Health and Environmental Guidelines for Selected Timber Treatment Chemicals

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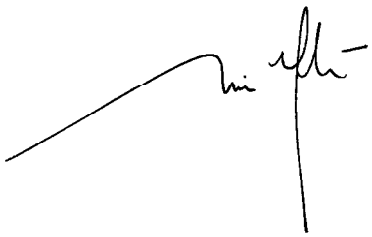
PREFACE

The *Health and Environmental Guidelines for Selected Timber Treatment Chemicals* have been prepared to assist with the assessment and management of contaminants on sawmill and timber treatment sites in New Zealand.

The Guidelines represent the first use of detailed risk assessment procedures to derive soil and water acceptance criteria for the assessment, management and remediation of contaminated land in New Zealand.

The Guidelines are a product of extensive cooperation and effort involving experts from central and local government, industry, scientists and consultants. The assistance and cooperation of all those involved is gratefully acknowledged.



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GLOSSARY

Acceptance criteria Levels of contaminants which are not considered to pose an unacceptable risk to human health or to the environment.

Acute An exposure or response which operates over a short term.

Background levels Levels of substances or chemicals that are commonly found in the local environment.

Bioaccumulation A general term for the process by which an organism stores a higher concentration of a substance within its body than is found in its environment.

Bioavailability The availability of a chemical in the surrounding environment for uptake by organisms.

Biodegradation Decomposition of substances into more elementary compounds by the action of micro-organisms.

Biomagnification The serial accumulation of a chemical by organisms in the food chain, with higher concentrations of the substance in each succeeding trophic level.

Carcinogen Cancer-causing agent.

Chronic An exposure or response which operates over a long term.

Clean-up The removal, treatment or containment of soil contaminated with chemicals at unacceptable concentrations.

Conservative In risk assessment or management, an analysis or a course of action which overestimates the risk to human health or the environment.

Contaminated A condition or state which represents or potentially represents an adverse health or environmental impact because of the presence of potentially hazardous substances.

Dermal Of, through or by the skin.

Ecosystem An area of nature including living organisms and non-living substances interacting to produce an exchange of material between the living and non-living parts. The term ecosystem implies interdependence between the organisms comprising the system.

Ecotoxicity	The property of being harmful to an ecosystem or to the wider environment.
Environmental risk assessment	The process of estimating the potential impact of a chemical or physical agent on a specified ecological system under a specific set of conditions.
Epidemiology	The study of the distribution and determinants of disease frequency in humans.
Exposure	Contact with a chemical, physical or biological agent.
Exposure assessment	The estimation (qualitative or quantitative) of the magnitude, frequency, duration, route and extent of exposure to a chemical substance or contaminant.
Fate and transport	Chemical, physical and biological processes that modify the concentration of a chemical through transformation (e.g. degradation), transfer between environmental media (e.g. soil to groundwater) and transport (e.g. moving with groundwater).
Genotoxic	Damaging to DNA and thereby capable of causing mutations or cancer.
Hazard	The capacity to produce a particular type of adverse health or environmental effect.
Hazard index	Sum of hazard quotients for exposure to more than one chemical simultaneously.
Hazard quotient	Ratio of exposure to tolerable daily intake for a single chemical.
Health risk assessment	The process of estimating the potential impact of a chemical or physical agent on a specified human population under a specific set of conditions.
Lowest observed adverse effect level (LOAEL)	The lowest exposure level at which there are statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control group.
No observed adverse effect level (NOAEL)	An exposure level at which there are no statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control.
Phytotoxicity	The property of being harmful to a type of plant.
Potable water	Water destined for human consumption.

