2.2 FUNGICIDAL ADDITIVES

- 5.2.2.1 Boron preparations frequently include antisapstain fungicides, which can contribute significantly to the total toxicity of the preservative mix. Section 6 contains further information on antisapstain chemicals.

5.2.3 HAZARDS OF BORON COMPOUNDS

- 5.2.3.1 Boron compounds are toxic to wood-boring insects at very low concentrations and possess fungicidal properties at higher concentrations. They are also moderately toxic to plant life and fish.
- 5.2.3.2 The human toxicity of boron compounds is generally low. The usual form of exposure is through skin contact with either the liquid or dried dusts. This will often produce a skin rash and irritation (dermatitis). Other forms of exposure to toxic amounts of boron salts during the treatment process can be regarded as low. Appendix 7 provides further information on boron toxicity.

- 5.2.3.3 Any non-fixed type preservative may leach out of the timber if it is exposed to water or moisture. When handling such timber, employees should take the same care and precautions as for handling the preservative solutions.

5.3 VAPOUR BORON TYPE

5.3.1 GENERAL

- 5.3.1.1 The preservative is a volatile organic boron chemical known as trimethyl borate and is nominally marketed as the azeotrope, a solution containing 70% trimethyl borate + 30% methanol. It can provide timber with the same degree of protection as water-borne boron products, (section 5.2). Fungicidal and other types of additives are unlikely to be used in conjunction with trimethyl borate.

5.3.2 HEALTH HAZARDS

- 5.3.2.1 In contrast to water-borne boron products, trimethyl borate is moderately toxic by contact with the skin and from inhalation of the vapours. The liquid is a severe irritant to the eyes and can cause permanent loss of vision.
- 5.3.2.2 Precautions must be taken to avoid skin and eye contact, and breathing of trimethyl borate vapours. It should be noted that at the completion of a correctly operated treatment cycle, there should be no residual trimethyl borate present in either the treated timber or the treatment vessel.
- 5.3.2.3 Appendix 7 contains additional information on trimethyl borate toxicity.

5.3.3 FIRE HAZARDS

- 5.3.3.1 The trimethyl borate azeotrope is a Class 3(a) Dangerous Goods and is rated as a very dangerous fire hazard. Hazardous combustion products include carbon monoxide and boron oxides. Fires should be controlled with CO₂, spray or foam. Avoid contact with heat, naked flames and oxidising agents.

5.3.4 STATIC ELECTRICITY

- 5.3.4.1 Organic chemicals are poor conductors of electricity and can develop static charges when pumped through metal or plastic pipes causing sparking and ignition. Precautions must be taken against this possibility by ensuring that all metal components of the plant including the treatment vessel, storage tanks, pumps and associated pipe work are continuously bonded and earthed according to NZS/AS 1020: 1984 *The control of undesirable static electricity*.

5.4 LIGHT ORGANIC SOLVENT PRESERVATIVES (LOSP)

5.4.1 GENERAL

- 5.4.1.1 Light organic solvent preservatives are solutions of fungicides that may also contain insecticides and water-repellent waxes or resins dissolved in an organic solvent. These formulations are designed primarily for the treatment of fully machined timber components, or plywood.
- 5.4.1.2 The most common fungicide applied is a 2.5% w/w strength solution of bis (tri-n-butyl tin) oxide (TBTO) in a white spirit solvent, or an equivalent concentration of bis (tri-n-butyl tin) naphthenate (TBTN). Other preservatives that may be used include copper naphthenate, copper-8-hydroxyquinolate (oxine-copper), chlordane, pentachlorophenol, and synthetic pyrethroids. Appendix 4 contains a list of current LOSP formulations and their trade names. Note, future developments in LOSP formulations are likely and may not be fully covered by this code.
- 5.4.1.3 In a well-operated plant, timber treated with LOSP solutions should be surface dry and drip free on removal from the treatment vessel.

5.4.2 VENTILATION—ADDITIONAL REQUIREMENTS FOR LOSP

- 5.4.2.1 LOSP treatment plants shall be designed and sited as far as practicable in the open to minimise the risk of high concentrations of flammable solvent vapour (normally white spirit) occurring if a chemical spillage or leak occurs. Where this is not possible, the building structure should be of light construction with at least two sides open to the atmosphere to improve the natural ventilation.
- 5.4.2.2 The drying shed used to store the LOSP-treated timber shall be well ventilated by providing good natural air circulation or, if this is not practical by mechanical means. As the solvent vapours are much heavier than air the Department suggests that the buildings contain large air vents located close to the ground and near roof level to maximise the effectiveness of the natural ventilation.

5.4.3 HEALTH HAZARDS OF LOSPS

- 5.4.3.1 Where used, TBTO in concentrated form is probably the most hazardous chemical present in the preservative formulation. It is a viscous liquid that is extremely irritating if splashed in the eyes or on unprotected skin. Preservative concentrates are usually supplied at 15% w/w TBTO, but may contain up to 60% w/w TBTO. Concentrates at 60% w/w TBTO are about as hazardous as pure TBTO because the solvent reduces the viscosity and assists spreading. The solvent also increases the permeability of the skin so that the available TBTO is absorbed faster. However, when the TBTO is further diluted to 2.5 - 3.5% w/w strength in the LOSP treatment solution, the major hazard to employees is likely to arise from possible contact with the solvent (white spirits) rather than the TBTO.
- 5.4.3.2 Precautions must be taken to avoid skin and eye contact with LOSP solutions and their concentrates, and breathing the vapours in poorly ventilated areas. Sections 3 and 4 consider the specific safety requirements in detail. Appendix 7 discusses the toxicity of some LOSPs.

- 5.4.3.3 Many copper-based preservatives and the waxes or resins used are of low toxicity and require no special precautions in themselves. However, when formulated in LOSP solutions, precautions are required to prevent exposure to the organic (white spirit) solvent.
- 5.4.3.4 Insecticides may be added to LOSP formulations, and some of these can be moderately toxic. Appendices 4 and 7 contain specific details.

5.4.4 FIRE HAZARDS

- 5.4.4.1 The organic solvent used in LOSP, usually a special grade of white spirit, is a Class 3 (b) Dangerous Goods. It is rated as a moderate fire risk both in its pure state, and when used in timber preservative formulations.
- 5.4.4.2 **Solvent Flash Point Specification:** The flash point of the solvent used in LOSPs shall be 35°C or higher when tested in the Abel Apparatus, (Dangerous Goods (Class 3 - Flammable Liquids) Regulations 1985, Second Schedule) to be compatible with the hazardous area classification guidelines given in sections 2.3.2, 4.2.8.2 and 4.2.8.3. It should be noted that solvent mists, which may be present when the treatment vessel door is opened can be combustible at about 4°C below the flash point.
- 5.4.4.3 **Branding of Timber:** The practice of hot-iron branding of timber within a few days of the treatment process can result in ignition of residual white spirit vapours and cause a substantial fire. All burn branding of timber treated with LOSP shall be before treatment.

5.4.5 STATIC ELECTRICITY

- 5.4.5.1 Organic solvents are poor conductors of electricity and can develop static charges when pumped through metal or plastic pipes, (especially at speeds above 5 m/sec), causing sparking and ignition. Precautions must be taken against this possibility by ensuring that:
- (a) All metal components of the plant, including the treatment vessel, trolley rails, storage tanks, pumps and associated pipe work, are continuously bonded and earthed according to NZS/AS 1020: 1984 *The control of undesirable static electricity*.
 - (b) The white spirit solvent contains antistatic additives to produce a minimum conductance of at least 100 picomho/m at 20°C. The employer should place responsibility for meeting this requirement on the supplier;
 - (c) The LOSP solutions shall enter all vessels preferably through a bottom-filling device that prevents the issuing jet of liquid splashing on the tank surfaces, but otherwise by using a standpipe extending almost to the bottom of the tank.