Quality assurance	A system of activities which provides assurance that defined standards are met for the product or service concerned.
Quality control	The day-to-day operations which deliver the quality standards specified.
Receptor	An organism, plant, human or physical structure which may be exposed to a chemical or other hazardous agent.
Remediation	The clean-up or mitigation of contamination.
Risk	The probability of an adverse outcome in a person, a species, a group, or an ecosystem that is exposed to a hazardous agent. Risk depends on both the level of toxicity of the hazardous agent, and the level of exposure.
Risk assessment	The process of estimating the potential impact of a chemical or physical agent on an ecosystem or specified human population under a specific set of conditions.
Slope factor	The slope of the dose-response curve in the low-dose region, used to relate the probability of getting cancer to the chemical exposure.
Superfund	A system in the United States whereby specific industries contribute to a fund to be used for the clean-up of contaminated land.
Teratogenic	Producing malformation in embryos.
Threshold	The dose or exposure below which a significant adverse effect is not expected.
Tolerable daily intake (TDI)	An estimate of the amount of a substance in food or drinking water, expressed on a body weight basis, that can be ingested daily over a lifetime without appreciable health risk.
Toxicity	The quality or degree of being poisonous or harmful to plant, animal or human life.
Uncertainty	Imperfect knowledge concerning the present or future state of the system under consideration; a component of risk resulting from imperfect knowledge of the degree of hazard or its spatial and temporal distribution.

ABBREVIATIONS

AAS	Atomic Absorption Spectrophotometry
ACGIH	American Conference of Governmental Industrial Hygienists
ACS	American Chemical Society
ADI	Acceptable Daily Intake
AF	Absorption Factor
AH	Soil Adherence
AH_{adj}	Age Adjusted Soil Adherence
ANZECC	Australian and New Zealand Environment and Conservation Council
APHA	American Public Health Association
AR	Area
AR	Analytical Reagent Grade
ARMCANZ	Agricultural and Resource Management Council of Australia and New Zealand
As	Arsenic
As(III)	Trivalent Arsenic
As(V)	Pentavalent Arsenic
ASTM	American Society for Testing and Materials
AT	Average Time
ATSDR	Agency of Toxic Substances and Disease Registry
AWWA	American Water Works Association
B	Boron
BCD	Base Catalysed Dechlorination
BCF	Bioconcentration Factor
BCF_{FD}	Bioconcentration Factor for Foliar Deposition
BCF_{root}	Bioconcentration Factor for Roots
BH	Borehole
B_v	Bioconcentration Factor for Vegetation
BW	Body Weight

C	Concentration
C_A	Water Threshold Concentration - Aquatic Ecosystems
$CaCl_2$	Calcium Chloride
CAE	Centre for Advanced Engineering (University of Canterbury)
CAL	Calibration Standard
CCA	Copper Chrome Arsenate
CCME	Canadian Council of Ministers of the Environment
CCREM	Canadian Council of Resource and Environmental Ministers
C_D	Water Threshold Concentration - Drinking Water
CDI	Chronic Daily Intake
C_E	Soil Threshold Concentration - Environment
CF	Conversion Factor
CGSB	Canadian Government Standards Board
C_H	Soil Threshold Concentration - Human Health
COC	Chain of Custody
CP	Concentration in Plant
Cp_{FD}	Concentration in Plant due to Foliar Deposition
Cp_{root}	Concentration in Plant due to Root Uptake
Cr	Chromium
Cr(III)	Trivalent Chromium
Cr(VI)	Hexavalent Chromium
CRC	Canterbury Regional Council
Cs	Concentration in Soil
CSF	Camp Scott Furphy Pty Ltd
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Cu	Copper
DASET	Department of Arts, Sports, Environment and Territories
DCM	Dichloromethane
DDT	Dichloro Diphenyl Trichloroethane
DF	Dilution Factor
DNA	Deoxy Ribosenucleic Acid
DQO	Data Quality Objective

DRo	Deposition Rate
DWG	Drinking Water Guidelines
DWSNZ	Drinking Water Standard for New Zealand
ECD	Electron Capture Detector
ECETOC	European Centre for Ecotoxicology and Toxicology of Chemicals
ED	Exposure Duration
EDTA	Ethylene Diamine Tetra-acetic Acid
EE	Equilibrium Extraction
EEC	European Economic Community
EF	Exposure Frequency
EP Tox	Extraction Procedure Toxicity Test
EPAV	Environment Protection Authority - Victoria
ETI	Environmental Toxicology International
EXSTD	External Standard
FAO	Food and Agriculture Organisation
FC	Fraction Contaminated
FCS	Field Control Sample
fei	Weathering Constant
FID	Flame Ionisation Detector
fin	Initial Fraction of Interception
frs	Fraction of Soil in Dust
GC	Gas Chromatography
GC-MS	Gas Chromatography - Mass Spectrometry
GF-AAS	Graphite Furnace Atomic Absorption Spectrophotometry
GI	Gastrointestinal
GRI	Gas Research Institute
GW	Groundwater
H_2SO_4	Sulphuric Acid
HA	Hand Auger

HASP	Health and Safety Plan
HAV	Highest Acceptable Value
HCl	Hydrochloric Acid
HESP	Human Exposure to Soil Pollutants
HI	Hazard Index
HMDS	Hexamethyldisilazane
HNO_3	Nitric Acid
HpCDD	Heptachlorodibenzodioxin
HpCDF	Heptachlorodibenzofuran
HPLC	High Performance Liquid Chromatography
HQ	Hazard Quotient
HR-MS	High Resolution Mass Spectrometry
IARC	International Agency for Research on Cancer
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
ICRCL	Interdepartmental Committee on the Redevelopment of Contaminated Land
IH	Inhalation Rate
IH_{adj}	Age Adjusted Inhalation Rate
ILCP	Interlaboratory Comparison Program
IP	Produce Ingestion Rate
IP_{adj}	Age Adjusted Produce Ingestion Rate
IR	Ingestion Rate
IR_{adj}	Age Adjusted Ingestion Rate
IRIS	Integrated Risk Information System
ISO	International Standards Organisation
ISTD	Internal Standard
Kd	Distribution Co-efficient
KH_2PO_4	Potassium Dihydrogen Phosphate
K_{oc}	Organic Carbon/Water Partition Co-efficient
K_{ow}	Octanol Water Partition Co-efficient

LC_{50}	Median Lethal Concentration for 50% of Test Species
LEP	Leachate Extraction Procedure
LFB	Laboratory Fortified Blank
LFM	Laboratory Fortified Matrix
LIM	Land Information Memorandum
LOD	Limit of Detection
LOSP	Light Organic Solvent Phase
LPC	Laboratory Performance Check
LRB	Laboratory Reagent Blank
MAH	Monocyclic Aromatic Hydrocarbons
MAV	Maximum Acceptable Value (defined in Drinking Water Standards for New Zealand, 1995)
MBLP	Multiple Batch Leaching Procedure
MCC	Materials Characterization Centre
MCL	Maximum Contaminant Level
MDL	Method Detection Level (or Limit)
MEP	Multiple Extraction Procedure
MF	Matrix Factor
MfE	Ministry for the Environment
MOH	Ministry of Health
MRL	Maximum Residue Limit (Food Regulations 1984)
MS	Mass Spectrometry
MSW	Municipal Solid Waste
MTR	Maximum Tolerable Risk
MWEP	Monofill Waste Extraction Procedure
NA	Not Applicable
NaOH	Sodium Hydroxide
Na-PCP	Sodium Pentachlorophenate
NAPLH	Non Aqueous Phase Liquid Hydrocarbon
NATA	National Association of Testing Authorities
NATO	North Atlantic Treaty Organisation

ND	Not Detected
NECAL	National Environmental Chemistry and Acoustics Laboratory (now Mt Eden Science Centre, ESR)
NEHF	National Environmental Health Forum
NHMRC	National Health and Medical Research Council
NL	Not Limited
NOAEL	No Observed Adverse Effect Level
NOEL	No Observed Effect Concentration
NTG	National Task Group on Site Contamination from the Use of Timber Treatment Chemicals
OCDD	Octachloro Dibenzo Dioxin
OCN	Octachloronaphthalene
OECD	Organisation for Economic Co-operation and Development
OSH	Occupational Safety and Health Service of the Department of Labour
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PCDD/PCDF	Polychlorinated dibenzodioxin/Polychlorinated dibenzofuran (dioxins)
PCP	Pentachlorophenol
PEF	Particle Emission Factor
Pg	Proportion of Produce Grown Onsite
PID	Photo Ionization Detection
PM_{10}	Concentration of particulates of less than 10 μm diameter
PPB	Parts per billion (1 in 10^9)
PPM	Parts per million (1 in 10^6)
PRG	Preliminary Remediation Goal
P_{RP}	Respirable Fraction
PTFE	Teflon
PTWI	Provisional Tolerable Weekly Intake
PVC	Poly Vinyl Chloride