5.5 OIL-BORNE PRESERVATIVES

5.5.1 GENERAL

- 5.5.1.1 The only oily preservative currently in use in New Zealand is creosote. There is only one treatment plant using it in commercial quantities, and then only to treat railway sleepers.
- 5.5.1.2 Creosote treatment is undertaken in a pressure plant using a hot (90-100°C) mixture of 60 : 40 creosote : heavy fuel oil so that the general provisions that apply to water-borne preservatives in pressure processes are relevant. Some additional hazards exist and are considered in sections 5.5.2 and 5.5.3.

5.5.2 HEALTH HAZARDS

- 5.5.2.1 Creosote is produced as a by-product from either coking or smokeless fuel manufacture. Both types of creosote are corrosive. If splashed onto the skin and eyes, creosote will cause chemical burns and promote the formation of skin cancers unless employees wear protective clothing. Exposure to sunlight greatly increases its corrosiveness. In consequence, people with fair skins are much more easily burned than darker skinned people. The application of a total block sunscreen will reduce this effect, but is not a substitute for following correct safety procedures including the wearing of appropriate protective clothing (section 3.9).
- 5.5.2.2 **Skin Contact:** After washing with soap and water (Section 3.11), swab affected skin with methylated spirits or preferably with a 50 : 50 mixture of methylated spirits and PEG (polyethylene glycol) followed by further washing with soap and water. Repeat if necessary and seek medical attention.
- 5.5.2.3 Creosote fumes must be contained as far as practical in closed storage tanks fitted with vent pipes to discharge any fumes generated directly to atmosphere above the roof. Fumes that may be present within the plant room shall be controlled by ensuring a high standard of maintenance of all seals and glands, and by natural or mechanical ventilation so that the concentration of creosote fumes does not exceed the NIOSH recommended limit of 0.1 mg/m³.
- 5.5.2.4 As timber preserved with creosote can continue to “bleed” for many months or even years after the treatment process, and particularly if the wood is exposed to warm temperatures, protective gloves must be worn whenever the timber is handled.
- 5.5.2.5 Sawdust from oil-borne treated timber is always hazardous if it is inhaled or comes into contact with unprotected skin.
- 5.5.2.6 Pressure treatment with creosote based preservatives generally leaves the timber dry and drip free, provided a high final vacuum is applied for at least 15 minutes. Some narrow sapwood species such as Douglas fir or larch however, may require the provision of a suitable dripping area.
- 5.5.2.7 Appendix 7 contains additional information on creosote toxicity.

5.5.3 FIRE HAZARD

- 5.5.3.1 The flash point of all oil-borne preservatives used shall be above 61°C when tested in the Pinsky-Martens Apparatus (see Dangerous Goods (Class 3 - Flammable Liquids) Regulations 1985, Second Schedule).
- 5.5.3.2 At room temperature creosote does not represent a serious fire risk. However, once alight it will greatly add to the intensity of any existing fire.
- 5.5.3.3 The hot creosote and oil mixture used in the pressure treatment process is significantly above its flash point. It is therefore just as hazardous as any Class 3(a) Dangerous Goods at room temperature. Leaks or spills of hot creosote will therefore be a high fire risk and all sources of ignition must be eliminated. Electrical fittings shall comply with the current Electrical Wiring Regulations within the hazardous area, as defined by the Dangerous Goods Inspector. The plant also shall be bonded and earthed according to NZS/AS 1020: 1984 *The control of undesirable static electricity*.

6. ANTISAPSTAIN CHEMICALS

6.1 INTRODUCTION

- 6.1.1 The sapwood of all timber is susceptible to disfigurement or degradation by mould, sapstain and decay fungi, especially during air seasoning or storage either as sawn timber or roundwood. In addition, timber undergoing boron diffusion storage is also susceptible to sapstain and mould.
- 6.1.2 Fungal degradation can be controlled with fungicidal chemicals. These are normally applied in a bath through which all timber passes on the “green chain”, or in a dip tank into which packets of timber are momentarily immersed, or in a spray tunnel. Appendix 6 provides details of the current trade names and active ingredients present.
- 6.1.3 Antisapstain formulations may contain one or more different chemicals; antisapstains may be applied directly to timber, or in combination with other preservatives such as boron-type treatments or with insecticides.

6.2 HEALTH AND ENVIRONMENTAL HAZARDS

- 6.2.1 Although the antisapstain chemicals in present use are less toxic to people than previously used chemicals such as sodium pentachlorophenate, it is still important to take precautions to avoid excessive inhalation of fumes or mists and to prevent contact with the skin and eyes.
- 6.2.2 Insecticides may be incorporated in any antisapstain formulation and can significantly increase the total toxicity of the formulation. Substances such as lindane or chlordane used in the past have been replaced by considerably less toxic compounds such as synthetic pyrethroids.
- 6.2.3 All known antisapstains are moderately to highly toxic to fish.
- 6.2.4 Appendix 7 provides information on the human toxicology of some antisapstain agents and insecticides.
- 6.2.5 **Antisapstain residues:** Historically antisapstain chemicals such as Captafol, Folpet and sodium pentachlorophenoxide were used extensively until around the mid 1980s when they were replaced by newer, safer chemicals. The residues associated with the historical use of antisapstains may still be present on many sites. Advice on the appropriate precautions for handling such residues will need to be sought from OSH and the regional council.

7. MIXING OF TREATMENT CHEMICALS

7.1 GENERAL

- 7.1.1 The practice of delivering timber treatment chemicals in liquid or emulsion form offers major safety and health advantages by eliminating most of the handling and dust problems inherent in dry mixing processes.

7.2 SUPPLY OF CHEMICALS

- 7.2.1 Manufacturers normally supply CCA type preservatives as bulk liquid concentrates at about 600% w/v by road tanker. LOSP preservatives may be supplied at concentrations ranging from 15% to 60% w/w TBTO in drums, or at working strength in bulk deliveries. Water-borne boron formulations are available for bulk delivery at around 24-45% w/v boric acid equivalent. It should be noted that LOSP formulations may in addition contain organic insecticides and water-borne boron concentrates, antisapstain chemicals.
- 7.2.2 Where treatment plants require smaller quantities of preservative or antisapstain chemicals, delivery may be in 1000 litre IBCs (intermediate bulk containers), or plastic or metal drums for liquid concentrates or flowable formulations, and kegs or bags for solids. All such containers must comply with the requirements of NZS 5433, *Code of practice for the transport of hazardous substances on land*.

7.3 GENERAL PROVISIONS FOR MIXING

7.3.1 MECHANICAL/MANUAL HANDLING

- 7.3.1.1 Research has shown that the risk of injury resulting from manual handling increases when loads of more than 4.5 kg sitting, and 16 kg standing are handled. These figures should not be regarded as fine lines between safe and unsafe, but should be used as a guide when assessing the overall risk of any manual handling task.
- 7.3.1.2 To minimise the risk of physical injury to employees, OSH recommends that mechanical handling equipment such as forklift hoists be provided to move drums and bags of chemicals.
- 7.3.1.3 Forklift hoists can be hazardous if employees do not observe safe operating procedures. Advice is contained in the OSH publication, *Safety Code for Forklift Operators, No. 1 Front Loading Forklift Trucks*

- 7.3.1.4 Manual handling methods may be employed provided attention has been given to the principles of minimising the risks of physical injury. Detailed advice on risk assessment and control is contained in the OSH publication *Manual Handling Guidelines for the Workplace*.