QA	Quality Assurance
QAP	Quality Assurance Plan
QC	Quality Control
QCS	Quality Control Standard
R	Proportion Particulates Retained
RCRA	Resource Conservation and Recovery Act (USA)
RDL	Reliable Detection Level
RfC	Reference Concentration
RfD	Reference Dose
RfDc	Chronic Reference Dose
RMA	Resource Management Act
RME	Reasonable Maximum Exposure
RPD	Relative Percent Difference
RQL	Reliable Quantitation Level
RSD	Risk Specific Dose
SASG	Sulphuric Acid Silica Gel
SBE	Sequential Batch Extraction
SF	Slope Factor
SG	Specific Gravity
SLT	Standard Leaching Test
SPT	Standard Penetration Test
SWLP	Solid Waste Leaching Procedure
TCDD	Tetrachlorodibenzodioxin
TCLP	Toxicity Characteristic Leaching Procedure
TDI	Tolerable Daily Intake
TDS	Total Dissolved Solids
te	Crop Growth Period
TE	Toxic Equivalent (relates to toxicity of dioxin mixture)
TEF	Toxic Equivalence Factor
TELARC	Testing Laboratories Accreditation Council

TLV	Threshold Limit Value
TMS	Trimethylsilyl
TMS	Trimethylsilazane
TOC	Total Organic Carbon
TP	Testpit
TPAA	Timber Preservation Association of Australia
TRD	Technical Resource Document
TSCA	Toxic Substances Control Act (USA)
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
VSS	Volatile Suspended Solids
WEF	Water Environment Federation
WET	Waste Extraction Test (California)
WHO	World Health Organisation
WPCF	Water Pollution Control Federation
WRU	Waste Research Unit
Yv	Vegetative Productivity
ZHE	Zero Headspace Extractor

CHAPTER 1
OVERVIEW

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1. OVERVIEW

1.1 BACKGROUND

1.1.1 The Purpose of these Guidelines

The Health and Environmental Guidelines for Selected Timber Treatment Chemicals provide owners, occupiers, regulators and assessors of sawmill and timber treatment sites with detailed, practical advice on site assessment and management.

The guidelines set out acceptance criteria for the timber treatment chemicals copper, chromium, arsenic, boron and pentachlorophenol.

The guidelines have been developed to protect human health and the environment, both on-site and off-site. They do this by promoting the following goals:

- protection of the health of site users, appropriate to the current or intended uses of the site;
- protection of the on-site environment consistent with the intended land use (e.g. protection of plant life on residential or agricultural sites);
- protection of the off-site environment, by specifying appropriate criteria for surface water and groundwater and for disposal of waste materials to landfills.

The guidelines are intended to provide a best-practice reference for parties involved in managing sites contaminated by timber treatment chemicals and are based on the best information that is currently available. Where this information is limited, the guidelines incorporate which have sought to combine:

- the need to protect human health and the environment;
- technical and scientific defensibility;
- practicality and pragmatism.

1.1.2 Timber Treatment Chemicals

Chemical treatment has been used for many years throughout New Zealand for the preservation of timbers, particularly softwoods. These guidelines focus on the following chemicals:

- Copper
- Chromium
- Arsenic
- Boron
- Pentachlorophenol.

Use of pentachlorophenol and its derivatives in timber preservation ceased several years ago whereas use of arsenic, chromium, copper and boron continues.

CCA Treatment

The CCA treatment process used water-soluble salts of copper, chromium and arsenic. CCA preservatives are mixtures of the following compounds:

- Chromium – sodium dichromate, chromic acid and chromic oxide
- Copper – copper sulphate and copper oxide
- Arsenic – arsenic pentoxide and sodium pyroarsenate.