7.3.2 CHEMICAL MIX AREAS

- 7.3.2.1 Particular attention shall be paid to the layout and design of chemical areas, including bunding. For example, mix areas should have a minimum of ledges where dust particles may accumulate and shall be capable of being hosed down and/or vacuum cleaned using portable equipment. The washings from such areas must be drained to a suitable collection sump for recycling or waste disposal.
- 7.3.2.2 As a minimum requirement mix areas shall be supplied with good natural ventilation to remove fumes and dust as far as practical below the corresponding WES limit (appendix 2). In situations where fumes and dust remain a problem, exhaust ventilation hoods shall be provided with a capture velocity of at least 0.6 m/sec. (See section 3.3 for additional requirements.)

7.3.3 MIXING OF BULK LIQUID CONCENTRATES

- 7.3.3.1 Dilution mixing of bulk liquid concentrates with water or other solvent is the safest method of providing working strength formulations.

7.3.4 MIXING OF PACKAGED LIQUID CONCENTRATES

- 7.3.4.1 Manufacturers may supply packaged liquid concentrates in containers of 20-200 litres capacity. In situations where less than whole 200 litre drum quantities are required, employees must be able to measure the required amount without hazard.
- 7.3.4.2 All 200 litre drums shall be used with either a suitable pump inserted into the larger bung opening or, alternatively, a drum tap or valve with the drum supported on a tipping stand.
- 7.3.4.3 The preferred method of transferring the drum contents to the mix tank is by pump and flowmeter device. The use of plastic or rubber buckets is acceptable for transferring small quantities.

7.3.5 MIXING OF FLOWABLE SUSPENSIONS

- 7.3.5.1 These treatment chemicals may contain both soluble and insoluble components and should be mixed using either the "in-drum" or "overflow" methods.
- 7.3.5.2 "In-drum" mixing involves inserting a device consisting of two concentric pipes into the larger bung hole of the drum. Water or treatment solution is pumped through the inner pipe using a low pressure centrifugal pump, and rises through the flowable suspension carrying a dilute suspension of the preservative or antisapstain out via the outer pipe. This method has the advantage of providing the employee with good protection from contact with the treatment chemical.

- 7.3.5.3 “**Overflow**” mixing is carried out by placing the drum on a grating above the mixing tank and running water into the drum so that it overflows carrying the diluted suspension down the sides of the drum and into the mixing tank.
- 7.3.5.4 Once mixed, flowable suspensions usually require periodic agitation to prevent suspended solids from settling. This may be achieved with paddles, mechanical stirring, hydraulic pump bypass, or gently with compressed air. Over aeration can cause excessive frothing leading to the release of foam containing preservatives and/or antisapstain chemicals into the atmosphere, and must be avoided.

7.3.6 MIXING OF DRY CHEMICALS

- 7.3.6.1 Dry chemicals should be mixed in purpose-built plant located in a mix room. To minimise the formation of dust, opened bags of chemicals shall be carefully upended into a hopper, which can be situated either above the enclosed mix tank or at ground level. In the latter case the hopper should be provided with a water supply and its exit connected to a medium diameter pipe (c. 100 mm ID) with a centrifugal pump to transfer the solids and water to the mix tank. This arrangement has the advantage of reducing the handling and lifting operations to a minimum.
- 7.3.6.2 Open mixing areas may be approved by the Inspector for small operations where it can be shown that the provision of a separate chemical mix area is impractical. In these situations the treatment tank may be used to mix the treatment chemicals provided it complies with the following conditions:
- (a) A substantial platform is constructed at the top of the mixing tank so that drums or bags can be handled or tipped safely.
 - (b) The requirements of section 2.6.8.

8. DISPOSAL OF WASTES

8.1 METAL OR PLASTIC DRUMS

8.1.1 WATER-BASED TREATMENT CHEMICALS

Drums that have contained water-based chemicals must be thoroughly flushed and rinsed three times with water before they leave the site. All washings shall be returned to the mix tank. Drums that have contained pesticides must not be sold to third parties. Cleaned drums should be returned to the supplier for refilling, provided written documentation accompanies any such consignment stating that the drums may contain pesticide residues. Where drums are to be destroyed their disposal shall be by way of the regional council consent, or as otherwise authorised.

8.1.2 DRUMS CONTAINING LOSP CONCENTRATES

The Department recommends that empty drums, which have contained LOSP concentrates are flushed out with solvent or working strength treatment solution. The washings shall be recycled to the treatment storage tank using a sump or other method. After draining the solvent from the drums, the bungs should be well secured. Drums that have contained pesticides must not be sold to third parties. Cleaned drums should be returned to the supplier for refilling, provided written documentation accompanies any such consignment stating that the drums contain residues of Class 3(b) solvents and pesticides. Where drums are to be destroyed their disposal shall be by way of the regional council consent, or as otherwise authorised.

8.1.3 DRUMS CONTAINING VAPOUR BORON PRESERVATIVE

The Department recommends that empty drums be used to collect the vacuum condensate, mainly methanol, and returned to the supplier for reprocessing. Alternatively the drums may be thoroughly rinsed out (3 times) with water, the washings used as make up water for antisapstains, and the drums steam cleaned prior to resale. Where drums are to be destroyed their disposal shall be by way of the regional council consent, or as otherwise authorised.

8.1.4 DRUMS CONTAINING OIL-BASED PRESERVATIVES

Any drums that have contained creosote should be thoroughly drained and no attempt made to clean them on site. Drums with the appropriate labelling and documentation may be returned to the supplier for refilling, or to drum reconditioners. Where drums are to be destroyed their disposal shall be by way of the regional council consent, or as otherwise authorised.

8.2 PLASTIC OR PAPER BAGS

- 8.2.1 Paper bags or kegs, and all plastic except PVC may be incinerated in accordance with the regional council consent, or as otherwise authorised, e.g. in a purpose-designed burner where the minimum combustion temperature is at least 1000° C, and where the gases in the combustion zone have minimum residence time of at least 1.0 seconds, except for containers that may have contained arsenic. Packaging materials that are not burnt shall be disposed of by way of the regional council consent, or as otherwise authorised, e.g. in an approved landfill.

8.3 SLUDGE

- 8.3.1 The Department of Health's publication *Waste Management Guide: 02, Treatment and Disposal of Timber Preservative Wastes: Copper, Chromium, and Arsenic* sets out procedures for handling collected CCA sludge. Either this or an approved alternative method must be followed.
- 8.3.2 Final disposal of the following types of waste shall be by way of the regional council consent, or as otherwise authorised:
- (a) The sludge from any treatment plants;
 - (b) All silt collected in stormwater sumps (section 2.1.2.1);
 - (c) Any contaminants captured by filters or scrubbers.

8.4 SPILLAGES

- 8.4.1 Spillages of any treatment chemical shall be handled as follows:
- (a) Isolate the source of the spillage and ensure no further discharge occurs;
 - (b) Remove all potential sources of ignition if LOSP, trimethyl borate or oil-borne preservatives are involved; wear full protective clothing which may include breathing apparatus.
 - (c) Contain the spill with soil or sand, and mop up with sawdust or other absorbent material;
 - (d) If substantial quantities are present, e.g., over 50 litres, an attempt shall be made to recover the liquid by pumping into a storage tank or other container. Smaller quantities shall be absorbed completely and placed in a drum or similar container and clearly labelled;
 - (e) Disposal of contaminated sawdust, soil, etc. shall be by way of the regional council consent, or as otherwise authorised.
- 8.4.2 It should be noted that the regional council may require a site spillage contingency plan as a condition of the resource consent.
- 8.4.3 If a spillage occurs in an unbunded area or extends beyond the site perimeter, the New Zealand Fire Service, the regional council, city or district council, and downstream landowners must be notified immediately. It is also suggested that advice is sought from the chemical supplier.

8.5 OFF-CUTS

- 8.5.1** When CCA-treated timber is burnt the highly toxic arsenic is released into the atmosphere as smoke. (The ash contains copper and chromium and some arsenic.) To avoid the possibility of employees or others breathing such smoke and to protect the environment, the burning of CCA-treated wood, shavings and sawdust shall not be permitted at the treatment plant site or complex unless specifically authorised. Where burning is permitted the resulting ash shall be disposed of by way of the regional council consent, or as otherwise authorised, e.g. in an approved landfill.
- 8.5.2** Where permits to burn CCA-treated off-cuts, shavings and sawdust do not exist, all such waste shall be disposed of by way of the regional council consent, or as otherwise authorised, e.g. in an approved landfill.
- 8.5.3** The off-cuts, chips, sawdust and shavings from timber treated with boron and LOSP preservatives or antisapstains:
- (a) Should not be provided to a person for use as a mulch or animal bedding, for burning in a residential fireplace (except as provided for in section 8.5.4), in a barbecue or for the purpose of smoking foodstuffs;
 - (b) May be incinerated in accordance with the regional council consent, or as otherwise authorised, e.g. in a purpose-designed burner where the minimum combustion temperature is at least 1000°C, and where the gases in the combustion zone have minimum residence time of at least 1.0 seconds. The ash containing either borates from the diffusion process or tin or copper from LOSP treatments shall be disposed of by way of the regional council consent, or as otherwise authorised, e.g. in an approved landfill;
 - (c) May be disposed of as required by section 8.5.2.
- 8.5.4** The off-cuts, chips, sawdust and shavings from all timber treated only with antisapstains on or after January 1992 should not be burnt in an open fire but may be burnt in a residential wood burning stove.
- 8.5.5** Surplus stocks of supplied treatment chemicals shall be disposed of by one of the following methods:
- (a) Returned to the supplier;
 - (b) Any other means that has the prior approval of the regional council.
- 8.5.6** Only untreated wood should be used for barbecues and smoking foodstuffs.

8.6 STEAMING RESIDUES

- 8.6.1** Normally the aqueous portion containing the various soluble constituents can be safely disposed of after its biochemical oxygen demand (BOD) and resin acid content has been reduced to comply with the regional council discharge permit. The solid waste shall be disposed of in accordance with the regional council consent, or as otherwise authorised, e.g. in an approved landfill.

9. MISCELLANEOUS TOPICS

9.1 GRADING OF TIMBER

- 9.1.1 To reduce the contact and handling of wet-treated timber by employees, the timber should be graded, where practicable before any application of chemicals.

9.2 SAWDUST AND SHAVINGS

- 9.2.1 When treated or untreated wood is machined or sanded, a dust mask or particulate respirator fitted with the appropriate filter must be worn if there is any doubt concerning the effectiveness of the dust extraction or containment system. Dust masks and respirators shall comply with NZS/AS 1715 and 1716 and must be adequate for the particular hazard.

9.3 FUMIGATION OF TIMBER

9.3.1 GENERAL

- 9.3.1.1 Timber may be fumigated using any suitable approved toxic gas to destroy all insect life on or under the surface of the wood. The fumigation process is normally carried out by covering the timber with a canopy and injecting the fumigant into the enclosure. As the gas used must be highly toxic to insects to be effective, the fumigant will usually also be a health risk to humans unless employees take stringent precautions.

9.3.2 APPLICATION OF FUMIGANTS

- 9.3.2.1 The fumigation process must be carried out by at least two employees, one of whom holds a certificate of competence issued by the Public Health Unit, Crown Health Enterprise.
- 9.3.2.2 The most widely used fumigant material for timber is the gas methyl bromide to which a small amount (c. 2%) of chloropicrin has been added. Chloropicrin is an intense eye irritant and therefore acts as a warning agent for the colourless, odourless and highly toxic methyl bromide. Appendix 7 contains further toxicological information. Other approved fumigants include cyanides and phosphine gas.
- 9.3.2.3 Before and during the fumigation process the whole area shall be cordoned off and warning signs “DANGER—POISON GAS—KEEP AWAY” prominently displayed.

9.3.2.4 Respiratory protective equipment must be worn during the fumigation process by all persons entering the cordoned off area.

9.3.2.5 Note, the Fumigation Regulations 1967 contain additional requirements and must be followed. Before starting any fumigation process, employees are advised to contact the Public Health Unit of their local Crown Health Enterprise for further information on this subject.

RELATED DOCUMENTS

NEW ZEALAND LEGISLATION

- The Health and Safety in Employment Act 1992
- ¹ Dangerous Goods Act 1974
- ¹ Dangerous Goods (Class 3 - Flammable Liquids) Regulations 1985
- Health Act 1956
- Resource Management Act 1991
- ¹ Pesticides Act 1979
- ¹ Toxic Substances Act 1979
- ¹ Toxic Substances Regulations 1983
- Fumigation Regulations 1967
- Electrical Wiring Regulations 1976
- Water Supplies Protection Regulations 1961

NEW ZEALAND STANDARDS

- NZS/AS 1020: 1984 *The control of undesirable static electricity*
- NZS/AS 1715: 1991 *Selection, use and maintenance of respiratory protective devices*
- NZS/AS 1716: 1991 *Respiratory protective devices*
- NZS 4503: 1974 *Code of practice for the distribution, installation and maintenance of hand operated firefighting equipment for use in buildings*
- NZS 4504: 1981 *Fire hose reels*
- NZS 4541: 1987 *Automatic fire sprinkler systems*
- NZS 4561: 1973 *Fire alarms systems manual*
- NZS 5433: 1988 *Code of practice for the transport of hazardous substances on land*
- NZS 6101: 1988 *Classification of hazardous areas, Part 1 - Explosive gas atmospheres*

OTHER DOCUMENTS

- AS 2843.1: 1985 *SAA timber preservation safety code, Part 1 - Plant design*
- AS 2843.2: 1985 *SAA timber preservation safety code, Part 2 - Plant operation*

NZ Chemical Industry Council	<i>Code of Practice - Warning Signs for Premises Storing Hazardous Substances</i>
NFPA 505: 1987	<i>Powered industrial trucks including type designations, areas of use, maintenance and operation, 1987</i>
British Wood Preservers Assn.	<i>Code of Practice for the Safe Use Design and Operation of Timber Treatment Plants, July 1991.</i>
MP 3640: 1992	<i>Specification of the Minimum Requirements of the NZ Timber Preservation Council Inc.</i>
OSH: 1992	<i>Code of Practice for the Design, Installation and Operation of Underground Petroleum Storage Systems</i>
OSH: 1992	<i>Draft Code of Practice for the Completion of a Material Safety Data Sheet for Use in New Zealand</i>

¹ To be administered by the Environmental Risk Management Authority under a new statute.