Boron Treatment

Boron has been used as a water-soluble salt for timber preservation in conjunction with an anti-sapstain fungicide, such as sodium pentachlorophenate.

Boron is still widely used, although sodium pentachlorophenate has been replaced by other less environmentally persistent additives for anti-sapstain fungicide protection. Boron compounds used for anti-sapstain purposes are highly mobile in the aquatic environment.

Pentachlorophenol or PCP Treatment

Pentachlorophenol (PCP) was used in the form of sodium pentachlorophenate (NaPCP) as an anti-sapstain fungicide for short-term surface protection of sawn timber, often in conjunction with boron treatment. PCP was also used in an oil carrier, such as diesel, for permanent protection of timber. PCP and NaPCP mixtures typically contain other chlorinated phenols and polychlorinated dioxins and furans as unwanted by-products of manufacture.

1.2 STRUCTURE OF THE GUIDELINES

The guidelines deal with a wide range of issues related to the assessment and management of contaminated sites. They are organised as follows:

Chapter 1: Overview

Chapter 1 sets out the purpose of the guidelines and explains why certain chemical contaminants have been investigated. It also explains the risk-assessment approach and describes the status of the guidelines as Government policy. Finally, it outlines plans for revision of the guidelines.

Chapter 2: Environmental Sampling Strategy

Chapter 2 sets out a quality assurance strategy for site assessment. It then discusses requirements for gathering of background information and the design of the sampling and analytical programme. The chapter also discusses the requirements for soil sampling, groundwater sampling, surface water and sediment sampling, and dust sampling.

Chapter 3: Field Sampling Procedures and Quality Assurance Plan

The chapter gives detailed sampling procedures for soil, water, sediment and surface dust, including requirements to ensure the quality of information obtained from the sampling programme.

Chapter 4: Laboratory Methodologies for the Analysis of Soil and Water Samples

The chapter discusses laboratory methods for the analysis of soil and water samples for arsenic, copper, chromium, boron, pentachlorophenol, and dioxins and furans. It provides guidance on analytical method selection and on quality control procedures to help users obtain consistent analysis of samples.

Chapter 5: Soil Acceptance Criteria

Chapter 5 develops soil acceptance criteria for a range of potential future site uses. Health risk assessment techniques, contaminant fate modelling and food uptake are used to estimate acceptable soil concentrations for each land use scenario. The chapter includes interim acceptance criteria for arsenic and dioxins.

Chapter 6: Surface Water and Groundwater Acceptance Criteria

Chapter 6 develops acceptance criteria for surface water and groundwater based on a range of beneficial uses (e.g. drinking and ecosystem protection).

Chapter 7: Disposal of Timber Treatment Wastes to Landfills

This chapter develops acceptance criteria for disposal of contaminated timber treatment wastes to landfills. It includes an outline of the ANZECC Scheduled Waste Guidelines, landfill practices, leachate test requirements and threshold quantity and concentrations for disposal of wastes to landfill.

1.3 THE RISK-BASED APPROACH TO SITE ASSESSMENT AND MANAGEMENT

1.3.1 The Risk Assessment Methodology

The guidelines use a risk assessment methodology to determine acceptable levels of chemical residues for timber treatment sites. Risk assessment is a technique which allows the issue of site contamination to be addressed in an objective way. It is based on a defined process and uses the best available data. It requires that the assumptions used in deriving estimates of risk are made explicit and also provides a mechanism by which societal judgements about what is an acceptable level of risk can be incorporated into the process.

The methodology used enables the risk posed by any particular site to be expressed in quantitative terms. In these guidelines risk assessment is used to calculate levels of contaminants that do not pose an unacceptable level of risk to human health and/or the environment. These are referred to as acceptance criteria. These acceptance criteria allow decisions to be made about whether the condition of the site is acceptable for the current or any likely future intended land use.

The basis of the methodology is that the risk posed by any substance is a combination of two quite distinct factors. These are the hazardous nature of the substance, and the likely exposure of humans or the environment to that substance. The hazard factor is dealt with by using available toxicological or environmental impact studies to determine maximum permissible intake levels. The exposure factor is dealt with by using formulae which express the exposure to the substance in terms of the exposure to the site or to materials derived from the site.

The methodology assesses the risk posed by each site contaminant separately. It also assesses the risk to humans and the various ecosystem components (receptors) separately. For each chemical, the receptor that would result in the lowest acceptance criterion is then used to determine the soil or water acceptance criteria for that particular contaminant. It should be noted that ecological risk assessment techniques are still in their infancy, and as a consequence these guidelines focus mainly on the protection of human health.

1.4 ACCEPTABLE RISK

The acceptance criteria in the guidelines are primarily based on the requirement to protect human health. Very little New Zealand data is available for ecological risk assessment.

1.4.1 Human Health

In these guidelines, the level of health protection provided for human exposure to carcinogenic chemicals is such that the lifetime risk of additional cancer should be no greater than 1 in 100,000. This level is consistent with World Health Organisation guidelines and with other recently developed New Zealand health guidelines and standards.[1] For non-carcinogens, values which are believed to be protective of health are derived by standard procedures.

1.4.2 Uncertainty and Environmental Risk Management

Assessing the environmental impacts of chemical contamination requires expert judgement, particularly in areas of scientific uncertainty.

It is very difficult to derive acceptance criteria that are appropriate for sensitive land uses and that also reasonably reflect the uncertainties in the risk assessment. In these guidelines, precautionary assumptions about exposure have been adopted where uncertainties are high (appropriate to uncontrolled, sensitive land uses such as residential and agricultural uses). Less conservative assumptions about exposure might be justifiable where management controls can be readily implemented (as, for example, in ongoing industrial use).

If attainment of the recommended criteria is not practicable, other risk management options may need to be explored. These might include the use of a barrier such as pavement or a layer of clean soil to reduce the risk of exposure. The level of residual contamination and the action taken should be noted on the Land Information Memorandum[2] relating to the site.

1.4.3 Site-specific Modification of the Acceptance Criteria

The acceptance criteria presented in this document are based on specific exposure scenarios. Therefore scope exists for different acceptance criteria to be developed on a site-specific basis. If this is done, justification for the process, consistent with the level of detail presented in this document, should be provided.

1 Guidelines for Drinking Water Quality Management for New Zealand (Ministry of Health, 1995), Drinking Water Standards for New Zealand (Ministry of Health 1995).

2 A Land Information Memorandum that can be sought under Section 10 of the Local Government Official Information and Meetings Act 1987.

1.5 STATUS OF THE GUIDELINES

1.5.1 Government Policy

The guidelines are endorsed by the Minister of Health and the Minister for the Environment. As guidelines they do not have statutory force but it is recommended that local authorities make reference to these guidelines when preparing their plans and policy statements, and when granting consents under the resource Management Act 1991 (RM Act).

Earlier drafts of these guidelines have been a applied in resource consents since September 1993.

1.5.2 The Resource Management Act 1991

The guidelines are designed to facilitate the implementation of the RM Act in the management of timber treatment sites. They do this in two ways:

- The risk assessment process provides a mechanism by which the adverse effects of contaminants on the environment may be quantified.
- The acceptance criteria derived using risk assessment provide information which can be used in formulating resource consents and their conditions.

1.5.3 Other Relevant New Zealand Legislation

Other legislation is also relevant in this area: the Health Act 1956, the Building Act 1991 (Building Code F1), and the Health and Safety in Employment Act 1992 (for site clean-up[3]).

1.5.4 ANZECC and New Zealand Policy Objectives

The risk assessment/risk management framework used by these guidelines is consistent with the "Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites" (ANZECC Guidelines; ANZECC/NHMRC, 1992). Guidance regarding investigation, assessment and management of sites, and disposal of site materials has been prepared in accordance with this risk-based approach.

3 "Health and Safety Guidelines on the Cleanup of Contaminated Sites", Occupational Safety and Health Service, Department of Labour, 1994.

The New Zealand goals for contaminated site assessment and clean-up (ANZECC Guidelines, p. 2) are:

- to render a site acceptable and safe for the long-term continuation of its existing use;
- to minimise environmental and health risks both on-site and off-site;
- where site clean-up is required, to achieve a standard that minimises risks to human health and the environment consistent with the existing and likely future use of the site, and in accordance with a system to inform future land owners that the clean-up has been conducted to an extent consistent with particular land uses.

The acceptance criteria in these guidelines achieve these goals.

The ANZECC Guidelines are currently under review, and draft revised guidelines are scheduled for release for public comment during 1997. The revision of the ANZECC Guidelines is likely to incorporate a number of land use scenarios that are broadly consistent with those developed and applied in these guidelines.

1.5.5 Application of the Guidelines in Other Industries

Although these guidelines address issues associated with the sawmilling and timber treatment industries, the guidance developed may be applicable (with expert judgement) in other situations. The elements for which guidance has been developed – copper, chromium, arsenic and boron – may also be of concern in other industries. For example, copper is a constituent of some fertilisers and pesticides; chromium is used in the electroplating and tanning industries; and arsenic and boron can arise from geothermal discharges.

1.5.6 Development of Other Guidelines

The guidelines are significant in that for the first time they set out a model of risk assessment adopted as Government policy for application to contaminated sites. Similar guidelines are being developed for other industry sectors to address the assessment and management of sites contaminated by hydrocarbons and gaswork chemicals.

1.6 SPECIFIC ISSUES REQUIRING FURTHER WORK

1.6.1 Dioxins

The Ministry for the Environment is currently undertaking a major review of specific organochlorine chemicals in the environment, including dioxins (The Organochlorines Programme). This review will develop acceptance criteria for dioxins in various environmental media. The acceptance criteria developed for the assessment of the Waipa Timber Processing Complex are referenced[4] in these guidelines and should be used in the interim for the assessment of dioxin contamination at sites where PCP has been used.

1.6.2 Arsenic

Considerable uncertainty remains regarding the bioavailability of arsenic on timber treatment sites where contamination is associated with current or historical use of copper chrome arsenate (CCA). The extent to which arsenic is taken up by plants is influenced by a number of factors, such as its chemical state, the presence of other contaminants, and soil characteristics such as composition, pH, organic content, nutrient status and porosity. Further research is needed to clarify the fate of arsenic in the soil resulting from industrial activity.

In these guidelines, only interim acceptance criteria are recommended for arsenic in agricultural and residential land use.

Due to the complexity of factors involved, consideration may need to be given to assessing the risk of exposure to arsenic on a site-specific basis.

1.6.3 Further Work on Ecosystems

The guidelines establish criteria for a range of beneficial uses of water and groundwater from the perspective of the protection of human health. In due course this work will extend to the development of New Zealand guidelines for the protection of ecosystems. In particular, future development of guidelines for the protection of aquatic ecosystems by the Ministry for the Environment[5] and the development of the National Environmental Risk Assessment Framework by ANZECC/NHMRC[6] may influence the management of sawmill and timber treatment sites. Methodologies for ecological risk assessment are still being developed internationally.

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4 Refer Chapter 5, section 5.9.2

5 "A Proposed Methodology for Deriving Aquatic Guideline Values for Toxic Contaminants", Ministry for the Environment, June 1996.

6 Draft Proc. 4th National Workshop Health Risk Assessment and Management of Contaminated Land, October 1996.

1.7 REVIEW OF THE GUIDELINES

Further work is required to address some of the issues in the guidelines, and risk assessment and management is a developing practice. It is thus proposed that these guidelines be reviewed in five years, or sooner if a significant issue arises or if new information indicates that amendment is necessary. It is expected that any review would be undertaken in the same manner as the development of these guidelines, by involving central government, regulatory authorities and the timber industry. Responsibility for any review lies with the Government.

It is likely that the interim acceptance values for arsenic and dioxins will be reviewed in advance of the revision of the guidelines as a whole.