APPENDIX 1: ENFORCEMENT AGENCIES

REGIONAL COUNCIL		DEPARTMENT OF LABOUR			
Sections:					
^{1,2} 1.2.7	5.5.2.6	1.2.6	3.3.3	4.4.2	8.5.1
1.2.8	6.2.5	1.2.8	3.4.1	4.6.1.2	9.2.1
1.5.1	7.3.2.1	1.5.1	3.5.1	4.6.2.1	² 9.3.2.1
1.5.2	8.1.1	1.5.4	3.6.2	4.6.3.1	² 9.3.2.3
1.5.4	8.1.2	2.2.1	3.7.1	4.7.1	² 9.3.2.4
^{1,3} 2.1.1.2	8.1.3	2.2.2.1	3.8.1	4.7.2	² 9.3.2.5
2.1.1.3	8.1.4	2.2.2.2	3.9.1	5.1.2.5	
³ 2.1.1.4	8.2.1	2.2.2.5	3.9.2	5.3.2.2	
2.1.1.5	8.3.1	2.2.3	3.10.1	5.3.3.1	
2.1.1.6	8.3.2	2.2.4	3.10.3	5.3.4.1	
2.1.2.1	8.4.1	2.3.2	3.11.1	5.4.2.1	
2.1.2.2	8.4.2	2.3.3	3.12.1	5.4.2.2	
2.2.2.1	8.4.3	2.3.4	3.12.2	5.4.3.2	
2.2.2.2	8.5.1	2.3.5	3.12.3	5.4.4.2	
2.2.2.3	8.5.2	2.3.6	3.12.4	5.4.4.3	
2.2.2.4	8.5.3	2.3.7	3.13.1	5.4.5.1	
2.2.2.5	8.5.5	2.4.1	3.14.1	5.5.2.3	
2.3.5	8.6.1	2.4.2	3.14.2	5.5.2.4	
2.5.3		2.5.1	4.2.2.2	5.5.2.5	
2.6.1		2.5.2	4.2.2.3	5.5.3.1	
2.6.3		2.5.3	4.2.2.4	5.5.3.3	
2.6.4		2.5.4	4.2.2.5	6.2.1	
2.6.6		2.5.5	4.2.2.6	6.2.5	
2.6.7		2.5.6	4.2.3.1	7.3.1.1	
2.6.8		2.5.7	4.2.4.1	7.3.1.2	
^{1,3} 2.9.1		2.6.1	4.2.4.2	7.3.1.3	
2.9.2		2.6.2	4.2.4.3	7.3.1.4	
3.2.1		2.6.5	4.2.5.1	7.3.2.1	
3.3.1		2.7.1	4.2.5.2	7.3.2.2	
3.3.2		2.7.2	4.2.6.1	7.3.4.1	
4.2.6.2		2.8.1	4.2.7.1	7.3.4.2	
4.6.1.1		2.10.2	4.2.8.1	7.3.5.4	
4.6.1.3		3.1.1	4.2.8.2	7.3.6.1	
4.6.2.2		3.2.1	4.2.8.3	7.3.6.2	
¹ 4.6.3.1		3.2.2	4.2.9.1	8.1.1	
² 5.1.3		3.3.1	4.2.10.1	8.1.3	
³ 5.5.2.1		3.3.2	4.4.1	8.4.1	

APPENDIX 2: WORKPLACE EXPOSURE STANDARD (WES)

The WES is believed to be the level at which nearly all employees may be repeatedly exposed to airborne contaminants day after day without adverse health effects. Because of wide variation in individual susceptibility a few employees may experience discomfort from some substances at concentrations at or below the WES; a smaller number may be affected more seriously by aggravation of a pre-existing condition or by development of an occupational illness. Smoking of tobacco, taking certain types of medication, and/or a genetic predisposition in some individuals may intensify the harmful effects of airborne contaminants in the place of work.

The WES-TWA is the Workplace Exposure Standard expressed as a time weighted average over an 8-hour workday.

APPENDIX 3: TRADE NAMES OF FIXED WATER-BORNE PRESERVATIVES IN CURRENT USE

REGISTERED WITH THE PESTICIDES BOARD

CCA PRESERVATIVES RATIOS OF ELEMENTS PRESENT

Tanalith AWPA C 60%	)	Copper: 23-25%
Tanalith C 60%	)	Chromium: 43-47%
Tanalith C oxide 60%	)	Arsenic: 30-32%
Tanalith NCA 50%	)	Copper: 20-30%
	)	Chromium: 25-47%
	)	Arsenic: 30-50%
Imprect C	)	Copper: 23-25%
Imprect 95 CP	)	Chromium: 43-47%
Imprect Oxide	)	Arsenic: 30-32%
Ayrton C Oxide	)	Copper: 23-25%
	)	Chromium: 43-47%
	)	Arsenic: 30-32%

APPENDIX 4: TRADE NAMES OF LOSP PRESERVATIVES IN CURRENT USE

**REGISTERED WITH THE PESTICIDES BOARD OR WITH
REGISTRATION PENDING**

LOSP PRESERVATIVES	ACTIVE INGREDIENTS
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Protim 235 WR) Concentrates: 12.5 - 15% w/w as TBTO ¹
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Protim 95 WR) Working solutions: 2.5 - 3.5% w/w as TBTO
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Protim 95 LCWR)
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Vacsol Clear) Concentrate: 15% w/w as TBTO
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Insecticides that may be used with LOSP solutions:

Pyrethroids) At approx 0.5% w/w in the working solution
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**NOTE: The Pesticides Board requires that all wood preservatives and
antispain chemicals are registered before sale in New Zealand.**

¹ TBTO may be replaced by an equivalent amount of TBTN

APPENDIX 5: NON-FIXED PRESERVATIVES IN CURRENT USE

REGISTERED WITH THE PESTICIDES BOARD

BORON PRESERVATIVES

CHEMICAL NAMES

Boric acid H_3BO_3) used in ratio of 1 : 1.54
Sodium borate $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10 \text{H}_2\text{O}$) used in ratio of 1 : 1.54

Trimethyl borate azeotrope

TRADE NAMES

Diffusol

F-Bor

L-Bor Sodium borate

Boracol 100RH

Boracol 200REI

Boracol 400RH

Borasol 27%

ACTIVE INGREDIENTS

Borates + isothiazoline

Usually only borates

Sodium borate + benzalkonium chloride

Sodium borate + benzalkonium chloride

Sodium borate + benzalkonium chloride

Sodium borate + benzalkonium chloride

APPENDIX 6: TRADE NAMES OF ANTISAPSTAIN CHEMICALS IN CURRENT USE

REGISTERED WITH THE PESTICIDES BOARD

TRADE NAME	ACTIVE INGREDIENTS
Tanalith Antimould	Octhilinone
Antiblu 246	Chlorothalonil/Carbendazim (MBC)
Busan 30 WB	2-(Thiocyanomethylthio) benzothiazole (TCMTB) in water base
Busan 1118	2-(Thiocyanomethylthio) benzothiazole (TCMTB) in solvent base
Busan 30L	2-(Thiocyanomethylthio) benzothiazole (TCMTB) in solvent base
Hylite 711	Carbendazim (MBC) + Zinc octoate
Hylite Extra	Carbendazim (MBC) + Copper-8-hydroxyquinolate
Cutrol 375/AP5	Oxine copper (Copper-8-hydroxyquinolate or Cu-8)
Antiblu 375	Oxine copper (Copper-8-hydroxyquinolate or Cu-8)
Taratek 5F	Thiophanate-methyl + Chlorothalonil
Taratek AS	Thiophanate-methyl + Chlorothalonil + Benzalkonium chloride
NP-1	Iodocarb (3-Iodo-2 propynyl butyl carbamate (IPBC) + didecyldimethyl ammonium chloride (DDAC)
Lustral	Carbendazim (MBC) + didecyl dimethyl ammonium bromide + 2-(diiodomethylsulphonyl) toluene
Sinesto B	2-ethyl hexanoic acid + trimethyl coco ammonium chloride
Rodewod SB 80-40400	Azaconazole (registration pending)

Insecticides being used as additives to antisapstain formulations:
Synthetic pyrethroids e.g. Fenvalerate .

NOTE: The above information is believed to be substantially correct. Users should be aware that manufacturers may make changes to proprietary products without notice.

APPENDIX 7: HUMAN TOXICITIES OF CONSTITUENT CHEMICALS

1. CCA FORMULATIONS

- 1.1 The most common timber preservatives used in New Zealand are the copper-chrome-arsenic (CCA) mixtures. The arsenic used is in the soluble pentavalent form as arsenic pentoxide, arsenic acid, sodium arsenate or disodium hydrogen arsenate. The chromium used is in the water soluble hexavalent form as chromic acid, sodium dichromate, potassium dichromate or sodium chromate. Divalent copper is used in the form of copper oxide, copper carbonate, copper sulphate or copper hydroxide.
- 1.2 The formulations used in New Zealand fall within the range of ratios shown in appendix 3. These ratios ensure that when the CCA is impregnated into the wood and allowed to dry, the chemicals react with the wood and with each other to produce insoluble complexes that are extremely resistant to leaching. As a result, the treated wood is of very low hazard to human or animals. The fixation mechanism is complex and the reactions involved are dependent upon time, temperature, wood species, preservative type, pH and drying conditions. In all instances however, highly insoluble arsenate salts are fixed in the timber. Copper is generally fixed by ion exchange interactions with the wood. Chromium is reduced to trivalent chromium and is fixed by ion exchange and later by precipitation. The final primary conversion products are:
 - (i) copper fixed by ion exchange to the wood;
 - (ii) chromium arsenate;
 - (iii) copper arsenate;
 - (iv) chromium hydroxide.
- 1.3 The valencies of arsenic and chromium are critical as certain valencies are more toxic than others. For example, hexavalent chromium is much more toxic than trivalent chromium, while pentavalent arsenic is less toxic than trivalent arsenic.
- 1.4 **Arsenic:** Arsenic is stored mainly in the liver, hair, nails and kidneys, however, most absorbed arsenic (80%) is excreted in the urine within two days of exposure. It is metabolised in the liver mainly to dimethyl arsenic acid, which then passes out in the urine. This organic arsenical has only 1% of the toxicity of inorganic trivalent arsenic, and as the liver carries out the conversion rapidly, this offers some protection to the body. As the amount of

arsenic absorbed increases, there is a proportional increase in the methylated arsenic excreted. Arsenic is the most acutely toxic of the timber treatment components. While small exposures are not hazardous, excess exposure is.

- 1.5** Exposure to arsenic compounds in the air produces irritation and sensitisation of the mucous membranes of the respiratory system and of the skin. This can lead to severe irritation of the nasal mucosa, larynx and bronchi, also conjunctivitis and dermatitis. Some tolerance to acute poisoning is believed to develop after repeated exposure, which causes inflammation of the skin. An oral dose of 5-50 mg is toxic to humans; the minimum lethal dose is 2 mg/kg. The half life of arsenic in the body is about 6 weeks.
- 1.6** Chronic (long-term exposure) poisoning produces local changes in the mucous membranes of the respiratory tract and abnormal skin pigmentation. Chronic poisoning also can lead to weight loss, bowel upsets, and loss of energy. Changes may occur in the nervous and circulatory systems including the liver, and cancer of the respiratory tract may develop. All arsenicals become toxic when their level reaches 1 ppm in vital tissues.
- 1.7** Inhaled arsenic (particularly inorganic) has been linked to skin cancer although experiments with animals do not confirm this. People exposed to trivalent arsenic at respirable concentrations exceeding $50 \mu\text{g}/\text{m}^3$ are known to be at high risk of developing both skin and lung cancers. Epidemiological surveys among groups of people exposed to high levels of arsenic in the environment have shown a higher incidence of respiratory- and blood-related cancers. Unfortunately, these surveys have never been entirely free from other factors that might cause cancer such as sulphur dioxide. The investigators did not establish a direct causal link between these cancers and arsenic exposure.
- 1.8** Swallowing more than 1000 mg arsenic per year from medicines and water has been shown to cause skin cancer. Other studies have shown that pentavalent arsenic and fixed arsenic does not cause cancer.

WES-TWA: $0.2 \text{ mg}/\text{m}^3$

- 1.9** Chromium: Trivalent chromium is not readily absorbed from the digestive system, but combines with proteins present to form stable complexes. Hexavalent chromium compounds are both irritant and corrosive and are absorbed by ingestion, skin contact and inhalation. The lethal oral dose for humans is between 1-10 grams.
- 1.10** Exposure to chromium can cause irritation (both primary and sensitisation), corrosion, dermatitis and chrome ulceration of the skin and nasal passages. An increase in the incidence of lung cancer has been documented in primary chromate production and chrome pigment industries but the significance of chromium exposure in other industries is uncertain.

WES-TWA: $0.5 \text{ mg}/\text{m}^3$ trivalent chromium

$0.05 \text{ mg}/\text{m}^3$ hexavalent chromium

- 1.11** Copper: Compared to the arsenic and chromium present in CCA treatments, copper compounds are only of moderate toxicity. When inhaled they can cause congestion of the nasal and mucous membranes. Nausea, gastric pain and diarrhoea have also been associated with copper exposure.

WES-TWA: $1 \text{ mg}/\text{m}^3$

- 1.12 The possibility of long term effects from exposure to CCA formulations, particularly to solutions or freshly treated timber, highlights the need to minimise exposure to these preservatives.

2. BORON COMPOUNDS, WATER-BORNE

2.1 **Absorption:** There are no major toxicological differences between boric acid and inorganic boron salts. Entry into the body may be through the nose, throat and lungs, or the gastrointestinal tract. Absorption through undamaged skin is slow and toxic effects less likely; absorption through damaged skin can be rapid.

2.2 **Short-term effects:**

Inhalation: Spray mist or dust from treated timber may irritate nose, throat and lungs.

Skin contact: Irritant. Repeated or prolonged exposure may cause a rash or dermatitis.

Eye contact: Moderate irritant.

Swallowed: Harmful. Ingestion of large amounts may result in nausea, vomiting, diarrhoea, headache, restlessness and weakness. Severe poisoning with borax can result in urinary failure along with lethargy, twitching of facial muscles and extremities, and blueness of the skin.

2.3 **Long-term effects:** Chronic intoxication with boric acid can cause anorexia, loss of strength, confusion and baldness. A rash may develop followed by skin shedding in the area of the rash.

WES-TWA: anhydrous boron salt	1 mg/m ³
decahydrate (borax)	5 mg/m ³
pentahydrate	1 mg/m ³

2.4 **Environmental toxicology:** Water soluble boron salts are moderately toxic to both plant and aquatic life possibly due more to their associated high pH of 10, than any intrinsic property of boron. Thus, boron salts (Ecobrite) neutralised to pH 7 had a 96 hour LC₅₀ value for rainbow trout in the range 9431 - 14372 ppm whereas unneutralised Ecobrite, pH 10 had a 96 hour LC₅₀ value for rainbow trout of 500 ppm.

3. TRIMETHYL BORATE

3.1 **Absorption:** Trimethyl borate is an organic compound and is more rapidly absorbed into the body by all entry routes than inorganic boron salts. Also, once in the body trimethyl borate will break down into boric acid and methanol.

3.2 **Short-term effects:**

Inhalation: Not specified in the literature. OSH expects it will produce irritation of the nasal passages and lungs, also headaches and light-headedness.

- Skin contact: Irritant. Repeated or prolonged exposure may cause a rash or dermatitis.
- Eye contact: Moderate to severe irritant; has been known to cause permanent eye damage.
- Swallowed: Harmful. Ingestion of large amounts may result in nausea, vomiting, diarrhoea, headache, restlessness and weakness. Severe poisoning can result in urinary failure along with lethargy, twitching of facial muscles and extremities, and blindness.
- WES-TWA: Not specified.

4. LOSP FORMULATIONS

- 4.1 **Bis (tri-n-butyl tin) Oxide (TBTO):** In the short term, TBTO present in concentrations of 60% w/w and over is a severe skin irritant that can cause pain, redness, swelling, and discolouration. Thus, special care is required when handling the more concentrated solutions. However, skin irritation arising from contact with working strength solution containing about 2.5% w/w TBTO is more likely to be caused by the organic solvent than the TBTO. The toxicity of the 15% w/w TBTO will be intermediate between the concentrated and working strength solutions.
- 4.2 Pure TBTO is extremely hazardous to the eyes and may lead to permanent damage. Contact with dilute solutions of TBTO causes severe irritation. Prompt irrigation of the eyes with water is essential.
- 4.3 Following skin absorption TBTO causes symptoms such as weight loss, slowed reflexes, collapse and convulsions in animal tests. Reports of effects in humans from occupational exposure have so far been limited to irritation.
- 4.4 Inhalation of the spray mist produced from a paint formulation containing 20% TBTO produced irritation of the nasal passages and the eyes. After repeated exposures over a fortnight the employees suffered more severe effects including nose bleeds, and excessive nasal mucous discharge. The working strength range used in timber treatment plants is 2.0-3.5% TBTO.
- 4.5 Due to the scarcity of long-term toxicity studies on TBTO, tests based on other organotin compounds have been considered. There was no evidence of cancer or birth deformities in animals exposed to such compounds. Rodents showed some reproductive defects but the results were variable and needed confirmation in further studies.

WES-TWA: 0.1 mg/m³ as tin

- 4.6 **Environmental toxicology:** The highly toxic effects of TBTO on marine life is well documented in the literature, (see Report of the *Working Party Reviewing the Use of Antifoulants Containing Organotins in New Zealand*, published by the Ministry for the Environment). The 96 hour LC₅₀ values for algae, molluscs, crustacea, and fish range from TBTO concentrations of 0.1 to 1000 µg/L (ppb).

- 4.7 **Copper naphthenate:** The preservative concentrate contains 6-8% copper naphthenate as copper. Investigations of the toxicological properties of a 4% copper naphthenate solution using laboratory animals and its long history of usage in industry suggest it has a very low level of toxicity.

WES-TWA: 1 mg/m³ as copper

- 4.8 **Resins and waxes:** Waxes and resins may be added to LOSPs in concentrations up to 5% in the concentrate. In their pure state these substances are solids at room temperature and similar to paraffin wax and fatty acid esters. They have low toxicities at room temperature.

WES-TWA: 2 mg/m³ for fumes

- 4.9 **Insecticides:** Certain highly toxic insecticides may be added to LOSP solutions, especially those used to treat timber destined for export. Further details are included in appendix 4 and appendix 7, section 6.

- 4.10 **White spirits:** These are typically hydrocarbon solvents containing about 85% paraffins and 15% aromatic constituents, mainly alkyl benzenes. A trace of benzene is also normally present.

- 4.11 Short-term overexposure to white spirits can produce the following symptoms:

Inhalation: Some irritation of the nasal passages followed by dizziness, nausea, and loss of consciousness in extreme cases.

Skin contact: Removes fats from skin tissues leading to dry and flaking skin. Prolonged contact causes dermatitis.

Eye contact: High vapour concentrations or direct liquid contact irritates the eyes.

Swallowed: Moderately toxic. Unlikely to be fatal provided prompt medical attention is obtained.

- 4.12 Long-term overexposure (4-6 months) by both skin contact and inhalation has caused anaemia and liver disorders and proved fatal.

WES-TWA: 100 ppm

5. OIL-BORNE FORMULATIONS

- 5.1 **Creosote:** Creosote contains over 150 chemicals, of which a large proportion are polycyclic aromatic hydrocarbons. Some of the chemicals present are known carcinogens.

- 5.2 It has a characteristic smell, which provides good warning properties of exposure by inhalation.

- 5.3 Short-term overexposure can produce the following symptoms:

Inhalation: Some irritation of the nasal passages and in high concentrations burning of the respiratory tract followed by headaches and dizziness.

Skin contact: Itching followed by redness and burning sensation and later blisters. Sunlight aggravates all symptoms especially in people with fair skin.

Eye contact: Vapours and liquid can produce intense burning leading to conjunctivitis and permanent eye damage.

Swallowed: Toxic, causing nausea, abdominal pain, respiratory distress, convulsions and death in extreme instances.

- 5.4 Long-term exposure to creosote at high levels constitutes a skin cancer risk in humans and may also result in mental disturbances.

WES-TWA: not specified

NIOSH recommended limit: 1 mg/m³

6. ANTISAPSTAIN CHEMICALS

- 6.1 **Carbendazim (MBC):** Carbendazim is a fungicide of very low toxicity, non irritant to eyes and skin when used as directed. However, based on animal studies, long-term overexposure to carbendazim may produce slight genetic damage and tumours.

WES-TWA: not specified

- 6.2 **2-(Thiocyanomethylthio) benzothiazole (TCMBT):** This is a fungicide of moderately low toxicity. Tests on animals indicate that it has no adverse carcinogenic or genetic effects, and no harmful effect on the liver, kidneys, brain or any other internal organ. It does produce irritation and burning of the skin (similar to sunburn) and eyes, especially in the concentrated form; the dilute working strength solution produces dermatitis in susceptible persons. Note, whenever aqueous formulations of TCMBT are sprayed the aerosol present in the spray mist is toxic. But any vapours, gases and the solution itself that is not presented to the lungs as an aerosol is not normally a problem. Solvent-based formulations that are diluted with water have approximately the same toxicity as aqueous dispersions of TCMBT.

WES-TWA: not specified

Environmental toxicology: All products containing TCMBT are highly toxic to fish; the 96 hour LC₅₀s for rainbow trout range from 0.039 - 0.054 ppm.

- 6.3 **Copper-8-hydroxyquinolate (oxine-copper):** The pure substance has very low toxicity and is generally non irritant. However, the aqueous solution is acidic (pH 1), and can cause itching and dermatitis in contact with the skin.

WES-TWA: 1 mg/m³ as copper

Environmental toxicology: Copper-8-hydroxyquinolate is highly toxic to freshwater fish: a Canadian value for the 48 hour LC₅₀ for rainbow trout is given as 500 µg/L.

- 6.4 **Chlorothalonil:** A fungicide of low acute oral toxicity due to poor absorption. It is an eye irritant, and humans exposed to chlorothalonil may develop contact dermatitis. Rats fed chlorothalonil develop carcinomas but mice are unaffected by oral doses. There have been no reports that chlorothalonil may cause cancer in humans even though it has been widely used to spray crops since 1969.

WES-TWA: not specified

- 6.5 Thiophanate Methyl:** A fungicide of low toxicity. When absorbed in large amounts, symptoms of poisoning include tremors, a decrease in respiratory rate, lethargy, dilation of the pupil of the eye, tears and convulsions. Inhalation may cause gasping and wheezing. Skin contact produces no effect. In the body thiophanate methyl is initially converted to carbendazim.

WES-TWA: not specified

- 6.6 Iodocarb (3-Iodo-2-propynyl butyl carbamate):** A water-based fungicide of low toxicity, non sensitising to the skin and non irritant to the eyes. The water-based concentrate is classified as category III by the EPA.

EPA TOXICITY CATEGORIES: Category I-“Danger” or “poison”; Category II-“Warning”; Category III-“Caution”; Category IV-“Caution”.

WES-TWA: not specified

Environmental toxicology: Iodocarb (3-Iodo-2-propynyl butyl carbamate) is moderately toxic to aquatic life; the 96 hour LC_{50} value for rainbow trout is 0.31 mg/L.

- 6.7 Didecyl dimethyl ammonium chloride:** A fungicide that is usually marketed as a 60% concentrate in water often in combination with other antisapstain agents. The concentrate has the following effects on health:

Inhaled: Moderately toxic and in extreme cases could be fatal. Concentrate must be handled in well ventilated areas. Ready to use diluted solutions are of low toxicity.

Skin contact: A severe irritant that can be absorbed through the skin. Ready to use diluted solutions may irritate the skin but will cease to do so when washed off with soap and water.

Eye contact: A severe irritant and contact may result in permanent eye damage. Ready to use diluted solutions may irritate but will cease once exposure ceases.

Swallowed: Moderately toxic and may be fatal in extreme cases; LD_{50} 450 mg/kg.

WES-TWA: not specified

Environmental toxicology: DDAC is less toxic to aquatic life than many other antisapstains; the 96 hour LC_{50} value for rainbow trout is 2.6 mg/L.

- 6.8 2-n-Octyl-4-isothiazolin-3-one:** It is usually marketed as a concentrate in propylene glycol solvent for use as a mouldicide. The concentrate has the following effects on health:

Inhalation: Spray mists can cause severe irritation of the nose, throat and lungs (corrosive).

Skin contact: Direct contact can cause skin burns or damage, and possible skin sensitisation.

Eye contact: Severe irritation and possible corneal injury (corrosive).

Swallowed: Moderately toxic, LD_{50} (m-rat) 550 mg/kg.

WES-TWA: not specified; suggested limit 0.5 mg/m³

- 6.9 **Zinc Octoate:** It is related to chemicals such as zinc stearate, and may be an eye irritant. Otherwise it is of low toxicity, and in solid form should be treated as a nuisance dust.

WES-TWA: not specified

7. INSECTICIDES

- 7.7 **Chlordane:** A moderately toxic insecticide. Avoid inhalation of sprays and mists. It acts on the central nervous system, often causing convulsions after excessive exposures. Once absorbed, chlordane is an extremely persistent poison (half life of 88 days in a child) and is predominantly stored in body fat so that it has a high potential for neurotoxicity. Chlordane has also been implicated as a carcinogenic agent.

WES-TWA skin: 0.5 mg/m³

- 7.8 **Synthetic Pyrethroids**, e.g. Allethrin, Bio-allethrin, Cypermethrin, Deltamethrin, Fenvalerate, and Permethrin: These are derivatives of naturally occurring pyrethrins and are generally more effective than the natural product. They are moderately toxic compounds in the pure state, but as they have very high insecticidal activity they can be used at very low concentrations. However, they remain toxic to fish even at very low concentrations. They are not significantly absorbed through intact skin. Skin contact and inhalation may however cause allergic attacks in sensitive people. Although the gastrointestinal tract readily absorbs pyrethroids, the breakdown products of metabolism are rapidly excreted in the urine and faeces.

When exposed to large amounts of pyrethroids, these chemicals probably act through the central nervous system to cause repetitive nerve activity. Early symptoms of poisoning include numbness of exposed skin, lips, and tongue. Further exposure may cause irritation of the skin nose and eyes; nausea, vomiting, diarrhoea and convulsions.

WES-TWA: not specified

- 7.9 **Methyl Bromide:** Contact with methyl bromide is irritating to the eyes, skin, and mucous membranes of the respiratory tract. Moderate exposure to skin causes itching and in severe cases second degree burns. Inhalation at concentrations above 100 ppm can be fatal. It attacks the nervous system and produces various symptoms that normally include headaches, nausea, and visual disturbances. The onset of symptoms is always delayed, usually by 4-6 hours following exposure, but can occur at any time between 2 and 48 hours.

WES-TWA skin: 5 ppm (20 mg/m³)

APPENDIX 8: EXAMPLE OF AN ENTRY PERMIT

Place of work*

Description of work

SAFETY CHECK

STATE YES, NO OR NOT APPLICABLE (NA)—ALL SPACES MUST BE COMPLETED

<p>1. Has equipment been completely:</p> <p>(a) Depressurised? <input type="checkbox"/></p> <p>(b) Drained? <input type="checkbox"/></p> <p>(c) Isolated by: Blanking? <input type="checkbox"/></p> <p style="padding-left: 40px;">Disconnecting? <input type="checkbox"/></p> <p style="padding-left: 40px;">Valving? <input type="checkbox"/></p> <p>(d) Steamed? <input type="checkbox"/></p> <p>(e) Water flushed? <input type="checkbox"/></p> <p>(f) Ventilated: Naturally? <input type="checkbox"/></p> <p style="padding-left: 40px;">Mechanically? <input type="checkbox"/></p>	<p>3. (a) Sewers, drains and trenches within 15 m of workplace sealed? <input type="checkbox"/></p> <p>(b) Combustible material cleared? <input type="checkbox"/></p> <p>(c) Fire protection sited? <input type="checkbox"/></p> <p>(d) Suitable access and egress provided? <input type="checkbox"/></p> <p>(e) Stand-by personnel detailed? <input type="checkbox"/></p> <p>(f) Lifebelts, ropes and breathing apparatus? <input type="checkbox"/></p>																									
<p>2. Electrical equipment disconnected and tagged? <input type="checkbox"/></p>	<p>4. Are repeat gas tests required? <input type="checkbox"/></p> <p>5. Excavations:</p> <p>(a) Sides safely shored? <input type="checkbox"/></p> <p>(b) Barriers erected? <input type="checkbox"/></p>																									
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;"></th> <th style="width: 15%;">OXYGEN TEST</th> <th style="width: 15%;">COMBUSTIBLE GAS TEST</th> <th style="width: 15%;">TOXIC GAS TEST</th> <th style="width: 40%;">PROTECTIVE EQUIPMENT REQD, INDICATE BY "X"</th> </tr> </thead> <tbody> <tr> <td>READING</td> <td></td><td></td><td></td> <td>NONE ACID CLOTHING</td> </tr> <tr> <td>TIME</td> <td></td><td></td><td></td> <td>GOGGLES CANISTER MASK</td> </tr> <tr> <td>SIGNATURE</td> <td></td><td></td><td></td> <td>PVC GLOVES FRESH AIR MASK</td> </tr> <tr> <td></td> <td></td><td></td><td></td> <td>LIFELINE</td> </tr> </tbody> </table>		OXYGEN TEST	COMBUSTIBLE GAS TEST	TOXIC GAS TEST	PROTECTIVE EQUIPMENT REQD, INDICATE BY "X"	READING				NONE ACID CLOTHING	TIME				GOGGLES CANISTER MASK	SIGNATURE				PVC GLOVES FRESH AIR MASK					LIFELINE
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				LIFELINE																						

Special instructions: _____

Electrical isolation by: _____ Certified by: _____ Designation: _____

I have personally checked the site and conditions, permission is granted for entry to be made.

Signature: _____ Superintendent

This permit must be held at the place of work, a duplicate (where required) is to be displayed in the service's supervisor's office. Completion and acceptance will be recorded on the third copy which will be held by the superintendent.

* Provide sketch of the place of work on reverse if considered necessary.

Work completed at: _____ on: _____ Work accepted at: _____ on: _____

Signature: _____

Signature: _____

I/C work: _____

Superintendent: _____

APPENDIX 9: EXAMPLE OF A MATERIAL SAFETY DATA SHEET

Page x of total y

Date of issue:

Company Details:

Company:

Telephone Number:

Emergency Telephone Number:

IDENTIFICATION

Product Name:

Other Names:

Manufacturer's Product Code:

U.N. Number:

Dangerous Goods Class:

Hazchem Code:

Toxic Substances Schedule:

Uses:

Physical Description/Properties:

Appearance:

Boiling Point/Melting Point (°C):

Vapour Pressure (pascals or mm of Hg at 25°C):

Specific Gravity:

Flashpoint (°C):

Flammability Limits:

Solubility in Water (g/L):

Other Properties:

Ingredients:

Chemical Entity:

CAS No:

Proportion:

HEALTH HAZARD INFORMATION

Health Effects:

Acute: Swallowed:

Eye:

Skin:

Inhaled:

Chronic:

First Aid:

Swallowed:

Eye:

Skin:

Inhaled:

Advice to Doctor:

PRECAUTIONS FOR USE

Exposure Limits:

Engineering Controls:

Personal Protection:

Flammability:

SAFE HANDLING INFORMATION

Storage and Transport:

Spills and Disposal:

Fire/Explosion:

Other Information:

Contact Point: