Former Lands Department Chemical Inquiry

NOVEMBER 2015

Inquiry into the use of chemical substances by employees of the former Victorian Department of Crown Lands and Survey (and its successor departments)

VICTORIA
State Government

Former Lands Department
Chemical Inquiry

Level 36
2 Lonsdale Street
Melbourne 3000
Victoria

11 November 2015

Hon. Lisa Neville MP
Minister for Environment, Climate Change and Water
8 Nicholson Street
East Melbourne VIC 3002

Dear Minister

The Report on the Independent Inquiry into the use of chemical substances by employees of the former Victorian Department of Crown Lands and Survey (and its successor departments) is contained herein in accordance with the Terms of Reference.

Consistent with the Terms of Reference the Report includes:

- A review of past policies and practices for the handling, storage and use of 2,4-D and 2,4,5-T between 1965 and 1995.
- An examination of regulations, laws and Australian Standards relating to the chemicals during that time and whether or not they were followed.
- An examination of exposure of former employees to these chemicals, the response of the former Lands Department to health concerns raised by employees and an assessment of the potential health risk/s.

The Report is historical in nature. It does not contain commentary on current practices and procedures for dealing with weeds and vermin with the chemicals 2,4-D and 2,4,5-T but focuses on the period 1965 to 1995.

I approached this Inquiry as a search for truth; to discover what was known, what should have been known, what was done and what should have been done. I was guided by five key principles throughout the preparation of this Report that I felt were important to the integrity of the Inquiry:

- having an open mind and letting the evidence inform the outcome
- being open and transparent
- listening to all and being empathetic
- thoroughness
- protecting the privacy of individuals.

While I appreciate that the conclusions of this Inquiry will not satisfy every stakeholder, I am confident that they are founded on sound reason applied to the best available evidence and, wherever appropriate, pay due regard to the laws and standards prevailing at the time.

Yours sincerely

Greg Tweedly

Independent Chair
Former Lands Department Chemical Inquiry

Acknowledgements

A large number of people contributed to the preparation of this Report. I sincerely thank the former and current employees of the former Lands Department (and its successor departments) and their family members who generously and courageously took the time to provide valuable information through interviews, submissions, and in providing their documents and records.

I thank other members of the community who, likewise, took the time to provide written submissions.

I thank the subject-matter experts who provided technical expertise and guidance throughout the Report preparation in particular Dr Brian Priestly, Professor Ian Rae and the Department of Health and Human Services' Senior Health Scientist. My thanks also to peer reviewers Claire Thomas PSM and Associate Professor Alan Clayton who provided valuable feedback on drafts of the Report.

I acknowledge Professor John Mathews's generous contribution of time, and in providing valuable insight and data on the worker health studies he conducted during the 1980s with Dr William Parsons.

I thank staff in the Department of Environment, Land, Water and Planning; the Department of Economic Development, Jobs, Transport and Resources; the Department of Health and Human Services; the Department of Premier and Cabinet; the Victorian Government Library Service; the Victorian Managed Insurance Authority and Victorian WorkCover Authority in searching for, and providing documents and records relevant to the Terms of Reference.

I finally acknowledge the Inquiry Secretariat for their support, dedication, hard-work and scrupulous eye for detail in preparing this Report. The team was:

Caitlin Barratt

Lucy Ellston

Julie Keating

Peter Lyon

Neil Robertson

Zoe Toogood

Joanne Wallace.

The team was excellently led by Olivia Kings and I would like to sincerely thank her and the team for their outstanding contribution.

Greg Tweedly

Independent Chair
Former Lands Department Chemical Inquiry

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Terms of reference

Inquiry into the use of chemical substances by employees of the former Victorian Department of Crown Lands and Survey (and its successor departments)

Terms of Reference

1. Preamble

1.1 The Government is conducting an independent inquiry into the use of chemical substances 24D and 245T by the former Victorian Department of Crown Lands and Survey (and its successor departments) for weed and pest control between 1965 and 1995 in Ballarat and surrounding areas.[1] This inquiry has been established as a result of concerns raised by former employees of the Victorian Department of Crown Lands and Survey (and its successor departments) in 2014 in the geographical area cited above.

1.2 These Terms of Reference establish the Former Lands Department Chemical Use Independent Inquiry and set out the scope of the inquiry to be conducted by the Chair.

2. Former Lands Department Chemical Use Independent Inquiry

2.1 A Ministerial Advisory Committee (MAC), to be referred to as the Former Lands Department Chemical Use Independent Inquiry, is established by the Minister for Environment, Climate Change and Water by these Terms of Reference from 1 March 2015 to 11 November 2015.

2.2 The Former Lands Department Chemical Use Independent Inquiry consists of one member (the Chair), who is appointed by the Minister for Environment, Climate Change and Water by instrument of appointment.

2.3 The Chair is entitled to such remuneration and expenses as are fixed by the Minister in his instrument of appointment.

2.4 The Chair is subject to the terms set out in his instrument of appointment and these Terms of Reference.

2.5 The Former Lands Department Chemical Use Independent Inquiry is accountable to the Minister.

2.6 The Minister may abolish the Former Lands Department Chemical Use Independent Inquiry or terminate the Chair appointment at any time prior to the end of the inquiry by providing written notice to the Chair, which will be effective immediately or such later date as specified in that notice.

[1] 'Ballarat and surrounding areas' comprise the following Local Government Areas: Golden Plains Shire, Moorabool Shire, Hepburn Shire, Ballarat City Council, Pyrenees Shire, Ararat Rural City Council and Central Goldfields Shire

3. Scope of Inquiry

3.1 The inquiry Chair is to:

- Identify and review past policies and practices relating to the handling, storing and use of 24D and 245T between 1965 and 1995 by the former Victorian Department of Crown Lands and Survey (and its successor departments)
- Identify and review regulations, laws and Australian Standards relating to the handling, storing and use of 24D and 245T that applied between 1965 and 1995 and assess, to the extent possible, whether the policies and practices of the former Victorian Department of Crown Lands and Survey (and its successor departments) adhered to those regulations, laws and Australian Standards
- Investigate the adequacy of the former Victorian Department of Crown Lands and Survey (and its successor departments) processes and responses to any health concerns raised by employees over the handling, storing and use of 24D and 245T between 1965 and 1995 in Ballarat and surrounding areas
- Investigate the likely exposures of employees of the former Victorian Department of Crown Lands and Survey (and its successor departments) to 24D and 245T between 1965 and 1995 in Ballarat and surrounding areas to understand the potential health risk

3.2 In conducting the inquiry, the Chair will:

- Have access to all documents and information held by the Department of Environment, Land, Water and Planning that relate to the terms of reference, including:
  - documents and information created within the former Department of Crown Lands and Survey (and its successor departments)
  - existing work of the internal Department of Environment and Primary Industries inquiry that commenced in September 2014
- Seek information and input from present and former employees (including family members and friends of employees) of the former Department of Crown Lands and Survey (and its successor departments) in Ballarat and surrounding areas1 who believe employee health has been adversely affected from exposure to 24D and 245T (subject to their willingness to participate in the inquiry)
- Travel to key locations to seek this information and input
- Seek specialist and expert advice as required within a budget capacity agreed between the Minister for Environment, Climate Change and Water and the inquiry Chair

3.3 The report will be submitted to the Victorian Government by 11 November 2015.

3.4 The Victorian Government will respond and make available the report publicly, at its discretion, within six months of receipt.

Hon Lisa Neville MP
Minister for Environment, Climate Change and Water

29 / 9 / 2015

Glossary of terms and acronyms

2,3,7,8	2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD)
2,4-D	2,4-Dichlorophenoxyacetic acid
2,4,5-T	2,4,5-Trichlorophenoxyacetic acid
AAC	Australian Agricultural Council (Commonwealth)
AAVCC	Australian Agricultural and Veterinary Chemicals Council (Commonwealth)
ACTU	Australian Council of Trade Unions
ADI	Acceptable daily intake
AgVet	Agricultural and veterinary
ALP	Australian Labor Party
APVMA	Australian Pesticides and Veterinary Medicines Authority (Commonwealth)
AS	Australian Standard
ATSDR	Agency for Toxic Substances and Disease Registry (US)
AWU	Australian Workers Union
CDC	Center for Disease Control and Prevention (US)
CEP	Community Employment Programs
CFL	Conservation, Forests and Lands (Department of, Victoria)
CLL	Chronic lymphocytic leukaemia
CCP	Coordinating Committee on Pesticides (Commonwealth)
COAG	Council of Australian Governments
CPSU	Community and Public Sector Union
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAC	District Advisory Committee (Victoria)
DCFL	Department of Conservation, Forests and Lands (Victoria)
DCLS	Department of Crown Lands and Survey (Victoria)

DCE	Department of Conservation and Environment (Victoria)
DCNR	Department of Conservation and Natural Resources (Victoria)
DDT	Dichlorodiphenyltrichloroethane
DEDJTR	Department of Economic Development, Jobs, Transport and Resources (Victoria)
DELWP	Department of Environment, Land, Water and Planning (Victoria)
DLI	Department of Labour and Industry (Victoria)
DNA	Deoxyribonucleic acid
EnTox	National Research Centre for Environmental Toxicology (Australia)
EPA	Environment Protection Authority (Victoria)
FAO	Food and Agriculture Organisation of the United Nations
FSANZ	Food Standards Australia New Zealand
HCV	Health Commission Victoria
HHRA	Human health risk assessment
HR	Human Resources
HSO	Health and Safety Organisation (Victoria)
HVE	High volatile esters
IARC	International Agency for Research on Cancer (UN)
IGA	Intergovernmental Agreement
IOM	Institute of Medicine (US)
IRIS	Integrated Risk Information System
JECFA	Joint FAO/WHO Expert Committee on Food Additives
KTRI	Keith Turnbull Research Institute (Victoria)
LOAEL	Lowest observed adverse effect level
MRL	Maximum residue levels
NAS	National Academy of Sciences (US)

NATA	National Association of Testing Authorities (Commonwealth)
NEPM	National Environment Protection Measures
NHL	non-Hodgkin lymphoma
NOAEL	No observed adverse effect level
NHMRC	National Health and Medical Research Council (Commonwealth)
NICNAS	National Industrial Chemicals Notification and Assessment Scheme (Commonwealth)
NIOSH	National Institute for Occupational Safety and Health (US)
NOHSC	National Occupational Health and Safety Commission (Commonwealth)
NRA	National Registration Authority (Commonwealth)
NRS	National Registration Scheme (Commonwealth)
OCS	Office of Chemical Safety, Australian Government Department of Health (Commonwealth)
OHS	Occupational health and safety
OHSA	Occupational Health and Safety Authority (Victoria)
OHSC	Occupational Health and Safety Commission (Victoria)
POD	Point of Departure
PPE	Personal protective equipment
ppm	parts per million
PRC	Pesticides Review Committee (Victoria)
PSM	Public Service Medal
PSIC	Product Safety and Integrity Committee (Commonwealth)
RAC	Regional Advisory Committee (Victoria)
RED	Regional Employment Development
RfD	Reference dose
SCA	Standing Committee on Agriculture (Commonwealth)
SCoPI	Standing Council on Primary Industries (Commonwealth)

SF/UF	Safety Factors/Uncertainty Factors
SIO	State Insurance Office (Victoria)
STS	soft tissue sarcoma
SYETP	Special Youth Employment Training Program
TCAC	Technical Committee on Agricultural Chemicals (Commonwealth)
TCDD	Tetrachlorodibenzo-*p*-dioxin
TCVD	Technical Committee on Veterinary Drugs (Commonwealth)
TDI	Tolerable daily intake
TEF	Toxic equivalency factor
TEQ	Toxic equivalent quantity
TI	Tolerable intake
TMI	Tolerable monthly intake
US	United States of America
US EPA	United States of America Environmental Protection Agency
VCR	Victorian Cancer Registry
VMIA	Victorian Managed Insurance Authority
VNWDB	Vermin and Noxious Weeds Destruction Board (Victoria)
VPSA	Victorian Public Service Association
VTHC	Victorian Trades Hall Council
VWA	Victorian WorkCover Authority
WHO	World Health Organisation (United Nations)

Terminology

For ease of reading this Report:

- 'the Department' is taken to mean the Victorian Department of Crown Lands and Survey and all its successors in the period 1965 to 1995. It also is taken to include the Superintendent appointed under the *Vermin and Noxious Weeds Act 1958*, who was also the Chair of the Vermin and Noxious Weeds Destruction Board, for part of this period. Chapter 3 explains the changes to the 'Lands Department' and its instrumentality (the Vermin and Noxious Weeds Destruction Board) that occurred in the period.
- 'Department employee' is taken to mean both inspectors employed under the relevant Public Sector Act and field staff who were employed under the *Vermin and Noxious Weeds Act 1958*.
- 'the Inquiry' is used when referring to the Inquiry pertaining to this Report (that is, the Former Lands Department Chemical Inquiry).
- 'the Inquiry Chair' is used for the title of the independent Chair of this Inquiry.
- 'the Period' is used when referring to the period of interest (1965 to 1995) defined in this Inquiry's Terms of Reference.
- 'Ballarat region' is used when referring to the geographic area of interest defined in this Inquiry's Terms of Reference.
- 'pesticide/s' is taken to include herbicide/s and weedicide/s. These terms have been used interchangeably throughout the Report, as they have been throughout history.

ACRONYMS

There are numerous acronyms used throughout the Report (a full listing is provided in the Glossary of Terms immediately prior to this section). There are a few key acronyms that are used very frequently:

2,4-D	2,4-Dichlorophenoxyacetic acid
2,4,5-T	2,4,5-Trichlorophenoxyacetic acid
TCDD	2,3,7,8-Tetrachlorodibenzo-*p*-dioxin
PRC	Pesticides Review Committee
VNWDB	Vermin and Noxious Weeds Destruction Board
KTRI	Keith Turnbull Research Institute

Executive summary

This Inquiry comes at a time of heightened concern in the Ballarat community around the impact of exposure to the chemicals 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) on the Department's employees. The Inquiry has investigated the likely exposures of Department employees in the Ballarat region to these chemicals from 1965 to 1995 and any potential health risks.

Many people will be looking for this Report to find out if there is a definite link between 2,4-D and 2,4,5-T to cancers and other illnesses of family, friends and work colleagues. The Inquiry was not tasked to assess this but to ascertain the likely exposure of employees to 2,4-D and 2,4,5-T and therefore better understand any potential health risks.

Our key finding is that, prior to 1981, it is plausible that exposure to 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD,a contaminant in 2,4,5-T) may cause non-Hodgkin lymphoma or soft tissue sarcoma. With so many possible causes of cancer, however, it's impossible to be absolutely certain that this exposure is one of those causes.

Between 1965 and 1995 – the period of interest to the Inquiry and henceforth known as 'the Period' – there were numerous inquiries and reviews into 2,4-D and 2,4,5-T throughout Victoria, Australia and overseas. Many tens of thousands of scientific, academic and policy papers have also been written. Despite this, a number of general community concerns remain such as:

- Has there been a cover-up?
- Have we been lied to regarding safety claims?
- Is it safe to 'interfere' with nature?
- There must be a big problem because there is an (another) Inquiry.

Questions the Inquiry considered include:

- What did responsible parties (i.e. suppliers, the Department, employers, employees and regulators) know?
- What should they have known?
- What did they do?
- What should they have done?
- Have these chemicals increased the risk of cancer/illness to exposed workers?

Drawing on current and past scientific knowledge, this Report offers a detailed review of the Department's role. It has poured over tens of thousands of documents. However, due to the 30 to 50 years that have passed, record series were often incomplete and so presented significant challenges to the Inquiry's analysis. Despite these substantial gaps, however, it is possible to make reasonable hypotheses of what work was like during the Period. Importantly, any judgements made have been made in the full context of the standards of the day, not with the benefit of hindsight.

This Report is based on a thorough examination and analysis of:

- over 100,000 pages of historical documents
- 76 interviews
- 29 written submissions
- a broad list of literature including scientific studies, legislation and Standards.

This Report did not assess:

- areas outside of the Ballarat region
- other chemicals
- other employers
- the Department's current policies and procedures.

The Inquiry also undertook a retrospective exposure assessment based on as much information as it could glean from historical data. While the data had significant gaps, the Inquiry was able to apply a series of robust assumptions to inform findings and recommendations.

While this Inquiry makes no judgements on the policies and procedures of the Department after 1995, the Department would be wise to review current policies and practices to ensure that the problems identified, prior to 1995, are no longer present.

The Inquiry would also like to acknowledge the generous input of those who agreed to tell their stories through interviews or submissions – something many found difficult. This was crucial to the successful conclusion of the Inquiry's work.

THE CHEMICALS

The process of making 2,4,5-T produces minute proportions of a highly toxic dioxin called TCDD. Over the years there have been thousands of academic and scientific papers written on the potential links of these chemicals and TCDD to cancer.

TCDD has been recognised as carcinogenic to humans since 1997. Chemicals 2,4-D and 2,4,5-T – commonly referred to by scientists as chlorophenoxy herbicides – are now recognised as 'possibly carcinogenic' to humans but with limited evidence. The use of 2,4-D and 2,4,5-T in Victoria stretches back to the 1950s. 2,4,5-T ceased being used by the Department after 1988. 2,4-D is still available for use and is still considered safe if used as directed; however, further regulatory reviews are underway by the regulatory authority Australian Pesticides and Veterinary Medicines Authority (APVMA).

The two most important questions for this Inquiry were:

- How toxic were the chemicals used by the Department during the Period?
- How much were workers exposed to these chemicals during the Period?

PAST PRACTICES IN CONTEXT

The use of Agent Orange by the US military in the Vietnam war as part of its herbicidal warfare program drew enormous publicity across the world in the late 1960s and began a serious debate that has raged ever since. This debate has focused mainly on the human health impacts of 2,4-D and 2,4,5-T – the two chemicals that are the focus of this Inquiry and the two chemicals that make Agent Orange. This, together with uncertainty about the toxicity levels within Agent Orange and its potential health effects, fuelled a community concern about chemical exposure.

The regulatory environment of the past was comparatively lax by today's standards and Occupational Health and Safety (OHS) was not much of a consideration. In other words, employee safety was not a key management focus and, even when there were safety policies and standards in place, compliance was *laissezfaire*. It was an era in which workers didn't challenge the boss, even if they did have concerns. While management usually followed the latest science that indicated a low safety risk, workers weren't convinced they were safe.

THE TERMS OF REFERENCE

The Inquiry addressed the terms of reference in a structured way. Firstly, the Inquiry sought to ascertain the current state of knowledge and how this has evolved over the Period. Secondly, the Inquiry identified and reviewed the regulations, laws and standards. Thirdly, the Inquiry sought to determine the responsibilities of various parties. The Department's policies and practices were identified and reviewed with reference to similar organisations of the day to determine if it adhered to the regulations, laws and standards and how it dealt with employee health concerns. Finally, the Inquiry assessed the level of worker exposure and any potential health concerns.

THE REGULATIONS, LAWS AND STANDARDS

Over the Period, both the framework of regulations, laws and Australian Standards governing safe use and storage of chemicals and employers' OHS duty of care underwent many changes. The most significant was the progressive ramping-up of workplace OHS regulation and workers compensation regulations and laws. The era also saw the Commonwealth and its agencies assume an increasingly significant role in setting the standards in chemicals registration prior to the point of sale.

The Inquiry examined Department adherence with many regulations, laws and Australian Standards through the Period under the following categories:

- Land Management
- Fungicides and Pesticides

- Occupational Health and Safety
- Workers Compensation
- Civil Proceedings
- Public Service and Record Retention
- Australian Standards.

RESPONSIBILITIES AND ACCOUNTABILITIES OF PARTIES

During the Period, the legislative responsibilities and accountabilities for safe storage and use of agricultural chemicals, and for the protection of the health and safety of workers exposed to those chemicals, were clarified and strengthened. The Department's responsibility as an employer subsequently increased.

By the end of the Period, the Commonwealth's regulatory responsibility included the approval and setting of agricultural chemicals standards up to the point of sale. States remained responsible for all regulation after sale.

DEPARTMENT POLICIES AND PRACTICES

Throughout the 1960s and 1970s and into the early 1980s, Department policies described 2,4-D and 2,4,5-T as relatively safe, which was reflected in safety policy and culture until the mid-1980s.

The Inquiry found the Department lagged significantly behind similar departments in implementing safe pesticide use in the workplace with specific reference to:

- pesticide safety information
- personal protective equipment (PPE) provision
- poison storage sheds
- washing facilities
- chemical safety training.

Pesticide safety and workplace instructions were often inappropriate as was PPE, particularly for sprayers.

Between the mid-1970s to the early 1980s communications around pesticide safety were late to arrive, confusing and the vagueness of the language often left it to workers to decide on what to do. There was little evidence of a culture of compliance, particularly before the mid-1980s, and improvements to Department systems were slow and inconsistenly implemented.

HANDLING, STORING AND USE OF 2,4-D AND 2,4,5-T

From the mid-1980s the Department took measures that mainly met the requirements of the various OHS requirements including having in place safety policies, procedures, manuals and information sheets, safety training, safety committees and health monitoring. However, many of these lacked appropriate consistency, timeliness and follow-up to assess implementation and compliance.

In the early years the Department did not consistently meet its statutory obligations in relation to the storage and safe work practices for pesticides. Workplace conditions were often inadequate and the response to bring sites up to standard was slow and inconsistent.

The use and availability of suitable PPE was often non-compliant with important issues remaining unresolved for long periods of time. Workers' dissatisfaction with the available equipment made compliance problematic.

HEALTH CONCERNS

Early on in the Period the pesticides were considered low risk. The Department did seek timely advice on how to respond to health concerns. From 1980 onwards, it supported further research into the pesticides' health effects and conducted a number of internal reviews. Its communication with those directly affected, however, was poor and had it adopted a more cautious approach it could have responded faster with appropriate precautions in working with these chemicals.

EXPOSURE AND POTENTIAL HEALTH RISKS

Due to incompleteness of data, the Inquiry cannot calculate individual exposure to risk. Using an independent expert, however, the Inquiry was able to estimate exposure scenarios based on the best available evidence and applying conservative assumptions to ensure that exposure was not underestimated.

Evidence of potential health effects is ambiguous but, given the estimated exposures, the Inquiry makes the following conclusions:

- Exposure to 2,4-D is unlikely to be linked to cancer or illness other than dermatological illness.
- Exposure to TCDD (through it being a contaminant of 2,4,5-T) was in excess of today's exposure standard during spraying seasons before 1981.
- It is plausible that sprayers (pre 1981) who contracted soft tissue sarcomas or non-Hodgkin lymphoma may have contracted these cancers from TCDD exposure.

While possible, there is insufficient data/evidence to conclude that TCDD exposure caused any other cancers.

CONCLUSIONS

There are numerous findings outlined throughout the report, the key conclusions are:

Exposure to a dangerous dioxin

- It is estimated that sprayers between 1965 and 1981 were exposed to more than double today's standard tolerable monthly intake (TMI) of TCDD (a contaminant of 2,4,5-T). From 1981, however, exposure was lower than the TMI. Importantly, Australia didn't introduce exposure standards until 2002.
- The International Agency for Research on Cancer (IARC) – a World Health Organization body – has classified TCDD as 'carcinogenic to humans' since 1997 and 'possibly carcinogenic to humans' since 1982.
- A 1982 Victorian government policy to test the urine of all sprayers to monitor their health was never implemented by the Department.

Health effects

- An epidemiological study of Victorian sprayers in the 1980s found no abnormal incidence of cancer.
- The consensus among subsequent academic papers finds a link between exposure to TCDD and the incidence of soft tissue sarcomas and non-Hodgkin lymphoma.

Policy and practices

The Department initiated a number of excellent research activities and reviews but did not fully implement their findings/recommendations or successfully communicate their results. Washing facilities on trucks were not routinely available until the late 1970s and it took until the late 1980s for substantive improvements in safety systems and approaches to come on line. Through most of the Period the Department's safety messages were inconsistent and untimely while the availability and use of PPE were poor.

Training

Formal training in the safe use of pesticides began in 1976 with 2,4,5-T training introduced in 1982.

Structured training of Department employees was infrequent, at times 'above their heads' and not compulsory. Despite the Department identifying serious flaws in its training regimes in 1982, 1988 and 1991, there was no follow-through to implement change.

RECOMMENDATIONS

The Inquiry recommends:

- updating the 1980s Worker Health Study for the same group of sprayers (1951 to 1970) and comparing with the Victorian Cancer registry for evidence of causation or lack thereof.

- checking current and former sprayers for a history of chloracne, soft tissue sarcoma and non-Hodgkin lymphoma and consideration of a policy response for those who contracted these conditions.

and that the Department should:

- review all current policies and practices to ensure that no failings of the Period remain
- view all chemicals as potentially dangerous, give maximum safety precautions and ensure compliance with those precautions
- introduce a health-monitoring regime for all workers exposed to chemicals that the IARC classifies as:
  - carcinogenic to humans
  - probably carcinogenic to humans
  - possibly carcinogenic to humans
- introduce a regular auditing program to ensure adherence to safety precautions
- keep up-to-date with current research on 2,4-D and 2,4,5-T.

Findings

Chapter 8 Department policies and practices

Terms of Reference

> *Identify and review past policies and practices relating to the handling, storing and use of 2,4-D and 2,4,5-T between 1965 and 1995 by the former Victorian Department of Crown Lands and Survey (and its successor departments)*

Policies

- In the 1960s there was a lack of awareness about the risks of herbicides as opposed to fumigants or poisonous baits.
- Department policies described 2,4-D and 2,4,5-T as relatively safe throughout the 1960s and 1970s and into the early 1980s, and did not emphasise any potential long-term health impacts.
- Policies shifted between being mandatory to optional and back again, and lagged behind similar organisations by many years.
- In 1986 the Department finally had a comprehensive policy on the safe use of pesticides.

Workplace practices

Roles and supervision

- Early duty statements covering supervisory roles didn't specifically refer to worker safety.
- The leading hand managed crews, provided work instructions and oversaw field work. By 1977, the Inspectors' Manual obliged inspectors to maintain safe workplaces and gave instructions on the safe use of pesticides.
- The lack of written evidence of daily work indicates work programs were probably issued verbally.

Storage

- Storage sheds were basic and often unventilated.
- In the 1960s and 1970s ex-army Nissan huts were used for storage.
- In the early 1980s many sheds were still not secure.
- By the late 1980s storage sheds were being retrofitted with ventilation.

PPE

- Early PPE was basic bib-and-brace overalls and, due to budget issues, often in limited supply.
- By the early 1980s comprehensive PPE was available, however, use was not always enforced, supply was a problem and it was often not designed for the prevailing conditions.
- By the late 1980s most workers were wearing PPE.

Handling

- Policies and practices for handling pesticides were not well communicated until 1986.

Washing facilities

- Water bags were provided in the 1960s in some areas, however, showers and washing facilities were not installed in many depots until the early 1980s.

Safety committees

- A Departmental Safety Committee was established in 1971.
- Regional safety committees were often slow to respond to local issues.
- The lack of suitable PPE equipment and its low use were issues.

A significant evolution in the safety committee membership began in mid-1985 to increase representation of regional staff viewpoints.

Communications

While the Department took many steps to communicate its safety policy to staff, there were many failings and an 'all care, no responsibility' attitude pervaded. These failings included:

- No checks and balances on inspectors implementing safety policy.
- Important safety information was not available to workmen in the workplace.
- A 1993 internal assessment of OHS management systems in Ballarat found that the Health and Safety Policy was not clearly displayed at any work site.
- There were conflicting safety messages at all levels.

Training

The Department provided formal training in the safe use of pesticides from 1976 and more specifically 2,4,5-T training from 1982. There's evidence of many failings, with the Department admitting in 1991 that staff pesticide training had been a low priority and an 'all care, no responsibility' attitude pervaded. Key points to note are:

- Department reviews in 1982 (KTRI), 1988 (Wells) and 1991 (Department of Conservation and Natural Resources) highlighted serious flaws, e.g. content was above the workers' heads.
- The VTHC gave a scathing review of the 1982 training courses for herbicide users, particularly regarding how it conveyed 2,4,5-T information.
- The Department considered the VTHC's feedback in detail but strongly refuted it.
- There is no evidence the Department kept staff attendance records, even in 1982 when the training was mandatory for all workers using 2,4,5-T.
- No action was taken to enforce attendance, even when it was known staff members didn't attended.

In 1991, feedback from the AWU showed largely positive feedback but was long overdue.

Chapter 9 Adherence to regulations, laws and Australian standards

Terms of Reference

> *… assess, to the extent possible, whether the policies and practices of the former Victorian Department of Crown Lands and Survey (and its successor departments) adhered to those regulations, laws and Australian Standards.*

The Department largely met the requirements of the *Industrial Safety, Health and Welfare Act 1981* and the *Occupational Health and Safety Act 1985*. This included having:

- safety policies and procedures
- manuals and information sheets
- safety training
- safety committees
- health monitoring.

Many of these, however, lacked appropriate consistency, timeliness and follow-up to ensure implementation and compliance.

The Department may not have met its statutory obligations in relation to storage and safe work practices for pesticide use. The use and availability of suitable PPE was a key area of non-compliance, with important related issues remaining unresolved for a long time.

Chapter 10 Health concerns

Terms of Reference

> *Investigate the adequacy of the former Victorian Department of Crown Lands and Survey (and its successor departments) processes and responses to any health concerns raised by employees over the handling, storing and use of 2,4-D and 2,4,5-T between 1965 and 1995 in Ballarat and surrounding areas.*

1965 to 1979

- Both the science of the time, and advice from the Department of Health maintained that the pesticides presented a low risk.
- There were few reported cases of pesticide-related injuries over the Period.
- The Department responded to these cases in a timely manner.
- The Department didn't enforce PPE use. However, this was understandable given its knowledge at the time, and the low numbers and types of injuries.

1980 to 1995

- The Department was made aware of possible links to cancer of 2,4-D and 2,4,5-T.
- The Department supported further research in the 1980s but could have better communicated the results to staff. It appears that information passed on to inspectors was assumed to be passed on to sprayers.
- There was some delay in making PPE compulsory after the Department became more aware of the risks.
- The Department undertook internal reviews on pesticide use but there is limited evidence on how it implemented any recommendations.
- It's unclear why the Department of Health did not implement a Cabinet decision to provide staff urine testing to monitor sprayers' health.

Chapter 11 Exposure and potential health risks

Terms of Reference

> *Investigate the likely exposures of employees of the former Victorian Department of Crown Lands and Survey (and its successor departments) to 2,4-D and 2,4,5-T between 1965 and 1995 in Ballarat and surrounding areas to understand the potential health risk.*

Exposure

- The exposure to 2,4-D, while higher than the ADI in the later years and in the high scenarios, was well below the NOAEL for the whole Period.
- In the first two decades of the Period, the workers' estimated exposure to TCDD in Table 11.2 was 2 to 2.5 times Australia's current TMI during the spraying season (70 pg /kg bw/month) and substantially below the TMI in 1982–1995.

The estimated high exposure scenarios result in a TCDD of six to eight times the TMI in the early years, and well below the TMI from 1982.

Potential health risks

2,4-D:

- Although exposure may have given sprayers skin and eye irritations, their exposure levels were probably well below that of the production workers who triggered the IARC to classify 2,4-D as possibly carcinogenic to humans. The conclusion there was a link to non-Hodgkin lymphoma which were based on mixed results that indicate a low potential for cancer formation.

2,4,5-T:

- Sprayers may have experienced irritation to skin and eyes from inadvertent exposure. Evidence of 2,4,5-T's carcinogenicity is lacking so no conclusion can be reached about chronic effects of exposure to it.

TCDD:

- Exposure to 2,4,5-T and its dioxin TCDD present the potential for sprayers to contract soft tissue sarcoma or non-Hodgkin lymphoma.
- The potential health risk would have been greater before TCDD levels in 2,4,5-T were reduced in 1982.
- Due to its contamination with TCDD, it's plausible that a number of years spent spraying 2,4,5-T could contribute to soft tissue sarcoma or non-Hodgkin lymphoma.

The data isn't strong enough to conclude that exposure may lead to other cancers.

Part 1: Introduction

Chapter 1: Introduction

BACKGROUND

This Inquiry was established to examine concerns raised by members of the community in and around Ballarat. In 2014, the *Ballarat Courier*[1] published a series of articles outlining concerns by former employees of the Department of Crown Lands and Survey (commonly referred to as the 'Lands Department') in Ballarat and surrounding areas. The former employees had worked as sprayers to eradicate and control weeds and pests. The articles included reports of alleged inappropriate workplace practices relating to chemical use, handling and storage. In addition, individuals cited in the articles expressed concern for their health as a result of their exposure to the chemicals. The chemicals 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) were highlighted as key chemicals of concern.

As a result, the Victorian State Government committed to conduct an independent inquiry to examine the concerns. On 20 February 2015, the Minister for Environment, Climate Change and Water, the Hon. Lisa Neville MP, announced the independent Inquiry into the use of chemical substances by employees of the former Victorian Department of Crown Lands and Survey (and its successor departments) and appointment of Mr Greg Tweedly as Chair of the Inquiry.

Mr Tweedly's career has included nearly 25 years' experience in regulation, operation and research of occupational health and safety (OHS) and workers compensation. He has been Chief Executive Officer and Director of the Victorian WorkCover Authority, Chief Operating Officer of the Transport Accident Commission and held directorships of the Institute for Safety, Compensation and Recovery Research, the Personal Injury Education Foundation, and the Victorian Trauma Foundation. He has also been Chair of the Heads of Workers' Compensation Authorities of Australia and New Zealand, and a Member of SafeWork Australia (representing Victoria) and its predecessor organisations.

ESTABLISHMENT

The Inquiry was established as a Ministerial Advisory Committee under the auspices of the Hon. Lisa Neville MP, Minister for Environment, Climate Change and Water. Mr Greg Tweedly was appointed as sole member of the Ministerial Advisory Committee in the role of independent Chair of the Inquiry.

The Inquiry was not established under any statutory framework or legislation, and therefore did not have the power to, for example, compel the production of documents or order that witnesses appear. As an administrative Inquiry it relied on the cooperation of government departments and agencies to provide historical documents and records, and former employees of the former Lands Department (and its successor departments) to voluntarily share their experiences and recollections of their work.

The Inquiry formally commenced on 1 March 2015. The Chair was supported throughout the Inquiry by a Secretariat drawn from the Victorian Public Service, and external experts and advisers.

TERMS OF REFERENCE AND SCOPE

The Inquiry has focused on addressing the Terms of Reference (refer to page 8).

In summary, in relation to the handling, storing and use of 2,4-D and 2,4,5-T between 1965 and 1995 by the former Victorian Department of Crown Lands and Survey (and its successor departments), the Inquiry Chair is required to:

- Identify and review past policies and practices, regulations, laws and Australian Standards.
- Assess, to the extent possible, whether these policies and practices adhered to those regulations, laws and Australian Standards.
- Investigate the adequacy of the processes and responses to any health concerns raised by employees.
- Investigate the likely exposures of employees to 2,4-D and 2,4,5-T to understand the potential health risk.

[1] The Ballarat newspaper, *The Courier*, published a series of articles from 29 October 2015, by J. Oliver and D. Jeans that commented on reports by Former Lands Department workers about pesticide use and health concerns. See: www.thecourier.com.au

Within scope

The scope of the Inquiry **included** employees of the former Victorian Department of Crown Lands and Survey and its successor departments (including those that worked under the *Vermin and Noxious Weeds Act 1958*), and its successor departments who:

- used the chemicals 2,4-D or 2,4,5-T in their work
- worked in Ballarat and surrounding shires
- worked between the years 1965 and 1995.

Chemicals resulting from mixing 2,4-D and 2,4,5-T were considered in scope. 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), a toxic dioxin contaminant created as a by-product in the manufacturing of 2,4,5-T, was also considered in scope.

Out of scope

The scope of the Inquiry **excluded:**

- Time periods pre-1965 and post-1995 (except where they provided context to the use of chemicals between 1965 and 1995).
- Employees who worked outside Ballarat and surrounding areas.
- Chemicals other than 2,4-D, 2,4,5-T and TCDD.
- The potential health impacts on family members of former employees of the Department.
- The potential health impacts on members of the general public who may have been exposed to chemical sprays or residues.
- Departments or entities outside the former Department and its successor departments.

Chemicals other than 2,4-D and 2,4,5-T were examined only to provide context to the use of the specific chemicals.

Observations made relating to issues out of scope are included in Appendix 3 for the sake of completeness. Most of the observations made relate to the experiences of former employees of the Department (or their family members in instances when the employee was deceased) who worked outside of the geographic areas of the Inquiry's scope. The experiences cited in these submissions were consistent with those cited within scope. This suggests that the experiences and practices occurring within Ballarat and surrounding areas were likely indicative of what was happening across the whole of Victoria at those times.

Extension of time

The Inquiry's Terms of Reference specified a reporting date of 30 September 2015. However, the Inquiry received an unexpectedly large volume of documents and records to review. While this was pleasing, the considerable task of analysing such a large collection of documents saw the Chair seek a six-week extension from the Minister, which was granted, to 11 November 2015.

INQUIRY APPROACH

This Report is the product of an extensive review of academic studies, existing research, Department records and the recollections of people employed by the Department, whose employment involved the use of 2,4-D and 2,4,5-T between 1965 and 1995.

This Report seeks to distil and summarise accurately, and in a balanced way, what was happening in the time period 1965 to 1995. The findings and recommendations of this Report have been informed by asking many questions. Importantly, these have included:

- What did responsible parties know?
- What should the responsible parties have known?
- What did the responsible parties do?
- What should the responsible parties have done?

The Inquiry considers that responsible parties for the safe use of pesticides includes the Department and employees (See Chapter 7).

The Inquiry has sourced and referenced the most credible and widely-recognised academic studies to assist in addressing the Terms of Reference and in determining this Report's conclusions and recommendations.

The concerns cited in the *Ballarat Courier* articles are not unique to the area or Victoria. At the commencement of the Inquiry it quickly became apparent that concerns about the use and effects of 2,4-D, 2,4,5-T and a range of other chemicals have been voiced and examined for many decades right across the world. As a result, a huge number of academic studies exist that have examined the effects of 2,4-D, 2,4,5-T, TCDD and what is commonly referred to as 'Agent Orange', in Australia and overseas, across many decades.

This Report has not aimed to be a new academic study, but rather has sought to utilise the best available evidence to address the Terms of Reference.

Importantly, this Inquiry was not a health or epidemiological study. Some members of the public may be seeking very specific answers to their own health concerns and circumstances, and consequently, may not receive the answers to the questions they have from this Report.

The Chair recognises that concerns about the use of 2,4-D and 2,4,5-T and their alleged health impacts have existed for many decades, and debate continues despite thousands of scientific studies analysing the effects of these chemicals.

The debate has constantly posed alternative arguments, ranging from the probability that the chemicals are safe versus the possibility that they are not. Whilst there are many laboratory tests involving animals, the data on human exposure is limited by the many variables that have confounded any analysis.

Concerns that the issue has not been fully addressed are a worldwide phenomenon with reviews occurring throughout the Inquiry period across the globe. As recently as 2011, the government of Ontario, Canada established an Independent Fact Finding Panel[2] to review the use of 2,4,5-T, with similar terms of reference to this Inquiry.

While this Report provides further information for those affected at the time it is highly likely that community concern will remain.

Timelines

Many Australian and international studies, and literature reviews were used by the Inquiry to help develop conclusions and recommendations. In analysing the research the Inquiry used a number of time brackets throughout the Report to reflect the developing state of knowledge and to give context to the periods between 1965 and 1995, during which the state of knowledge, roles and responsibilities changed significantly. The most common time brackets used were:

- 1965 to 1976
- 1976 to 1981
- 1982 to 1995.

These three periods were chosen because concentration of the contaminant TCDD in 2,4,5-T was known to have changed due to improved manufacturing techniques, and standards and laws were updated to reflect that change.

Other time brackets were also used in the Report because they reflected substantial legislative changes in OHS:

- 1965 to 1980
- 1981 to 1985
- 1985 to 1995.

The state of knowledge for each of these time periods was reconstructed using national and international research, standards, guidelines, policies and procedures to present a picture of the time.

This Report makes observations about the possible levels of exposure, and the potential health risks from that exposure, to the chemicals 2,4-D and 2,4,5-T, and is based on information gleaned from documents, records, and the recollections of those who participated in the Inquiry.

While the Terms of Reference are to examine the period of time against the standards of that time, some general comments and observations on what would be acceptable today are made at key points in the Report.

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[2] Fact-Finding Panel on 2,4,5-T April 2013, *Report of the Independent Fact-Finding Panel on Herbicide 2,4,5-T: Final Report*, Queen's Printer for Ontario, Ontario Canada.

The conclusions of this Inquiry will not satisfy every stakeholder. However, the conclusions are based on sound reason, founded on the best available evidence, and with due regard to the laws and standards prevailing at the time.

CONDUCTING THE INQUIRY

Communication

The ability to communicate with the community, particularly those exposed to the chemicals in Ballarat and surrounding areas, was important in providing information about the Inquiry's purpose, processes and progress, and how people could participate. A 1800-hotline number was established on 20 February 2015, when the Inquiry was announced by the Minister for Environment, Climate Change and Water, to enable members of the public to register their interest in participating. An email address was also quickly established to provide another avenue by which members of the public could register their interest and ask questions. A website followed later, which provided up-to-date information on the Inquiry and its progress. 71 calls were made to the 1800-hotline and 58 emails were received via the email address.

All calls made to the 1800-hotline were followed up when requested by the member of the public. All requests for an interview were responded to personally by either a member of the Inquiry Secretariat or interview team. All written submissions received were acknowledged by either email or personal letter.

Advertisements were placed in local newspapers (Figure 1.1) including the *Ballarat Courier*, the *Castlemaine Mail*, the *Ararat Advertiser*, the *Beaufort Pyrenees Advertiser* and the *Maryborough Advertiser*, which invited people in the local areas to attend the public information sessions held in late March 2015. Local radio was also used to help advertise the sessions. Further advertisements were placed in local and statewide newspapers in April 2015 including the *Herald Sun*, *The Age*, the *Weekly Times*, the *Golden Plains Miner*, the *Ballarat Courier*, the *Ararat Advertiser*, the *Stawell Times News*, the *Castlemaine Mail*, the *Maryborough Advertiser* and the *Midland Express* seeking written submissions, and registrations for one-on-one interviews.

The Chair was interviewed a number of times by local radio and television during the course of the Inquiry as a way to spread messages to the community about the Inquiry, its purpose and progress.

Information gathering

The Inquiry's Terms of Reference contain elements guiding how the Inquiry was to be conducted including:

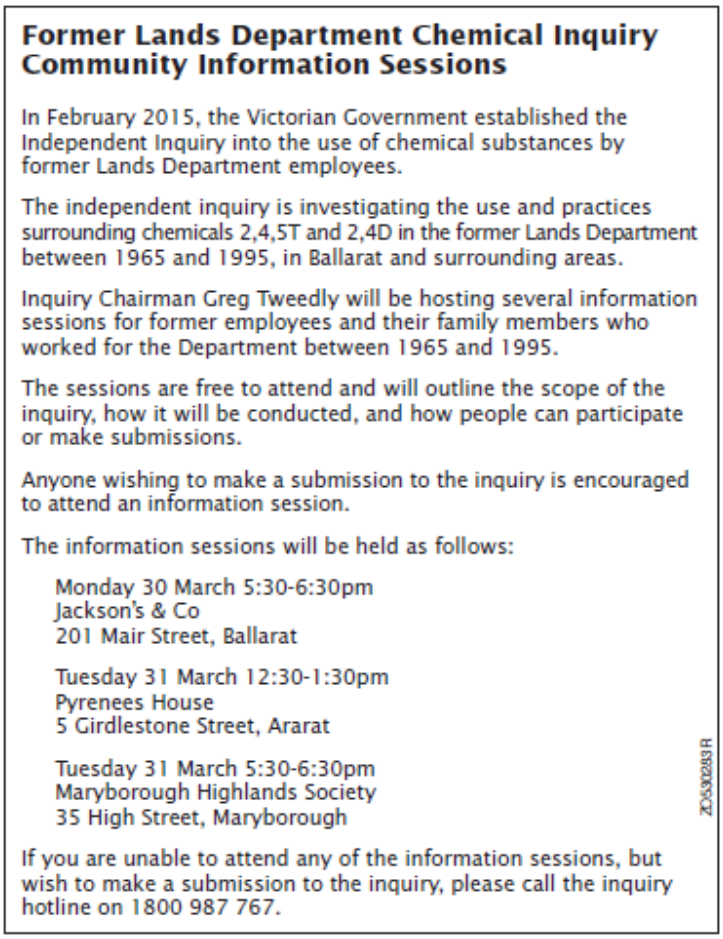
- Seeking information and input from present and former employees (including family members and friends of employees) of the former Department of Crown Lands and Survey (and its successor departments) in Ballarat and surrounding areas who believe employee health has been adversely affected from exposure to 2,4-D and 2,4,5-T (subject to their willingness to participate in the inquiry).
- Travelling to key locations to seek this information and input.
- Seeking specialist and expert advice, as required, within the budget capacity agreed between the Minister for Environment, Climate Change and Water and the Inquiry Chair.

The Inquiry used these three points in determining how it would gather and analyse information.

Information and data was collected from the following sources.

Public information sessions

Three public information sessions were held in March 2015 in Ballarat, Ararat and Maryborough. The sessions were advertised in local newspapers, through local radio and were promoted through the Department of Environment, Land, Water and Planning and relevant trade unions. The sessions, led by the Chair Greg Tweedly, outlined the Inquiry's Terms of Reference, methodology and timeframes. The sessions also provided an opportunity for local community members to ask questions and seek clarification, and for the Chair to hear, first-hand, the concerns of the local community.



Former Lands Department Chemical Inquiry
Community Information Sessions

In February 2015, the Victorian Government established the Independent Inquiry into the use of chemical substances by former Lands Department employees.

The independent inquiry is investigating the use and practices surrounding chemicals 2,4,5T and 2,4D in the former Lands Department between 1965 and 1995, in Ballarat and surrounding areas.

Inquiry Chairman Greg Tweedly will be hosting several information sessions for former employees and their family members who worked for the Department between 1965 and 1995.

The sessions are free to attend and will outline the scope of the inquiry, how it will be conducted, and how people can participate or make submissions.

Anyone wishing to make a submission to the inquiry is encouraged to attend an information session.

The information sessions will be held as follows:

Monday 30 March 5:30-6:30pm
Jackson's & Co
201 Mair Street, Ballarat

Tuesday 31 March 12:30-1:30pm
Pyrenees House
5 Girdlestone Street, Ararat

Tuesday 31 March 5:30-6:30pm
Maryborough Highlands Society
35 High Street, Maryborough

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If you are unable to attend any of the information sessions, but wish to make a submission to the inquiry, please call the inquiry hotline on 1800 987 767.

Figure 1.1 Advertisement for Inquiry information sessions, March 2015.

Literature search and analysis

Since the 1950s there have been well over 40,000 national and international scientific and academic research papers published on the safety and potential health impacts of 2,4-D and 2,4,5-T.

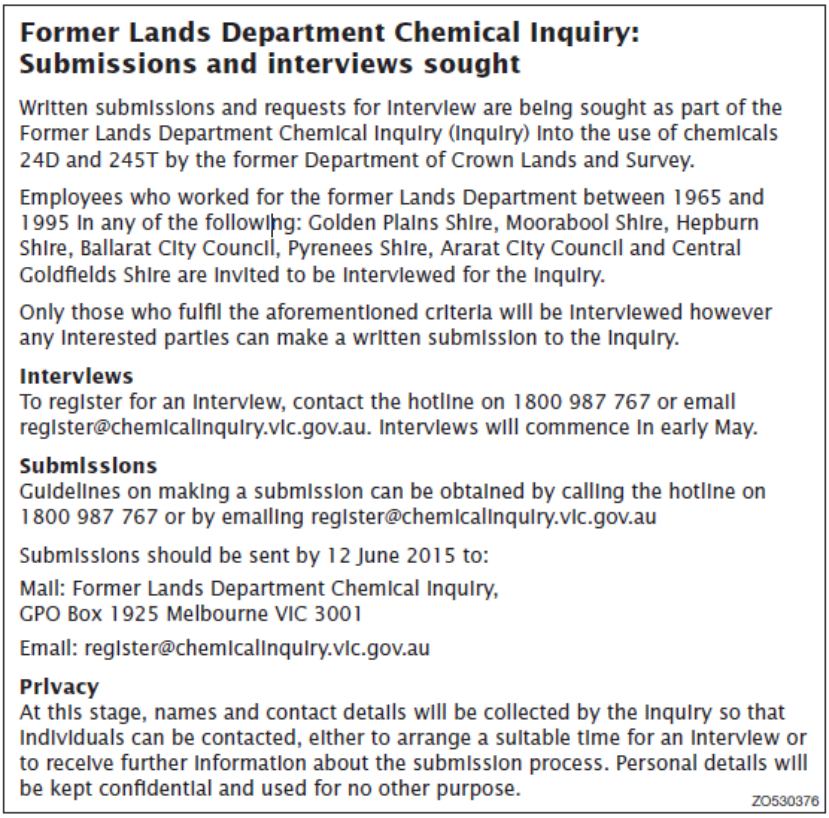
The Inquiry reviewed many of the more recent papers and reviews but drew heavily on the work of the International Agency for Research on Cancer (IARC, auspiced by the World Health Organization, WHO) and the National Research Centre for Environmental Toxicology (EnTox), which is based in Queensland.

The IARC regularly reviews the latest academic papers through an international peer review process that draws on the best scientific minds across the world to build a consensus of possible causes of cancer. In 2003 EnTox conducted a significant worldwide literature search on 2,4-D and 2,4,5-T for the Western Australian Government's review into the use of these chemicals in the Kimberley.

Information from these and other international agencies are referenced in Chapter 4, where the chemicals are fully reviewed and considered in determining the state of knowledge between 1965 and 1995, and today.

Interviews

Advertisements (Figure 1.2) were placed in local and statewide newspapers in April 2015 seeking written submissions and registrations for interviews. Those employees who fell within the scope of the Inquiry were invited to participate in a one-on-one interview. A call-centre hotline and a dedicated email address were set-up to take registrations for interviews.



Former Lands Department Chemical Inquiry: Submissions and interviews sought

Written submissions and requests for interview are being sought as part of the Former Lands Department Chemical Inquiry (Inquiry) into the use of chemicals 24D and 245T by the former Department of Crown Lands and Survey.

Employees who worked for the former Lands Department between 1965 and 1995 in any of the following: Golden Plains Shire, Moorabool Shire, Hepburn Shire, Ballarat City Council, Pyrenees Shire, Ararat City Council and Central Goldfields Shire are invited to be interviewed for the Inquiry.

Only those who fulfil the aforementioned criteria will be interviewed however any interested parties can make a written submission to the Inquiry.

Interviews
To register for an interview, contact the hotline on 1800 987 767 or email register@chemicalinquiry.vic.gov.au. Interviews will commence in early May.

Submissions
Guidelines on making a submission can be obtained by calling the hotline on 1800 987 767 or by emailing register@chemicalinquiry.vic.gov.au

Submissions should be sent by 12 June 2015 to:

Mail: Former Lands Department Chemical Inquiry,
GPO Box 1925 Melbourne VIC 3001

Email: register@chemicalinquiry.vic.gov.au

Privacy
At this stage, names and contact details will be collected by the Inquiry so that individuals can be contacted, either to arrange a suitable time for an interview or to receive further information about the submission process. Personal details will be kept confidential and used for no other purpose.

ZO530376

Figure 1.2 Advertisement seeking submissions and interview registrations, April 2015.

The purpose of the interviews was to enable the individuals to tell their stories, and for the Inquiry team to gather valuable recollections about how chemicals were used and handled during the period, and to hear the experiences of those who were there. Seventy-six interviews were conducted between June and August 2015, most within Victoria and a small number interstate. The interviews are summarised in Appendix 3. An external organisation specialising in investigative interviewing conducted the interviews on behalf of the Inquiry. Consistent with the Terms of Reference, these were conducted in the regions and locations that were convenient to the interviewees. The identities of those who were interviewed are not disclosed in this Report.

Written submissions

Written submissions were invited from any interested party. Those that the Inquiry team considered were outside the scope of the Terms of Reference because, for example, they worked in Gippsland or other parts of Victoria outside of the geographic scope, have been recognised and referenced in Appendix 3. Guidelines to assist with written submissions were prepared and offered to all individuals who expressed interest in providing a written submission.

The organisations invited to provide a written submission included:

- Australian Workers Union (AWU)
- Community and Public Sector Union (CPSU)
- Dow Chemicals
- Monsanto
- NuFarm
- Plastics and Chemicals Industry Association
- CropLife.

Of the 29 written submissions received, 26 were from individuals and three were received from union, industry or other interested parties. One offered 26 written case studies on current or former sprayers. The identities of individuals who provided written submissions are not disclosed in this Report.

The information from the interviews and written submissions was carefully analysed against the Inquiry's Terms of Reference and used in developing the conclusions and recommendations. The stories of those interviewed, or contained in submissions, richly illustrated the practices and culture of chemical use in past periods. All interviews or written submissions cited in this Report have been de-identified to protect the privacy of those individuals.

Documents and records

Documentary evidence was sought in Department documents and records to corroborate the oral and written information provided. This was challenging since many former employees are deceased, and Department/s documents and records dated back 50 years.

In April 2015, the Chair wrote to the Secretary of the Department of Environment, Land, Water and Planning and the Secretary of the Department of Economic Development, Jobs, Transport and Resources seeking hard copy and electronic files, documents and records dating back to 1965 that were relevant to the Inquiry's Terms of Reference. These two departments are the current custodians of files that were generated by the former Department, its successor departments, and bodies associated with those departments such as the Keith Turnbull Research Institute (KTRI), the Vermin and Noxious Weeds Destruction Board (VNWDB) and the Pesticides Review Committee (PRC).

Locating documentary evidence in department documents and records was challenging. The departments offered nearly 8,000 potentially relevant files. The Inquiry sought a subset of these based on their likely relevance, these were found:

- within current department offices
- at third-party archival storage
- at the Public Record Office Victoria
- in the regions.

Of that, 2,252 were eventually supplied. Over 100 files were unable to be located; unfortunately destroyed in decades past or not found.

The Victorian Government Library Service provided over 200 hardcopy and electronic texts, as well as excellent service to the Inquiry.

Interviewees, and those who provided written submissions, provided the Inquiry with documents and records comprising around 480 items. These included:

- personal diaries
- work records
- photographs
- personal medical histories
- training certificates and letters.

These contributed to the stock of information and helped to form the basis of the Inquiry's conclusions and recommendations. In addition, the Inquiry received 13 boxes of loose-leaf documents and notebooks from an anonymous source, which equated to several thousand documents.

Document digitisation and analysis

An organisation specialising in document discovery was contracted to digitise and process documents. Of the 2,252 files supplied, 747 Department files were deemed to be relevant and eventually digitised. Together with records from private individuals and other sources, this equated to 63,163 documents and over 122,000 pages of information. Secretariat staff examined and analysed these to develop this Report and its conclusions and recommendations. This document pool included:

- research
- OHS records
- invoices
- minutes of meetings
- correspondence

- file notes
- diaries
- reports
- a variety of other records created between 1965 and 1995.

Of these, 10,517 documents were deemed relevant to the Inquiry's Terms of Reference (Figure 1.3).

Figure 1.3 Photographs of some of the department's archive boxes containing files supplied to the Inquiry.

The Chair sought records from the Victorian WorkCover Authority (VWA) and Victorian Managed Insurance Authority (VMIA) of claims made by employees for compensation due to illness caused by exposure to chemicals while working for the Department between 1965 and 1995. Eight records were provided by the VMIA, one by the VWA. The Inquiry also asked for employer inspection reports from the VWA but there were none available. The Chair also wrote to the Department of Health and Human Services, National Library of Australia and also sought some assistance from the Australian Pesticides and Veterinary Medicines Authority (APVMA). In addition, the Department of Premier and Cabinet also facilitated access to files that were in the custodianship of the Public Record Office Victoria for use by the Inquiry.

Exposure and health risk assessment

In order to investigate the likely exposures of employees to 2,4-D and 2,4,5-T and to understand the potential health risk, the Inquiry sought to determine how many employees were exposed to 2,4-D and 2,4,5-T in Ballarat and surrounding areas. This was one of the Inquiry's biggest challenges due to:

- Privacy requirements limiting direct access to some records.
- A lack of electronic personnel records before 1985.
- Electronic records post-1985 not identifying who may have been exposed.
- Hard-copy personnel records throughout the period not always directly identifying people whose roles may have exposed them to chemicals.
- The inaccuracy of some employee recollections and memories.

The absence of this data presented challenges to the Inquiry in conducting the exposure analysis and health risk assessment. In order to address these data gaps, other documents and records provided by participating departments and secured via interviews or written submissions were scoured for data that could shed more light on the employee group.

Employee data contained within letters, memoranda and circulars were able to provide information for the Period including information to support a robust exposure scenario analysis and health risk assessment.

Through examination of Department records, the Inquiry was able to determine that, in the 1980s, a health study of over 2,000 sprayhands employed by the Department was undertaken into the possible health effects of exposure to 2,4-D and 2,4,5-T. Professor John Mathews (then Principal Research Fellow at the University of Melbourne and the Department of Medicine at the Royal Melbourne Hospital) and Dr William Parsons (former Chair of the VNWDB) were the principal researchers in the study.

Its data and analysis was incorporated in an international cohort study of 18,910 workers – a world-leading study at the time that was published in *Lancet* in October 1991[3]. The cohort was established using the International Register of Persons Exposed to Phenoxy herbicides and contaminants. It was used for other key IARC epidemiological studies up until 1998. The data from just the Victorian herbicide sprayers has not been the subject of a separate publication.

Professor John Mathews graciously agreed to be interviewed about this key study and he provided a crucial data file to the Department to be used for further work if needed (see Chapter 10). Professor Mathews was also a key witness in *The Royal Commission on the Use and Effects of Chemical Agents on Australian Personnel in Vietnam* (chaired by The Hon. Mr Justice Phillip Evatt) in 1985 and cited this research in evidence.

Exposure scenarios

A health risk assessment was used to understand the potential health risk (see Chapter 11 and Appendix 5) of employees.

Due to the lack of data on employee health and accurate chemical use records (by type and by depot) the Inquiry used a hypothesis-based approach to undertake the health risk assessment. This approach uses scenarios with average, high and low levels of exposure (see Appendix 4) over three time periods.

For each scenario, chemical quality, use rates and the use of PPE are varied to draw broad conclusions about the risks to employees.

Available workforce and chemical data was cross-referenced with written submissions and interview data to ensure consistency.

The exposure analysis and health risk assessment are based on the assumptions detailed in Chapter 11. The results must be viewed with these assumptions in mind.

EXPERT ADVICE AND INPUT

The Terms of Reference allowed specialist and expert advice to be sought as required to inform the Inquiry. The following experts were engaged for the following tasks:

[3] Saracci R., et al, 1991, '*Cancer mortality in workers exposed to chlorophenoxy herbicides and chlorophenols*'. *Lancet,* 338:1027–1032.

- Professor Ian Rae is an Honorary Professorial Fellow in the School of Historical and Philosophical Studies at the University of Melbourne. His qualifications in chemistry include a Diploma of Applied Chemistry, Bachelor of Science, Master of Science and Doctor of Philosophy. Professor Rae is a Fellow of the Australian Academy of Technological Sciences and Engineering, and a fellow and past-president of the Royal Australian Chemical Institute. He used the best information that was gathered by the Inquiry team from the documents and records, interviews and written submissions to create exposure scenarios and identify potential health risks.
- Dr Brian Priestly peer-reviewed Professor Rae's work and he and Professor Rae also peer-reviewed Chapter 4 of this Report. Dr Priestly is a Professorial Fellow in the Department of Epidemiology and Preventive Medicine at Monash University and Director of the Australian Centre for Human Health Risk Assessment. Dr Priestly has Masters and Doctoral qualifications in pharmacy, and is a Fellow of the Australasian College of Toxicology and Risk Assessment.
- Associate Professor Alan Clayton (Principal, Bracton Consulting Services Pty Ltd) is an independent research consultant working primarily in accident compensation and injury prevention. He is an Adjunct Associate Professor at Monash University, associated with the Institute for Safety, Compensation and Recovery Research. He also holds other adjunct appointments including that of an honorary Associate with the University of Melbourne and the Australian National University, and is an honorary Senior Research Fellow with the University of Ballarat. He peer reviewed early drafts of the Report.
- Claire Thomas PSM (Principal, Claire Thomas Public Policy Consulting) has an extensive background in public policy, as an academic researcher and senior public policy executive advising the Victorian Government on economic, social, environmental, budgetary and fiscal policy reforms. She was a recipient of the Public Service Medal in 2009 for services to public policy. She peer reviewed early drafts of the Report.
- A senior health scientist at the Department of Health and Human Services also peer-reviewed, and provided expert advice on the exposure and health risk components of the Report.

PRIVACY AND CONFIDENTIALITY

This Report was prepared consistent with the *Privacy and Data Protection Act 2014*, which seeks to protect the privacy of individuals. Safeguarding the privacy of individuals throughout the Inquiry was critical. Any personal and health information collected by the Inquiry was handled in accordance with the principles of the Victorian privacy laws and used only for the purposes of addressing the Inquiry's Terms of Reference.

Practical implications of adhering to the privacy legislation included:

- The need to implement specific processes to review and redact personal information in certain classes of files by the owning department prior to review by Inquiry staff, including OHS and employee records.
- Provision of privacy collection statements to interviewees, to recipients of written guideline submissions and in advertisements.
- The de-identification of any material quoted in this Report that was provided by a private member of public.

The need to implement specific processes to review and redact records subject to legal professional privilege in certain classes of files by the owning department prior to review by Inquiry staff.

Maintaining confidentiality around all information and data gathered and developed by the Inquiry was, likewise, critical. The Inquiry facilitated confidentiality through confidentiality briefings and agreements with all Inquiry staff and contractors, and the use of secure physical and electronic equipment.

Part 2: Background

Chapter 2: Ballarat region

DEFINING THE BALLARAT REGION

In considering previous periods and departmental restructures the Inquiry used the nearest equivalent in old structures of the Department to define the Ballarat region, which was often referred to as the 'midlands district' within the South West region. For the purposes of the Inquiry it will be referred to as the 'Ballarat region' and includes the local government areas specified in the Terms of Reference including:

- Golden Plains Shire
- Moorabool Shire
- Hepburn Shire
- Ballarat City Council
- Pyrenees Shire
- Ararat Rural City Council
- Central Goldfields Shire.

The region covers approximately 16,220 square kilometres. (Figure 2.1). It has a current population of around 190,000 and is in a key strategic position at the centre of some of Victoria's most important freight, tourist and commuter transport routes. The four main highways radiating from Ballarat – the Western, the Midland, the Glenelg and the Sunraysia – connect it to industrial centres like Melbourne and Adelaide.

DEPARTMENT RESPONSIBILITIES

The Department's key responsibility relevant to the Inquiry was weed eradication. Fifteen depots across the Ballarat region acted as the base for small workforces devoted to eradicating weeds and vermin. The community had worked hard since the early 20th century to control both these pests, which reduce crop yields and impact on natural flora and fauna.

SOCIAL HISTORY

Europeans arrived in the region between 1830 and 1850 and this is reflected in the character of the towns and surrounding areas. This character is particularly evident in the north, where gold was discovered and a timber industry flourished.

Ballarat became a service centre to the gold diggings with land sales dating from 1852. Due largely to the gold rush, the population exploded, peaking at about 64,000 in 1868. During the 1870s other industries were established including woollen mills, flour mills, tanneries, boot-making enterprises, meat-preservation works, brick-making and breweries.

The Ballarat region's landscape is a mosaic of public, private, forested and non-forested land. Rocky volcanic plains span the region from its historic gold mining towns in the north, to the river valleys in its south.

The climate varies between the north and the south of the region. North of the Pyrenees Ranges is warmer and drier with about 650 mm of rain a year. South of the Pyrenees Ranges is cooler and wetter, with in excess of 750 mm of rain per year.

When gold supplies waned and mines closed in the late 1890s the region experienced some population loss, and land was increasingly used for timber milling and agriculture. This shift was accompanied by a lot of vegetation clearance and soil disturbance that made much of the region vulnerable to weeds – the worst of which included blackberry, furze (gorse), sweet briar, ragwort and variegated thistle.

BALLARAT TODAY

The City of Ballarat lies in the centre of the region, within a gently undulating section of the midland plains. These plains are made up of alluvial sediment and volcanic flows, and rich agricultural soils. The region is an important contributor to the state's water catchments, with the Moorabool River providing input to the Barwon River and Geelong's water supply.

In the east, the region is bounded by Moorabool Shire, a growing commuter settlement area for Melbourne.

The west of the region is bounded by the Rural City of Ararat, a regional service centre in Victoria's mid-west and a gateway to the Grampians, where local produce, wine production, agriculture and tourism are among the economic mainstays.

The north of the region is bounded by the Central Goldfields Shire where Maryborough is the most significant town. The region’s history is based on gold mining, forestry and agriculture. The Pyrenees Shire produces cereal and hay crops, wool, viticulture and forestry products. Gold, along with sand, gravel and slate, also contribute to the region's economy. The Hepburn Shire area is popular among tourists seeking mineral springs and boutique agriculture.

The Golden Plains Shire area in the south is characterised by small towns and communities with a strong tradition of wool and grain growing. Intensive animal farming, particularly poultry and pigs, is also increasingly common.

Some of the regions key natural attractions include:

- Wombat State Forest
- Brisbane Ranges National Park
- Lerderderg State Park
- Werribee Gorge State Park
- Enfield State Forest
- Lal Lal State Forest
- the Moorabool River.

Figure 2.1 Local Government Areas (LGA) and depots within the scope of the Inquiry for 1965 to 1995.

Chapter 3: Department of Crown Lands and Survey and its successor departments and governance structures

INTRODUCTION

This Inquiry is investigating the use of 2,4-D and 2,4,5-T chemicals for weed and pest control by the former Victorian Department of Crown Lands and Survey (DCLS) and its successor departments. This chapter outlines those successor departments and explains their role in weed and pest control. It also describes the range of governance structures in place over the Period of the Inquiry.

The DCLS, formed in 1857, was subsumed into the Department of Conservation, Forests and Lands in 1983 and also joined by these three bodies:

- Ministry for Conservation
- Forests Commission (Department of State Forests)
- Soil Conservation Authority.

DCLS was succeeded by the Department of Conservation and Environment in 1990 and that Department was succeeded by the Department of Conservation and Natural Resources in 1992.

Figure 3.1 outlines the Department's evolution over the relevant time period.

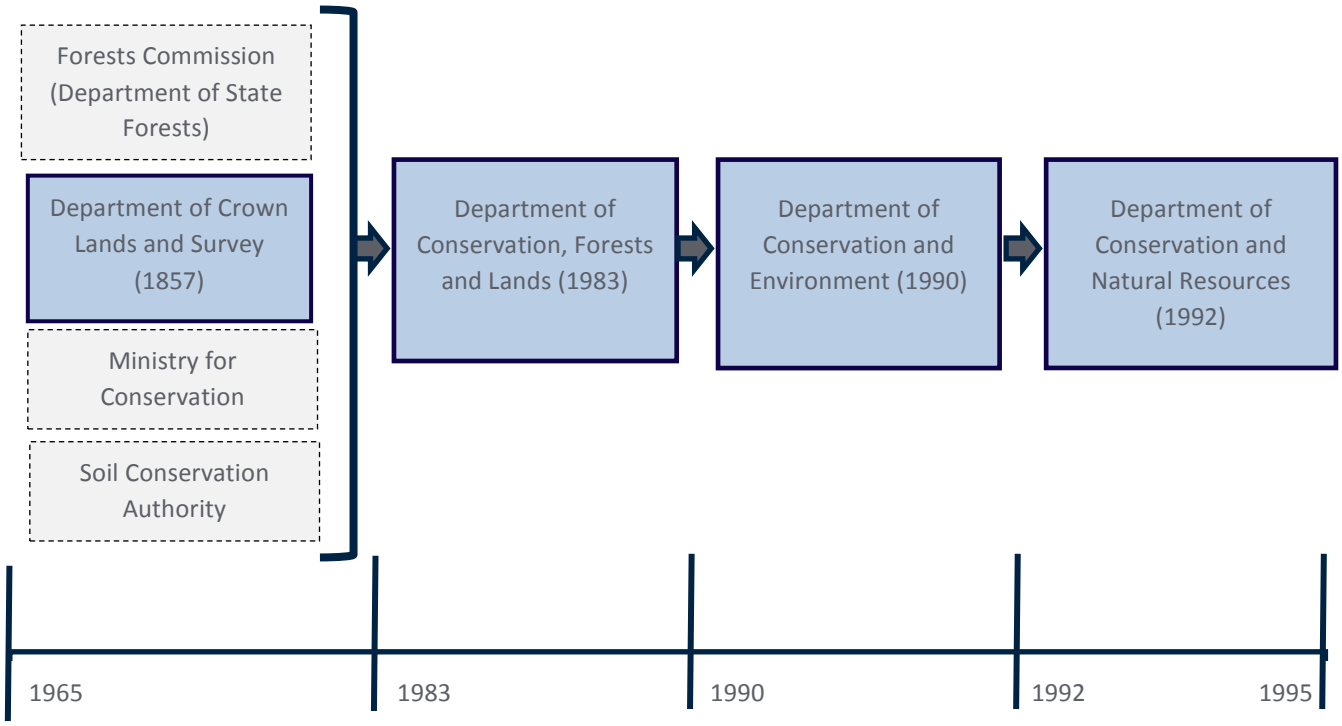


Figure 3.1 History of the Department

To ease confusion, the four configurations of the Department covered by the Inquiry will all be referred to as 'the Department' throughout the Report.

Figure 3.2 outlines precisely which workers fall within the Inquiry's scope.

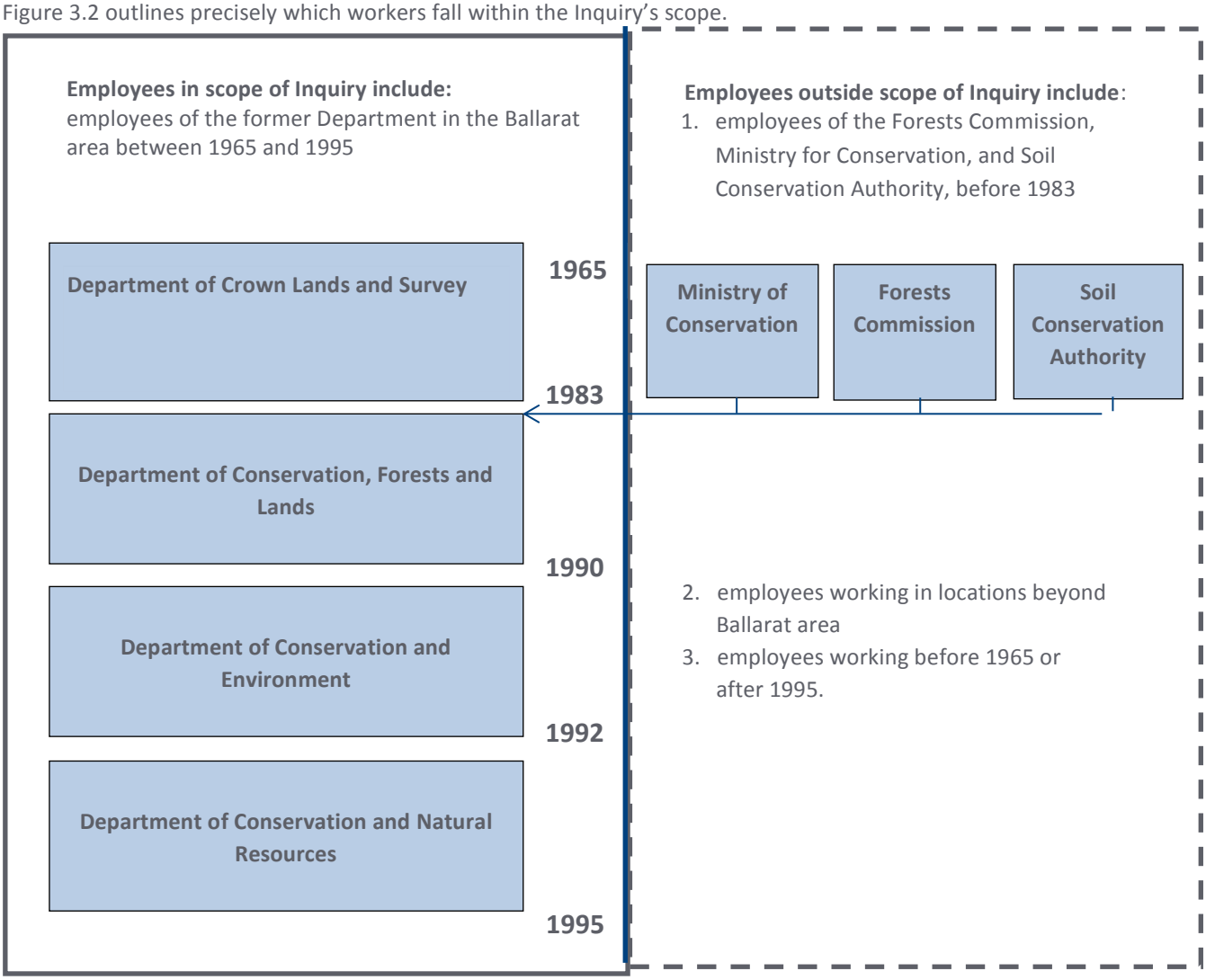


Figure 3.2 Employees within the Inquiry's scope

DEPARTMENT AND SUCCESSORS

Department of Crown Lands and Survey (1965 – 1983)

The Department of Crown Lands and Survey led the policies and programs for vermin and noxious weed control in Victoria for over a century. Its role evolved from the *Rabbit Suppression Act 1880* and the *Thistle Act 1915*.

From 1964, the principal Acts administered by the Department included the *Lands Act 1928*, *Closer Settlement Act 1938*, *Land (Residence Area) Act 1935*, *Survey Co-ordination Act 1940*, *Land (Development Leases) Act 1951*, *Vermin and Noxious Weeds Act 1958*, *North-West Mallee Settlement Act 1948*, and *Wire Netting Act 1929*. The Department's responsibilities included:

- disposal of Crown lands for agricultural and pastoral purposes (including related survey work)
- issuing leases and licences for unreserved land
- encouraging closer settlement
- coordinating soldier settlement
- compiling State of Victoria maps
- destroying vermin and eradicating noxious weeds.[4]

[4] Arnold, V.H, 1968, *Victorian Year Book 1968, No. 82,* Commonwealth Bureau of Census and Statistics.

Over the Department's history its significant roles in vermin and noxious weed management included:

- responsibility, with municipal councils, for the extermination of rabbits
- operational weed and vermin control on public land
- ensuring legal compliance by private land owners in weed and vermin management
- scientific research into controlling noxious weeds and vermin
- implementing the policies of the Vermin and Noxious Weeds Destruction Board (VNWDB)
- overseeing the Keith Turnbull Research Institute (KTRI).[5]

Between 1965 and 1983 the Department led large-scale programs aimed at eradicating priority noxious weeds and controlling others to improve agricultural productivity. For example, the Regional Employment Development (RED) Scheme, funded by the Australian Government through the Treasury of Victoria, employed 317 unemployed people in the 1974–75 financial year (in addition to the VNWDB's normal workforce of 660) in pest plant and animal control programs.[6]

Inspectors were appointed and paid as Inspectors of Land Settlement and Crown Land Bailiffs but their main duties were imposed by the *Vermin and Noxious Weeds Act 1958.*[7] They were employed under the provisions of the *Public Service Act 1958* at the time.[8] For example, in 1965 there were 650 field staff, 140 district inspectors and 18 senior inspectors employed to administer vermin and noxious weeds control.[9] The Vermin and Noxious Weeds and Inspection Branch, the Division of Vermin and Noxious Weeds and later, the Division of Inspection and Vermin and Noxious Weeds Destruction ('the Division') within the Department, led statewide operational programs to eradicate and control vermin and noxious weeds. The Division's role was to implement the VNWDB's operational policies, which were based on scientific research work undertaken at the KTRI.[10]

Department of Conservation, Forests and Lands (1983 – 1990)

The Department of Conservation, Forests and Lands was formed on 2 November 1983.[11] At the time, the role of Inspector was replaced by a Land Management Officer.[12] It was soon joined by the Ministry for Conservation, Forests Commission, and Soil Conservation Authority but these continued to operate as individual bodies within the Department until 1987, when these bodies and the VNWDB were abolished. From 1983, the Department was responsible for the control of vermin and noxious weeds across public land and had duties in the 'protection of private land' under the *Vermin and Noxious Weeds Act 1958*. Forests Commission employees who joined the new department also sprayed weeds before and after 1983 and are included in the Inquiry's scope.

Department activities in 1984–85 targeted three categories of noxious weeds and other problem plants of a lower priority.[13] All category 1 weeds were treated on any land, and the Department had an extensive program for category 2 and 3 weeds on public land, and provided guidance for their treatment on private land. On-ground works were the responsibility of the Department's Regional Management Division.[14]

In 1987, with the enactment of the *Conservation, Forests and Lands Act 1987*, the Director-General of Conservation, Forests and Lands was established, overseeing a number of Acts including the *Vermin and Noxious Weeds Act 1958.*

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5 Public Record Office Victoria, 2005, *Department of Crown Lands and Survey, Record, Agency VA 538.*

6 Department of Crown Lands and Survey 1975, *Annual Report 1974-75*, Department of Crown Lands and Survey Victoria

7 Department of Crown Lands and Survey, 1969, *Report for the Financial Year ended 30th June 1968*, p26.

8 Victorian Parliament, *Victoria Gazette*, No. 19, 16 March 1960, p954, Re: Public Service (Public Service Board) Regulation 39 – Reclassifications.,

9 Department of Crown Lands and Survey, 1965, *Report for the Financial Year ended 30th June 1965*, p22.

10 Public Record Office,2005 *Department of Crown Lands and Survey,* Government of Victoria, Public Record No. VF 538, <http://goo.gl/rQb7wc> [accessed 9 November 2015].

11 Victorian Parliament, *Victoria Gazette*, No. 114, Wednesday, 2 November 1983, 3597, Re: Amendment to Schedule Two to *Public Service Act 1974*.

12 Vermin and Noxious Weeds (Re-Organisation) Act s 3A(1) s9.

13 Department of Conservation, Forests and Lands, 1986, *Annual Report 1985-86*, Victorian Government, 90-91, p2.

14 Department of Conservation, Forests and Lands, 1986*Annual Report 1985-86,* Victorian Government, p90.

Department of Conservation and Environment (1990 – 1992)

The Department of Conservation, Forests and Lands was succeeded by the Department of Conservation and Environment in 1990. As reflected in its 1990–92 annual reports, weed control using herbicides was not a big focus. Instead, the reporting focus was on works supporting land owners to manage their land through Landcare. The Department organisational structure changed during 1990–92, to adopt 17 regions, but there was no change to the boundaries of the Ballarat, Geelong and Bendigo regions.

The Department's weed eradication works in 1991–92 included:

- Nodding Thistle
- Camel Thorn
- Mesquite
- Water Hyacinth
- Golden Dodder.

Biological control programs for weed control of the thistle, St John's Wort, and Blackberry, were noted as a major focus of weed research.

Department of Conservation and Natural Resources (1992 – 1995)

All the responsibilities of the former Department of Conservation and Environment were carried into the Department of Conservation and Natural Resources, in addition to water resource management and rural water resource policy from the Department of Water Resources. The responsibilities for weed control were maintained until the *Catchment and Land Protection Act 1994* repealed the *Vermin and Noxious Weeds Act 1958.* The Department retained the responsibility as lead agency for the regulation of weeds on private and public land in Victoria, including responsibility for the actual physical control/removal of weeds on public land.

Several of the Department's programs involved weed and pest control. For example, the Weeds and Pests program protected public land, agricultural land and natural resources from noxious weeds and pest animals. The National Parks program included weed control along private land boundaries particularly where there were threatened species. The Flora and Fauna program controlled environmental weeds threatening biodiversity.

GOVERNANCE

Over the period of the Inquiry the Department oversaw the management of vermin and noxious weeds across the state. In doing so, it interacted with a number of other bodies and committees and even set up its own research institute. The section below elaborates on these arrangements.

Statewide governance for vermin and noxious weeds control – 1965 to 1985

The *Vermin and Noxious Weeds Act 1959* established a statewide governance framework for the strategic management of vermin and noxious weeds. This included setting up the following:

- **Vermin and Noxious Weeds Destruction Board** (VNWDB) to research vermin and noxious weed control and instruct and supervise landowners with specific problems
- **Central Advisory Council** to advise the VNWDB on everything to do with weed control and destruction
- **District Advisory Committees** to establish the priority and approach for control at a district level and promote weed research that helped landholders.

The Department delivered its vermin and noxious weeds responsibilities through 140 districts, each controlled by an Inspector who worked in consultation with their District Advisory Committee to develop localised programs.

There were 18 groups of districts, each overseen by senior inspectors reporting to the two chief inspectors (Eastern and Western) overseeing Victoria's vermin and noxious weed control.

The KTRI undertook research on behalf of the VNWDB and provided expert representation on relevant committees.(Refer to Table 3.1)

Statewide governance for vermin and noxious weeds control – 1985 to 1995

The *Vermin and Noxious Weeds (Re-organisation) Act 1983* and the *Vermin and Noxious Weeds (Amendment) Act 1985* introduced a broader focus and a new governance framework across Victoria. The broadened focus meant it was no longer just a 'war against weeds' and included how weed control could most efficiently contribute to agricultural productivity and land protection.

The Secretary for Lands replaced the role of the Superintendent of the VNWDB. The Land Protection Council replaced the Central Advisory Committee. Regional Advisory Committees were established to advise on regional matters. District Advisory Committees were renamed Land Protection District Advisory Committees and Inspectors became Land Management Officers.

At around the same time (1983) the Department of Crown Lands and Survey, Forests Commission, Ministry of Conservation, and Soil Conservation Authority were amalgamated to form the Department of Conservation, Forests and Lands, which was organised into 11 regions and 105 districts.

The KTRI continued to conduct its research into optimum herbicide treatments and advise the Department.

Vermin and Noxious Weeds Destruction Board

The VNWDB operated from 1959 until 1987 advising the Minister of Lands about controlling and destroying vermin and noxious weeds. Some of its functions were reorganised in 1983[15] with the intention that the Board would later be abolished. It was formally abolished in 1987 under the *Conservation, Forests and Lands Act 1987*. After this time all statutory functions were administered from within the Department.

The VNWDB had three members including the Superintendent, who was also an employee of the Department. The VNWDB was chaired by the Superintendent who had extensive powers in relation to the destruction of vermin and noxious weeds.

The duties of the Superintendent were described as:

> *Under the direction of the Secretary for Lands to control the field staff and act as Chief Valuer of the Department; to take charge of all work associated with the Vermin and Noxious Weeds Act; to be Chairman of the Vermin and Noxious Weeds Destruction Board.*[16]

Under the *Vermin and Noxious Weeds Act 1958* the Superintendent and inspectors had a number of powers and functions including the power to engage or employ staff.[17] The Superintendent employed field staff (i.e. sprayers and leading hands) directly and directed the work of inspectors who were employed through the Department under the relevant Public Service Act.

The field staff (ie sprayers, leading hands) were paid by the Department throughout the entire period and became direct employees of the Department from 1987.[18] They were engaged under the AWU Construction and Maintenance Award.[19]

As outlined in the *Vermin and Noxious Weeds Act 1958*, the VNWDB's functions included weed control on public land and advising and supervising private landowners on weed control. More specifically, the VNWDB's functions were to:

- investigate, promote and undertake remedial and preventative control of vermin and noxious weeds
- conduct scientific research
- oversee the control and/or destruction of proclaimed vermin or noxious weeds by providing instruction to landholders and regulatory compliance management through field inspections.[20]

Inspectors had broad powers to:

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15 Department of Crown Lands and Survey, 1983, *Circular No. 61/83, Circular to all Staff Members Division of Inspection and Vermin and Noxious Weeds Destruction*, 20 July 1983, Circular.

16 Victorian Parliament, *Victoria Gazette*, No. 19, 16 March 1960, p954, Re: Public Service (Public Service Board) Regulation 39 – Reclassifications.

17 *Vermin and Noxious Weeds Act 1958* s 5.

18 *Conservation, Forests and Lands Act 1987* s 108 (4).

19 Vermin and Noxious Weeds Destruction Board, 1970, Circular 69/70 Secretary of VNWDB to all Inspectors RE *AWU Construction and Maintenance Award*, *8 October 1970*, Circular.

20 Public Record Office Victoria, *Vermin and Noxious Weed Control Board,* , Victoria, VA 1376..

- inspect land for vermin and noxious weeds
- instruct landholders about controlling vermin and noxious weeds
- require noxious weed control treatment on any land in Victoria.[21]

Keith Turnbull Research Institute

The KTRI was established in 1966 as part of the Department, and undertook research into vermin and noxious weed control.[22] It was situated in Ballarto Road in Frankston. It continued as part of successor departments, including to 1995 in the Department of Conservation and Natural Resources.[23] Its research aimed to determine the most effective weed control techniques and use of registered pesticides, to establish weed control policies and instructions for use by employees and private landholders. Its functions included testing pesticides for efficacy prior to registration by the Department of Agriculture and post-registration trials and research. The KTRI sought to apply its research findings to effective control strategies on public land and to advise private landowners. It also provided training schemes for field staff such as the Certificate of Applied Science (Conservation and Resource Development).[24]

Between 1966 and 1987, the VNWDB drew on the KTRI's research in deciding herbicide treatment guidelines. The research was also used to prepare pamphlets on specific weeds including chemical treatment rates, and warnings like 'Read the label before using any herbicide' and to be cautious near cattle and crops.[25]

In addition, KTRI routinely tested 2,4-D and 2,4,5-T purchased by the Department for compliance with quality standards. It also tested chemicals that employees lodged complaints about.[26] The KTRI functioned for the time covered by the Inquiry, beyond 1995 and into the early 2000s.

Pesticide Review Committee

The Pesticide Review Committee was created in 1966. It was not part of the Department but did consist of officers from many departments[27]:

- Ministry of Conservation, Forests and Lands
- Department of Health
- Department of Agriculture
- State Rivers and Water Supply Commission
- Forest Commission
- Environment Protection Authority
- Vermin and Noxious Weeds Destruction Board
- Fisheries and Wildlife Division.

This is relevant to the Inquiry because the Department was represented on the committee and its decisions influenced the Department's field operations. For example, it issued a code of practice in 1978 which set the conditions for large-scale applications, including aerial spraying conducted by the Department.[28]

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21 *Vermin and Noxious Weeds Act, 1958*, s 13, s 37(2).

22 Department of Crown Lands and Survey, 1966, *Annual Report 1966*, Report, p25,

23 In 2012, the AgriBio facility at La Trobe University Bundoora opened and Keith Turnbull Research Institute staff were located there. AgriBio is a $288 million joint venture between the Victorian Government and La Trobe University, established to conduct agricultural research. For more refer to <http://www.latrobe.edu.au/synergy/synergy-news-articles/agribio-launched-at-la-trobe-university and http://www.agribio.com.au/>.

24 Department of Crown Lands and Survey, 1975, *Annual Report 1974-75*, Report.

25 Vermin and Noxious Weeds Destruction Board, 1976, *Ragwort, Leaflet No. LW6*, Leaflet.

26 Donaldson, T.W. and Shaw, K., 1978, *Specifications and standards for phenoxyacetic acid herbicides*, Keith Turnbull Research Institute, Vermin and Noxious Weeds Destruction Board, Department of Crown Lands and Survey presented at First Conference of the Council of Australian Weed Societies, Melbourne, < http://www.caws.org.au/awc/1978/awc197812671.pdf> [accessed 21 October, 2015].

27 The government departments changed names and structures over the period. This references the composition in 1982 as cited in Committee minutes of that year.

28 Pesticide Review Committee, 1978, *Code of Practice for the Mass or Blanket Application of Pesticides by Aerial Spraying in Victoria*, Report,, 1978, *Minutes of Meeting held on 17/2/1978*, Minutes.

The Committee's functions were to:

- advise the Premier on pesticides
- review proposed pesticide legislation and advise on changes
- advise on the need for new legislation or amend the existing
- review proposals under relevant Acts and Regulations for various pesticide usages
- review Department proposals for broad-scale pesticide use
- make or arrange appropriate enquiries on pesticides and their use
- consult persons or organisations that manufacture, sell, distribute, or use pesticides, about relevant matters.

Dr William Parsons

This Report makes frequent references to Dr William Parsons. Dr Parsons became Officer-in-Charge of the Keith Turnbull Research Station in 1966, responsible for research projects including vermin and weeds, extension activities and administration of the Station. In the late 1970s Dr Parsons became an Executive Research Officer in the Division of Inspection and Vermin and Noxious Weeds. Later he became Chair of the VNWDB and was a member of the Premier's Pesticide Review Committee and the Consultative Council on Congenital Abnormalities in the Yarram District.[29]

WEED MANAGEMENT IN BALLARAT AND SURROUNDING AREAS

The 13 districts covered by the Inquiry are Dunolly, Maryborough, Clunes, Daylesford, Avoca, Beaufort, Ararat, Streatham, Linton, Ballarat No. 1, Ballarat No. 2, Meredith and Bacchus Marsh. Due to departmental restructures and/or boundary changes, parts of these and others districts may have fallen in or out of scope over the Period.

Vermin and noxious weed control was operated out of 15 depots across these districts in Dunolly, Maryborough, Clunes, Daylesford, Avoca, Beaufort, Ararat, Streatham, Linton, Smythesdale, Scarsdale, Sebastapol, Buninyong, Meredith and Bacchus Marsh. The Forest Commission's depot at Creswick was added in 1983 as part of the departmental restructure. Workers, their equipment, chemicals and other materials were all based at these depots where gangs undertook weed control, usually for three to six months a year (or longer depending on favourable weather conditions), and vermin control in between. The working week was 40 hours long until May 1982 when it was reduced to 38 hours.

Gangs were led by leading hands, with day-to-day work priorities set by inspectors and/or assistant inspectors (where they existed) with input from the District Advisory Committees.

While the Inquiry team has not seen records detailing how many people the Department actually employed to control weeds and pests, anecdotal evidence via written submissions and interviews, and in numerous Department documents indicates that:

- numbers varied from season to season and year to year
- each depot averaged around four workmen[30]
- some were full-time permanent, others short-term, seasonal or project[31] based
- district inspectors generally recruited their workers locally
- various resourcing programs dealt with the high seasonal demand for workers such as the Labour Pool[32], Special Entry Scheme[33] and Mobile Gangs[34]

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[29] Faithfull, I. 2010, *Vale Bill (W.T.) Parsons) 1928-2010*, cited in Weedscene, *Newsletter of the Weed Society of Victoria*, Vol. 21 Issues 1&2 2010, Newsletter.

[30] Department of Crown Lands and Survey, 1976, Letter to Legislative Assembly RE *advertising of vacant positions for workmen,* Letter.

[31] Department of Crown Lands and Survey, Division of Inspection and Vermin & Noxious Weeds Destruction, 1981, *Letter from Senior Inspector to Superintendent RE Furze Project - Ballarat Group 1981/82,* Letter; Vermin and Noxious Weeds Destruction Board, 1981, RE *Serrated Tussock control*, Letter.

[32] Vermin and Noxious Weeds Destruction Board, 1977, *Vote 450-3-1 - Labour Pool*, Letter; Vermin and Noxious Weeds Destruction Board, 1977, Attachment to letter *RE Estimates for Special Projects 1977/78*, Report; Vermin and Noxious Weeds Destruction Board, 1978, *Vermin and Noxious Weeds Destruction Board Estimates 1978-79*, Memorandum.

- contract labour was occasionally used for special projects and/or when demand outstripped supply. Contracts were issued for spraying blackberry and furze on Crown lands in the Ballarat area in 1982[35] and a weed control contract was also awarded in Ballarat in 1994.[36] Three-year contracts with preferred suppliers were proposed from the mid-1990s to increase efficiency in the tendering process[37]
- various state and commonwealth government employment schemes were used to source seasonal staff. These included the Commonwealth Drought Relief Scheme[38], Rural Employment Scheme[39], Regional Employment Development (RED) Scheme[40], Dairy Farmers' Employment Scheme[41], Community Employment Programs (CEPs)[42] and Special Youth Employment Training Program (SYETP)[43]
- one interviewee participant recalled that prisoners from Ararat Prison were also used as labour and undertook some spraying.[44]

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[33] Department of Crown Lands and Survey, 1980, Attachment to Letter *Proposed Special Entry Scheme for Division of Inspection and Vermin and Noxious Weeds Destruction and the Vermin and Noxious Weeds Destruction Board* , Report; Vermin and Noxious Weeds Destruction Board 1975 (est), *Vermin and Noxious Weeds Destruction Board Achievements 1972-73-74-75 - Special Drive Against Blackberry,* Report.

[34] Department of Crown Lands and Survey, 1968, *Mobile Gang*, Letter.

[35] Department of Crown Lands and Survey, 1982, *Contracting* Note

[36] Department of Conservation and Natural Resources, 1994, *Weed Control Contract at Ballarat*, Letter; Department of Conservation and Natural Resources, 1994, Memorandum from Catchment Management Officer to Advertising Manager RE *Placing Advertisements*, Memorandum.

[37] Department of Conservation and Natural Resources, 1996, *Contracting Out Weeds Control*, Memorandum.

[38] Parliament of Victoria, 1972, *Commonwealth Relief Scheme*, Letter; Central Advisory Council to the Vermin and Noxious Weeds Destruction Board, 1973, *Minutes of Meeting held on 30/5/1973*, Minutes.

[39] Department of Crown Lands and Survey, 1973, *Workman – [name redacted],* Letter; Vermin and Noxious Weeds Destruction Board, 1973, *Rural Employment Scheme*, Letter; Department of Crown Lands and Survey, 1977, *State Rural Employment Scheme* 1977, Letter.

[40] Department of Crown Lands and Survey, 1975, *Replacement of Workman Ballarat No 1 District,* Letter; Department of Crown Lands and Survey, 1975, *Minutes of the annual meeting of the Maryborough District Advisory Committee* held on 8/10/1975, Letter; Vermin and Noxious Weeds Destruction Board, 1977, *Vote 450-3-1 - Labour Pool*, Letter.

[41] Vermin and Noxious Weeds Destruction Board, 1977, *Vote 450-3-1 - Labour Pool*, Letter.

[42] Department of Conservation Forests and Lands, 1984, *Community Employment Program (CEP) Project No 9: Softwood Silviculture*, Letter.

[43] Department of Crown Lands and Survey, 1977, *[name redacted] SYETP*, Letter; Department of Crown Lands and Survey, 1978, *Application to replace workman*, Letter; Department of Crown Lands and Survey, 1979, *Application to replace workman*, Letter; Vermin and Noxious Weeds Destruction Board, 1977, *Vote 450-3-1 - Labour Pool*, Letter.

[44] Interviewee participant 085.

COMMITTEE REPRESENTATION

The Department was represented on many state and national committees involved in making decisions on weed management and pesticide use (see Table 3.1).

Table 3.1 Related committees and Department representation

	Committee name	Committee role
Pesticide-related committees		
State level	The Pesticides Review Committee (Est 1966) (later renamed the Agricultural and Domestic Chemicals Review Committee)	Established by recommendation of the 1966 Committee of Enquiry.[45] Advised on manufacture, sale, distribution, and use of agricultural chemicals. Considered new chemicals and new uses for old ones following clearance by the Technical Committee on Agricultural Chemicals.
	Interdepartmental Committee on Pesticides (Est 1960)	Appointed by the Department of Health to consider controls over organic substances in insecticides, fungicide, weedkillers and fumigants.[46]
Department level	Recommendations Committee (Est 1980)	Reviewed new recommendations provided by the KTRI on weed control methods and conveyed these to field staff and the Tender Board.[47]
Weed management committees		
National level	Australian Weeds Committee (Est mid-1960s)	National coordination and exchange of information between state and commonwealth authorities managing noxious weeds.[48]
	Technical Subcommittee on Skeleton Weed Research (Subcommittee of the Australian Weeds Committee)	Interstate CSIRO chaired committee on research being undertaken on Skeleton Weed. The Department also contributed research on chemical control.[49]

45 Victorian Premier's Department, 1966, *Newly established Pesticides Review Committee*, Letter.

46 Vermin and Noxious Weeds Destruction Board, 1960, *Interdepartmental Committee Appointed by Health Department to Consider Matters Relating to the Control or Organic Substances Used in Insecticides, Fungicides, Weedkillers and Fumigants,* Memorandum; Inter Departmental Committee on Pesticides, 1961, *Minutes of Meeting Held on 1 May 1961*, Minutes.

47 Vermin and Noxious Weeds Destruction Board, 1982 (est), *Board Policy Items- Recommendations Committee*, Extract; Recommendations Committee, 1980, *Minutes of Meeting Held on 31 December 1980*, Minutes; Vermin and Noxious Weeds Destruction Board, 1980, *Minutes of Meeting Held on 5 November 1980*, Item 5.2 New herbicide recommendations - procedure, Minutes; Recommendations Committee, 1982, *Minutes of Meeting Held on 18 June 1982,* Minutes.

48 Keith Turnbull Research Institute, 1972, *Meeting of Australian Weeds Committee Held on 5 July 1972*, Memorandum; Australian Weeds Committee, 1972, *Minutes of Meeting held on 5 to 6 July 1972*, Minutes.

49 Technical Sub-Committee on Skeleton Weed Research, 1968, *Minutes of Meeting Held on 12 February 1968*, Minutes; Department of Agriculture, 1969, *Australian Weeds Committee*, Letter, and attachment to letter *Technical Sub-Committee on Skeleton Weed Research*, Letter.

	Committee name	Committee role
State level	Victorian Weeds Society (Est 1966)	Promotes awareness and information exchange on weeds between all levels of government, industry and the community, and provides policy advice to state and federal authorities.[50]
Department level	Central Advisory Council (renamed Land Protection Council in 1983)	Advised VNWDB on control and destruction of vermin and noxious weeds.
	Noxious Weed Control Committee (Est 1980)[51]	Coordinated and integrated all weed management across the Department and the National Parks Service.
	Weed Management Planning Group	Coordinated and integrated the Department's weed management, recommended priorities and resource allocation to subprogram coordinators and reported back on targets and objectives.[52]

[50] The Weed Society of Victoria, *About the Weed Society, <http://www.wsvic.org.au/node/3>* [accessed 9 November 2015].

[51] Department of Crown Lands and Survey, 1980, *Inaugural Noxious Weed Control Committee Meeting*, Memorandum.

[52] Weed Management Planning Group, 1989, *Proceedings of Meeting Held on 7 February 1989*, Minutes.

Chapter 4: The chemicals

Key Messages

- The chemicals 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) were used by the Department from 1965 to 1988 and 2,4-D remains in use within Victoria.
- 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), - a contaminant by-product in manufacturing 2,4,5-T - was internationally recognised as carcinogenic in 1997.
- In 1982 the World Health Organization's (WHO) International Agency for Research on Cancer (IARC) determined that chlorophenoxy herbicides such as 2,4-D and 2,4,5-T were possibly carcinogenic. Prior to this the IARC would not classify them due to inadequate/insufficient data.
- Thousands of subsequent worldwide studies and papers have drawn different conclusions.
- In 2003 an Australian review of scientific studies across the world evaluated the range of findings linking cancers to 2,4-D, 2,4,5-T and TCDD. An established causal link was found to chloracne, and a probable causal link with total cancer, soft tissue sarcoma and non-Hodgkin lymphoma.
- Australia's current occupational exposure standard for TCDD concentration is 70 pg/kg bw/month.
- Toxicity and exposure must be properly assessed in ascertaining any potential health risk (See Chapter 11 for more detail).

INTRODUCTION

This chapter describes how knowledge of these chemicals has progressively changed over the decades based on extensive academic research, and the extent of domestic and international concerns. As it is a technical chapter it is important to refer to Appendix 7 for the key definitions of some scientific words and concepts. The Department used 2,4-D, 2,4,5-T and a combination of 2,4-D and 2,4,5-T during the Inquiry Period. It also used many other chemicals against noxious weeds and vermin but these chemicals aren't within the scope of this Inquiry. A full list is provided in Appendix 6. Their use over the same time period may lead to confounding conclusions on the potential health effects (see Chapter 11) of 2,4-D and 2,4,5-T exposure.

The Inquiry's Terms of Reference required it to review the Department's use of 2,4-D and 2,4,5-T. Very early on in the Inquiry's research and analysis it became apparent that the Inquiry also needed to consider TCDD, a by-product (contaminant) from the manufacture of 2,4,5-T. The change in levels of TCDD in 2,4,5-T over the Period, generally decreasing in concentration from 1965 to 1995, have impacted the Inquiry's analysis of potential health risks.

2,4-D and 2,4,5-T were developed in the 1940s as herbicides, mainly to control noxious weeds. Being much more effective than options like land clearing and other herbicides they were very popular, worldwide. It was the Department's responsibility to ensure private land owners were active in eradicating noxious weeds on their land and that Crown Land was also free of them. To this end, the Department used 2,4-D and 2,4,5-T during most of the Inquiry Period and also sold both chemicals to landowners. The Department ceased using 2,4,5-T in 1988, 2,4-D is still used today in Victoria. There are currently over 200 products containing 2,4-D and its salts/esters on the Australian Pesticides and Veterinary Medicines Authority (APVMA) register, a register of pesticides approved for use in Australia. It is worth noting that, in 2013, APVMA cancelled the registration of 11 High Volatile Ester (HVE) products containing 2,4-D.

These two chemicals became notorious in the late 1960s when they were combined to make Agent Orange. Agent Orange was used very heavily between 1965 and 1969 by US armed forces in Vietnam but its use was suddenly stopped following allegations of a spike in birth deformities among the exposed Vietnamese population. Despite this, these chemicals were used worldwide for many years afterwards although mainly in situations where extensive personal exposure could be avoided.

'In 1981 there were at least 40,000 scientific papers on 2,4,5-T alone, with probably an equal number on 2,4-D. Several thousand books on herbicides could also be added to this figure, making the total volume of information difficult to

examine and collate.'[53] Many thousands more have been created since. In answering the Terms of Reference, the Inquiry team has reviewed what it considers to be the most relevant and highly-regarded of these sources as the basis for this Inquiry.

A key source of information is the WHO IARC,[54] which draws on a huge number of academic papers from across the globe for 2,4-D, 2,4,5-T and TCDD. The IARC considered a large number of studies, including those from the United Kingdom (UK), Finland, Denmark, West Germany, New Zealand, the US and Australia to assess the risks and correlations of cancers to chemical exposure. While the IARC Monographs include a substantial amount of information about the toxicology of the substances reviewed, the primary focus is on their ability to cause cancer. The research of many other organisations and previous government reviews[55] are also referenced throughout this Report. Throughout this chapter we reference these organisations' views over time, and trace the state of knowledge of the chemicals and how assessment of them has changed. These analyses are used later in the Report in assessing the impacts of the Department's use of 2,4-D and 2,4,5-T between 1965 and 1995.

To assess the health risk associated with an employee's use of a particular chemical, the dangers (hazard assessment) and the extent (frequency and level) an employee was exposed (exposure assessment) needed to be determined. This is considered in Chapter 11. Broadly speaking, the risk is a product of two factors; the intrinsic hazard (usually equated with toxicity) and the extent of exposure. A basic concept in human health risk assessment (HHRA) is that there is likely to be a level of exposure that is without significant risk, no matter how high the intrinsic toxicity. HHRA uses conservative methodologies, addressing variability in sensitivities and other uncertainties, to determine the level of exposure that should not lead to any adverse health outcomes.

Human and animal studies have identified the potential health effects of individual chemicals and the dose likely to activate these.[56]. There are literally tens of thousands of scientific studies on the potential adverse health effects of 2,4-D, 2,4,5-T and TCDD. Additionally, a number of internationally recognised organisations have tried to assimilate this enormous and complex body of knowledge to provide classifications and reference values to help the non-scientific community understand it all.

The possible adverse health effects can broadly be categorised as either carcinogenic or non-carcinogenic, i.e. cancer causing or not. As Table 4.1 shows, IARC's classification for carcinogenicity has changed over time as more research has come to hand. The IARC classification system is based on weight-of-evidence. The classification can change simply because more or stronger evidence comes to light. Earlier IARC rules dictated that the highest classification (Group 1) could only be applied where there was 'sufficient' evidence from human exposures (epidemiological evidence). More recent IARC rules have allowed for higher classifications where weaker epidemiological evidence is supported by stronger evidence from animal-based studies and/or mode of action.

Carcinogenic health effects

IARC classification of 2,4-D and 2,4,5-T

The IARC created a classification system in 1971-72 for chemicals and their carcinogenicity, and has evaluated 2,4-D, 2,4,5-T, the class of polychlorinated dibenzo-*p*-dioxins and the most toxic member of that class, TCDD, over time.

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[53] Queensland Government, 1981, *A report on 2,4-D and 2,4,5-T and Human Health, Interdepartmental Committee appointed by Queensland Cabinet, 1981, p4.*

[54] In 1969, the International Agency for Research on Cancer (IARC) began an evaluation of the carcinogenic risk of chemicals to people and created critically evaluated monographs on individual chemicals. In 1980 and 1986, the program was expanded to the evaluation of carcinogenic risks of exposure to complex mixtures and other agents. Its objective was to elaborate and publish monographs and critical reviews of data on carcinogenicity for those agents that people are exposed to and in specific exposure situations; to evaluate human risk helped by an international working group of experts in carcinogenesis and related fields; and to indicate where additional research is needed.

[55] Including but not limited to US EPA, IOM, State and Commonwealth of Australia Government reviews.

[56] Current ADI list cites 2,4-D ADI at 0.01mg/kg, based on NOAEL for kidney effects in a two year rat study in 2006. The ADI for 2,4,5-T was 0.03mg/kg, based on the WHO JMPR value; the Australian ADI was withdrawn in 2003 when product registrations were withdrawn. To see the ADI List: Acceptable Daily Intakes for Agricultural and Veterinary Chemicals. Australian Government of Health, Office of Chemical Safety <http://www.health.gov.au/internet/main/publishing.nsf/content/ocs-adi-list.htm.> ADI/RfD values established for 2,4,5-T by the WHO ((0.003mg/kg) and US EPA (0.01mg/kg/d). A basis for these values for both 2,4-D and 2,4,5-T is summarised in 2013 contaminated sites NEPM. See <https://www.comlaw.gov.au/Details/F2013C00288/Html/volume_13.>

The IARC classification system is based on weight-of-evidence assessment of published toxicity studies and epidemiological studies (usually for occupationally-exposed cohorts or other cohorts where a high exposure has been verified). The classifications do not imply potency or magnitude of the risk. They simply reflect the strength of the evidence for an association with cancer. A more detailed explanation and definitions of the italicised terms below is available on the IARC website[57] and in the explanatory sections of each of the Monographs.

Group 1 (*carcinogenic to humans*) usually requires *sufficient* evidence from human studies but, recently, some chemicals have been included in Category 1 where there is *limited* human evidence but *sufficient* animal-based evidence and a mechanistic link.

Group 2A (*probably carcinogenic to humans*) is where the human data are *limited* but other data are *sufficient*.

Group 2B (*possibly carcinogenic to humans*) is where the human evidence is *limited* or *inadequate*, but there is *limited* or *sufficient* evidence from animal and/or mechanistic studies

Group 3 (*not classifiable as to its carcinogenicity to humans*) is where the strength of evidence in both categories is *inadequate* or does not quite reach *sufficient*.

Table 4.1 IARC Classification of Carcinogenicity over time

Year	Monograph Title	Group Classification
1977[58]	2,4-D and esters	3
	2,4,5-T and esters	3
	Chlorinated dibenzodioxins (TCDD and congeners)	3
1982	2,4-D and esters	3
	2,4,5-T and esters	3
	Phenoxyacetic acid herbicides (occupational exposures)	2B
	TCDD	2B
1986	Chlorophenoxy herbicides (occupational exposures)	2B
1987[59]	Chlorophenoxy herbicides	2B
	TCDD	2B
1997	TCDD	1
	Other polychlorinated dibenzodioxins	3
	Polychlorinated dibenzofurans (PCDFs)	3
2012	TCDD	1
		1
2015	2,4-D	2B[60]

[57] IARC, 2015, *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, <http://www.iarc.fr/en/publications/list/monographs/index.php> [accessed 9 November 2015]. See also Appendix 4.3 of this Report.

[58] Classification system applied in retrospect by IARC.

[59] The 1982 and 1987 monographs were not full evaluations. They summarised recent evidence and confirmed or updated the classifications based on earlier evaluations.

Australia's National Research Centre for Environmental Toxicology (EnTox) position on 2,4-D and 2,4,5-T

In 2003 Australia's National Research Centre for Environmental Toxicology (EnTox) in conjunction with Queensland Health undertook a Literature Review On The Human Health Effects Associated With Exposure To The Herbicides 2,4,5-T and 2,4-D And Dioxins for the Department of Health Western Australia. The authors drew from the considerations of the IARC, the Agency for Toxic Substances and Disease Registry (ATSDR), US Environmental Protection Agency (US EPA), WHO and the US National Academy of Sciences (NAS) and their assessments of cancers and other health effects. EnTox then made an evaluation by individual cancer endpoints (Table 4.2) and also non-cancer endpoints (Table 4.3). Many of these organisations conducted the assessment of the likely link between cancer and chemical exposure by considering links to a mixture of the chemicals 2,4-D and 2,4,5-T (containing the dioxin TCDD). The reason for this approach is that the data that exists relates to health effects following exposure to mixtures of 2,4-D and 2,4,5-T. For example, an important data set is health data from Vietnam veterans because, as soldiers, they were exposed to a mixture of 2,4-D and 2,4,5-T. The approach taken by the US EPA was to focus on the likely association between cancer and the dioxin TCDD.

Table 4.2 Summary of evaluation outcomes or conclusions from the EnTox review and provided by the key reviews considered (cancer endpoints)[61]

Cancer Endpoints	EnTox 's Review	IARC	ATSDR	US EPA	WHO	NAS
Total cancer	Probable	Carcinogenic to humans Group 1	May be human carcinogen	Human carcinogen	N/A	N/A
Gastrointestinal cancer	Evidence of no causal link	N/A	N/A	N/A	N/A	Limited or suggestive evidence of no association.
Hepatobiliary cancer	Insufficient evidence	N/A	N/A	N/A	N/A	Inadequate or insufficient evidence
Head and neck cancers	Insufficient evidence	N/A	N/A	N/A	N/A	Inadequate or insufficient evidence
Larynx cancer	Possible causal link	N/A	N/A	N/A	N/A	Limited or suggestive evidence.
Lung cancer	Possible causal link	Elevated in occupational cohorts, unlikely due to change or confounding.	Some data suggests a possible relationship.	Significant risk in occupational and Yusho cohorts.	N/A	Limited or suggestive evidence

[60] IARC confirmed Group 2B classification for 2,4-D in June 2015. The IARC review will be published as Volume 113 of the series. Acknowledged in the APVMA review. See also Loomis et al, 2015, *Lancet Oncology* 16(8), p891-892.

[61] National Research Centre for Environmental Toxicology, 2003, *Final Report: Literature Review on the Human Health Effects Associated with Exposure to the Herbicides 2,4,5-T and 2,4-D and Dioxins. Prepared for the Department of Health, Government of Western Australia, Queensland Health Pathology and Scientific Services, Queensland Government*, <http://www.dioxinnz.com/pdf-Reports/wa-lit-review.pdf> [accessed 9 November 2015], p84.

Cancer Endpoints	EnTox 's Review	IARC	ATSDR	US EPA	WHO	NAS
Bone cancer	Insufficient evidence	N/A	N/A	N/A	N/A	Inadequate or insufficient
Soft tissue sarcoma	Probable causal link	Significantly increased risk in occupational cohorts.	Some data suggests a possible relationship.	Direct linkage could not be made.	N/A	Sufficient evidence
Skin Cancer, Melanoma and non-melanoma	Insufficient evidence	N/A	N/A	N/A	N/A	Inadequate or insufficient
Prostate cancer	Possible causal link	N/A	N/A	N/A	Weak human evidence. Some animal evidence	Limited or suggestive
Testicular cancer	Insufficient evidence	N/A	N/A	N/A	Limited data available	Inadequate or insufficient
Urinary bladder cancer	Insufficient evidence	N/A	N/A	N/A	N/A	Inadequate or insufficient
Renal cancer	Insufficient evidence	N/A	N/A	N/A	N/A	Inadequate or insufficient
Brain tumours	Evidence of no causal link	N/A	N/A	N/A	N/A	Limited or suggestive evidence of no association.
Non-Hodgkin's lymphoma	Probable causal link	Human data show weak evidence of an association	Some data suggests a possible relationship	No consistent picture at the present time	N/A	Sufficient evidence
Hodgkin's disease	Possible causal link	N/A	N/A	N/A	N/A	Sufficient evidence
Multiple myeloma	Possible causal link	N/A	N/A	N/A	N/A	Limited suggestive evidence
Leukaemia	Insufficient evidence (Leukaemia) possible causal link (CLL).	N/A	N/A	N/A	N/A	Inadequate insufficient (Leukaemia) Sufficient evidence (CLL)

Table 4.3 Summary of evaluation outcomes or conclusions from the EnTox review and provided by the key reviews considered (non-cancer endpoints)[62]

Non-cancer Endpoints	EnTox's Review	IARC	ATSDR	US EPA	WHO	NAS
Neurobehavioral disorders	Insufficient evidence	N/A	Effects may occur in adults exposed to high levels; TCDD may be a neurological hazard to developing organisms.	Acute effects	No causal relationship could be deduced from human data.	Inadequate or insufficient evidence
Chloracne	Established causal link	N/A	Data suggests that TCDD is a dermal toxicant.	Positive relationship	N/A	Sufficient evidence
Porphyria cutanea tarda	Possible causal link	N/A	N/A	Acute effects	N/A	Limited or suggestive evidence
Respiratory disorders	Insufficient evidence	N/A	Acute exposure may cause respiratory effects.	Acute effects	N/A	Inadequate or insufficient evidence
Immune system disorders	Possible causal link	No clear relationship	No consistent information in humans but immune system is a target for TCDD in many animal species.	Inconclusive	Alterations of human immune parameters are in line with animal studies but mechanism of action is unknown.	Inadequate or insufficient evidence
Male reproductive disorders	Insufficient evidence	Human studies have limited power but developmental and reproductive toxicity in animals.	Reproductive effects may occur	Positive relationship (reproductive hormones) inconclusive (semen changes).	Inadequate human data but strong biological plausibility.	Inadequate or insufficient evidence

[62] National Research Centre for Environmental Toxicology, 2003, *Final Report: Literature Review on the Human Health Effects Associated with Exposure to the Herbicides 2,4,5-T and 2,4-D and Dioxins. Prepared for the Department of Health, Government of Western Australia, Queensland Health Pathology and Scientific Services, Queensland Government,* <http://www.dioxinnz.com/pdf-Reports/wa-lit-review.pdf> [accessed 9 November 2015], p 85.

Non-cancer Endpoints	EnTox's Review	IARC	ATSDR	US EPA	WHO	NAS
Diabetes	Possible causal link	N/A	Exposure to high levels may induce alterations in glucose metabolism.	Possible	N/A	Limited or suggestive evidence
Lipid and lipoprotein disorders	Possible causal link	N/A	N/A	Possible	N/A	Inadequate or insufficient evidence
Thyroid homeostasis	Insufficient evidence	N/A	Exposure to high levels may induce subtle alteration in thyroid function.	Possible	N/A	Inadequate or insufficient evidence
Circulatory disorders	Insufficient evidence	N/A	No conclusive evidence	Inconclusive	N/A	Inadequate or insufficient evidence
Gastrointestinal disorders	Insufficient evidence	May be related to high acute exposure	Data suggests that the gastrointestinal tract is not a target for TCDD.	Inconclusive (liver enzymes) Positive (GGT)	N/A	Inadequate or insufficient evidence

Threshold of exposure

The threshold of exposure is a concept of the non-cancer health effects of a chemical. The threshold below which there is no appreciable risk of adverse health effects is called the no observed adverse effect level (NOAEL). A reference dose (RfD) is the estimated daily exposure likely to be without appreciable risk of adverse health effects over a lifetime.[63]

Where there is evidence that a chemical causes cancer, especially where a genotoxic mode-of-action is suspected, a no threshold approach is taken to the risk assessment. This means that no threshold is presumed, and the risk at low levels of exposure is determined by linear extrapolation to zero exposure from a dose (point of departure, POD), where the cancer incidence can be quantified. For carcinogenic risk assessment the target risk that may be assumed to be 'safe' is usually between one in a million to one in ten thousand. IARC assessments merely determine whether there is sufficient evidence to categorise the 'hazard' potential.

The NOAEL is the usual POD for conducting a risk assessment. It is divided by safety/uncertainty factors (SF/UF) to derive an RfD or acceptable daily intake (ADI). The NOAEL is the highest dose in a study where there is no evidence of an adverse effect (i.e. no different from the untreated controls). If the study does not establish a NOAEL, the lowest observed adverse effect level (LOAEL) may be used instead, generally incorporating a larger SF/UF to derive the RfD/ADI.

The US EPA is an internationally respected source of information on these reference values (Table 4.4). It evaluates current scientific information on the health effects associated with exposure to specific chemicals and records the findings in a

[63] US EPA, 2015 *Integrated Risk Information System, 2,4-Dichlorophenoxyacetic acid (2,4-D) (CASRN 94-75-7),* US EPA, <http://www.epa.gov/iris/subst/0150.htm> [accessed 9 November 2015].

database known as the Integrated Risk Information System (IRIS).[64] As this information supports the US EPA's regulatory activities it is, from time to time, comprehensively reviewed to ensure it includes current scientific findings.[65]

The US EPA has reviewed 2,4-D, 2,4,5-T and TCDD but is yet to publish data on their carcinogenic effects.

Table 4.4 The US EPA's reference values (LOAELs, NOAELs and RfDs)[66]

Chemical	LOAEL (mg/kg/day)	NOAEL (mg/kg/day)	RfD (mg/kg/day)	Last Updated
2,4-D	5	1	1×10^{-2}	1988
2,4,5-T	10	3	1×10^{-2}	1989
TCDD	2×10^{-8}	N/A	7×10^{-10}	2012

While not absolute, these limits imply that if a person is exposed to 2,4-D, 2,4,5-T and/or TCDD in amounts less than those described then a health risk is not probable. However, exposure to levels above those described means there is a possible risk of the health conditions listed below. The exposure levels of Department employees are discussed in Chapter 11.

In 2003 EnTox collated international research and concluded that:

> *The following lists the outcomes of the overall evaluation on the strength of evidence of association between exposure to 2,4,5-T, 2,4-D and/or 2,3,7,8-TCDD and each investigated adverse health endpoint. The health outcomes where an* ***ESTABLISHED CAUSAL LINK*** *exits was Chloracne. Health outcomes where a* ***PROBABLE CAUSAL LINK*** *exists included Total Cancer, Soft Tissue Sarcoma and Non-Hodgkin's Lymphoma. Health outcomes where a* ***POSSIBLE CAUSAL LINK*** *exists include Laryngeal Cancer, Lung Cancer, Prostate Cancer, Hodgkin's disease, Multiple Myeloma, Chronic Lymphoid Leukaemia, Immune System Disorders, Diabetes, and Lipid, Lipoprotein Disorders and* Porphyria Cutanea Tarda*. Health outcomes where* ***INSUFFICIENT EVIDENCE*** *exists to make a classification included Hepatobiliary Cancer, Cancers of the Head and Neck, Bone Cancer, Skin Cancer (melanoma and non-melanoma), Testicular Cancer, Urinary Bladder Cancer, Renal Cancer, Leukaemia (other than CLL), Neurobehavioral Disorders, Respiratory Disorders, Male Reproductive Disorders, Thyroid Homeostasis, Circulatory Disorders, and Gastrointestinal Disorders. Health outcomes where* ***NO CAUSAL LINK*** *is established included Gastrointestinal Cancer and Brain Tumours.*[67]

While this Report made some firm conclusions it left a very important qualifier in the final paragraph of its executive summary noting, 'however, due to a number of limitations regarding the study design of descriptive case series, case reports or medical surveys, the frequent lack of exposure information, broad symptom definitions and different approaches taken, an evaluation on the causal link of the observed health outcomes and exposure to these compounds **cannot** [emphasis added] be made.' [68]

Two 2015 articles demonstrate that, 12 years later, despite enormous scientific research the conclusions from the scientific literature remain uncertain.

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64 US EPA, 2015, *Basic Information about the Integrated Risk Information System*, <http://www2.epa.gov/iris/basic-information-about-integrated-risk-information-system> [accessed 9 November 2015].

65 US EPA 2015, *Basic Information about the Integrated Risk Information System*, <http://www2.epa.gov/iris/basic-information-about-integrated-risk-information-system> [accessed 9 November 2015].

66 US EPA 2015, *Integrated Risk Information System, 2,4-Dichlorophenoxyacetic acid (2,4-D) (CASRN 94-75-7)*, <http://www.epa.gov/iris/subst/0150.htm> [accessed 9 November 2015].

67 National Research Centre for Environmental Toxicology, 2003, *Final Report: Literature Review on the Human Health Effects Associated with Exposure to the Herbicides 2,4,5-T and 2,4-D and Dioxins. Prepared for the Department of Health, Government of Western Australia, Queensland Health Pathology and Scientific Services, Queensland Government*, <http://www.dioxinnz.com/pdf-Reports/wa-lit-review.pdf> [accessed 9 November 2015], p1.

68 National Research Centre for Environmental Toxicology 2003, *Final Report: Literature Review on the Human Health Effects Associated with Exposure to the Herbicides 2,4,5-T and 2,4-D and Dioxins. Prepared for the Department of Health, Government of Western Australia, Queensland Health Pathology and Scientific Services, Queensland Government,*<http://www.dioxinnz.com/pdf-Reports/wa-lit-review.pdf> [accessed 9 November 2015], p1.

An article in the *British Medical Bulletin* concluded:

> *In summary, extensive epidemiological evidence is now available on the relationship of phenoxy herbicides and STS and NHL.*[69]*. Although this does not clearly indicate that such herbicides cause either disease, findings have not been entirely consistent and the possibility of a hazard cannot be confidently ruled out. If there is a hazard, however, the absolute increase in risk is small.*[70]

An article in the *Annals of Epidemiology* concluded:

> *… the weight of evidence does not support causal relationships between 2,4-D exposure and NHL, gastric cancer or prostate cancer.*[71]

The risk to Department employees therefore needs to be considered based on the overall exposure (both acute and over their career), the level of the toxin (especially TCDD) in the chemicals at the time the chemicals were used as a result of the manufacturing process, and the extent that the directions for use were followed and enforced by the Department and its employees (refer to Chapter 11).

2,4-D (2,4-DICHLOROPHENOXYACETIC ACID)

Still used in Australia and overseas, the 2,4-D herbicide was developed in the 1940s to target broadleaf weeds without affecting grasses and non-target species. Since the 1950s it has been widely used in agriculture, forestry, public land management and domestic applications. It forms part of a broader group of chemicals collectively known as phenoxy herbicides. Accountability for registration for its use is covered in Chapter 7.

2,4-D is an off-white coloured solid that is sparingly soluble in water and solvents. As a herbicide, it comes in a variety of forms:

- water-soluble salts including amine salts
- oil or solvent-soluble esters of various volatility.[72]

Each form offers different attributes and behaviours and hence different risks.

No studies considered by the IARC over the past 50+ years have identified TCDD in 2,4-D (see the section below on TCDD). The analysis in this chapter therefore considers pure 2,4-D.

The IARC classification of the carcinogenicity of 2,4-D remained in Group 3 (up to 1987) but moved to Group 2B in its own right in 2015. The broader group of (chloro)phenoxyacetic acid herbicides, which includes 2,4-D, has been classified in Group 2B since 1982 (Table 4.1).

A confounding factor in determining the carcinogenicity of 2,4-D is the frequent exposure of workers to both 2,4-D and 2,4,5-T together with the latter's contaminant TCDD. The US EPA evaluated 2,4-D for carcinogenic effects in 1988, 1992 and again in 2004. Each evaluation concluded that 'the data are not sufficient to conclude that there is a cause and effect relationship between exposure to 2,4-D and non-Hodgkin lymphoma.' 2,4-D was categorized as 'Group D – not classifiable as to human carcinogenicity in 2004'.[73]

There are currently over 200 products with 2,4-D content approved for use in Australia. Eleven products and two constituents with highly volatile esters have recently been deregistered. Approvals of the active constituent 2,4-D are being reconsidered by APVMA because of toxicological concerns. Products containing 2,4-D and all associated labels are being

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69 STS (soft tissue sarcoma) and NHL (non-Hodgkin lymphoma)

70 Jayakody, N., et al, 2015, *Phenoxy herbicides, soft-tissue sarcoma and non-Hodgkin lymphoma: a systematic review of evidence from cohort and case–control studies,* British Medical Bulletin Advance Access, Oxford University Press.

71 Goodman, J.E., et al, 2015, '2,4-Dichlorophenoxyacaetic acid and non-Hodgkin lymphoma gastric cancer and prostate cancer: meta analysis of published literature', Annals of Epidemiology.

72 Registration of these (HVE) products was withdrawn by the APVMA in 2013.

73 US National Pesticide Information Centre ,2009, *2,4-D Technical Fact Sheet, National Pesticide Information Centre*, <http://npic.orst.edu/factsheets/archive/2,4-DTech.html> [accessed 9 November 2015], p5.

reviewed because of environmental, toxicological and occupational health and safety (OHS) concerns. A determination is expected to be made by 2018.[74]

2,4,5-T (2,4,5-TRICHLOROPHENOXYACETIC ACID)

2,4,5-T was developed in the 1940s and used heavily in Australia and overseas until the 1980s to control perennial broad-leaf weeds. It was last used in Victoria in 1988–89.

Agent Orange combines 2,4,5-T and 2,4-D and its use came into stark profile in the late 1960s following its controversial use in the Vietnam War. The Department's use of it is dealt with in Chapter 11.

TCDD is a carcinogenic dioxin contaminant produced during the manufacture of 2,4,5-T (see the section below on TCDD). The contaminant levels have varied over time and between manufacturers. The greater the level of TCDD in 2,4,5-T, the greater the hazard. When TCDD is present in 2,4,5-T at very low levels it is unlikely to pose a risk to health. These very low limits have become better understood over time and the quality of the manufacturing process has improved. This has meant TCDD levels in 1965 were higher than those in 1985 products.

In the late 1960s to 1971 it is believed, based on US data[75], that in the 2,4,5-T manufactured in Australia the TCDD level generally fell between 0.1 ppm and 0.5 ppm,[76] though there were exceptions. However, between 1970 and 1975 concentrations most likely fell below 0.1 ppm.[77]

The 1976 Australian Standard AS1175 set the manufacturing limit to 0.1 mg/L (0.1 ppm) and this was made law in 1977.[78] In 1982 the law raised the quality standard by a factor of 10 to 0.01 ppm.[79]

In 1958, legislation gave purchasers the entitlement to request the Department of Agriculture to test the chemicals and certify their content.[80] From 1972 the Department of Agriculture was not to approve a pesticide that was not in accord with any standard prescribed and in force for that pesticide.[81] In 1976, an Australian Standard established the maximum concentration of TCDD allowed in 2,4,5-T as 0.1 mg/L of the total acid content (0.1 ppm), and in 1977, this standard was in force in Victoria.[82] In 1982 the quality standard was raised to 0.01 ppm in law.[83] Evidence discussed in Chapter 9 shows that some testing was undertaken.

2,4,5-T was used in two forms:

- aqueous salts (solid)
- oil-soluble ester (liquid).

The IARC classification of the carcinogenicity of 2,4,5-T has essentially remained at Group 3, although the broader group of (chloro)phenoxyacetic acid herbicides, which includes 2,4,5-T, has been classified in Group 2B since 1982 (Table 4.1).

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74 Australian Pesticides and Veterinary Medicines Authority, 2015, '*2,4-D, Issue* <http://apvma.gov.au/node/15581> [accessed 9 November 2015].

75 It has been difficult for the Inquiry to access Australian laboratory results for TCDD concentrations in 2,4,5-T prior to the late 1970s. US data cited from the 1960s and early 1970s has been applied as indicative data, applicable to Australia.

76 US Advisory Committee on 2,4,5-T, 1971, *Report of the Advisory Committee on 2,4,5-T to The Administrator of the Environmental Protection Agency* Report, p66.

77 Westman, W.E., et al, (Queensland Conservation Council Subcommittee), 1973, *The use and effect of plant-hormone herbicides (2,4-D and 2,4,5-T) in Australia*, Paper.

78 Victorian Parliament, *Victoria Gazette*, No. 58 – 6 July 1977, 2212, Re: Proclamation pursuant to Pesticides Act 1958, Standards for Pesticides.

79 Victorian Parliament, *Victoria Gazette*, No. 80 - 11 August 1982, 2659, Re: Proclamation pursuant to Agricultural Chemicals Act 1958, Prescribing Standards for Agricultural Chemicals and Declaring Products or classes of Products to be Insecticides and Plant Regulators.

80 *Pesticides Act 1958* s 17.

81 Pesticides (Amendment) Act 1972 s 8(2).

82 Standards Australia 1976, *AS 1175-1976 Herbicides of the phenoxyacetic acid type, Standards Australia; and* Victoria, *Victoria Gazette, No. 58, July 6 1977, p2212, Re: Proclamation pursuant to the Pesticides Act 1958 Standards for Pesticides*.

83 Victoria, *Victoria Gazette*, No. 80, 11 August 1982, p2659, Re: Proclamation pursuant to Agricultural Chemicals Act 1958, Prescribing Standards for Agricultural Chemicals and Declaring Products or classes of Products to be Insecticides and Plant Regulators.

TCDD (2,3,7,8-TETRACHLORODIBENZO-*P*-DIOXIN)

Small quantities of TCDD are produced in the chlorination of phenol to 2,4,5-trichlorophenol, a precursor of 2,4,5-T. This is especially the case when the reaction mixture is allowed to overheat. Dioxins, including TCDD, are commonly formed as unintended by-products of incomplete combustion, and because they are thus released to the atmosphere they are ubiquitous in our environment (e.g. caused by bush fires, municipal waste incinerators and, previously, chlorine-bleached paper production), albeit in minute quantities.[84]

It is now known that exposure to TCDD can cause cancer and it has been classified as a Group 1 carcinogen, i.e. to humans, by the IARC and the US EPA. The IARC classification has escalated from Group 3 (in 1977) to Group 2B (from 1982 to 1987) and then to Group 1 (in 1997) (Table 4.1). The IARC classification does not take into account the exposure levels that result in a risk of cancer, and the US EPA has yet to conclude its quantitative evaluation of the dose-response relationships. However, since the TCDD carcinogenic response may be initiated by interaction with specific receptors, rather than via a genotoxic effect on cell DNA, it is possible that the RfD for non-cancer effects may also be applicable to cancer.

The US EPA, through its 2012 assessment recorded in the IRIS database (<http://www.epa.gov/iris/subst/1024.htm>), has established an oral RfD[85] for non-cancer effects at 7 x10^{-10} mg/kg/day (0.7 pg/kg bw/day or equivalent to 30 pg/kg.bw/month). This RfD is based on analysis of epidemiological studies, where a decreased sperm count in men exposed as boys, and increased thyroid hormone TSH in neonates were the key toxicological endpoints.

The US EPA RfD (based on non-cancer effects in humans) is lower than the 2005 Australian Government TCDD tolerable monthly intake (TMI) of 70 pg/kg.bw/month[86] (based on non-cancer effects in rats). It is currently endorsed by Australian authorities.[87] It has been reduced over time as scientific knowledge of TCDD toxicity has increased. The TMI for TCDD is measured on a monthly rather than daily intake basis because of its toxicokinetics (tissue accumulation and very slow clearance from the body).

The 0.7 pg/kg bw/day RfD is based on an endpoint for decreased sperm production and altered sexual behaviour in the male offspring of female rats treated with TCDD.[88] This endpoint was used by several other agencies at around that time. The TMI derived from this study included uncertainty factors and adjustment for human doses based on TCDD body burdens.

As the RfD and TMI have reduced over time, so have the regulatory limits on TCDD in pesticides reduced over time. In 1976 the Australian Standard AS1175 set the limit of TCDD in 2,4,5-T at 0.1 ppm and, for products to be re-registered in 1982, the standard was raised to 0.01 ppm. These limits were set as low as possible, primarily on the basis of what could be reliably measured at the time, but they were also intended to be protective against the effects of TCDD causing birth defects in pregnant women potentially exposed to TCDD-contaminated 2,4,5-T.

A few accidents in chemical manufacturing plants in Europe in the 1950s and 1960s exposed workers to dioxins but little was known about long-term effects. A serious industrial accident in Seveso, Italy in 1976 resulted in the highest ever TCDD exposure to a residential population. A significant numbers of scientific studies followed and standards were set. The Seveso Directives now issued by the European Commission apply to over 10,000 industrial establishments in the European Union that use or store dangerous substances. They are also referenced by safety regulators worldwide. This development

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[84] Office of Chemical Safety, 2005, *National Dioxins Program Technical Report No. 12: Human Health Risk Assessment of Dioxins In Australia, Australian Government, Department of the Environment and Heritage,*. It notes that the Tolerable Monthly intake (TMI) of 70pg/kg/month set by the NHMRC/OCS in 2002. Report, p132.

[85] "In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime." <https://www.environment.gov.au/system/files/pages/e66156a9-a7ac-4bc9-b256-5cf41daaaed1/files/report-12.pdf>

[86] Office of Chemical Safety, 2005, *National Dioxins Program Technical Report No. 12: Human Health Risk Assessment of Dioxins In Aust*ralia, Australian Government, Department of the Environment and Heritage <https://www.environment.gov.au/system/files/pages/e66156a9-a7ac-4bc9-b256-5cf41daaaed1/files/report-12.pdf> [accessed 5 November 2015], pv and p132.

[87] Based on the WHO and JECFA evaluations in 2001, endorsed by the NHMRC in 2002 and published in the National Dioxins Program monographs (Technical Report No. 12) in 2005.

[88] US EPA, National Centre for Environmental Assessment, 2012 (est), *Integrated Risk Information System (IRIS) Chemical Assessment Summary - Table I.A.1 Chronic Oral RFD*. Summary, US EPA <http://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/1024_summary.pdf#nameddest=rfd> [accessed 5 November 2015], p2.

coupled with the US EPA research following the Agent Orange controversy has substantially increased knowledge of carcinogenicity of TCDD.

It was not until 1997 that the international scientific community, as reflected in IARC findings, acknowledged TCDD was carcinogenic to humans and has the potential to cause cancer. How this related to Department employees is further discussed in Chapter 11.

MIXTURE OF 2,4-D AND 2,4,5-T (AGENT ORANGE)

Agent Orange was given its name by the way in which the 50:50 mix of 2,4-D and 2,4,5-T was identified by the American armed forces in its strategy to defoliate the jungles of Vietnam to assist their war effort from 1965 to 1970. An orange band of paint was put on 55 gallon drums of the chemicals to differentiate them from others.

Health concerns were first raised in 1969 following the alleged spike in birth defects in Vietnam. In response to growing public concern 'the White House announced on December 26 1970, that it was initiating an orderly yet rapid phase out'[89] of its defoliation program. It was alleged that the level of TCDD was not systematically monitored and controlled, and tests revealed concentrations ranging from 0.02 to 47 ppm with an average of 1.98 ppm.[90] The maximum concentration of TCDD in commercially available 2,4,5-T in Australia at the time was believed to be in the range 0.1 ppm to 0.5 ppm.[91]

AUSTRALIAN AND INTERNATIONAL REVIEWS AND APPROVAL FOR USE IN AUSTRALIA

The US stopped using Agent Orange in Vietnam in 1971.[92] The US EPA restricted the use of 2,4,5-T for agricultural purposes in 1979, and launched several attempts in the early 1980s to ban it completely.[93] In 1983, 2,4,5-T-based herbicides were largely withdrawn from the US market and replaced by alternatives such as dicamba and triclopyr.[94] The international scientific community was generally of the view that the US decisions were not based purely on the available scientific evidence at the time and so decisions to ban 2,4,5-T varied across the globe, in the UK, Sweden, New Zealand, and West Germany.[95] In 1992, in Australia, 2,4,5-T was classified as a scheduled waste, that is, a material that is toxic to humans[96] due to the significant levels of dioxin contained in early formulations.[97] The international trade of 2,4,5-T is restricted by the Rotterdam Convention 1988, that Australia ratified in 2004.[98]

Listed below is the chronological order of Australian studies and decisions, with some international studies and reviews cited for international context.

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89 Institute of Medicine, 1994, *Veterans and Agent Orange, Health Effects of Herbicides Used in Vietnam, Committee to review the Health Effects in Vietnam Veterans of Exposure to Herbicides*, Division of Health Promotion and Disease Prevention Paper, p27.

90 Commonwealth of Australia, 1985, *Royal Commission on the Use and Effects of Chemical Agents on Australian Personnel In Vietnam – Final Report Volume 1, Introduction and Exposure,* Report, p IV-30.

91 W.E. Westman, et al, of the Queensland Conservation Council Subcommittee 1973, *The use and effect of plant-hormone herbicides (2,4-D and 2,4,5-T) in Australia*, Paper.

92 Commonwealth of Australia (Evatt, P.,), 1985, *Royal Commission on the Use and Effects of Chemical Agents on Australian Personnel in Vietnam, Vol. 1, p.I30-I-31, What is Agent Orange?,* The Aspen Institute, Agent Orange in Vietnam Program, Report., <http://www.aspeninstitute.org/policy-work/agent-orange/what-is-agent-orange> [accessed: 9 November 2015].

93 Jacob, C. & Walters A., 2005, *Risk and Responsibility in Chemical Research: The Case of Agent Orange, International Journal of Philosophy of Chemistry', Vol. 11, No. 2* <http://www.hyle.org/journal/issues11-2/jacob.pdf> [accesed 9 November 2015], p152.

94 Jacob, C. & Walters A., 2005, *Risk and Responsibility in Chemical Research: The Case of Agent Orange, International Journal of Philosophy of Chemistry*, Vol. 11, No. 2, < http://www.hyle.org/journal/issues11-2/jacob.pdf> [accessed 9 November 2015], p 154.

95 Department of Crown Lands and Survey, 1982, Attachment to Circular No. 90/82 Future Use of 2,4,5-T October 1982, Report.

96 Australian and New Zealand Environment and Conservation Council,, 1992, *National Strategy for the Management of Scheduled Waste*. <http://www.nepc.gov.au/system/files/resources/378b7018-8f2a-8174-3928-2056b44bf9b0/files/strategy-1992.pdf> [accessed 9 November 2015].

97 Australian and New Zealand Environment and Conservation Council, July 1999, *Organochlorine Pesticides (OCP) Waste Management Plan*, Appendix A, sub note 18.

98 Commonwealth of Australia, 2015, *Rotterdam Convention*, <http://www.agriculture.gov.au/ag-farm-food/ag-vet-chemicals/international/rotterdam> [accessed 9 November 2015].

Table 4.5 Australian and selected international studies, reviews and approvals for use (titles of studies are bold)

Year	Study
1947	2,4-D First registered (*Fungicides Act 1935*)
1950	2,4,5-T First registered (*Fungicides Act 1935*)
1975	National Health and Medical Research Council (NHMRC, Australian Government body) The Public Health Advisory Committee of NHMRC noted that the levels of TCDD contained in 2,4,5-T in Australia at the time were less than 0.1 ppm, a level at which no teratogenic activity had been reported. The council further recommended that '2,4,5-T containing more than 0.1 ppm of TCDD should not be permitted for use as a herbicide in Australia and that a maximum residue limit of 0.02 ppm of 2,4,5-T be permitted in water.'[99]
1976	AS1175 – Standards Association of Australia determined TCDD content in 2,4,5-T not to exceed 0.1 mg/L of total acid content. All purchasers (including the Department) could request tests of 2,4,5-T.
1978	**Consultative Council on Congenital Abnormalities in the Yarram District (Victoria)** (also known as **the** Aldred Report) *… the normal agricultural use of 2,4-D and 2,4,5-T has not been shown to cause birth abnormalities in domestic animals nor is there evidence to connect such use with human birth abnormalities*.[100] Report to Australian Parliament **Herbicides, Pesticides and Human Health: Progress Report on the Continuing Scrutiny of the Problems of Pollution** – Senate Standing Committee on Science and the Environment *… the Committee feels it is not in a position to recommend a formal Senate inquiry at this time*.[101] *Procedures for reporting and investigating possible long-term or obscure effects of the use of agricultural chemicals appear to be but weakly defined. In particular, current machinery for the systemic collection of relevant information such as the occurrence and frequency of congenital abnormalities and various kinds of cancer seems inadequate for the purpose. The Committee accordingly recommends an examination of this matter by the Minister for Health*.[102]
1979	**Report on the Status of the Herbicides 2,4,5-T and 2,4-D (Pesticides Review Committee, Victoria)** *… there is no evidence to suggest that the use of 2,4,5-T and 2,4-D under the current controls presents any hazard to human health*.[103] **Report of an Enquiry into the use of Herbicides 2,4-D and 2,4,5-T in South Australia (South Australia)** *… no substantial scientific evidence of a causal link between the use of 2,4,5-T and human birth defects … and … the very low concentrations of dioxin in Australian 2,4,5-T meant that any teratogenic risk is probably extremely small.*[104]

[99] National Health and Medical Research Council, 1979, *Report of the Eightieth Session*, Brisbane, April 1975, p9.

[100] Government of Victoria, Consultative Council and Aldred J, 1978, *Report of the Consultative Council on Congenital Abnormalities in the Yarram District*, p13.

[101] Commonwealth, Senate Standing Committee on Science and the Environment, 1979, *Herbicides, Pesticides and Human Health; Progress Report on the Continuing Scrutiny of the problems of Pollution*, June 1978, Report, p2.

[102] Commonwealth, Senate Standing Committee on Science and the Environment, 1979, *Herbicides, Pesticides and Human Health; Progress Report on the Continuing Scrutiny of the problems of Pollution*, June 1978, Report, p3.

[103] Pesticides Review Committee, 1979, *Report on the Status of the Herbicides 2,4,5-T and 2,4-D, Victorian State Government*. Report, p8.

Year	Study
	NHMRC The Council's Adhoc Working party on the use and safety of 2,4,5-T reviewed recent reports and studies including a report on an accident at Seveso in Italy in 1976 and again concluded that there was 'no substantial evidence of a causal link between 2,4,5 -T and human birth defects.'[105]
1980	**Review of the use of the herbicide 2,4,5-T in New South Wales (NSW)** *… extensive available scientific information indicates that the approved uses of 2,4,5-T in agriculture, forestry and land management do not pose any threat to the general public.*[106] **A Report on 2,4-D and 2,4,5-T and Human Health (Queensland)** *… no evidence exists to suggest that the continuation of present approved use of 2,4-D and 2,4,5-T will in any way harm the health and well-being of any members of the general public"* and *"evidence upon which this conclusion was based is clear and unambiguous.*[107]
1981	**Progress Report on the Status of the Herbicides 2,4,5-T and 2,4-D (Pesticides Review Committee, Victoria)** *… there is no scientific justification for discontinuing the use of either 2,4-D or 2,4,5-T in Victoria …* and that *… additional technical information which has come to hand since our last report in November 1979 supports the continued proper use of these chemicals*.[108]
1982	Registration of 2,4,5-T in Australia required maximum limits of TCDD of 0.01 ppm. Restricted use of 2,4,5-T salts and esters for aerial spraying or from misting machines in blackberry season and not within 50 m of a dwelling (*Agricultural Chemicals Act 1980*). **Report of the New South Wales Government Committee of Inquiry into the Use and Safety of 2,4,5-T (NSW)** *… the Committee saw no evidence of undue risk of teratogenic, mutagenic or carcinogenic effects. When used according to label directions very little danger to humans, other animals or the environment should result. … When 2,4,5-T is distributed, mixed and applied according to approved directions the additional danger to humans and the environment is slight*.[109]
1983	**Report on the use of 2,4,5-T in Victoria, Agricultural and Domestic Chemicals Review Committee, (Victoria)** *… the scientific position on the possible hazard of [2,4,5-T] to humans has not altered since our last report … We believe that the precautions and safeguards that apply to the use of 2,4,5-T in Victoria are more than adequate. Whilst it is not possible to say that the 2,4,5-T will never harm anyone*

[104] Government of South Australia, 1979, *Report of an Enquiry into the use of Herbicide 2,4-D and 2,4,5-T in South Australia*, Government Printer South Australia, Report, p5.

[105] National Health and Medical Research Council, 1979, *Report of the Eighty-Seventh session*, Sydney, unpublished June 1979, Report, p81.

[106] Department of Agriculture New South Wales, 1980, *Review of the use of the Herbicide 2,4,5-T in New South Wales*, unpublished January 1980, Report, p5.

[107] Queensland Government Land Administration Commission, 1981, *A Report on 2,4-D and 2,4,5-T and Human Health*, Report, p1.

[108] Victorian Government, Pesticides Review Committee, 1981, *Progress Report on the Status of the Herbicides 2,4,5-T and 2,4-D*, Report, p3.

[109] Government of New South Wales, 1982, *Report of the New South Wales Government Committee of Inquiry into the use and safety of 2,4,5-T*, Report, p(i).

Year	Study
	when used according to these precautions and safeguards, we can say that its effects on human health are clearly negligible …[110] Restricted use of 2,4,5-T salts and esters for aerial spraying or from misting machines in blackberry season and not within 50 m of a dwelling, and to prohibit use in urban or semi-urban areas, and restricted the more volatile (ethyl/methyl) forms for the control of trees, shrubs, woody plants and weeds (*Agricultural Chemicals Act 1980*).
1985	**Royal Commission on the Use and Effects of Chemical Agents on Australian Personnel in Vietnam (Commonwealth) (also known as the Evatt Royal Commission)** *Overall the likelihood of exposure to 2,4,5-T and 2,4-D in general was considered low for all Australian personnel serving in Vietnam including applicators, base personnel and other soldiers.*[111] *The estimated exposure of 6µg/m2 was said to be, 1/3 of a cutaneously applied dose which has been shown to produce no toxic effects.*[112]
1986	**Agricultural and Domestic Chemicals Review Committee – Fourth Report on the use of 2,4,5-T in Victoria (Victoria)** *After considering all the studies done to date, this Committee is now in the position to make reassurance that the use of 2,4,5-T does not pose a risk of cancer to humans.*[113]
1988	2,4,5-T last used by the Department in Victoria.
1994	Agricultural and Veterinary Chemicals Acts (states and Commonwealth) Full registration of chemicals responsibility was transferred from states and territories to Commonwealth although control of use remained with the states and territories. **The Veterans and Agent Orange: Health Effects of Herbicides used in Vietnam** – NAS Institute of Medicine (IOM) US, First published and then updated bi-annually.
2001	**Report of the Expert Medical Panel to evaluate recommendations of the Kimberley Chemical Use Review (West Australia)** The findings are summarised in five conclusions: • *Safety and work practices were inadequate relative to today's standards as well as those in effect at the time.* • *APB policies were consistent with advice from health authorities.* • *Illness did develop in association with the spray. However this has tended not to be diagnosed by treating doctors as chemical related illness.* • *Alienation has developed and is felt by those who were exposed to the spray.* • *Exposure to unregulated levels of dioxin cannot be ruled out.* And …

[110] Agricultural and Domestic Chemicals Review Committee, 1983, *Report on the use of 2,4,5-T in Victoria*, Report, p8.

[111] Commonwealth of Australia, 1985, *Royal Commission on the Use and Effects of Chemical Agents on Australian Personnel in Vietnam – Final report, Volume 1: Introduction and Exposure*, Commonwealth of Australia, Canberra, Report, pIV- 235.

[112] Commonwealth of Australia, 1985, *Royal Commission on the Use and Effects of Chemical Agents on Australian Personnel in Vietnam – Final report, Volume 1: Introduction and Exposure*, Commonwealth of Australia, Canberra. Report, pIV- 110 and 111.

[113] Agricultural and Domestic Chemicals Review Committee 1986, *Fourth Report on the use of 2,4,5-T in Victoria,* Victorian Government, Report, p3.

Year	Study
	The Review is not a scientific investigation designed to test specific questions of disease causation such as the relationship between herbicides and ill health. Rather, it is an assessment of a breadth of available health and safety evidence including the concerns of former employees of the program. The aim is to review this evidence and to evaluate its meaning and social relevance to those who participated in it and to the community more generally.[114]
2003	**Report of the Expert Medical Panel to Evaluate Recommendations of the Kimberley Chemical Use Review (West Australia) (also known as the Armstrong Report)** *The APB workers may suffer or may have suffered already an increase in the risk of cancer due to their exposure to herbicides containing the dioxin TCDD in the spray program …* *The symptoms of ill health that the APB workers reported to Dr Harper do not form a pattern such as to suggest that they were directly caused by their exposure to herbicides during their employment in the spray program. The Panel also concluded that the symptoms of anxiety and depression reported by the APB workers are unlikely to be due to their employment in the spray program …* *Little evidence was available to determine whether or not the APB workers have experienced increased rates of a number of other conditions that might possibly be caused by exposure to chlorophenoxy herbicides containing dioxins.*[115]
2005	**The Use of Herbicides at CFB Gagetown from 1952 to Present Day, National Defence and the Canadian Armed Forces (Canada)** The task force concluded that: *… the military chemicals tested at CFB Gagetown in 1966 and 1967, the known contaminants in the herbicides used at CFB Gagetown during the annual spray program in the period prior to the late 1960s, and the active ingredients in the herbicides used at CFB Gagetown during the annual spray program posed no long-term risk to human health and safety for most individuals. Those who were directly involved during applications or who worked in the bush immediately after application may have some increased risk. The contractor also concluded that the known contaminants in the herbicides used at CFB Gagetown during the annual spray program after the late 1960s posed no long-term risk to human health and safety.*[116.]
2006	2,4-D volatile esters were suspended from registration by APVMA.
2007	Canadian Government offer an ex-gratia payment to Canadian Military Personnel: *… to qualify for the ex gratia payment, individuals must have an illness associated with exposure to contaminants in Agent Orange, as determined by the U.S. National Academy of Sciences' Institute of Medicine (IOM).*[117]
2013	**Report of the Independent Fact-Finding Panel on Herbicide 2,4,5-T (Ontario, Canada)**

[114] Expert Medical Panel, 2003, Final *Report of the Expert Medical Panel to Evaluate Recommendationa of the Kimberley Chemical Use Review*, Report , p10.

[115] Expert Medical Panel, 2003, Final *Report of the Expert Medical Panel to Evaluate Recommendationa of the Kimberley Chemical Use Review*, Report., p5.

[116] Department of National Defence, undated, *The Use of Herbicides at CFB Gagetown from 1952 to Present Day, National Defence and the Canadian Armed Forces,* <http://www.forces.gc.ca/en/about-reports-pubs/herbicides-gagetown.page> [accessed 15 May 2015].

[117] Department of Veterans Affairs, 2007, *Agent Orange ex Gratia Payment, Government of Canada*, Report, <http://www.veterans.gc.ca/eng/about-us/reports/privacy-impact-assessment/pia-agent-orange> [accessed 9 November 2015].

Year	Study
	… even when exposure estimates exceed safe threshold levels, a wide margin of safety is incorporated into the estimates and adverse health effects may not occur. The risk assessment only indicates that acceptable margins of safety have been exceeded for certain occupationally exposed groups, and that their health could have been affected. … Such assessments, however, cannot be used to determine whether or not an exposed individual will actually develop a disease or adverse health event from exposure to 2,4,5-T or TCDD.[118]

[118] Government of Ontario 2013, *Report of the Independent Fact-Finding Panel on Herbicide 2,4,5-T, Final Report,* <http://www.ontario.ca/document/report-independent-fact-finding-panel-herbicide-245-t-0> [accessed 9 November 2015].

Chapter 5: Past practices in context

Key Messages

- The Agent Orange controversy during the Vietnam War, together with uncertainty about its potential health effects, fuelled a higher level of community concern about exposure to chemicals.
- The regulatory environment of the past was lax by today's standards and the community's tolerance of OHS risk was far higher.
- Employee safety was not a key management focus and even when there were safety policies and standards in place, compliance was *laissez faire*.
- It was an era in which workers didn't challenge the boss, even if they did have concerns — although they may have ignored instructions when the boss was out of sight.
- Even though management only ever followed the latest science that indicated a low safety risk, workers weren't convinced they were safe.

INTRODUCTION

The policies and practices of the Department should be judged by reference not to today's standards but to the regulations, standards and practices of the day. Due regard must also be had to the state of knowledge at the time, including in relation to the potential health risks associated with the use of the chemicals.

To truly understand the past practices in context the Inquiry has outlined below the evolving controversy of 2,4-D, 2,4,5-T and Agent Orange as well as the significant changes in public health, agriculture and OHS legislation between 1965 and 1995. Providing this context allows the reader to understand what was regarded as 'safe' during the period of the Inquiry and introduces the role of various parties, particularly the Department. Importantly it will enable the reader to avoid making assessments based on the benefit of hindsight.

COMMUNITY ATTITUDE IN CONTEXT

The evolving controversy of 2,4-D and 2,4,5-T and Agent Orange

The 1960s

The use of Agent Orange by the US military in the Vietnam War, as part of its herbicide warfare program, drew enormous publicity across the world. In the late 1960s a serious debate began, that has raged ever since, about the human health impacts of 2,4-D and 2,4,5-T – the two chemicals that made up Agent Orange.

Coinciding with the Agent Orange controversy, the environment protection movement was fuelled with the publication of Rachel Carson's *Silent Spring* in 1962.[119] *Silent Spring* received a strong reaction internationally, where the author drew the public's attention to the improper use of pesticides and the associated risks to the environment. The 1966 Victorian Committee of Enquiry into the Effects of Pesticides[120] commented that the US was quick to act on the recommendations in Carson's book, while the United Kingdom (UK) House of Representatives Committee was critical, stating the book was, 'drawing incorrect conclusions from unrelated facts'.

In the 1960s pesticides were used liberally in Victoria, both by the farming community and the Department. Few precautions were used and some authorities and workers were getting concerned. Two examples illustrate this. The first is the common practice in 1965 for farmers in the Ballarat region to aerial spray potato crops with arsenical pesticide at frequencies in excess of recommended rates. Dr Christophers, Chief Industrial Hygiene Officer at the Victorian Department of

[119] Carson, et al, 1962, *Silent spring*, Riverside Press.

[120] The Committee of Enquiry, 1966, *Report of the Committee of Enquiry Appointed by the Honourable The Premier of Victoria to Enquire into The Effects of Pesticides*, Report, p17.

Health commented that, the easy availability of arsenic for weed-killing made nonsense of the poisons legislation.[121] Second, there is evidence throughout the 1960s that the Department workers did not wear personal protective equipment (PPE), even when handling highly toxic mammal poisons – larvacide, chloropicrin, calcium cyanide,[122] cyanogen[123] – fumigants for rabbit control.[124]

In **November 1969** the US Consulate General wrote to the Victorian Premier advising him that the US was going to restrict the use of 2,4,5-T in response to a study, 'which indicated that offspring of mice and rats given relatively large oral doses of the herbicide during early stages of pregnancy, showed a higher than expected number of deformities'.[125]

The 1970s

In **January 1970,** a circular to all inspectors advised them of the Consulate General's advice but added, 'there is no evidence that the present use of 2,4,5-T by this Department is … detrimental to the health of our employees, the public or wildlife', although it did recommend that the 'workforce be advised to be careful in its use'.[126]

In **November 1976**, Mr Douglas, VNWDB Chairman wrote to Dr Christophers, about the concerns of two medical doctors, Drs Woodward and Guy, that the use of 2,4-D in the Yarram district may be linked to a cluster of still-births and birth abnormalities during 1975. Mr Douglas stated the main purpose of his correspondence was to 'confirm in writing … the concern my Board holds about any possible effects of 2,4-D ester on any persons using this material and to ask for your assistance in investigating the complaints made.'[127] Mr Douglas affirmed that the Board offered their full support and assistance to the Health Department undertaking an investigation.[128]

In **February 1978**, Mr Douglas wrote to the Minister of Lands regarding the 'public controversy' that had arisen 'during the last two weeks … over the use of 2,4,5-T and to some extent 2,4-D and abnormal birth occurrences in the Yarram district'. Mr Douglas described the matter as 'one of the most controversial and difficult problems which has arisen in the last 25 years of my experience in my job'.[129]

On **22 March 1978**, the Commission of Public Health commissioned an inquiry into these concerns.[130]

On **9 June 1978**, a circular to all senior inspectors and inspectors advised them that the Victorian Minster for Health had directed the Department, and other State Government entities, to cease the use and sale of 2,4-D and 2,4,5-T until further notice.[131]

On **21 June 1978**, a circular to all senior inspectors and inspectors advised them that the 2,4-D ban was lifted but the ban on 2,4,5-T would remain in place until further notice.[132]

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[121] The Committee of Enquiry, 1965, *Committee of Enquiry into the Effects of Pesticides - Interview with Mr G.H. Mattingley, Potato Expert, Department of Agriculture, 25 March 1965*, Report.

[122] Department of Crown Lands and Survey, 1967, *Buzzacoot Fumigator July 17 1967*, Memorandum.

[123] The Committee of Enquiry, 1965, *Committee of Enquiry into the Effects of Pesticides – Report of Interview with the Vermin and Noxious Weeds Destruction Board 18 March 1965,* Report.

[124] Vermin and Noxious Weeds Destruction Board, 1969, Circular 75/69 Observation of Safety Precautions, Circular; Department of Crown Lands and Survey, 1967, *Buzzacoot Fumigator, Buninyong District 17 July 1967*, Memorandum; The Committee of Enquiry, 1965, *Committee of Enquiry into the Effects of Pesticides – Report of Interview with the Vermin and Noxious Weeds Destruction Board 18 March 1965*, Report.

[125] Consulate General of the United States of America, 1969, *White House restrictions on 2,4,5-T, 5 May 1969*, Letter.

[126] Department of Crown Lands and Survey, Vermin and Noxious Weeds Destruction Board, *1970, Circular No 3/70 - Hormone 2, 4, 5 T Weed Killing Chemical,* Circular.

[127] Vermin and Noxious Weeds Destruction Board, 1976, *Letter to Chief Industrial Hygiene Officer Department of Health RE Use of 2 4-D Ester*, Letter.

[128] Vermin and Noxious Weeds Destruction Board, 1976, *Letter to Chief Industrial Hygiene Officer Department of Health RE Use of 2 4-D Ester*, Letter.

[129] Vermin and Noxious Weeds Destruction Board, 6 September 1978, *Memorandum to Minister of Lands RE 2, 4-D and 2, 4, 5-T Controversy - Yarram Area,* Memorandum.

[130] Division of Inspection and Vermin and Noxious Weeds Destruction, *Confidential – Not for Distribution - Internal Circular Only: The Present Status of 2,4-D and 2,4,5-T,* Circular.

[131] Department of Crown Lands and Survey, 1978, *2, 4, 5-T and 2, 4-D and Tordon 50-D,* Memorandum; Department of Crown Lands and Survey, Division of Inspection and Vermin and Noxious Weeds Destruction, 1978, *Circular No. 52/78 - Use and Sale of 2,4-D and 2,4,5-T*, Circular.

In **July and August 1978** a series of safety lectures was delivered to all senior inspectors, inspectors, assistants and workmen across the state, including in Ballarat. Along with other OHS topics, the lectures included a presentation from Dr William Parsons (Keith Turnbull Research Institute, KTRI) entitled, Herbicides and Human Health.[133] In preparation for these lectures a draft circular was prepared for Ministerial approval, titled, *The Present Status of 2,4,-D and 2,4,5-T.*[134] It was anticipated these herbicides would be a major topic of discussion at the lectures and a 'Ministerial authorised statement' would support 'open discussion' and assist in 'clarifying the possible hazards associated with the use of these herbicides'.[135]

Figure 5.1 Photo of Department spray hand circa 1975.[136]

The 1980s

In **May 1982** the Victorian Government announced a new 2,4,5-T policy to ensure it was, 'used safely and efficiently'. This included:[137]

- training courses for users
- all government workers using it to wear PPE
- regular urine sampling and analysis during and after spraying season
- manufacturers to comply with an upper limit of TCDD in 2,4,5-T of 0.01 ppm.[138]

In **August 1982,** the Victorian Governor in Council proclaimed that high volatile forms of 2,4,5-T were prohibited for use to control trees, shrubs, and other woody plants and weeds. The proclamation prohibited the application of 2,4,5-T esters and salts from aircraft or misting machine, and use by any means within 50 m of any inhabited dwelling or public building or

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132 Department of Crown Lands and Survey, Division of Inspection and Vermin and Noxious Weeds Destruction, 1978, *Circular No. 58/78 - Use and Sale of 2 4-D*, Circular.

133 Department of Crown Lands and Survey, 1978, *Memorandum from Chief Inspector to Superintendent Vermin and Noxious Weeds Destruction Board RE Safety Courses*, Memorandum.

134 Minister of Health, 1978 (est), *Confidential – Not for Distribution, Draft, Internal Circular Only to Inspectors RE The Present Status of 2 4-D and 2 4 5-T,* Circular.

135 Vermin & Noxious Weeds Destruction Board, 1978, *Memorandum from Acting Chairman of the Vermin and Noxious Weeds Destruction Board to Acting Minister of Lands RE 2,4,5-T and 2,4-D - Field Staff Circular*, Memorandum.

136 Photograph supplied by Department of Environment, Land, Water and Planning

137 Department of Crown Lands and Survey, 1982, Herbicide Training Course notes on State Government policy on sale and use of 2,4,5-T in Victoria, Note; Keith Turnbull Research Institute, 1982, *Information Sheet No 32 - 2,4,5-T Policy*, Publication.

138 This new standard was made in law by Proclamation in August 1982. See: Victoria, *Victoria Gazette*, No. 80, 11 August 1982, p2659, Re: Proclamation pursuant to *Agricultural Chemicals Act 1958*, Prescribing Standards for Agricultural Chemicals and Declaring Products or classes of Products to be Insecticides and Plant Regulators Note, this was a rise in standards, from the limit of 0.1ppm established in Victorian law in 1977.

within any urban or semi-urban area, and for the control of blackberries bearing ripe fruit.[139] In summary, these restrictions effectively allowed the Department to continue using only low volatile salts and ester forms of 2,4,5-T for weed control, away from populated areas and using equipment that could accurately deliver the pesticides,[140] like spray guns.

In **October and November 1982**, a Training Course for Users of Herbicides was delivered to over 1,500 personnel across the state, including Ballarat. Participants included Department staff and representatives from Forests, National Parks, and Fisheries and Wildlife. A KTRI review of the course found the technical content may have been 'above the workers heads', but did not criticise the accuracy of the content.[141] Victorian Trades Hall Council (VTHC) feedback was that the information on 2,4,5-T was 'grossly misleading' and 'an outrageous misrepresentation of the true positions', and that 'if 2,4,5-T is as safe as it is represented in this lecture, then Department employees attending the training courses must have wondered why the Government had introduced special controls over [it]'.[142] This highlights that, in 1982, there was still a difference in viewpoint among key parties about the risk of 2,4,5-T to workers.

Following the course, a circular was issued to all senior inspectors and inspectors in **November 1982** outlining the various Department approaches to comply with the 2,4,5-T policy. Requirements for training, PPE, and TCDD levels in 2,4,5-T were said to have been (or were being) addressed. Procedures for regular urine sampling, however, were 'yet to be finalised by the Health Commission'.[143]

Attached to the November 1982 circular was the 'Government's policy statement on 2,4,5-T'. It provided a detailed eight-page summary of two Pesticides Review Committee (PRC) reports (1979 and 1981) into 2,4,5-T. It referred to 2,4,5-T bans and/or restrictions in the US, Sweden, Holland, Italy and Australia, and studies on associated health risks undertaken (or underway) in the US, UK, West Germany, Sweden, New Zealand and Australia. It stated that, 'there is no evidence whatsoever to connect the normal use of 2,4,5-T with human birth abnormalities (or, for that matter, any other health problem apart from dermatitis and allergies)' and that, 'it is the unanimous view of the Pesticides Review Committee that there is no scientific justification for discontinuing the use of 2,4,5-T in Victoria'.[144]

In **January 1983** a circular to all senior inspectors and inspectors stated that, 'recent publication of Notices of Intent to Spray in local papers throughout the state has undoubtedly increased the level of enquiry regarding the future use of 2,4,5-T'. The circular provided inspectors with information so they could reply to enquiries from the public stating that, 'the Department of Crown Lands and Survey believes that the use of 2,4,5-T should continue in a responsible manner and that such use poses negligible hazard to the operator, the public and the environment.'[145]

On **30 November 1983** the Victorian Government suspended 2,4,5-T following, 'a call by the Federal ALP member for Casey … for a ban … after three women in Diamond Valley [Victoria] suggested the spray could have caused their miscarriages'.[146]

On **16 December 1983** a circular sent to all senior land management officers and land management officers (formerly senior inspectors and inspectors) to advise them that the government's 2,4,5-T suspension was now lifted and that, 'restrictions in force before that date again apply'.[147]

In **May 1984** the State Government prohibited 2,4,5-T use in urban and semi-urban areas under s 10A of the *Agricultural Chemicals Act 1958*.[148]

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[139] Victorian Parliament, *Victoria Gazette*, No. 80, 11 August 1982, 2659, Re: Proclamation pursuant to *Agricultural Chemicals Act 1958*, Prescribing Standards for Agricultural Chemicals and Declaring Products or classes of Products to be Insecticides and Plant Regulators.

[140] Norris, LA, 1971, *Chemical Brush Control: Assessing the Hazard, Journal of Forestry*, 1 October 1971, Volume 69, Number 10, Society of American Foresters, Paper, p715-720(6).

[141] Department of Crown Lands and Survey, 1982, *Circular No. 69/82 - Training Courses for Users of Herbicides*, Circular; Keith Turnbull Research Institute, 1982, Minutes the Meeting RE: *Herbicide Safety Courses Review* Held on 1 December 1982 Minutes.

[142] Victorian Trades Hall Council, 1983, *Letter to Minister of Lands RE feedback on Training Courses for Herbicide Users*, Letter.

[143] Department of Crown Lands and Survey, 1982, *Circular No. 90/82 - Future Use of 2,4,5-T*, Circular.

[144] Department of Crown Lands and Survey, 1982, *Attachment to Circular No. 90/82 Future Use of 2,4,5-T RE Some Information on 2,4,5-T*, October 1982, Report.

[145] Department of Crown Lands and Survey, 1983, *Circular No. 5/83 - Enquiries on the Use of 2,4,5-T*, Circular.

[146] Broadbent, D, 1983, The Age, *Labour MPs Demand a Ban on 2, 4, 5-T*, Newspaper Article.

[147] Department of Conservation, Forests and Lands, 1983, *Circular No 94/83 - Re Use of 2,4,5-T*, Circular.

[148] Victorian Government, 1983, *Agricultural Chemicals Act 1958* Prohibited Constituents of Agricultural Chemicals Used or intended to be Used for Prescribed Purposes, p4048, cited by Department of Conservation, Forests and Lands, Keith Turnbull Research Institute, 1984, *Revised 2,4,5-T Policy*, Report.

In **June 1987** the Minister announced a, 'review of pesticide use for the control of vermin and noxious weeds within DCFL … to examine the impact of pesticide use on the health of workers, farmers, and rural communities …'.[149] The Review of the Use of Pesticides in the Department of Conservation, Forests and Lands was finalised in February 1988. It provided further proof that 2,4,5-T use by the Department had been significantly reduced between 1984–85 and 1986–87.[150]

By **July 1987**, under the Minister's direction, the Department had, 'reduced the use of 2,4,5-T and has taken alternative steps in its weed management programs'.[151]

By **June 1988**, 2,4,5-T was no longer being used or sold by the Department.[152]

At the time of writing (**November 2015)** 2,4-D is available for weed control.

OHS IN CONTEXT

The regulatory framework and workplace culture for OHS, public health and agriculture changed significantly between 1965 and 1995, and continues to change.

Regulatory framework for safe use of pesticides

During the 1950s and 1960s the VNWDB assessed the effectiveness of 2,4-D and 2,4,5-T. Both were found to be effective and were widely used across Victoria and the world with little attention paid to precautions for workers' safe use of pesticides. In fact, the key OHS legislation of the day, the *Labour and Industry Act 1958*, focused more on safety in factories, shops and offices, and not safe work at forest or agriculture work sites. The Act was amended in 1978 to explicitly confirm that it bound the Crown with the inference being that previous applications of the Act were uncertain. Rather than being explicitly stated in the legislation, the key employer obligation for employee health and safety was under the common law principle of the duty of care. The *Industrial Safety, Health and Welfare Act 1981* significantly increased the expectations of all employers such as the Department and placed responsibility on employees to work in a safe manner. The joint responsibility of employers and employees for workplace safety substantially increased again with the *Occupational Health and Safety Act 1985*.

The workers' perspective

Submissions and interviews[153] describe the sprayer's job as tough, hot work, most often outdoors and in isolated bush locations. Spraying equipment cleaning and mending was often done on-site and at the depot if significant work was required. Small, depot-based teams worked under the instruction of an inspector or district supervisor. It was dirty, smelly unforgiving work often in difficult locations and bad weather. The work day, determined by the inspector, saw small, usually unsupervised, teams spray for five to six hours. Inspectors or their assistants may visit for a few hours a week. Spraying took place over five to six months from spring to autumn but, in climatically favourable years, weed spraying could last for nine months of the year.

A common memory is of a pungent smell that clung to clothes. Men returning home could be smelt from quite a distance and work clothes had to be washed separately. As one submission described it, 'At the end of a day's work you could walk into any pub and easily get a beer simply because no one would stand near you because of the chemical smell.'

Due to the length of time that has passed, the evidence provided isn't specific to exact dates so the Inquiry has assessed the submissions and interviews in two periods – up to the early 1980s, and then from the early to mid-1980s to 1995. Submissions and interviews that cover the earlier period describe a time where workers were glad to have a job and they just got on with it. Any concerns were almost always raised informally with immediate supervisors and workers were strongly encouraged to just 'get on with the job', with some even warned they may lose their job if they didn't comply. (Chapter 9 deals with the Department's formal processes.) Typical comments included:

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149 Department of Conservation, Forests and Lands, 1987, *Pesticide Review*, Memorandum.

150 Department of Conservation, Forests and Lands and Wells GJ, 1988, *Review of the Use of Pesticides in the Department of Conservation, Forests and Lands,* Report.

151 Department of Conservation, Forests and Lands, Land Protection Division, 1987, *Sale of 2,4,5-T Through Pesticide Supply Scheme*, Memorandum.

152 Minister for Conservation, Forests and Lands, 1988, *2,4,5-T ban*, Letter.

153 See Appendix 3

There was talk between the staff that the bosses would say if they were to get more safety equipment that one of us would have to leave.

I was raised in Ballarat in a working class family. I was taught to be grateful for any job I was fortunate enough to have, and to do as I was told … At that time it would not have even occurred to me to question a directive from my employer.

When the regional inspector came up from Geelong I asked him about the mixing of 2,4-D and 2,4,5-T together, what were the dangers of it and he said eating too much salt was more dangerous.

[Name redacted] and his crew did believe the chemical cocktail they were using was dangerous. They were told to leave if they didn't like it. "We stayed because we wanted the jobs, we liked the jobs."

He says he was always wary about the effect the chemicals may be having on crews. "We always said to the bosses, this stuff is terrible, and they would say, it won't hurt you," he says. "You had no choice if you wanted a job. You had to work there and use it."

I was only a kid working with two older blokes, I didn't ask any questions about anything much, I did as I was told. The smell of 2,4-D and 2,4,5-T was overwhelming and workers asked if a washing machine could be bought to launder clothes at the depot rather than having to take them home. They said, oh yeah, we can get a washing machine but it will cost one man his job.

Back in the 1960s there was a general acceptance that that was the way it was and sprayers should just get on with it. In this command and control environment rocking the boat was not tolerated. Workers had little or no PPE and workers would sometimes get saturated with the chemicals due to leaking knapsacks and/or by the mist. As one interviewee said, "There was no safety training, no protocols and no protective clothing. They were the days when dictatorial supervisors did not look kindly on health concerns. They used to say you could drink it." Little changed during the 1970s, even with the intense media interest following concerns over Agent Orange use in the Vietnam War. Management regularly assured sprayers they were safe. The Inquiry has one anecdote of a manager who said it was safe enough to drink and did so. Whether this was folk law or fact can't be determined but it does illustrate management's efforts at reassurance. In their defence, however, management was only ever following the latest scientific information, which indicated there were no safety issues.

OHS took a higher profile in the 1980s and this continued to grow into the 1990s. A number of interviewees commented that by the mid-1980s discussion and action started to take place around better access to PPE. However, even by the early 1990s there was still so much more that needed to be done and Ballarat region personnel were frustrated at times in attempts to develop a safer workplace culture. The Chemical Use and Safety Working Group, Ballarat Region, reported in minutes on 29 April 1992 concerns that, 'AWU sprayers should not be "chastised" or labelled "shit stirrers" or "trouble makers" (by other workers) for adopting safe work practice after attending [*sic*] Poison Safety Training School' … and also that the 'Department is falling down at top (state) level, e.g. such as employees having to fight for current safety data sheets.'[154]

Table 5.1 illustrates general impressions about the changing level of knowledge about the chemicals, and the safety culture that was observed in evidence available to the Inquiry. The evidence drawn on includes government file records, changes to the law and the recollections of workers.

Table 5.1 Summary of knowledge and culture of the day

Years	Science	Laws/Regulations	Workplace Safety Culture	Community Concerns
Pre-1970 DISCOVERY	2,4-D and 2,4,5-T considered very effective and economical for weed control. TCDD impurity known about but no manufacturing standards in place.	Primarily concerned with chemical effectiveness, little concern about safety.	Blasé	Little

[154] Chemical Use and Safety Working Group Ballarat Region, 1992, Minutes of the Meeting Held on 28 April 1992, Minutes.

Years	Science	Laws/Regulations	Workplace Safety Culture	Community Concerns
1970–1982 CRISIS, CONCERN and DEBATE	Questions raised about dioxin impurity (TCDD) in 2,4,5-T. Significant debate about safety but both chemicals still used.	In 1976, first purity standards set for 2,4,5-T at 0.1 ppm TCDD, made law in 1977. In 1982, raised standard for purity to 0.01 ppm TCDD. 2,4-D and 2,4,5-T gazetted as poisons.	General behaviour blasé, but workers beginning to raise concerns.	Significant
1982–1995 DECISION AND EVOLUTION	Dioxins in 2,4,5-T recognised as a health concern.	Fundamental upgrade in the law to 'mature safety laws'.	Beginning to be taken seriously.	Very significant but improved safety systems mitigate the risk.

WHAT INFLUENCED WHAT WAS CONSIDERED 'SAFE'?

To properly understand the attitudes to safety of the period and put past practices into context, this section outlines what the Inquiry understands to have influenced the workers, the supervisors and the Department throughout the period when they were working out what was safe. These should be seen against the background of five overarching influences.

1. There was a community 'war on weeds' to improve agricultural yields and productivity.[155] Pesticide use was greatly influenced and encouraged by the rural community, workers and supervisors.[156]
2. General OHS requirements had a very low profile until 1981, when industrial health and safety obligations were introduced in law, and then again with substantial change in 1985 that gave worker occupational safety a high profile.[157]
3. Evidence regarding chemical approvals by the National Health and Medical Research Council (NHMRC), PRC and relevant state and Commonwealth bodies indicates these bodies all assumed that the chemicals would be used as directed and with appropriate PPE.
4. As numerous Department workers attest in interviews and submissions, management regularly insisted that both chemicals were 'safe' notwithstanding the fact that both 2,4-D and 2,4,5-T were officially declared as poisons in 1972.[158]
5. The language of bulletins, circulars, information sheets and memorandums swung between being:
   a. Ambiguous, i.e. PVC or rubber gloves **MAY** be used or arms and legs **SHOULD** be covered[159], 'an employee cannot be forced to wear protective clothing and equipment' and it is 'the employer's responsibility to make the equipment available and to urge the employee to use it'.[160]
   b. Unambiguous, i.e. **USE** gloves and face shield when mixing concentrations.[161] Inspectors are to, 'Take disciplinary action against any employee, who by refusal or neglect fails to observe safety requirements'.[162])

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[155] Weekly Times, 1973, *New Discovery Will Aid War on Weeds*, 16 May 1973, Newspaper Article.

[156] Shire of Creswick, 1964, *Letter of submission to the Committee of Enquiry into the Effects of Pesticides*, Letter.

[157] *Occupational Health and Safety Act 1985*, and *Industrial Safety, Health and Welfare Act 1981.*

[158] Victorian Parliament, Victoria Gazette, No. 97, 15 November 1972, 3603, Amendment to schedules by proclamation pursuant to Poisons Act 1962 following the Proclamation that 2,4,5-T (Schedule 6, Industrial and Agricultural Poison) and 2,4-D (Schedule 5, Domestic Poisons) were scheduled poisons.

[159] Department of Crown Lands and Survey, 1979, *Pesticide Information No. 1.3, Toxicity of Pesticides, June 1979*, Information Sheet.

[160] Department of Crown Lands and Survey, 1983, *Safety Clothing and Equipment*, Memorandum; Department of Crown Lands and Survey, 1983, *Circular No. 8/83 - Safety Clothes*, Circular.

[161] Department of Crown Lands and Survey, 1983, *Recommendations for the Control of Noxious Weeds in Victoria, Bulletin No 3F,* Bulletin.

These influences were then considered to look at the question from the workers', supervisors' and the Department's perspectives.

The workers

A command and control style of management (leaders know best)

The workforce within the early part of the period (1965 to 1981) was prepared to do a very dirty job, glad to be employed and not at all keen to question their command and control style managers. It was a culture in which you did what the boss told you to do and got on with the job to avoid being called a "wimp".

Value of a job in a rural community during a drought

For low-skilled workers in rural Victoria a government job offered significant job security when compared to farm work that could, literally, change with the seasons. For this reason workers were not keen on raising their concerns.

OHS

Before the early 1980s there was little emphasis on OHS. PPE was prescribed but generally not worn as it was hot and impractical, and management did little to enforce its use. From the early 1980s, however, things began to change as OHS became more common before rapidly growing in importance from 1985.

When used as directed

Interviews and submissions indicate that when supervisors (senior inspectors, inspectors, assistant inspectors) verbally communicated with employees, the phrase "the chemicals are safe" was not usually followed by "when used as directed". And there is little evidence employees read the labels before use. Instead, they relied almost entirely on verbal directions and/or common sense.

Supervisors

The Department told them the chemicals were safe

When the supervisors said it was "safe" this was based on what they were told by the Department, which relied on international and Australian scientists who claimed both chemicals were safe. While internal management circulars regularly carried the phrase, 'Read the label, heed the label', it's not clear whether these types of warnings were communicated often enough or displayed prominently enough.

Small communities

Small communities with close relationships made it harder for supervisors to order subordinates they were also friends with to wear PPE on very hot days. In addition, as many of these groups operated in very small rural communities, some supervisors were able to create their own fiefdom and wield considerable power and influence.

Poisons are freely available

Many poisons are freely available (e.g. oven cleaner is poisonous if swallowed) but they are all considered safe if used as directed and with appropriate precautions. Within that context, one can understand how managers could say 2,4-D and 2,4,5-T were safe if used as directed and with appropriate precautions.

Culture of compliance

This was lax, voluntary, and compliance and supervision of safe work practices varied depending on the supervisor/manager.

Department

Told by NHMRC and the PRC the chemicals were safe

Both the NHMRC and the PRC provided advice about the registration of chemicals for sale on the open market. The members of those committees included eminent experts who drew on the most up-to-date international science. The Department would have had no reason to question their advice.

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[162] Department of Crown Lands and Survey, Vermin and Noxious Weeds Destruction Board, 1971, *Circular 5/71 from the Chairman VNWDB to all Inspectors for information of all employees – Workers Compensation and Safety on the Job*, Circular.

The decision makers of the day set limits

The manufacture of 2,4,5-T produced a dangerous dioxin called TCDD. The decision makers of the day set a maximum limit of TCDD and, at that limit, 2,4,5-T was deemed 'safe to use', importantly, when used 'as directed'. While no limits were set on TCDD concentrations before 1976 it's believed that 2,4,5-T manufactured between 1965 and 1969 was usually between 0.1 ppm and 0.5 ppm, and between 1970 and 1975 was at or below 0.1 ppm TCDD in 2,4,5-T.[163] There is some evidence of bad batches being above that.[164]

- In 1976, the Australian Standard AS 1175-1976 and subsequently in 1977, the law, required all manufactured product to be below 0.1 ppm TCDD.[165]
- In 1982, manufacturers had to comply with a maximum limit of 0.01 ppm of TCDD.

Today the scientific advisory bodies recommend a different measure: exposure should be less than 70 pg/kg bw/month.)[166]

Defending the status quo

The Department had a habit of defending the status quo.

THINGS HAVE CHANGED SIGNIFICANTLY

The numerous interviews and submissions describe behaviours that would be unacceptable today:

> *I can remember crew spraying in shorts and singlets during summer without any PPE as it was not issued, this did change later when staff received formal OHS training, inductions, chemical use qualifications and the issue of appropriate PPE.*
>
> *Clean-up of spray equipment would take place on-site when water was available or back at the depots. Spray crew would still be in the same clothing they sprayed in as I don't recall any crew ever changing into clean clothes, a basic shower facility was not available when I first commenced employment.*
>
> *The temperature was high so doing the task in shorts and T-shirts were more comfortable even though that was less than the required standard of dress.*
>
> *Apart from long rubber gloves, he never wore other protective clothing, masks or glasses.*
>
> *We were never given any lectures or talks on handling procedures, nor informed if there were dangers associated with the spraying. No waterproof clothing, hats, gloves or breathing apparatus were provided.*
>
> *With no protective clothing only bib and brace overalls and rubber boots.*
>
> *Mixing chemicals with bare arms in the field rather than going back to do it properly in the depot.*
>
> *Employees standing under the flight path of aerial sprayers and checking the concentration of the spray.*
>
> *Chemicals were mixed on site, without the protection of any personal protective equipment. Poisons were carried in the back of the work vehicles, along with our lunches and drinks. On very hot days being under the spray was actually quite cooling.*

There were a few comments made that indicate changes from around the mid-1980s:

> *We wore waterproof jackets and trousers and hats while spraying, and washed hands and faces with water upon completion.*

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[163] Westman, W.E. et al, 1973, *The use and effect of plant-hormone herbicides (2,4-D and 2,4,5-T) in Australia*, Paper.

[164] Unknown author, 1977, *Note 3 – TCDD Levels of Australian 2,4,5-T products (To 1977)*, File Note; Department of Agriculture, 1978, *TCDD in 2,4,5,T 27 October 1978*, Letter; and Attachment: *Information in Respect to Sample Submitted for TCDD Analysis by Victorian Department of Agriculture 20 March 1978*, Letter.

[165] Victorian Parliament, Victoria Gazette, No. 58, 6 July 1977, 2212, Re: Proclamation pursuant to Pesticides Act 1958, Standards for Pesticides.

[166] Office of Chemical Safety, 2005, *National Dioxins Program Technical Report No. 12: Human Health Risk Assessment of Dioxins In Australia*, Australian Government, Department of the Environment and Heritage, p132, <https://www.environment.gov.au/system/files/pages/e66156a9-a7ac-4bc9-b256-5cf41daaaed1/files/report-12.pdf> [accessed 9 November 2015].

> *I must mention, chemical protection + safety procedures have improved dramatically these days, which wasn't the case years ago. Early days of safety and protection at the department was fairly slack to say the least not until my later days of spraying at the department was precaution and safety procedures stepped up and tightened up.*

While containers were labelled, few recall reading them and they usually depended on instructions from the supervisor. Labelling and safety instructions were brief at the start of the Period. Label safety directions remained brief throughout the Period, but gradually material safety data sheets and safety instructions became more extensive and by 1995 were substantive[167] with ongoing improvements ever since.

Interviewees indicate that training was on the job and conducted mostly by leading hands or experienced sprayers. Inspectors were fully trained at KTRI seminars and were then expected to train workers with the latest training materials. Interviews suggest training quality varied widely depending on the inspector but the weight of input suggests that training was mostly either not undertaken or done poorly. Safety compliance was not greatly supervised and only showed signs of improvement from the mid-1980s.

Finally, as a way to understand how people use the word 'safe' when they refer to 'using as directed by the label', one can consider a common analogy – the car. As a general rule, over time, knowledge of what is safe, and the ability to make things safer improves. A well-serviced car that's always driven within the law may be considered 'safe'. But there can never be an absolute guarantee that no car accident will occur. Over time, car transport is becoming safer and annual per capita road fatalities have declined over decades. Back in the 1960s, it was not mandatory to wear a seat belt or to drive with a blood alcohol level below 0.05. As knowledge and technology have advanced, seat belts must be worn, drink driving is not permitted, and car safety features are improving, like the inclusion of air bags for passenger protection. However, even when a driver complies with the safety standards and maintains the car, there is a risk of road fatality. So despite the driver 'following directions on the label' there is always a slight risk of danger or damage in a car despite it being described as 'safe'.

[167] DOW Chemical (Australia) Pty. Ltd., 1965 (est), *Tordon 50-D, Label*; NuFarm Chemicals Pty. Ltd., 1987, *Low Volatile Ester 40 Herbicide, Label*; Nufarm Chemicals Pty. Ltd., 2011, *Amicide 625-Low, Label; Velsicol Australia Ltd, Banvel 2005 Product Information Bulletin*, Manual; Nufarm Chemicals Pty. Ltd., 1985, *Nufarm L.V. Ester 40 Material Safety Data Sheet*, Manual.

Part 3: Terms of reference

Chapter 6: Regulations, laws and Australian Standards between 1965 and 1995

TERMS OF REFERENCE

As part of its Terms of Reference, the Former Lands Department Chemical Inquiry was asked to:

> *Identify and review regulations, laws and Australian Standards relating to the handling, storing and use of 2,4-D and 2,4,5-T that applied between 1965 and 1995.*

Key Messages

- During the Period, the legislative responsibilities and accountabilities for safe storage and use of agricultural chemicals, and for the protection of the health and safety of workers exposed to those chemicals, were clarified and strengthened. The most significant change was the progressive ramping-up of regulation of the workplace under OHS and workers compensation regulations and laws.
- By the end of the Period, the regulatory responsibility of the Commonwealth and its agencies included approval and setting of agricultural chemicals standards up to the point-of-sale.

INTRODUCTION

The Department's land management and weed control functions, and its obligations to its workers between 1965 and 1995 were governed by extensive, constantly evolving and increasingly complex laws, regulations and Australian Standards. This chapter examines all of these, Chapter 7 will examine the responsibilities and accountabilities of the various parties being regulated and/or involved in the regulation process, including the Department, and Chapter 9 analyses the Department's compliance.

Overall, this task has involved consideration of over 120 Acts and Regulations and 66 Australian Standards. To make it as simple as possible we've broken this into the following seven sections.

LAND MANAGEMENT[168]

The primary responsibility of the Department was to administer the *Land Act 1958*. In addition, the Department was required to administer other Acts including the *Vermin and Noxious Weeds Act 1958*, which required controlling vermin and noxious weeds on all lands. Under the *Vermin and Noxious Weeds Act 1958* the Superintendent had wide powers to enter land to destroy and suppress noxious weeds.[169]

The VNWDB was created in 1959 and appointed by the Governor in Council. The VNWDB conducted research into vermin and noxious weed control and instructed and supervised landowners with special problems.

The VNWDB was subsumed into the Department in 1977 but its functions remained.

FUNGICIDES AND PESTICIDES[170]

The Acts and Regulations around fungicides and pesticides began with ensuring fungicides were fit-for-purpose and evolved into registering chemicals not harmful to agriculture (e.g. damage to crops from aerial spray drift) and, as these chemicals were used domestically, monitoring public health (e.g. poisons). The regulations also began specifying 'how-to-use' labelling.

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[168] See Appendix 1.1 Land Management Acts and Regulations.

[169] *Vermin and Noxious Weeds Act 1958* s 13(3).

[170] See Appendix 1.2 Fungicides and Pesticides Acts and Regulations. See also Appendix 1.4 Commonwealth Legislation and Codes.

The government started to recognise that the safety of users needed to be enshrined in legislation and, in 1964, the first evidence of this appeared in the new *Pesticides Act 1964*, which regulated the range of products on the market to eradicate vermin and weeds.

When introducing the *Pesticides Bill 1964* into Parliament the Minister for Lands noted in his second reading speech that the amendment to the *Pesticides Act 1958* was to 'bring [the Act] into conformity with present day requirements and to close loopholes which have been discovered and exploited by manufacturers and vendors'.[171]

And further:

> *The Act is designed to protect the purchasers and to prevent their exploitation by ensuring as far as possible that pesticides are true to label, and that the constituents are effective. It is also intended to protect users against the hazards associated with the use of pesticide. These ends are achieved by means of a system of registration, by labelling requirements, and by inspection of stocks and analysis of samples.*[172]

Notwithstanding the significance of these changes, worker safety was not considered to be as high profile/prominent as it is today.

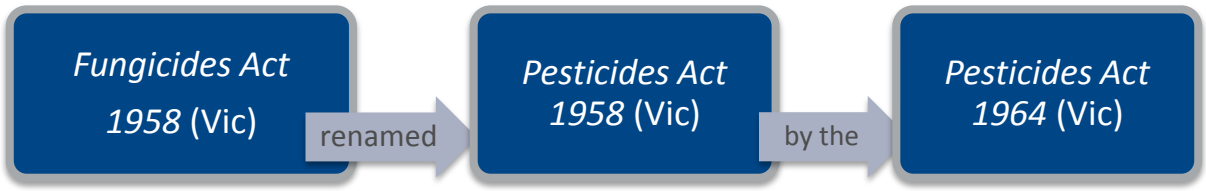

Figure 6.1 Evolution of the Pesticides Act.

By 1980, moves were made towards even stricter controls and the Act was amended. In his second reading speech the Minister for Agriculture explained that the reason for amending the Act was:

> *… to introduce stricter controls over the use of pesticides in Victoria. Its major purpose is to increase the options available to the government in restricting the use of agricultural chemicals when necessary.*[173]

During the parliamentary debate the then opposition stated, 'one of the worries concerning the use of these chemicals is that the symptoms do not develop for up to 30 years.'[174]

To this end the *Pesticides Act 1958* was renamed the *Agricultural Chemicals Act 1958* (retrospectively), and new powers were introduced to allow the Governor in Council to prohibit the use of chemicals with certain ingredients or constituents.[175]

Figure 6.2 Evolution of the Agricultural Chemicals Act.

[171] Victorian Parliament, *Parliamentary Debates*, Legislative Assembly, 27 October 1964, 1104 (J. Balfour, Minister for Lands).

[172] Victorian Parliament, *Parliamentary Debates*, Legislative Assembly, 27 October 1964, 1104 (J. Balfour, Minister for Lands).

[173] Victorian Parliament, *Parliamentary Debates*, Legislative Assembly, 21 November 1979, 4796 (I. Smith, Minister for Agriculture).

[174] Victorian Parliament, *Parliamentary Debates*, Legislative Council, 16 April 1980, 8049 (R. McKenzie).

[175] Victoria Parliament, *Parliamentary Debates*, Legislative Assembly, 21 November 1979, 4797 (I. Smith, Minister for Agriculture).

Authorisation/approval of pesticides

Getting a chemical approved was a complicated process through multiple committees at Commonwealth and state level with representation of eminent scientists of the day. In 1965, the states were fully accountable for the registration of pesticides. From 1969, both the Commonwealth and states shared the task, and the assessment or 'clearance for use' evolved as a Commonwealth role. In 1988, the Commonwealth Government was given statutory responsibility for the 'clearance' process and the states retained responsibility for registration for use. Then from 1992, the Commonwealth was made responsible for both clearance and registration through the establishment of a national regulator. These changes were implemented from 1992 to 1995. The states retained responsibility for regulation of agricultural chemicals after the point-of-sale.

While the Department was not responsible for the clearance and registration processes, it did have officers on the various committees that made recommendations on these matters, and was a major consumer of the products approved for sale. These and other accountabilities are further discussed in Chapter 7.

Details of the evolving registration and clearance processes are presented below. This serves as a useful illustration of the level of rigour involved in these processes, and demonstrates why it would have been reasonable for users (including the Department) to have confidence in the safety of registered products.

1950s and 1960s – Early registration process in Victoria

In Victoria the Department of Agriculture was responsible for registering pesticides under the *Pesticides Act 1958*. The primary purpose of registration was to protect the buyer by ensuring that pesticides contained 'the stated active constituent(s) in the stated proportion(s)'.[176]

The registration process involved the following steps:

- An application was forwarded to the Department of Agriculture covered by a statutory declaration and accompanied by the prescribed fee. The application had to outline:
  - applicant's name and place of business
  - pesticide's distinguishing name (brand)
  - purpose
  - manufacturer
  - where it was made
  - claimed active constituents and their percentage.
- A label or draft label was submitted.
- New pesticides had to include advice regarding:
  - toxicity
  - hazards to operators
  - how to use it
  - likely residues on harvested fruit, vegetables and other products when used as directed
  - value and effectiveness
  - the need for it in Victoria
  - if used overseas were there any related restrictions.
- The application was considered by Department officers.
- If it was a new pesticide it was referred to the Interdepartmental Committee on Toxic Hazards of Pesticides to assess toxicity and residue levels.

Department officers had to be satisfied that the product would be effective against the pests for which it was to be used. The Director of Agriculture made the final decision on registration (Figure 6.3).

[176] Government of Victoria, Committee of Enquiry, 1966, *The Effects of Pesticides,* Report, p53.

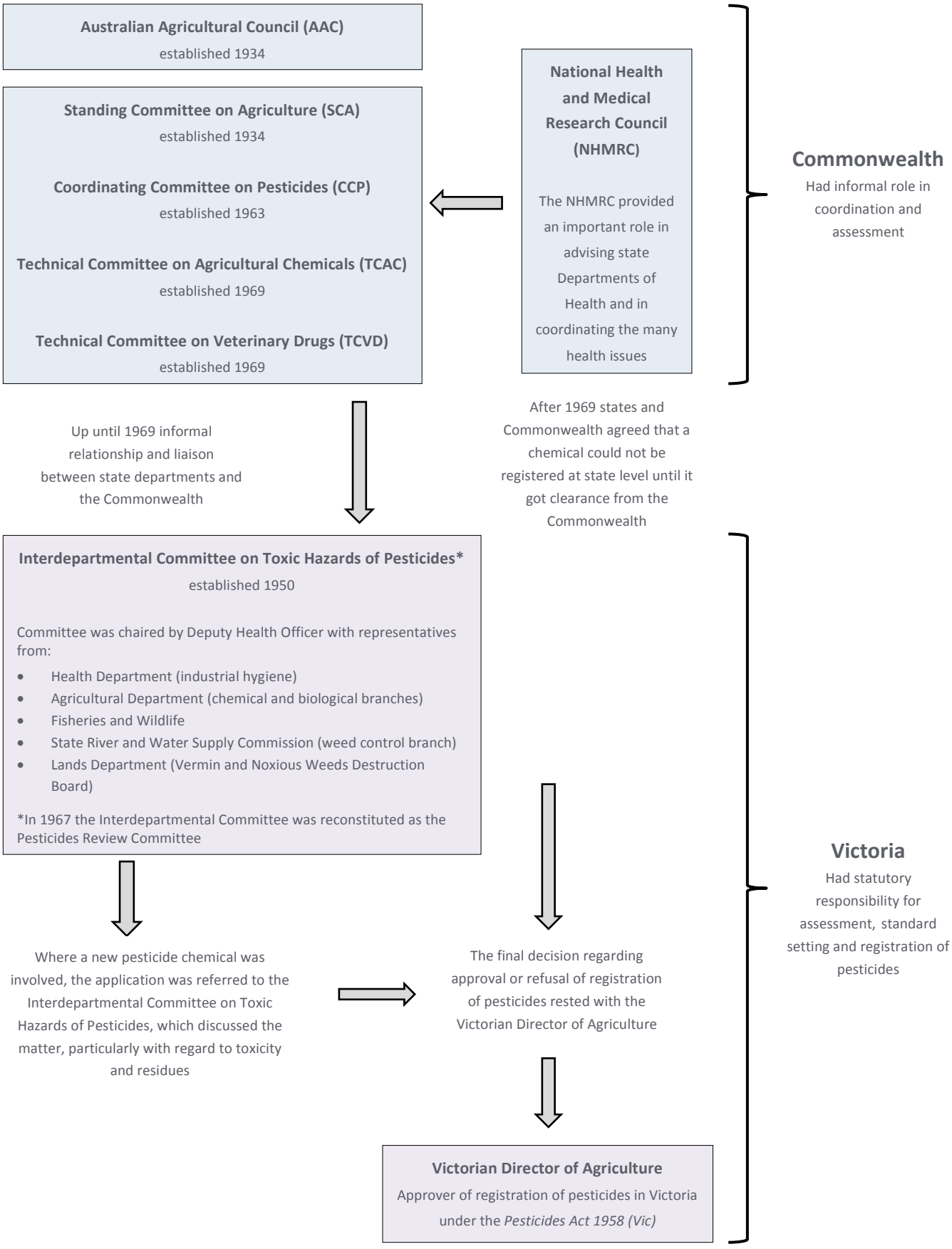

Figure 6.3 Clearance and registration process, 1950s and 1960s

Interdepartmental Committee on Toxic Hazards of Pesticides

In 1950, after other countries reported health problems associated with organophosphorus compounds, the National Health and Medical Research Council (NHMRC) recommended that the Victorian Department of Health establish the Interdepartmental Committee on Toxic Hazards of Pesticides. The committee primarily represented the Department of Health and the Department of Agriculture and was concerned with the toxic hazards associated with pesticides, and associated measures to protect users and the public.[177]

The interdepartmental committee was reconstituted in 1960, in recognition of 'the introduction of more toxic chemicals as pesticides with hazards not only to man but to domestic animals, fish and wildlife.'[178] It consisted of chairmanship of the Deputy Health Officer with representatives of the Health Department (industrial hygiene), Agricultural Department (chemical and biological branches), Fisheries and Wildlife, State Rivers and Water Supply Commission (weed control branch) and the Department (VNWDB).

Before the Department of Agriculture registered a new pesticide with known or suspected toxicity, the Committee would consider the available toxicity data and advise if registration should be granted and, if so, what precautions and/or precautionary wording was needed.

In 1967, the Interdepartmental Committee on Toxic Hazards of Pesticides was renamed the Pesticides Review Committee.

1970s and 1980s – A move towards national uniformity

The problems of varying state requirements for pesticide registration saw the Commonwealth develop nationally uniform requirements, procedures and assessments for registration. In March 1969, the Standing Committee on Agriculture (Commonwealth) established the Technical Committee on Agricultural Chemicals (TCAC) and the Technical Committee on Veterinary Drugs (TCVD) as subcommittees of the Coordinating Committee on Agricultural Chemicals (CCAC). The TCAC administered and coordinated the evaluation of applications for new pesticides and new uses of established ones. The TCVD had a similar role with veterinary chemicals. State authorities agreed to withhold registration of pesticides until the TCAC/TCVD had cleared them. Under this administrative arrangement, assessing agricultural and veterinary chemicals became a two-stage process, with the Commonwealth responsible for 'clearance' and states responsible for registration of products[179] (Figure 6.4).

[177] Government of Victoria, Committee of Enquiry, 1966, *The Effects of Pesticides,* Report p56.

[178] Government of Victoria, Committee of Enquiry, 1966, *The Effects of Pesticides,* Report p57.

[179] Michael O'Connor, Director, Advertising Compliance, Regulatory Practice, Education and Compliance Branch Therapeutic Goods Administration and Dr Les Davies, Principal Scientist, Pesticides, Australian Pesticides and Veterinary Medicines Authority (APVMA), 2015, *Regulation Of Agricultural And Veterinary Chemicals In Australia: History, Roles And Relationships (draft), Report*.

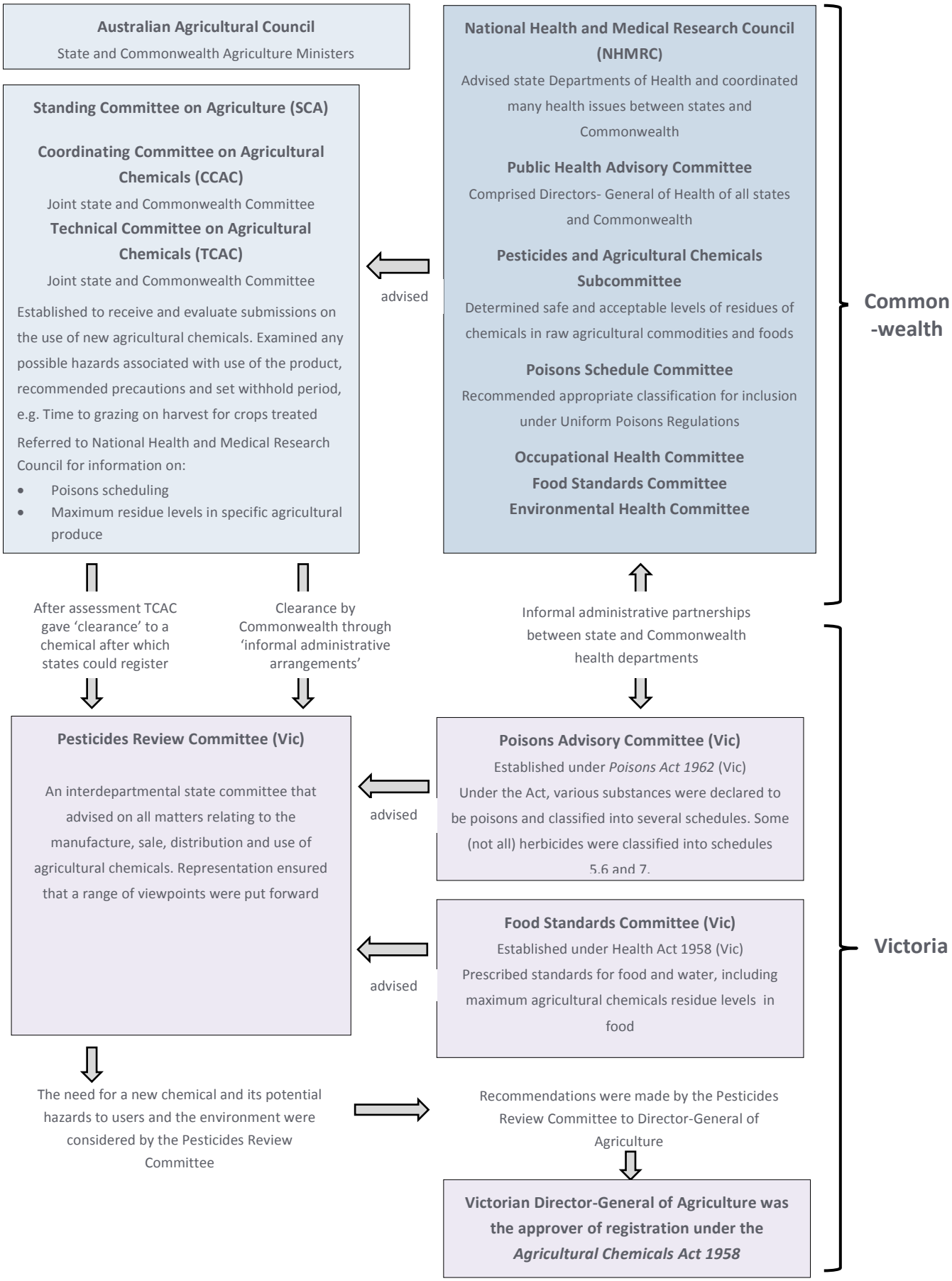

Figure 6.4 Clearance and registration process, 1970s and 1980s.

1990s – Introduction of a national regulatory system

In 1987, Australian agriculture faced a major trade crisis when organochlorine residues (DDT, dieldrin) were found in beef to be exported to the US, placing the $2 billion market for Australian meat in jeopardy.[180] A national debate on managing agricultural chemicals followed and, in 1989, the voluntary process of Commonwealth clearance was replaced with a legislative process under the auspices of the newly created Australian Agricultural and Veterinary Chemicals Council (AAVCC). A Commonwealth Senate Select Committee on Agricultural and Veterinary (AgVet) Chemicals was also established and reported back in July 1990 that the legislative basis for chemical regulation was too complex and required significant rationalisation. Its significant recommendation was that the inefficient state-based registration and national clearance scheme should be replaced by a National Registration Scheme. This was implemented under the *Agricultural and Veterinary Chemicals (Administration) Act 1992 (Cth)* and a Commonwealth statutory authority called the National Registration Authority for Agricultural and Veterinary Chemicals, now the Australian Pesticides and Veterinary Medicines Authority (APVMA), was established and began assessing agricultural and veterinary chemicals in 1995.[180]

Since 1995, the Commonwealth has regulated AgVet chemicals up to and including the point-of-sale, with states and territories regulating their use after sale. The Commonwealth assesses the suitability of new AgVet chemicals and products and the conditions of use on the label, in accordance with the AgVet Code contained in the *Agricultural and Veterinary Chemicals Code Act 1994 (Cth)*. The registration criteria of the AgVet Code at the time of the legislation's enactment stipulated chemicals and products would not:

- be an undue hazard to the safety of people exposed during handling or to their residues
- be likely to have an effect harmful to human beings
- be likely to have an unintended effect harmful to animals, plants or the environment
- unduly prejudice Australia's international trade or commerce.[181]

Australia currently has over 8000 agricultural chemicals registered with APVMA.[182] In addition to assessing new chemicals the APVMA may reconsider the registration of a chemical product or approval of an active constituent of an existing chemical or product at any time under the AgVet Code[183]. These powers are generally administered through the APVMA's Chemical Review Program, when new research or evidence raises safety concerns. Some aspects of the assessment are performed within the APVMA in consultation with other relevant agencies like Food Standards Australia New Zealand (FSANZ). The Office of Chemical Safety (OCS) in the Department of Health (Cth) also assesses risks to the health of workers and the environment. Once a review has been initiated a chemical can be deregistered if there's an unacceptable risk that it can't be adequately managed, such as by changing its label conditions (Figure 6.5).

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[180] Radcliffe J. , 2002, *Pesticide Use in Australia, Australian Academy of Technological Sciences and Engineering,* Paper, *p167-168.*

[181] *Agricultural and Veterinary Chemicals Code Act 1994 (Cth) s 14(3) (e).*

[182] Australian Pesticides and Veterinary Medicines Authority, *Public Chemical Registration Information System Search, <https://portal.apvma.gov.au/pubcris>* [accessed October 2015].

[183] *Agricultural and Veterinary Chemicals Code Act 1994* (Cth) *s 31.*

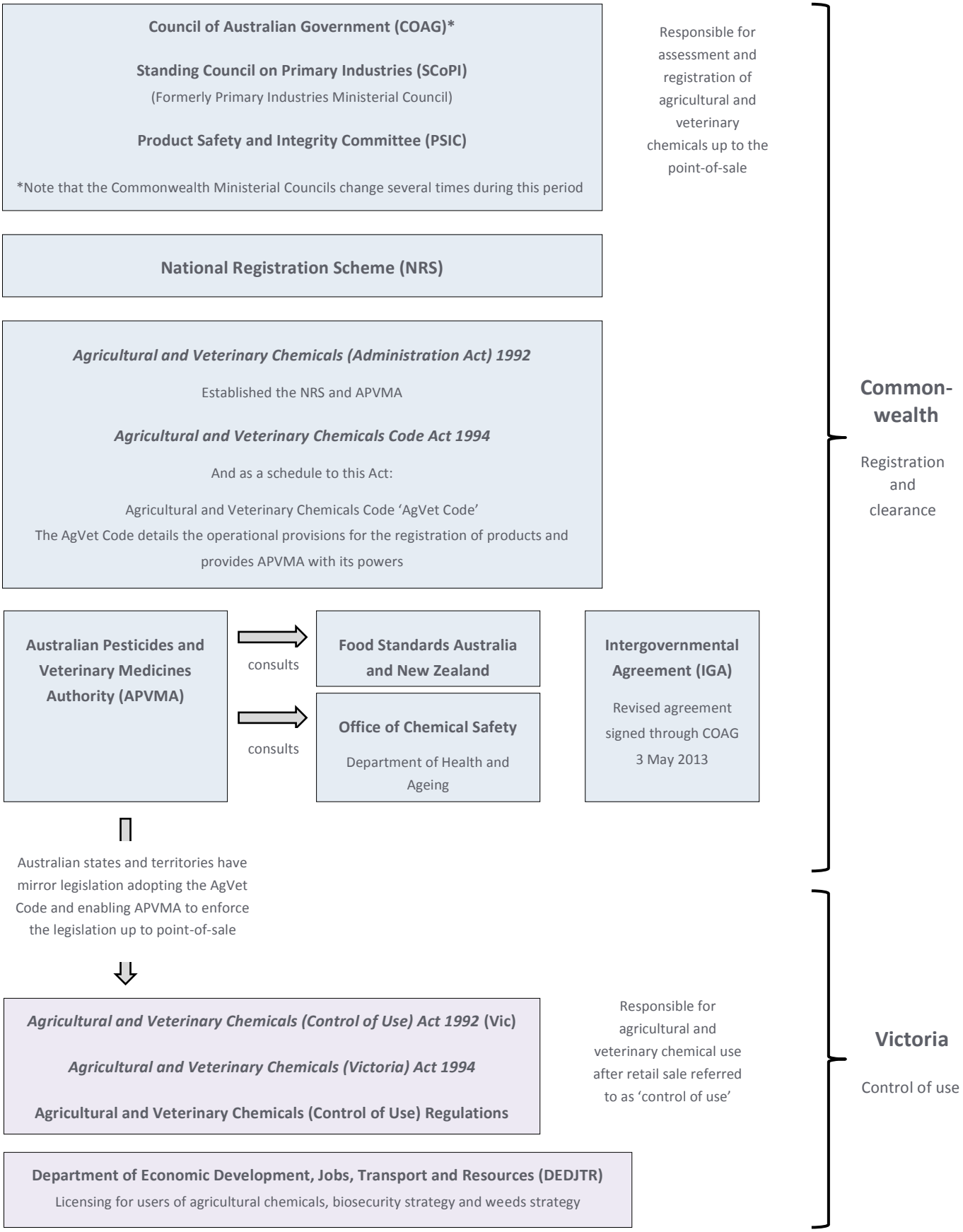

Figure 6.5 Clearance and registration process, 1995 onwards.

Control over use of pesticides

Control over the use of pesticides after the point-of-sale has always been a responsibility of the states and territories, including in Victoria. Under the *Poisons Act 1962* and associated Regulations, a permit/license was required to manufacture, buy and sell certain poisons including some pesticides, and certain requirements applied to their labelling, storage and disposal. Where the holder of a permit/license was a corporation, the Poisons Regulations 1963 r 7 required a responsible person to be nominated to hold the permit or license. In practice, the Department was reporting as if it was a corporation. These requirements applied from 1972 when 2,4-D became a Schedule 5 poison and 2,4,5-T a Schedule 6 poison[184].

The *Drugs Poisons and Controlled Substances Act 1981* replaced the Poisons Act and sought to control the manufacture, sale, distribution, possession, labelling, packaging, supply and use of any drug, poison or controlled substance within Victoria. Both 2,4-D and 2,4,5-T were classified as 'Hazardous Substances' under the new Act. The previous requirements for licensing to manufacture, wholesale and retail these products were also removed, but were reinstated following amendments to the Act in 1983[185].

In 1994, the *Agricultural and Veterinary Chemicals (Control of Use) Act 1992* came into full effect and was administered by the Department of Agriculture – now the Department of Economic Development, Jobs, Transport and Resources (DEDJTR). It is still the principal legislation and imposes controls in relation to the use and application of agricultural and veterinary chemicals, fertilisers, and stock foods in Victoria. Specifically, it imposes controls in relation to:

- The use, application and sale of agricultural and veterinary chemical products, fertilisers and stock foods and the manufacture of fertilisers and stock foods.
- Protection against financial loss caused by damage and contamination to land, plants and stock from agricultural spraying.
- Production of agricultural produce to avoid the contamination of human food.

The Agricultural and Veterinary Chemicals (Control of Use) Regulations 2007 support the Act and provide an operation framework for chemical use in Victoria. The objectives of the Regulations are to:

- Prescribe the records to be made and kept by users and sellers of certain chemical products.
- Prescribe information to be provided in relation to certain agricultural spraying on land near schools, hospitals, aged care services or children's services.
- Prescribe the equipment to be used when carrying out aerial spraying.
- Prescribe other matters as authorised by the *Agricultural and Veterinary Chemicals (Control of Use) Act 1992*.[186]

OCCUPATIONAL HEALTH AND SAFETY[187]

Victoria

OHS legislation was minimal at the beginning of the Inquiry Period and there is little reference to employee safety in the *Labour and Industry Act 1958*. While the *Industrial Safety Advisory Council Act 1960* established the Industrial Safety Advisory Council, with membership drawn from the Victorian Chamber of Manufacturers, employer groups, Victorian Trades Hall Council, Department of Health, Department of Labour and Industry and the National Safety Council,[188] it was silent on how the Council interacted with similar bodies at the time and what role they may have had to promote OHS.

The only explicit OHS obligation on employers relating to the chemicals between 1965 and 1981 was under the Harmful Gases, Vapours, Fumes, Mists, Smokes and Dusts (Amendment) Regulations 1965 and later the Health (Harmful Gases, Vapours, Fumes, Mists, Smokes and Dusts) Regulations 1984, established under the *Health Act 1958*. Under these, the maximum permissible airborne concentrations of 2,4-D and 2,4,5-T were 10 milligrams of substance per cubic metre of air,

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184 Victoiran Parliament, Victoria Gazette, No. 97, 15 November 1972, 3603.

185 Victorian Government, 1987, *Regulation Review Unit -1987, Draft Report on Chemicals, Drugs, Poisons and Controlled Substances,* Report, p21.

186 *Agricultural and Veterinary Chemicals (Control of Use) Regulations 2007* s 1.

187 See Appendix 1.3 Occupational Health and Safety Acts and Regulations.

188 *Industrial Safety Advisory Council Act 1960* s 3(2).

above which exhausts, ventilation and/or respirators were required. This placed an obligation on 'an employer of any person employed in or on any premises, building, house, ship, yard or **place of any nature.**' [emphasis added][189]

Legislation was not more broadly concerned with employee health and safety until the introduction of the *Industrial Safety Health and Welfare Act 1981*. These new safety provisions included:

- Employers required, so far as reasonably practicable, to ensure the safety, health and welfare of employees[190] and to
  - provide and maintain safe work systems and plant
  - ensure safety and eliminate health risks in connection with the use, handling, storage and transport of substances
  - provide information, instruction, training and supervision to ensure safety and health of employees
  - appoint safety supervisors
  - elect safety representatives.
- Employers had to prepare and revise written policies and make these available to workers.[191]

The *Occupational Health and Safety Act 1985* ushered in further and fundamental changes that lasted for 20 years. The Act aimed to:

- secure employees' health, safety and welfare
- protect employees' health and safety
- assist in securing safe and healthy work environments
- eliminate, at source, risks to the health, safety and welfare of employees
- involve employees and employers in the formulation and implementation of health and safety standards.[192]

The Act also made it the duty of employers to:

- maintain a working environment that is safe and without risk to health as far as practicable[193]
- maintain employee health and safety information and records[194]
- monitor employee health[195]
- monitor workplace conditions[196]
- provide information to workers about health and safety and how to make a complaint.[197]

Workers were also obliged to take care of their own and other workers' health and safety and not wilfully or recklessly interfere with or misuse OHS aids provided pursuant to the Act or Regulations, or wilfully place at risk the health or safety of any person at the workplace.[198]

The Act also created:

- OHS representatives and committees.
- inspection processes.
- the issue of notices and directions by the OHS regulator.

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189 *Harmful Gases, Vapours, Fumes, Mists, Smokes and Dust Regulations 1945* as amended by the *Harmful Gases, Vapours, Fumes, Mists, Smokes and Dust (amendment) Regulations 1965* ,reg 4 Schedule; *Health (Harmful Gases, Vapours, Fumes, Mists, Smokes and Dusts) Regulations 1984*, reg 4 and schedule.

190 *Industrial Safety, Health and Welfare Act 1981* s 11(2).

191 *Industrial Safety, Health and Welfare Act 1981* s 11(3).

192 *Occupational Health and Safety Act 1985* s 6.

193 *Occupational Health and Safety Act 1985* s 21(1).

194 *Occupational Health and Safety Act 1985* s 21(4) (b).

195 *Occupational Health and Safety Act 1985* s 21(4) (a).

196 *Occupational Health and Safety Act 1985* s 21(4) (d).

197 *Occupational Health and Safety Act 1985* s 21(1) (e).

198 *Occupational Health and Safety Act 1985* s 25(2).

In the second reading speech moved by the Attorney General, these obligations were clearly outlined:

> *The Bill sets out duties on employers and on self-employed persons, manufacturers and designers of equipment and so on. It also provides duties on employees.*
>
> *An employer must provide and maintain a working environment that is safe and without risk to health. This duty extends to all things under the employer's control in the workplace. It applies to the selection and maintenance of plant and machinery; the environmental conditions in which work is carried out and the manner in which work is organised and performed. This duty is limited by what is practicable which means account must be taken of the seriousness of a hazard and the availability of methods for removing or minimising it.*
>
> *All employees are required to do everything they are capable of doing to protect the health and safety of themselves and other people. They are under a duty not to interfere with anything provided in the interests of health and safety, and must not wilfully place at risk the health and safety of other persons.*[199]

A number of minor amendments over the following few years provided a solid framework for the Department's workplace handling, storage and use of hazardous chemicals. Despite legislation not referring to them specifically, this included 2,4-D and 2,4,5-T.

Labelling

The *Pesticides Act 1958* and the Regulations[200] established under the Act prescribed general label requirements such as the label size and wording, including a requirement to state the proportion and type of active constituents, using standard common names. The regulations also set out specific safety warnings that had to be stated on 2,4-D and 2,4,5-T labels. From 1966, these safety directions were:

> *Avoid contact with the skin and eyes to prevent possible irritation. Wash concentrate from skin and eyes immediately. Avoid working in and breathing spray mist. Wash exposed parts of the body after use and before eating, drinking or smoking.*

The Poisons Regulations 1963 outlined labelling requirements that applied to 2,4-D and 2,4,5-T from 1972 when they were declared poisons under the *Poisons Act 1962*. These requirements were primarily the manufacturer's responsibility but also applied to suppliers, which is relevant because the Department sold pesticides to the public.

Dangerous goods

Volumes of pesticides greater than 50,000 L had to be stored in accordance with the requirements set out in the *Inflammable Liquids Act 1966.* This Act was repealed by the *Dangerous Goods Act 1985*, under which the following two Regulations were established:

- The Dangerous Substances (Placarding of Workplaces) Regulations 1985, made under s 52 of the *Dangerous Goods Act 1985*, required the workplace manager responsible for storage of quantities of liquid greater than 50 L or 50 kg of 2,4-D and 2,4,5-T to display specific warning notices that read 'HAZCHEM 3WE', indicating a hazardous poison is stored at the facility.[201]
- The Dangerous Goods (Storage and Handling) Regulations 1989, also made under s 52 of the *Dangerous Goods Act 1985*, were designed to promote the health and safety of people and property in relation to the storage, handling, transport, use and sale of dangerous goods on premises. They set out the method for determining an 'assessment factor' for dangerous goods kept at premises, which then informed what action was required under the Regulations, e.g. self-assessment of hazards.

Commonwealth[202]

The National Occupational Health and Safety Commission (NOHSC) was established as a tripartite statutory authority under the *National Occupational Health and Safety Commission Act 1985 (Cth)* (OHS Act) and in 1994 produced the *National Code*

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[199] Victorian Parliament, *Parliamentary Debates,* Council, *17 July 1985,* p976 (J. Kennan, Attorney General)

[200] *Pesticide Regulations 1966*, *seventh schedule, p1020; Pesticides Regulations 1976,* sixth schedule, p81.

[201] *Dangerous Substances (Placarding of Workplaces) Regulations 1985,* reg 3, reg 4, schedule 1, 2.

[202] See Appendix 1.4 Commonwealth Legislation and Codes.

of Practice for the Control of Workplace Hazardous Substances. While this National Code only applied as aguide for a very short time within the Inquiry's Period it does illustrate the growth of employer obligations over time. These included:

- Ensuring all employees have ready access to material and data safety sheets for substances they may be exposed to at work.
- Keeping a register of all hazardous substances.
- Providing training to relevant employees commensurate with risk.
- Keeping individual training records for five years.
- Health surveillance of employees at significant exposure risk.
- Conducting rigorous risk assessments of working with hazardous substances and keeping records of these for 30 years.

WORKERS COMPENSATION[203]

At the beginning of the Period the *Workers Compensation Act 1958* provided the basis for no-fault compensation to the workers who were injured and to dependants of those who died in the course of their employment. It also required employers to keep a Notice of Injury Book to record the particulars of the injury at the time it happened.[204]

If an employee could establish employer negligence, they could sue for damages under common law. These damages were not capped.

The Act was amended in 1965 to define 'injury' as 'any physical or mental injury' including 'a disease contracted by a worker in the course of his employment whether at or away from his employment and to which the employment was a contributing factor'.[205]

In 1980, the definition of injury was tightened. The term 'contributed substantially' was replaced with 'was a contributing factor and contributed to a recognisable degree'.[206]

Claims for injuries are required to be lodged six months from the occurrence of the injury or death. However, extensions to the lodgement period may be granted if there is a reasonable reason.[207]

In 1985, the *Accident Compensation Act 1985* and associated Regulations brought fundamental changes to workers compensation law. These paralleled the introduction of the OHS Act mentioned above. Relevant changes and clarification to the *Accident Compensation Act 1985* between 1985 and 1995 were:

- New compensation provisions for employment related diseases.
- Diseases could be asserted in relation to places, processes or occupations (not for sprayers, although *Dermatitis venenata*, contact dermatitis, was listed)
- Employers had to keep an injuries register.
- Injuries by caused by gradual processes provisions were enhanced.
- Two changes to the definition of injury
  - in 1987, to include injuries, 'in the course of or due to the nature of employment' in relation to common law
  - in 1992, adding that employment was a 'significant contributing factor'.

The *Accident Compensation Act 1985*[208] allows the Victorian WorkCover Authority, the administrator of this legislation, to accept late lodged claims if it considered the worker had a special excuse for missing the applicable time limit. If a claim was accepted the worker was entitled to no-fault benefits related to hospital, medical and rehabilitation support. A worker

[203] See Appendix 1. 5 Workers Compensation Acts and Regulations.

[204] *Workers Compensation Act 1958* s 45 (3)(a).

[205] *Workers Compensation (Amendment) Act 1965* s 2(b).

[206] *Workers Compensation (General Amendment) Act 1980* s 2.

[207] *Workers Compensation Act 1958* s 41.

[208] *Accident Compensation Act 1985* s 103(8).

could claim for a disease-related illness if it could be proven the disease was contracted 'in the course of or due to the nature of employment' (1985–1992) or 'employment was a significant contributing factor' (1992–1995).

CIVIL PROCEEDINGS[209]

Throughout the Inquiry Period the Department had a duty to provide and maintain a safe workplace. Systemic deficiencies might be considered evidence of a breach of statutory duty or negligence by the Department officials. However, given the passage of time, gathering such sufficient evidence is problematic.

The *Limitation of Actions (Personal Injury Claims) Act 1983* extended the limitation period from three to six years but, importantly, the court was given the power to extend this if it 'decides that it is just and reasonable to do so'.and amended the *Wrongs Act 1958* if a person's death:

> *… was caused by an injury consisting of a disease or disorder contracted by a person and the person did not know that before he died –*
>
> *(a) that he had suffered the injury*
>
> *(b) that the injury was caused by the act or omission of some person.*
>
> *An action in respect of the injury shall be commenced within six years after the date when the person claiming to have a cause of action first knows that the death was caused by the injury and that the injury was caused by the act or omission of some person.*[210]

PUBLIC SERVICE AND RECORD RETENTION[211]

Under the *Public Service Act 1958* the Secretary was responsible for the Department's general working and transactions. The Secretary and anyone to whom his power was delegated (including officers/supervisors in the Ballarat region and bodies like the Keith Turnbull Research Institute, KTRI and the VNWDB) were accountable for day-to-day legislation and regulations compliance.

The *Public Records Act 1973* gave the Department obligations in providing a regime for preserving, managing and utilising Victorian Public Records, and outlining obligations to retain records to comply with the hazardous substance legislation and codes of practice, OHS and workers compensation laws.

AUSTRALIAN STANDARDS[212]

In 1988, the Australian Government endorsed Standards Australia as a peak body for the establishment of nationwide occupational standards. Australian Standards estsblish benchmarks for management operations and the quality of products and services to ensure they are safe, reliable and fit-for-purpose.[213] The Victorian Government makes some Australian Standards mandatory to implement when stated in law. A broad spectrum of Australian Standards for the safe occupational use of pesticides in the Period and are relevant to the Inquiry in two ways, either:

- They were specifically referenced in Acts and Regulations and therefore mandatory on the duty holders (usually employers), which are discussed further in Chapter 9, or
- They were a reference for best practice for duty holders and can be used to determine whether an employer fulfilled their obligations under OHS laws or under common law.

The Inquiry reviewed 66 Australian Standards that can be grouped under the following sub-headings:

- Policy

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[209] See Appendix 1.6 Civil Proceedings.

[210] *Wrongs Act 1958* s 20(1A) - as amended in *Limitation of Actions (Personal Injury Claims) Act 1983* s 7.

[211] See Appendix 1.7 Public Service and Record Retention Legislation.

[212] See Appendix 1.8 Australian Standards.

[213] Standards Australia, 2015, *About Us, History,* <www.standards.org.au/OurOrganisation/AboutUs/Pages/History.aspx> [accessed 20 April, 2015].

- Pesticide quality
- Storage, handling and use
- Personal protective equipment (PPE)
- Injury reporting.

These are detailed below.

Policy

In 1952, Australian Standard (AS) CZ5-1952 *General Principles for Safe Working in Industry* was the first Australian Standard that published general safety principles. It was revised and published as AS CZ5-1968 and AS 1470-1973, for the purpose of outlining action that should be taken by employers and employees in order to achieve 'safe and healthy working conditions'.[214] The standard was again revised and published as AS 1470-1986 *Health and Safety at Work – Principles and Practices*.[215] This 1986 revision incorporated contemporary concepts such as the responsibility of the employer and employee in maintaining safe workplaces, introduced the term 'regulatory authority', and the concept that 'reasonably practicable' action should be taken to address potential workplace hazards.[216]

Pesticide quality

In 1965, AS N50-1965 *Hormone Weed Killers of the Phenoxyacetic Acid Type* provided the first standard in Australia for the quality of phenoxy herbicides including 2,4-D and 2,4,5-T.[217] It was gazetted in Victoria as a standard pursuant to the Pesticides Act in 1975.[218]

In 1976 AS 1175-1976 *Herbicides of the Phenoxyacetic Acid Type* replaced the earlier standard and included a maximum concentration for 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) of 0.1 mg/kg.[219] In 1977, this new standard was also gazetted pursuant to the Pesticides Act.[220] In 1982, the standard was set in Victorian law, this time with a maximum TCDD content in 2,4,5-T of 0.01 mg/kg.[221]

AS K159-1967 *Recommended Common Names for Pesticides* stated the common names '2,4,5-T' and '2,4-D'. These common names were maintained in AS 1719-1975 and AS 1719-1981. In Victoria, from 1963, it was law for pesticide labels to use common names to identify active constituents such as 2,4-D and 2,4,5-T.[222]

Storage, handling and use

In 1981, AS 2507-1981 *The Storage and Handling of Pesticides* provided the first Australian Standard covering the storage, handling and disposal of chemicals. It required that pesticides be stored away from congested areas like schools, houses and hospitals. Specifically pesticides had to be:

- stored undercover
- on a concrete floor impervious to spills
- within a non-combustible wall and roof

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[214] Standards Association of Australia, AS 1470-1973, *Australian Code of General Principles for Safe Working in Industry,* Standards Association of Australia, Publication.

[215] Standards Association of Australia, AS 1470-1986, *Health and safety at work – Principles and practices,* Standards Association of Australia, Publication.

[216] Standards Association of Australia, AS 1470-1986, *Health and safety at work – Principles and practices,* Standards Association of Australia, Publication, p7-8.

[217] Standards Australia,1965, N50-1965, *Hormone weed Killers of the Phenoxyacetic Acid Type*, Standards Association of Australia, Publication.

[218] Victorian Parliament, *Victoria Gazette*, No 91, 12 November 1975 , p 3964 Re Proclamation pursuant to the *Pesticides Act 1958* prescribing standards for Pesticides.

[219] Standards Australia, 1976, AS 1175-1976 *Herbicides of the Phenoxyacetic Acid Type*, Standards Association of Australia, Publication.

[220] Victorian Parliament, *Victoria Gazette*, No. 58 – 6 July 1977, 2212, Re: Proclamation pursuant to *Pesticides Act 1958*, Standards for Pesticides.

[221] Victorian Parliament, *Victoria Gazette*, No. 80, 11 August 1982, 2659, Re: Proclamation pursuant to *Agricultural Chemicals Act 1958*, Prescribing Standards for Agricultural Chemicals.

[222] *Pesticides Regulations, 1963*, r 14(1).

- ventilated to allow for 12 changes of air every hour
- close to safety showers.

The standard was revised in 1984 and included label standards for packages and containers.[223]

AS 1940-1988 *The Storage and Handling of Flammable and Combustible Liquids* set out standards for chemical storage design including appropriate materials for floors, roof and wall requirements, and standards for the containment of spills or leaks using drainage channels, tanks and pits. The standards included ventilation, and features to reduce flammability such as fire-rated walls and windows.[224] The standard became mandatory when it was established in Victorian law in 1989.[225] The second edition, AS 1940-1993 superseded the 1988 version.

Personal protective equipment

AS CZ5-1952 *General Principles for Safe Working in Industry* advised employers around clothing and personal safety equipment.[226] This included advice that workers should only rely on personal protective clothing when it is impractical to remove the hazard by any other means and, where provided, this clothing should match the hazard. Clothing and equipment should be in a clean, effective and safe condition, and the employee should contribute to this.

In 1981, AS 2507-1981 *The Storage and Handling of Pesticides* recommended protective equipment for the handling of pesticides including:

- PVC jackets
- elbow length rubber or PVC gloves
- safety spectacles/goggles/full face shields
- PVC or rubber boots
- washable hat
- half-face respirators with cartridges.[227]

A large number of other Australian Standards applied to the design of PPE such as for respirators, gloves and overalls. See Appendix 1.8.

Injury reporting

Standards for recording injuries and accidents in a systematic manner were introduced in 1952. AS CZ6-1966 *Standard Code for Recommended Practice for Recording and Measuring Work Injury Experience* sets out the recommended approach to recording and measuring work injuries, including lost time and serious injuries, and was used by the Department (see Chapter 10). The standard includes formulas for calculating the incidence of injuries.[228]

AS 1339-1974 and AS 2507-1981 (and 1984) include recommendations for recording accidents, conducting investigations into accidents and then taking steps to prevent the accident occurring again.[229]

AS 1339-1974 and AS 2507-1981 *The Storage and Handling of Pesticides*, revised in 1984 as AS 2507-1984, includes recommendations for recording accidents, conducting investigations into accidents and then taking steps to prevent the accident occurring again.[230]

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[223] Standards Association of Australia, 1984, *AS 2507-1984 The Storage and Handling of Pesticides*, Standards Association of Australia, Publication, p2.

[224] Standards Australia, 1988, AS 1940-1988 *The Storage and Handling of Flammable and Combustible Liquids*, Standards Association of Australia, Publication.

[225] *Dangerous Goods (Storage and Handling) Regulations, 1989*, reg 200, reg 601, reg 902.

[226] Standards Association of Australia, 1952, *AS CZ5-1952 General Principles for Safe Working in Industry,* Standards Association of Australia, Publication.

[227] Standards Association of Australia, 1981, *AS 2507-1981 The Storage and Handling of Pesticides*, Standards Association of Australia, Publication.

[228] Standards Association of Australia, 1966, *AS CZ6-1966, Standard Code for Recommended Practice for Recording and Measuring Work Injury Experience*, Standards Association of Australia, Publication.

[229] Standards Association of Australia, 1974, *AS 1339-1974 Code of practice for manual handling of materials*, Standards Association of Australia, Publication.

Chapter 7: Responsibilities and accountabilities of parties

Key Messages

During the course of the Period of the Inquiry:

- Responsibilities and accountabilities for safe storage and use of agricultural chemicals, and for the protection of the health and safety of workers exposed to those chemicals, were clarified and strengthened.
- The Department's responsibilities as an employer in workplaces and as a provider of chemicals were strengthened.
- The Commonwealth's regulatory responsibility, by the end of the Inquiry Period, grew to approval and setting standards for agricultural chemicals up to the point-of-sale, while the states remained responsible for the regulation of use after the point-of-sale.

INTRODUCTION

This chapter extends on the regulations and laws described in the Chapter 6 to outline the key accountabilities and responsibilities of the various parties, especially those of the Department and its employees. For completeness, this chapter also briefly describes the accountabilities of the suppliers/manufacturers of 2,4-D and 2,4,5-T, and the relevant regulators.

THE DEPARTMENT

The Department had many accountabilities over the Period ranging from administrative, like keeping records of workplace injury, overseeing weed eradication on all lands in Victoria, and taking practical action to supervise a safe workplace. During these activities the Department had to ensure that staff were aware of safety policy, were adequately trained, that pesticides were labelled clearly, and that workers routinely followed safety instructions such as wearing of personal protective equipment (PPE). These accountabilities are outlined below, and have been used as the basis for the compliance assessment presented in Chapter 9.

Land Management

Under the *Vermin and Noxious Weeds Act 1958* and subsequent Acts, the Department's most relevant responsibility was destroying and suppressing noxious weeds. It had powers to enter land and use any means and measures to destroy and suppress noxious weeds deemed by the inspector to be appropriate.[231]

Fungicides and Pesticides

The quality, efficacy and health risks posed by pesticides was assessed through the clearance/registration process described in the Chapter 6. While the Department was not responsible for these processes it did have an advisory role (refer to Regulators of Chemicals below). Under the *Pesticides Act 1958* (s 17) it also had a right to test these chemicals, or request a certificate of compliance, to ensure they complied with the relevant standards of the day.

Occupational Health and Safety

Occupational Health and Safety (OHS) legislation generally imposes overall duties for safe workplaces and practices, while regulations, codes and standards provide more detail on how to maintain a safe workplace. As Figure 7.1 'Pyramid of authority for law regulations codes and standards' demonstrates, Acts and Regulations are most powerful and must be complied with. These are followed by codes of practice (compliance codes), standards and guidance notes that, while not

[230] Standards Association of Australia, 1984, *AS 2507-1984 The Storage and Handling of Pesticides*, Standards Association of Australia, Publication.

[231] *Vermin and Noxious Weeds Act 1958* s 13(3)

mandatory, still provide a benchmark to assess behaviour. It should be noted that when a code of practice (compliance codes) or standard is incorporated into law it goes to the top of the pyramid and becomes mandatory.

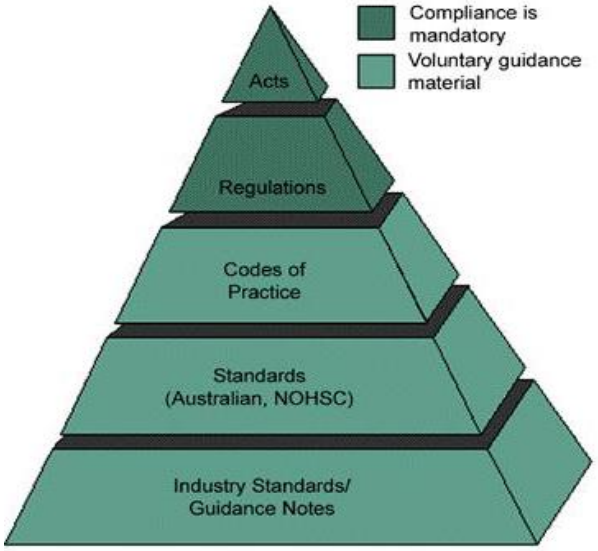

Figure 7.1 Pyramid of authority for law, regulations, codes, standards.[232]

OHS obligations on the Department from 1958 to 1981 were minimal with the *Labour and Industry Act 1958* focused mainly on factory and commercial workers, however, under common law the Department was obliged to provide and maintain a safe workplace. The only explicit OHS obligation on the Department during this time was under the Harmful Gases, Vapours, Fumes, Mist, Smokes and Dusts Regulations 1945, as amended by the Harmful Gases, Vapours, Fumes, Mists, Smokes and Dusts (Amendment) Regulations 1965, and later the Health (Harmful Gases, Vapours, Fumes, Mists, Smokes and Dusts) Regulations 1984. Under these regulations, the maximum permissible airborne concentrations of 2,4-D and 2,4,5-T were 10 milligrams of substance per cubic metre of air, above which exhausts, ventilation or alternatively an approval from the Minister for Health to use a respirator were required.[233] This applied to persons employed in or on any premises, building, house, ship, yard or **place of any nature** [emphasis added].

OHS obligations on employers took step changes in 1981 and 1985 with the implementation of the new Acts. Below are the key sections outlining the Department's OHS accountabilities from 1981 to 1985 and 1985 to 1995 (and beyond). We've highlighted key words in these sections for their relevance to the Department and to these chemicals.

The *Industrial Safety, Health and Welfare Act 1981* stated:

s 11. *(1) The occupier of a workplace*[234] ***shall ensure, so far as is reasonably practicable, the safety, health and welfare of persons employed or engaged in or on that workplace****.*

(2) Without prejudice to the generality of the provisions of sub-section (1), the matters to which that duty extends include in particular –

(a) the provision and ***maintenance of plant and systems of work*** *that are, so far as is reasonably practicable,* ***safe and without risks to health****;*

(b) arrangements for ensuring, so far as is reasonably practicable, safety and absence of risks to health in connexion with the ***use, handling, storage and transport of articles and substances****;*

(c) the ***provision of such information, instruction, training and supervision as is necessary*** *to ensure, so far as is reasonably practicable, the safety and health of persons employed in or on the workplace;*

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[232] Adapted from Fortress Learning, 2015, *What is WHS?* Available at: <http://students.fortresslearning.com.au/what-is-ohs/> [accessed 23 June, 2015].

[233] *Harmful Gases, Vapours, Fumes, Mists, Smokes and Dust (amendment) Regulations 1965*, sch, reg 4 of the Principal Regulations; *Health (Harmful Gases, Vapours, Fumes, Mists, Smokes and Dusts) Regulations 1984* reg 4 and schedule.

[234] Note that the occupier of the workplace was the employer.

(d) *so far as is reasonably practicable as regards* ***a workplace under his control, the maintenance of it in a condition that is safe and without risks to health*** *and the provision and maintenance of means of access to and egress from it that are safe and without such risks;*

(e) ***the provision and maintenance of a working environment*** *for persons employed in or on the workplace that is, so far as is reasonably practicable, safe, without risks to health, and adequate as regards facilities and arrangements for their welfare in or on the workplace;*

(f) *in such cases as are prescribed the appointment of safety supervisors who shall have such duties as are prescribed.*

(3) *Except as prescribed it shall be the duty of every occupier of a workplace* ***to prepare and as often as may be appropriate revise a written statement of his general policy with respect to the safety and health of persons employed*** *in or on the workplace and the organization and arrangements for the time being in force for carrying out that policy, and to bring the statement and any revision of it* ***to the notice of all persons employed in or on the workplace.*** [emphasis added]

s 12. (1) *In such cases as are prescribed the occupier of a workplace shall arrange for the election of safety representatives by and from the persons employed in or on the workplace.*

(2) *Where safety representatives have been elected in respect of a workplace the occupier shall consult the representatives with a view to the making and maintenance of arrangements which will enable the occupier and persons employed in or on the workplace to co-operate effectively in promoting and developing measures to ensure the safety and health of such persons while in or on the workplace and in checking the effectiveness of those measures.*

(3) *In such cases as are prescribed the occupier of a workplace shall, if requested to do so by the safety representatives, establish in the prescribed manner a safety committee having the function of keeping under review the measures taken to ensure the safety and health of persons employed in or on the workplace and such other functions as are prescribed.*[235]

The Occupational Health and Safety Act 1985 stated:

s 21. (1) *An employer shall provide and maintain so far as is practicable for employees a working environment that is safe and without risks to health.*

(2) *Without in any way limiting the generality of sub-section (1), an employer contravenes that sub-section if the employer fails –*

(a) *to provide and maintain plant and systems of work that are so far as is practicable safe and without risks to health;*

(b) *to make arrangements for ensuring so far as is practicable safety and absence of risks to health in connexion with* ***the use, handling, storage and transport of plant and substances;***

(c) *to maintain so far as is practicable any workplace under the control and management of the employer in a condition that is safe and without risks to health;*

(d) *to* ***provide adequate facilities for the welfare of employees at any workplace under the control and management of the employer****; or*

(e) *to provide such* ***information, instruction, training and supervision to employees as are necessary to enable the employees to perform their work in a manner that is safe and without risks to health****.*

(4) *An employer shall so far as is practicable –*

(a) ***monitor the health*** *of the employees of the employer;*

(b) *keep information and records relating to the health and safety of the employees of the employer;*

(c) *employ or* ***engage persons*** *who being* ***suitably qualified in relation to occupational health and safety*** *are able to provide advice to the employer in relation to the health and safety of the employees of the employer;*

(d) ***monitor conditions*** *at any workplace under the control and management of the employer; and*

(e) ***provide information*** *to the employees of the employer, in such languages as are appropriate, with respect to health and safety at the workplace,* ***including the names of persons to whom an employee may make an inquiry or complaint*** *in relation to health and safety.*[236] [emphasis added]

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[235] *Industrial Safety, Health and Welfare Act 1981* s 11, s 12.

[236] *Occupational Health and Safety Act 1985* s 21.

Both of these Acts substantially increased the obligations on employers compared to before 1981 and the key difference between these is the utilisation of the phrase 'so far as is reasonably practicable' and 'so far as is practicable.'

Chemical storage

The *Inflammable Liquids Act 1966* outlined requirements for storing volumes of pesticides greater than 50,000 L.[237] However, as volumes of pesticides stored by the Department at any one location were less than this, these requirements did not apply.[238]

Under the Dangerous Substances (Placarding of Workplaces) Regulations 1985 the Department was required to display specific warning notices when storing liquid 2,4-D and 2,4,5-T in quantities greater than 50 L or 50 kg.[239]
Under the Dangerous Goods (Storage and Handling) Regulations 1989, the Department was required to calculate an 'assessment factor' for dangerous goods kept at their premises and to take the appropriate action specified in the Regulations for that factor.[240]

Labelling

While labelling requirements were primarily the responsibility of the manufacturer (refer below), all chemicals used, stored and sold by the Department remained in the manufacturers' containers[241] and it was the Department's responsibility to ensure they were correctly labelled, intact and legible.

Workers compensation

Workers compensation legislation over the relevant period obliged the Department, in relation to all injury types including diseases to:

- keep injury books[242]
- receive and on-forward claims[243]
- follow processes relating to return to work etc.[244]

These obligations were applicable to any health claims relating to exposure to 2,4-D and 2,4,5-T.

Civil proceedings

In addition to the above legislation, throughout the period, the Department had a duty as an employer to provide and maintain a safe system of work for its employees. In the case where a worker suffered an injury from an alleged breach by the employer, the onus of proof lay with the worker. While it may appear statute barred, changes to the *Limitation of Actions Act 1958* and *Wrongs Act 1958* in 1983 may open this course of action for previous injuries if the court deems it to be appropriate.

DEPARTMENT EMPLOYEES

While statutory obligations varied between 1965 and 1995, employees remained obliged to take care for the safety and health of themselves and others in the workplace. The wording of the OHS legislation changed slightly between 1981 and 1985, as illustrated below:

The *Industrial Safety, Health and Welfare Act 1981* stated:

> S14. *It shall be the duty of every person employed in or on a workplace –*

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[237] *Inflammable Liquids Act 1966* s 12.

[238] Department of Crown Lands and Survey, 1978 (est), Legislative Assembly - Notice Paper RE regulations for poisonous chemicals, Report.

[239] *Dangerous Substances (Placarding of Workplaces) Regulations 1985* r 3, 4, schedule 1, schedule 2.

[240] *Dangerous Goods (Storage and Handling) Regulations 1989* r200, 601, 902, schedule 2.

[241] Department of Crown Lands and Survey, 1977, Circular No. 105/77 – Weedicide Supply Scheme – Weedicides to be sold only in original unopened containers, Circular.

[242] *Workers Compensation Act 1958* s 45(3).

[243] *Workers Compensation Act 1958* s 44.

[244] *Workers Compensation(Amendment) Act 1984* s 6A.

(a) *To take reasonable **care for the safety and health of himself and of other persons** who may be affected by his acts or omissions in or on the workplace; and*

(b) *As regards any duty or requirement imposed on his employer or any other person by or under any of the provisions of this Act or the regulations, to co-operate with him so far as is necessary to enable that duty or requirement to be performed or complied with.*[emphasis added]

The Occupational Health and Safety Act 1985 stated:

S25. (1) *An employee while at work shall take the care of which the employee is capable for the employee's own health and safety and for the health and safety of any other person who may be affected by the employee's acts or omissions at the workplace.*

(2) *An employee shall not –*

(a) ***wilfully or recklessly interfere** with or misuse anything provided in the interests of health safety or welfare in pursuance of any provision of this Act or the regulations; or*

(b) *wilfully place at risk the health or safety of any person at the workplace.* [emphasis added]

The Occupational Health and Safety Act 1985 qualifies the obligation on the worker with 'of which the employee is capable' and adds the concept of wilful or reckless behaviour.

REGULATORS OF CHEMICALS

Accountability for approval of agricultural chemicals (including pesticides and herbicides) varied throughout the Inquiry Period. From 1965 to 1994 the Department of Agriculture was responsible for the registration of these chemicals in Victoria under the *Pesticides Act 1958* and subsequent Acts. In undertaking this role, the Department of Agriculture sought input from various state and Commonwealth committees as outlined in Chapter 6. At the state level, up to 1966, the VNWDB was represented on the Interdepartmental Committee on Toxic Hazards of Pesticides, to provide advice on the efficacy of pesticides during decision-making about whether to register a pesticide for use in Victoria. From 1966, when the Pesticides Review Committee (PRC) replaced the Interdepartmental Committee on Toxic Hazards of Pesticides, the VNWDB continued its membership.

From 1969 the Commonwealth Technical Committee on Agricultural Chemicals (TCAC) had an informal role in the approval/clearance of chemicals before they were registered by the Department of Agriculture and, in 1989, the Commonwealth's role was made mandatory under the *Agricultural and Veterinary Chemicals Act 1988 (Cth)* (s 9).

From 1992 to 1995 responsibility for clearance and registration moved fully to the Commonwealth under the *Agricultural and Veterinary Chemicals (Administration) Act 1992*, which was administered by the National Registration Authority for Agricultural and Veterinary Chemicals – now the Australian Pesticides and Veterinary Medicines Authority (APVMA).

The approval and registration processes considered chemical quality, efficacy, labelling requirements and potential health risks. It was the regulator's responsibility to ensure that approved products, including those containing 2,4-D and 2,4,5-T, complied with the relevant standards of the day (see Chapter 6) and did not present undue health hazards to users or the general public. The Department of Agriculture's compliance role extended to the carrying out of inspections to pursue and determine who was responsible for a breach of chemical quality standards and to enter premises to take samples for testing.

SUPPLIERS/MANUFACTURERS

Over the Inquiry Period suppliers/manufacturers were responsible for supplying/making chemicals to standard and ensuring they were fit-for-purpose under common law. The Australian Standards for 2,4-D and 2,4,5-T varied throughout the Inquiry Period and included:

- AS N50-1965 *Hormone Weed Killers of the Phenoxyacetic Acid Type*
- AS 1175-1976 *Herbicides of the Phenoxyacetic Acid Type*.

Importantly, AS 1175-1976 set the maximum allowable concentration of TCDD in 2,4,5-T at 0.1 ppm in 1976, and this was established in law in Victoria in 1977. In 1982, the Victorian Government raised the maximum allowable concentration of TCDD to 0.01 ppm, and established this standard in law. No maximum limits on TCDD concentration standards applied in Victoria before 1976.

Suppliers/manufacturers were also required to meet the labelling requirements established by the *Pesticides Act 1958*[245] and associated Regulations. From 1972, when 2,4-D and 2,4,5-T were declared as poisons,[246] labels had to include information required by the *Poisons Act 1962* and associated Regulations.[247]

REGULATORS OF WORKPLACE OCCUPATIONAL HEALTH AND SAFETY

The Department of Labour administered Victoria's OHS legislation up to 1985, under both the *Labour and Industry Act 1958* and the *Industrial Safety, Health and Welfare Act 1981*. Initially the regulatory focus was on factories and commercial businesses, not agricultural workers like sprayers. However, awareness of OHS began to rise with the introduction of the new Act in 1981, and the Department of Labour began seeking advice from the Department of Health's industrial hygienists.

The creation of the Occupational Health and Safety Commission (OHSC) under the *Occupational Health and Safety Act 1985*, dramatically changed OHS in Victoria. The OHSC had wide ranging powers to regulate the full range of industries and it employed staff, including inspectors and industrial hygienists, to assist in this regard.[248] While the OHSC had a number of name changes over the next 10 years (it's now WorkSafe Victoria) its responsibilities remained largely the same.

REGULATORS OF WORKERS COMPENSATION

From 1965 until 1985 workers compensation was privately underwritten[249] in Victoria and, while there were documentation requirements for employers like a Notice of Injury Book, little was done to enforce these. However, Victorian Government departments were required to report their injuries to the Department of Labour.

In 1985, WorkCare was created and managed through the Accident Compensation Commission as the monopoly state workers compensation insurer. Many obligations were placed on employers at this time, with a small investigative team charged to enforce the *Accident Compensation Act 1985*. WorkCare became WorkCover in 1992 and remained a monopoly state-based scheme for the remainder of the period and beyond to the present day.

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[245] *Pesticides Act 1958* s 10.

[246] Victorian Parliament, *Victoria Gazette*, No. 97, 15 November 1972, p3603, RE amendment to schedules by proclamation pursuant to Poisons Act 1962.

[247] *Poisons Regulations 1963* pt II – Labelling.

[248] *Occupational Health and Safety Act 1985* s 20, pt V.

[249] *Workers Compensation Act 1958.*

Chapter 8: Policies and practices of the former Department of Crown Lands and Survey (and its successor departments)

TERMS OF REFERENCE

As part of its Terms of Reference, the Former Lands Department Chemical Inquiry was asked to:

> *Identify and review past policies and practices relating to the handling, storing and use of 2,4-D and 2,4,5-T between 1965 and 1995 by the former Victorian Department of Crown Lands and Survey (and its successor departments).*

Key Messages

- Throughout the 1960s and 1970s and into the early 1980s, Department policies described 2,4-D and 2,4,5-T as relatively safe. This was reflected in safety policy and culture up until the mid-1980s.
- The Department lagged significantly behind similar departments in implementing safe pesticide use in the workplace with specific reference to:
  - pesticide safety information
  - personal protective equipment (PPE)
  - poison storage sheds
  - washing facilities
  - chemical safety training.
- Between the mid-1970s to the early 1980s communications about safe pesticide use was late to arrive, confusing and the vagueness of the language left it to workers to decide on what to do.
- There was little evidence of a culture of compliance, particularly before the mid-1980s, and improvements to Department safety systems were slow and inconsistently implemented.

INTRODUCTION

This chapter identifies, describes and reviews the range of safety policies and workplace practices relating to the safe handling, use and storage of 2,4-D and 2,4,5-T in place during the Period. The review process also includes an examination of the way in which these policies and practices were communicated to employees and how the associated training was undertaken. Chapter 9 assesses how the Department adhered to the regulations, laws and standards of the day.

SAFETY POLICIES

Throughout the Period, the Department had numerous pesticide safety policies in place. The Inquiry has been able to review the quality and timeliness of the Department's safety policies and practices by comparing them with similar material from other departments, and in relation to directions set by State Government safety policy.

State Government policies

From the mid-1960s the Victorian Government took action to combat its high rate of workplace injury. From 1967 the Department of Labour and Industry required all government workplaces to record serious injury, and Department officers had to complete job safety training. In 1968, five Victorian Government employees were killed at work[250] hardening the

[250] Department of Crown Lands and Survey, 1969, *Circular No. 1969/379 - Occupational Safety,* Circular.

government's resolve to address the issue of safety. The State Government began publishing policies that were instructive to the Department (Table 8.1).

Table 8.1 State Government policies.

Year	Policy
1969	Victorian Government, *Safety in State Government Undertakings*[251]
1983	Victorian Government, *Safe Working in State Government Employment, Code of General Principles*[252]
1986	Public Service Board, *Policy Statement for OHS in the Victorian Public Service*[253]

In 1969 the then Premier of Victoria H. E. Bolte stated in the policy, *Safety in State Government Undertakings*, that it was the 'government's desire that greater efforts are made to reduce and control the number of injuries which occur in State Government Departments and Undertakings.'[254] The Department's 1969 safety policy mirrored this intent and required that 'as the compilation of detailed statistics on accidents are completed … appropriate instructions on safety measures necessary to eliminate these accidents will [be] issue[d] from time to time'.[255]

Between 1983 and 1995, State Government policy shifted, and safety became an integral part of work culture. The Victorian Government's *Safe Working in State Government Employment, Code of General Principles*[256] demonstrated this shift and then, in 1986, the term occupational health and safety was included in State Government policy. This change was reflected in Department policy over the time period, as described below.

Department safety policies

Table 8.2 shows the Department's safety policies that were in place during the Inquiry Period. Initially, the safety policies were narrow in focus and concentrated on physical injury prevention. The 1968 *Circular No.78/68- Workers Compensation and Safety on the Job*, was only general in nature and instructed inspectors to maintain a 'safety-first' attitude, and stated, 'There is an obligation upon Senior Inspectors and Inspectors to see that all equipment is maintained in safe working condition and that work practices in the field do not unnecessarily increase the risk of injury to employees.'[257]

The 1971 C*ircular No.5/71- Workers Compensation and Safety on the Job* focused on avoiding accidents while using vehicle, plant and equipment, however, the policy recommended that protective clothing should be worn to avoid injuries from 'harmful contacts' with chemicals.[258]

In 1983, the Government released a new policy on 2,4,5-T, which aimed to ensure worker safety when using it. The policy stated:

> *Government Departments are now required to give public notice before major spraying of 2,4,5-T, and all Government workers applying 2,4,5-T have been issued with protective clothing including overalls, rubber boots and gloves, face shields or respirators; operators also have attended training courses on the safe use of herbicides.*[259]

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[251] Government of Victoria, 1969, *Safety in State Government Undertakings*, Report.

[252] Government of Victoria, 1983 (est), *Safe Working in State Government Employment - Code of General Principles*, Manual.

[253] Government of Victoria, 1986, *Policy Statement for OHS in the Victorian Public Service 20 March 1986,* Attachment to Letter; Public Service Board of Victoria, 1986, Circular No. 6 of 1986, 20 March,1986, Circular.

[254] Government of Victoria, 1969, *Safety in State Government Undertakings,* Report.

[255] Department of Crown Lands and Survey, 1969, *Circular No. 1969/379 - Occupational Safety*, Circular.

[256] Government of Victoria, 1983 (est), *Safe Working in State Government Employment - Code of General Principles*, Manual.

[257] Department of Crown Lands and Survey, 1968, *Circular No. 78/68 - Workers Compensation and Safety on the Job*, Circular.

[258] Department of Crown Lands and Survey, 1971, *Circular No. 5/71 - Workers Compensation and Safety on the Job*, Circular.

[259] Keith Turnbull Research Institute, 1982, *Pesticide Information No. 32, 2,4,5-T Policy,* Publication.

Between 1983 and 1995 safety became an integral part of work culture. The Victorian Government's *Safe Working in State Government Employment, Code of General Principles*[260] introduced a 'team' approach to safety and required training at every level. Two policies were adopted by the Department in 1983, *Policy on Accident Prevention*[261] and *Summary of Safety Policy*.[262] These policies required Department employees to:

- know how to do their job safely
- follow recommended safety procedures
- use safety equipment
- ensure equipment was in good order and replaced/repaired if needed
- correct and/or report any safety hazard or incident and accident to their supervisor.[263]

In 1986, the first Department OHS policy was in place, and in 1989, the first edition of the Department's OHS Manual was published. This followed the introduction of the *Occupational Health and Safety Act 1985* (OHS Act).

Table 8.2 Department policies on general safety

Year	Policy
1968	*Circular No.78/68 Workers Compensation and Safety on the Job*[264]
1969	*Circular No. 75/69 Observation of Safety Precautions*[265]
1971	*Circular No. 5/71 Workers Compensation and Safety on the Job* (includes Safety Policy)[266]
1979	*Circular No. 36/79 Safety on the Job*[267]
1983	*Policy on Accident Prevention*[268] *Summary of Safety Policy*[269]
1986	*Occupational Health and Safety Policy*[270]
1988	*Occupational Health and Safety Policy*[271]
1989	*Occupational Health and Safety Manual*[272]
1995	*Occupational Health and Safety Manual*[273] including: – Section 3.13 Chemical Handling Policies and Instructions

[260] Keith Turnbull Research Institute, 1982, *Pesticide Information No. 32, 2,4,5-T Policy,* Publication.

[261] Department of Crown Lands and Survey, 1983, *Policy on Accident Prevention*, Note.

[262] Department of Crown Lands and Survey, 1983, *Summary of Safety Policy*, Note.

[263] Department of Crown Lands and Survey, 1983, *Summary of Safety Policy*, Note.

[264] Department of Crown Lands and Survey, 1968, *Circular No. 78/68 - Workers Compensation and Safety on the Job*, Circular.

[265] Department of Crown Lands and Survey, 1969, *Circular 75/69 Observation of Safety Precautions*, Circular.

[266] Department of Crown Lands and Survey, 1971, *Circular No. 5/71 - Workers Compensation and Safety on the Job*, Circular.

[267] Department of Crown Lands and Survey, 1979, *Circular No. 36/79 - Safety on the Job*, Circular.

[268] Department of Crown Lands and Survey, 1983, *Policy on Accident Prevention*, Note.

[269] Department of Crown Lands and Survey, 1983, *Summary of Safety Policy*, Note.

[270] Department of Conservation Forests & Lands, 1986, *Occupational Health and Safety Policy*, Note.

[271] Department of Conservation Forests and Lands, (unpublished 1988), *Ballarat Region Safety Bulletin No. 3,* Bulletin.

[272] Department of Conservation and Natural Resources, 1995, *Occupational Health and Safety Manual*, Manual.

[273] Department of Conservation and Natural Resources, 1995, *Occupational Health and Safety Manual*, Manual p3.13.1.

Department safety policies on the safe handling, storage and use of pesticides were developed over the course of the Period. These polices are described below in time brackets:

- 1965 to 1976
- 1976 to 1981
- 1982 to 1995.

These time periods were chosen because the contaminant TCDD in 2,4,5-T was known to have changed. Table 8.3 is a consolidated list of these policies for the Period.

Table 8.3 Department policy on the safe handling, storage and use of pesticides

Year	Policy
1963	*Bulletin No. 3 Noxious Weeds: Recommendations for Control*[274]
1970	*Bulletin No. 3b Noxious Weeds: Recommendations for Control*[275]
1972	*Bulletin No. 3c Noxious Weeds: Recommendations for Control*[276] *Circular No. 57/72 Safety & Pesticides*[277]
1975	*Bulletin No. 3D: Recommendations for the Control of Noxious Weeds in Victoria*[278]
1977	*Bulletin No. 3E: Recommendations for the Control of Noxious Weeds in Victoria*[279]
1982	*Circular No. 90/82 Future Use of 2,4,5-T*[280]
1983	*Bulletin No. 3F: Recommendations for the Control of Noxious Weeds in Victoria*[281] *Circular No. 5/83 Enquiries on the use of 2,4,5-T*[282] *Safety Clothing and Equipment*[283] *Circular No. 94/83 Use of 2,4,5-T*[284]
1984	*Circular No. 6/84 Compulsory use of safety clothing and equipment* [285]

[274] Department of Crown Lands and Survey, 1963, *Noxious Weeds - Recommendations for Control, Bulletin No. 3*, Publication.

[275] Department of Crown Lands and Survey, 1970, *Noxious Weeds - Recommendations for Control, Bulletin No. 3b*, Publication.

[276] Department of Crown Lands and Survey, 1972, *Noxious Weeds - Recommendations for Control, Bulletin No. 3c*, Publication.

[277] Department of Crown Lands and Survey, 1972, *Circular 57/72 - Safety & Pesticides*, Publication.

[278] Department of Crown Lands and Survey, 1975, *Recommendations for Control of Noxious Weeds, Bulletin No. 3D,* Publication.

[279] Department of Crown Lands and Survey, 1977, *Recommendations for Control of Noxious Weeds, Bulletin No. 3E,* Publication.

[280] Department of Crown Lands and Survey, 1982, *Circular No. 90/82 - Future Use of 2,4,5-T Division of Inspection and Vermin and Noxious Weeds Destruction*, Circular.

[281] Department of Conservation Forests and Lands, 1983, *Circular No. 87/83 - Recommendation Bulletin 3F*, Circular.

[282] Department of Crown Lands and Survey, 1983, *Circular No. 5/83 - Enquiries on the Use of 2,4,5-T*, Circular.

[283] Department of Crown Lands and Survey, 1983, *Safety Clothing and Equipment,* Memorandum.

[284] Department of Crown Lands and Survey, 1983, *Circular No. 94/83, Use of 2,4,5-T*, Circular.

[285] Department of Conservation and Natural Resources, 1993, *Safe Use of Herbicides - Policy No. 05-20-0114-1,* Policy; Department of Crown Lands and Survey, 1984, *Circular 6/84 Compulsory use of safety clothing and equipment*, Circular; Department of Conservation and Natural Resources, 1993, *Occupational Health and Safety*, Policy; Department of Conservation and Natural Resources, 1993, *Occupational Health & Safety Policy - Reissue and Update*, Memorandum; Department of Conservation and Natural Resources, 1995, *Occupational Health and Safety Manual*, Manual p3.13.1.

Year	Policy
1986	*Pesticide Manual*[286]
1993	*Safe Use of Pesticides*[287]
1995	Department of Conservation and Natural Resources, *Occupational Health and Safety Manual* includes:[288] – Section 3.13 Chemical Handling Policies and Instructions – Safe Use of Agricultural Chemicals for Weed Control (PO 99).

Department safety policies 1965 to 1976

There was generally an absence of specific policy for the safe use of pesticides during this period. There were no standards relating to TCDD levels in 2,4,5-T before 1976 and there was also no obligation for employers to have a safety policy. However, there was a great focus placed on taking safety precautions when workers used pesticides like larvacide, a poison used for rabbit control. There was little detailed reference to pesticides safety in Department safety policy or in the large volume of policies and instructions issued to inspectors and then on to workers in this time period. See the section below entitled **Communications** that provides a detailed overview of this communication that occurred via circulars, pesticide information sheets and correspondence.

From the early 1960s, the over-riding instruction in the policies on the use of pesticides was to keep spray vapour and drift away from agricultural crops and orchards to avoid damage.[289] In 1968, following a tragic accident, a Department circular advised senior inspectors and inspectors to 'see that all equipment is maintained in safe working condition and that working practices in the field do not unnecessarily increase the risk of injury to employees.' The directions that followed applied predominantly to safe vehicle use.[290] The *Noxious Weed Recommendations for Control Bulletin* (the *Bulletin*) highlighted the absence of specific pesticide safety instructions during the early stages of the Period. The *Bulletin* was a key policy of the VNWDB, published in five editions from 1963, that drew on the research and extension work of the Department's officers to ensure effective use of pesticides.[291] It was not until 1972, in the third edition of the *Bulletin*, that brief pesticide safety warnings were communicated, including to read the label, and to note in particular the warnings and cautions on the label.[292]

It is interesting to note that evidence from several pesticide labels, for pesticides used by the Department, did not prescribe (recommend) any protective clothing for 2,4-D or 2,4,5-T, even in some cases up to 1987 (Figures 8.1 and 8.2). Despite this gap in information, the Department relied on the standard instruction to 'read the label' and did not provide alternative details of appropriate PPE. Worker's health did not seem to be an imperative.

[286] Department of Conservation Forests and Lands, 1986, *Forestry Pesticide Manual,* Manual.

[287] Department of Conservation and Natural Resources, 1993, *Safe Use of Herbicides,* Policy.

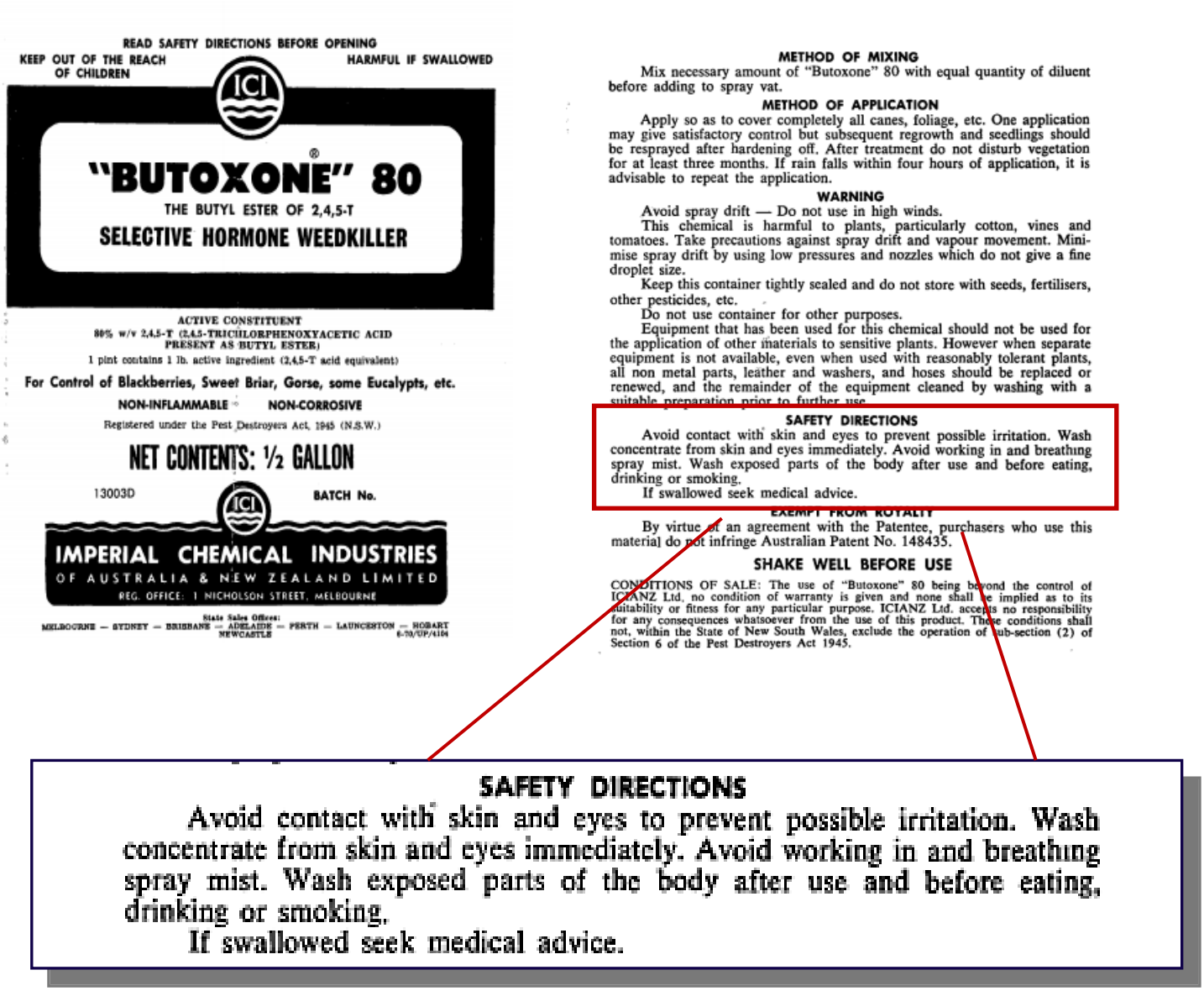
[288] Department of Conservation and Natural Resources, 1993, Safe use of Herbicides, Policy.

[289] Department of Crown Lands and Survey, 1983, *Recommendations for Control of Noxious Weeds, Bulletin No. 3F*, Publication; Department of Crown Lands and Survey, 1977, *Recommendations for Control of Noxious Weeds, Bulletin No. 3E*, Publication; Department of Crown Lands and Survey, 1975, *Recommendations for Control of Noxious Weeds, Bulletin No. 3D*, Publication; Department of Crown Lands and Survey, 1970, *Noxious Weeds - Recommendations for Control Bulletin No. 3b*, Publication; Department of Crown Lands and Survey, 1963, *Noxious Weeds - Recommendations for Control, Bulletin No. 3*, Publication.

[290] Department of Crown Lands and Survey, 1968, *Circular No. 78/68 - Workers Compensation and Safety on the Job*, Circular.

[291] Department of Crown Lands and Survey, 1963, *Noxious Weeds - Recommendations for Control, Bulletin No. 3*, Publication.

[292] Department of Crown Lands and Survey, 1972, *Noxious Weeds - Recommendations for Control Bulletin No. 3c*, Publication.



READ SAFETY DIRECTIONS BEFORE OPENING

KEEP OUT OF THE REACH OF CHILDREN

HARMFUL IF SWALLOWED

"BUTOXONE" 80

THE BUTYL ESTER OF 2,4,5-T

SELECTIVE HORMONE WEEDKILLER

ACTIVE CONSTITUENT

80% w/v 2,4,5-T (2,4,5-TRICHLORPHENOXYACETIC ACID PRESENT AS BUTYL ESTER)

1 pint contains 1 lb. active ingredient (2,4,5-T acid equivalent)

For Control of Blackberries, Sweet Briar, Gorse, some Eucalypts, etc.

NON-INFLAMMABLE NON-CORROSIVE

Registered under the Pest Destroyers Act, 1945 (N.S.W.)

NET CONTENTS: ½ GALLON

13003D BATCH No.

IMPERIAL CHEMICAL INDUSTRIES

OF AUSTRALIA & NEW ZEALAND LIMITED

REG. OFFICE: 1 NICHOLSON STREET, MELBOURNE

State Sales Offices:

MELBOURNE — SYDNEY — BRISBANE — ADELAIDE — PERTH — LAUNCESTON — HOBART NEWCASTLE

6-70/UP/4104

METHOD OF MIXING

Mix necessary amount of "Butoxone" 80 with equal quantity of diluent before adding to spray vat.

METHOD OF APPLICATION

Apply so as to cover completely all canes, foliage, etc. One application may give satisfactory control but subsequent regrowth and seedlings should be resprayed after hardening off. After treatment do not disturb vegetation for at least three months. If rain falls within four hours of application, it is advisable to repeat the application.

WARNING

Avoid spray drift — Do not use in high winds.

This chemical is harmful to plants, particularly cotton, vines and tomatoes. Take precautions against spray drift and vapour movement. Minimise spray drift by using low pressures and nozzles which do not give a fine droplet size.

Keep this container tightly sealed and do not store with seeds, fertilisers, other pesticides, etc.

Do not use container for other purposes.

Equipment that has been used for this chemical should not be used for the application of other materials to sensitive plants. However when separate equipment is not available, even when used with reasonably tolerant plants, all non metal parts, leather and washers, and hoses should be replaced or renewed, and the remainder of the equipment cleaned by washing with a suitable preparation prior to further use.

SAFETY DIRECTIONS

Avoid contact with skin and eyes to prevent possible irritation. Wash concentrate from skin and eyes immediately. Avoid working in and breathing spray mist. Wash exposed parts of the body after use and before eating, drinking or smoking.

If swallowed seek medical advice.

EXEMPT FROM ROYALTY

By virtue of an agreement with the Patentee, purchasers who use this material do not infringe Australian Patent No. 148435.

SHAKE WELL BEFORE USE

CONDITIONS OF SALE: The use of "Butoxone" 80 being beyond the control of ICIANZ Ltd, no condition of warranty is given and none shall be implied as to its suitability or fitness for any particular purpose. ICIANZ Ltd. accepts no responsibility for any consequences whatsoever from the use of this product. These conditions shall not, within the State of New South Wales, exclude the operation of sub-section (2) of Section 6 of the Pest Destroyers Act 1945.

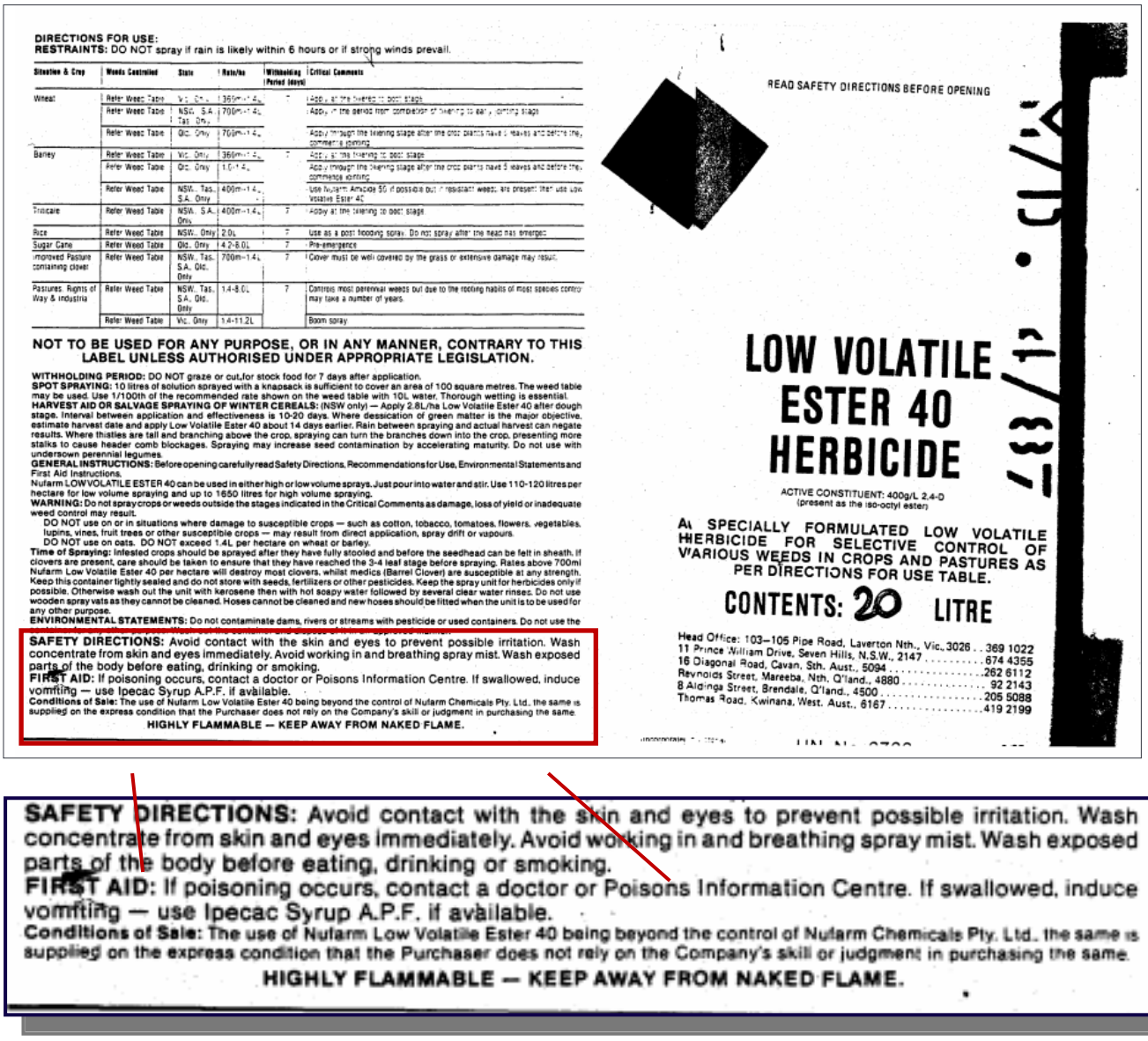
SAFETY DIRECTIONS

Avoid contact with skin and eyes to prevent possible irritation. Wash concentrate from skin and eyes immediately. Avoid working in and breathing spray mist. Wash exposed parts of the body after use and before eating, drinking or smoking.

If swallowed seek medical advice.

Figure 8.1 'Butoxone' 80 label.[293]

[293] Imperial Chemical Industries (ICI), 1965 (est), *Butoxone 80,* Label.



DIRECTIONS FOR USE:
RESTRAINTS: DO NOT spray if rain is likely within 6 hours or if strong winds prevail.

Situation & Crop	Weeds Controlled	State	Rate/ha	Withholding Period (days)	Critical Comments
Wheat	Refer Weed Table	Vic. Only	360ml–1.4L	7	Apply at the tillering to boot stage
	Refer Weed Table	NSW., S.A., Tas. Only	700ml–1.4L		Apply in the period from completion of tillering to early jointing stage
	Refer Weed Table	Qld. Only	700ml–1.4L		Apply through the tillering stage after the crop plants have 3 leaves and before they commence jointing
Barley	Refer Weed Table	Vic. Only	360ml–1.4L	7	Apply at the tillering to boot stage
	Refer Weed Table	Qld. Only	1.0–1.4L		Apply through the tillering stage after the crop plants have 5 leaves and before they commence jointing
	Refer Weed Table	NSW., Tas., S.A. Only	400ml–1.4L		Use Nufarm Amazole 50 if possible but if resistant weeds are present then use Low Volatile Ester 40
Triticale	Refer Weed Table	NSW., S.A., Qld. Only	400ml–1.4L	7	Apply at the tillering to boot stage
Rice	Refer Weed Table	NSW., Qld. Only	2.0L	7	Use as a post flooding spray. Do not spray after the head has emerged.
Sugar Cane	Refer Weed Table	Qld. Only	4.2–8.0L	7	Pre-emergence
Improved Pasture containing clover	Refer Weed Table	NSW., Tas., S.A., Qld. Only	700ml–1.4L	7	Clover must be well covered by the grass or extensive damage may result.
Pastures, Rights of Way & Industrial	Refer Weed Table	NSW., Tas., S.A., Qld. Only	1.4–8.0L	7	Controls most perennial weeds but due to the rooting habits of most species control may take a number of years.
	Refer Weed Table	Vic. Only	1.4–11.2L		Boom spray

NOT TO BE USED FOR ANY PURPOSE, OR IN ANY MANNER, CONTRARY TO THIS LABEL UNLESS AUTHORISED UNDER APPROPRIATE LEGISLATION.

WITHHOLDING PERIOD: DO NOT graze or cut for stock food for 7 days after application.
SPOT SPRAYING: 10 litres of solution sprayed with a knapsack is sufficient to cover an area of 100 square metres. The weed table may be used. Use 1/100th of the recommended rate shown on the weed table with 10L water. Thorough wetting is essential.
HARVEST AID OR SALVAGE SPRAYING OF WINTER CEREALS: (NSW only) — Apply 2.8L/ha Low Volatile Ester 40 after dough stage. Interval between application and effectiveness is 10-20 days. Where dessication of green matter is the major objective, estimate harvest date and apply Low Volatile Ester 40 about 14 days earlier. Rain between spraying and actual harvest can negate results. Where thistles are tall and branching above the crop, spraying can turn the branches down into the crop, presenting more stalks to cause header comb blockages. Spraying may increase seed contamination by accelerating maturity. Do not use with undersown perennial legumes.
GENERAL INSTRUCTIONS: Before opening carefully read Safety Directions. Recommendations for Use, Environmental Statements and First Aid Instructions.
Nufarm LOW VOLATILE ESTER 40 can be used in either high or low volume sprays. Just pour into water and stir. Use 110-120 litres per hectare for low volume spraying and up to 1650 litres for high volume spraying.
WARNING: Do not spray crops or weeds outside the stages indicated in the Critical Comments as damage, loss of yield or inadequate weed control may result.
DO NOT use on or in situations where damage to susceptible crops — such as cotton, tobacco, tomatoes, flowers, vegetables, lupins, vines, fruit trees or other susceptible crops — may result from direct application, spray drift or vapours.
DO NOT use on oats. DO NOT exceed 1.4L per hectare on wheat or barley.
Time of Spraying: Infested crops should be sprayed after they have fully stooled and before the seedhead can be felt in sheath. If clovers are present, care should be taken to ensure that they have reached the 3-4 leaf stage before spraying. Rates above 700ml Nufarm Low Volatile Ester 40 per hectare will destroy most clovers, whilst medics (Barrel Clover) are susceptible at any strength.
Keep this container tightly sealed and do not store with seeds, fertilizers or other pesticides. Keep the spray unit for herbicides only if possible. Otherwise wash out the unit with kerosene then with hot soapy water followed by several clear water rinses. Do not use wooden spray vats as they cannot be cleaned. Hoses cannot be cleaned and new hoses should be fitted when the unit is to be used for any other purpose.
ENVIRONMENTAL STATEMENTS: Do not contaminate dams, rivers or streams with pesticide or used containers. Do not use the

SAFETY DIRECTIONS: Avoid contact with the skin and eyes to prevent possible irritation. Wash concentrate from skin and eyes immediately. Avoid working in and breathing spray mist. Wash exposed parts of the body before eating, drinking or smoking.
FIRST AID: If poisoning occurs, contact a doctor or Poisons Information Centre. If swallowed, induce vomiting — use Ipecac Syrup A.P.F. if available.
Conditions of Sale: The use of Nufarm Low Volatile Ester 40 being beyond the control of Nufarm Chemicals Pty. Ltd., the same is supplied on the express condition that the Purchaser does not rely on the Company's skill or judgment in purchasing the same.
HIGHLY FLAMMABLE — KEEP AWAY FROM NAKED FLAME.

READ SAFETY DIRECTIONS BEFORE OPENING

LOW VOLATILE ESTER 40 HERBICIDE

ACTIVE CONSTITUENT: 400g/L 2,4-D (present as the iso-octyl ester)

A SPECIALLY FORMULATED LOW VOLATILE HERBICIDE FOR SELECTIVE CONTROL OF VARIOUS WEEDS IN CROPS AND PASTURES AS PER DIRECTIONS FOR USE TABLE.

CONTENTS: 20 LITRE

Head Office: 103–105 Pipe Road, Laverton Nth., Vic., 3026 . . 369 1022
11 Prince William Drive, Seven Hills, N.S.W., 2147 . . . . . 674 4355
16 Diagonal Road, Cavan, Sth. Aust., 5094 . . . . . 262 6112
Reynolds Street, Mareeba, Nth. Q'land., 4880 . . . . . 92 2143
8 Aldinga Street, Brendale, Q'land., 4500 . . . . . 205 5088
Thomas Road, Kwinana, West. Aust., 6167 . . . . . 419 2199

Figure 8.2 Low Volatile Ester 40 Herbicide, circa 1987.[294]

The Department's 1969 policy, *Observation of Safety Precautions*[295] highlighted the poor use of PPE as one of the three main causes of injury. It also pointed to the long-term impacts that can result years later from what, at the time, may seem insignificant injuries.[296]

In 1972, *Circular No. 57/72 Safety & Pesticides* signalled a significant shift in pesticide use policy. The policy still maintained that, 'pesticides in common use by the Board are relatively low hazard to users', however, the policy stated, 'persons using pesticides regularly, even at low concentrations must safeguard themselves against the possibility of chronic effects'. The policy required that 'correct protective clothing as specified on the label is used and it is in good condition' and cautioned that 'prolonged inhalation of fumes and sprays is normally harmful, so use a mask'.[297] The Department's policy began to focus on protecting worker health, and included directions for hygienic practices, like washing thoroughly after use or

[294] Nufarm Chemicals Pty. Ltd, 1987, *Low Volatile Ester 40 Herbicide*, Label. (Note: Assumed date stamped on label is April 1987).

[295] Department of Crown Lands and Survey, 1969, *Circular No.75/69 Observation of Safety Precautions,* Circular.

[296] Department of Crown Lands and Survey, 1969, *Circular No.75/69 Observation of Safety Precautions,* Circular.

[297] Department of Crown Lands and Survey, 1972, *Circular No. 57/72 - Safety & Pesticides,* Circular.

immediately after a spill. The inclusion of a specific requirement to wear a mask and to wear PPE, in accordance with the label, was a significant change to the safety message[298] but it appears to be an isolated position.

In comparison, in 1965 the Victorian Forests Commission was proactive in directing all officers who used pesticides that they 'must note the cautions and safety measures' stated in the communiqué, that they must wear protective clothing when handling poisonous substances, and that 'gas masks, not respirators are to be worn where poisonous pesticides are mixed in close or inadequately ventilated spaces or when operators are exposed directly to concentration of dusts, sprays, etc.'[299]

While the safety messages in the Department's circulars improved by the mid-1970s, safety policy was not embedded into work practice. For example, circulars on safety and the safe use of pesticides were prepared independently, rather than as a standard part of business planning, work instructions and safety policy. The 1972 *Statement of the Objectives of the Vermin and Noxious Weeds Destruction Board* did not include safety objectives[300] and neither did the 1974 senior inspector's duty statement.[301]

Department safety policies 1976 to 1981

During this period, the level of awareness grew that 2,4,5-T was hazardous due to the contaminant TCDD, and the Department responded by revising pesticide safety policy, for example, by encouraging workers to wear PPE. In 1976, the maximum level of 0.1 ppm of TCDD content in 2,4,5-T became law. In 1977–1978 the *Inspectors' Manual* required inspectors to foster a 'safety-first' attitude[302] particularly in relation to vehicles and plant. The manual gave instructions for safe pesticide use and how to prevent absorption into the body. The 1979, *Circular No. 36/79, Safety on the Job* required senior inspectors and inspectors to increase worker supervision. Instructions were issued for the safe use of vehicles, plant and equipment, and inspectors were to instruct workers that they **should wear** the protective clothing and boots supplied when pesticides were used.[303]

In response to the Victorian Trade Hall Council resolution on the use of herbicides,[304] a draft 2,4-D and 2,4,5-T use policy was developed in 1979 by the Health Department. It proposed that all persons exposed to these chemicals during use should have special protective clothing to ensure that skin absorption does not occur, access to gauze face masks, towelling and gloves for mixing the spray, and sufficient quantities of water, soap and towelling available for clean-up after use. The Minister for Health recommended standard issue PPE when using 2,4-D and 2,4,5-T as boiler suits, bib-and-brace overalls and rubber boots.[305] There is no evidence of a response from the Minister for Lands, however, in separate correspondence three months later, the Minister for Lands stated, 'The herbicides used by the Department are not highly toxic and therefore protective clothing of this nature (waterproof suits and face masks) is not required. Nevertheless the Department does provide its workmen with overalls or boiler suits and rubber boots for use when applying any herbicide'.[306]

In mid-1979, a series of pesticide information sheets[307] were made available to all workers (see the Communication section later in this chapter for further detail on these) and also formed the basis of Department training. They emphasised the risks of herbicides generally and the requirement to cover exposed skin by wearing PVC gloves when handling concentrate[308], or a face shield where there was a risk of splashing[309], but they did not include a requirement for respiratory protection.

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298 Department of Crown Lands and Survey, 1972, *Circular No. 57/72 - Safety & Pesticides*, Circular.

299 Forests Commission of Victoria, 1965, *Current Affairs and Information Subject – Pesticides*, Communique.

300 Vermin and Noxious Weeds Destruction Board, 1972, *Statement of the Objectives of the Vermin and Noxious Weeds Destruction Board*, Report.

301 Vermin and Noxious Weeds Destruction Board, 1974, *Duties of a Senior Inspector*, Report.

302 Department of Crown Lands and Survey, 1977 (est), *Inspectors' Manual*, Manual.

303 Department of Crown Lands and Survey, 1979, *Circular No. 36/79 - Safety on the Job*, Circular.

304 Victorian Trades Hall Council, 1979, Letter to the Premier in regard to VTHC Resolution on the use and handling of 2,4-D and 2,4,5-T, 14 February 1979, Letter.

305 Minister of Health, 1979, *Resolution carried by the Victorian Trades Hall Council on the use of herbicides*, Letter; Minister of Health, undated, *Response to VTHC letter to Premier, Letter (draft only).*

306 Minister of Lands, 1979, *RE: noxious weed control,* Letter.

307 Keith Turnbull Research Institute, 1979, *Pesticide Information No. 1.1 Introduction*, Publication.

308 Keith Turnbull Research Institute, 1979, *Pesticide Information, No 1.3 Toxicity of Pesticides*, Publication.

The pesticide information sheets on 2,4-D[310] and 2,4,5-T[311] recommended operators to, 'Avoid contact with the skin and eyes to prevent possible irritation. Wash concentrate from skin and eyes immediately. Avoid working in and breathing spray mist. Wash exposed parts of the body after use and before eating, drinking or smoking.' *Pesticide Information No 1.3 Toxicity of Pesticides* defined the lethal dose and toxicity for each pesticide for a 70 kg person and emphasised the importance of PPE, advising that 'the risk is greater when handling the concentrate.'[312] This communication included the following directives:

> *Avoid skin contact wherever possible and provide protection for body surfaces. Extra care is necessary if wounds are present as entry is faster where skin is broken.P.V.C. or rubber gloves **may** be used when handling concentrates.*
>
> *Where splashing of liquid concentrates **may** occur a clear plastic face shield is **recommended**. Many formulations may irritate or damage eyes.*
>
> *Arms and legs **should** be covered while spraying and rubber boots are necessary to prevent absorption through the feet. A wide brimmed hat or P.V.C. sou'wester will help keep spray mist off the face and neck. Avoid working in and breathing the spray mist.*
>
> *Protective clothing **should** be regularly washed. It should be changed immediately if concentrate is spilled on it.*
>
> *Rubber boots **should** be decontaminated regularly both on the inside as well as the outside.* [313] [emphasis added]

The notable absence of the word '**must**' conveys the possibility that these directives were perceived to be not mandatory. *Pesticide Information No. 2.1 Safe Use of Herbicides*, went to all inspectors[314] and included these instructions:

> *Follow mixing instructions carefully.*
>
> *Wear clean protective clothing and equipment recommended on label.*
>
> *Use face shield where there is danger of splashing concentrate.* [315]

Even the phrase 'where there is danger of splashing concentrate' leaves the decision to the worker and could give the impression it was optional.

In 1979, following several accidents, the Department *Circular No. 36/79, Safety on the Job*, advised 'Senior Inspectors and Inspectors of the need for greater supervision over the workforce and to instruct employees of the need for much greater care in implementation of their work'.[316] *Pesticide Information No. 4.12 2,4-D Sodium Salt*, dated June 1981, instructed pesticide users on precautions when using 2,4-D salt forms and included these instructions:

> *2,4-D, like any herbicide, could be dangerous if swallowed, inhaled or absorbed through skin. Wear rubber gloves when handling the concentrate. If splash of the concentrate occurs wash from skin and eye immediately. Avoid working in and breathing the spray mist. Wash exposed parts of the body after spraying and before eating, drinking or smoking.*[317]

In 1981, the Department's position on the use of PPE when spraying 2,4,5-T, according to the Secretary for Lands was:

> *2,4,5-T is the most cost efficient material to use and has the advantage of being the most selective. 2,4,5-T is not harmful to the operator in normal use … Exposed skin should be kept to a minimum by wearing protective clothing – coveralls, rubber boots and wide brimmed hats. Rubber or PVC gloves should be worn when handling the concentrated material in the can. Face and hands should be washed with soap and water before eating or smoking. Avoid working down-wind of the spraying and the spray mist.*[318]

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309 Keith Turnbull Research Institute, 1979, *Pesticide Information, No 2.1 Safe Use of Pesticides*, Publication.

310 Keith Turnbull Research Institute, 1979, *Pesticide Information No. 4.2 - 2,4-D Ester Formulations*, Publication.

311 Keith Turnbull Research Institute, 1979, *Pesticide Information No. 4.4 - 2,4,5-T (Ester Formulations)*, Publication.

312 Keith Turnbull Research Institute, 1979, *Pesticide Information No. 1.3 Toxicity of Pesticides*, Publication.

313 Keith Turnbull Research Institute, 1979, *Pesticide Information, No 1.3 Toxicity of Pesticides*, Publication.

314 Keith Turnbull Research Institute, 1979, *Pesticide Information No. 2.1, Safe Use of Herbicides,* Publication.

315 Keith Turnbull Research Institute, 1979, *Pesticide Information No. 2.1 - Safe Use of Herbicides*, Publication.

316 Department of Crown Lands and Survey, 1979, *Circular No. 36/79 RE: Safety on the Job*, Circular.

317 Keith Turnbull Research Institute, 1981, *Pesticide Information No. 4.12 - 2,4-D Sodium Salt*, Publication.

318 Department of Crown Lands and Survey, 1981, *Control of Blackberry,* Letter.

This was more prescriptive than the generic 1979 pesticide information sheet instructions for the use of 2,4,5-T that read:

> *Avoid contact with the skin and eyes to prevent possible irritation. Wash concentrate from skin and eyes immediately. Avoid working in and breathing spray mist. Wash exposed parts of the body after use and before eating, drinking and smoking.*[319]

Department safety policies 1982 to 1995

In 1982, following release of a revised government policy on 2,4,5-T, there was clearly a higher level of awareness around TCDD, a contaminant of 2,4,5-T. The superintendent wrote to all senior inspectors and inspectors in *Circular No. 90/82 Future use of 2,4,5-T*, and stated the Government's policy position on 2,4,5-T. The policy was discussed at training courses and included:

> *All future supplies of 2,4,5-T had to meet the standard for the level of TCDD of 0.01 ppm.*
>
> *High volatile formulations of 2,4,5-T (80% active constituent) are no longer to be sold or used* [by the Department].
>
> *Inspectors were to hold (not to sell, use or dispose of) high volatile formulations* [of 2,4,5-T] *until further notice.*

And further:

> *Operator Safety – (i) Protective clothing: All Government workers when using 2,4,5-T are* ***required*** *to wear boots (rubber boots* ***are preferred*** *to leather because they are less absorbent), overalls, rubber gloves, and a face shield or respirator. Rubber gloves, as displayed at the training courses, have already been supplied, and* ***the preferred*** *PVC type will be available shortly. (Kitchen-type gloves are acceptable and, if necessary, can be purchased locally).*
>
> *Face shields* ***are preferred*** *to respirators and have been, or will be, issued to all workers. The type on issue at present is fitted to a hard-hat but other types may be available in the future. Respirators are available for workers who* ***prefer*** *them to face shields. Inspectors should order any of this equipment which they require.* [320] [emphasis added]

Whilst these policy documents are more specific, the language was still not clear, for example, ' … rubber boots are preferred … the preferred PVC type will be available shortly … Face shields are preferred to respirators …'

In response to the new government policy, the 1983 Department policy on the safe use of 2,4-D and 2,4,5-T included the requirement for more specific safety requirements and PPE, such as the requirement for full face protection when mixing. During 1983, the Department policy was that 'an employee cannot be forced to wear protective clothing and equipment' and that it was 'the employer's responsibility to make the equipment available and to urge the employee to use it.'[321] However, in 1984, the Department altered this position, and established policy that it was compulsory for workers using pesticides to wear PPE issued.[322]

The 1986 publication of the Department's *Pesticides Manual* was a watershed in the Department's pesticides safety policy. It was communicated to relevant officers and embedded through training.[323] It provided very clear instructions about the hazards and safety precautions associated with 2,4-D and 2,4,5-T including very clear instructions about the essential and optional PPE to be worn when either mixing, spraying or injecting pesticides.[324]

It was a revised version of the 1982 Forests Commission *Pesticides Manual***.**[325] It was based on the highly regarded herbicide use policy[326] *Safety precautions in the use of all chemicals and pesticides* introduced by the Forests Commission in 1972.

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[319] Keith Turnbull Research Institute, 1979, *Pesticide Information No. 4.4 - 2,4,5-T (Ester Formulations)*, Publication.

[320] Department of Crown Lands and Survey, 1982, *Circular No. 90/82 - Future Use of 2,4,5-T*, Circular.

[321] Department of Conservation Forests and Lands, 1984, *Circular No. 6/84 Compulsory use of safety clothing and equipment,* Circular.

[322] Department of Conservation, Forests and Lands, 1984, *Circular No. 6/84 Compulsory use of safety clothing and equipment*, Circular.

[323] Department of Conservation Forests and Lands, 1987, *Reprinting of the Forestry Pesticide Manual*, Memorandum; Department of Conservation Forests and Lands, 1987, *Reprinting of the Forestry Pesticides Manual*, Note; Department of Conservation Forests and Lands, 1987, *Pesticide Information Manual Enclosed*, Memorandum; Department of Conservation Forests and Lands, 1987, *Pesticide Information Manual*, Memorandum; Department of Conservation Forests and Lands, 1987, *Forestry Pesticide Manual*, Memorandum; Department of Conservation Forests and Lands, 1987, *Pesticide Information Manual,* Memorandum.

[324] Department of Conservation, Forests and Lands, 1986, *Forestry Pesticides Manual*, Manual.

[325] Forests Commission Victoria, 1982, *Pesticide Manual*, Manual.

[326] In June 1969 a member of the *Parliamentary Enquiry into the Effects of Pesticides* made this comment in relation to the publication during preparation for publication: "*An excellent manual. Those who have been involved in its preparation are to be commended. It*

While a big step forward for the Department, its safety policy for 2,4-D and 2,4,5-T had lagged 16 years behind the more proactive safety policies of the Forests Commission, and seven years behind the advice the Minister of Health had communicated to the Minister for Lands in 1979.[327] See Table 8.4 for a list of policies of other government bodies, against which the Department policies can be compared, and Table 8.5 for a summary of past policies on safe handling and use of pesticides during the Inquiry Period.

In 1986, the Department released an OHS policy.[328] It was revised in 1988,[329] and was followed by the release of the Department's first OHS Manual in 1989. The OHS policy may have been further revised and remained valid until 1995.[330] There is evidence it was broadly distributed to staff through safety bulletins.[331] Two specific 'safe pesticide use' policies were issued in the 1990s[332], and in 1991 and 1993 the Department published the *Safe Use of Agricultural Chemicals for Weed Control*.[333] These documents stated that the Department would only use agricultural chemicals registered for use in Victoria and only in accordance with the registered use including:

- rate of application
- application method situation
- safety precautions
- for approved weed species.

By 1991, the Department's position on compliance with safety policy was clear and worker participation in understanding their responsibilities was evident in the policy, *DCE's Responsibilities for Ensuring use of Safety Equipment when employees are using pesticides*. This policy stated that, where employees refused to wear PPE, and maintained that position after counselling with a supervisor and/or leading hand, the employee should be 'summarily dismissed'.[334]

A number of Department procedures gave the policy effect.[335] On 23 June 1993 the memo *Safe Use of Pesticides* was widely distributed and displayed.[336] The 1993 policy was endorsed by the Department OHS Committee, which included union representation, and was reissued following an update.[337]

Table 8.4 Comparative policies on the safe handling, storage and safe use of pesticides

Year	Policy
1970	Forests Commission, *Safety Precautions in the use of Chemicals and Pesticides*[338]
1976	CSIRO, *Code of Practice for Safe Use of Pesticides*[339]

appears very comprehensive but not too much so – very readable, comprehendible, as a manual should be." See Forests Commission, Division Of Education And Research, 1969, *Manual of Safety Procedures in the Use of Chemicals and Pesticides*, Memorandum.

327 Minister of Health, 1979,*The resolution carried by the Victorian Trades Hall Council on the use of herbicides, April 1979,* Letter.

328 Department of Conservation Forests and Lands, 1986, *Occupational Health and Safety Policy*, Note.

329 Department of Conservation Forests and Lands, 1988, *Ballarat Region Safety Bulletin No. 3*, February 1988, (unpublished), Bulletin.

330 Department of Conservation and Natural Resources, 1995 *Occupational Health and Safety Manual*, (unpublished), Manual.

331 Department of Conservation Forests and Lands, 1988, *Ballarat Region Safety Bulletin No. 3*, February 1988, (unpublished), Bulletin.

332 Department of Conservation and Environment, 1990, *Safe Use of Herbicides*, Policy (draft only); Department of Conservation and Natural Resources, 1993, *Safe use of Herbicides*, Policy.

333 Department of Conservation Forests and Lands, (unpublished 1988), *Ballarat Region Safety Bulletin No. 3*, February 1988, Bulletin.

334 Department of Conservation and Environment, 1991, *DCE's Responsibilities for Ensuring use of Safety Equipment when employees are using pesticides*. Memorandum.

335 Department of Conservation and Environment, 1992, *Use of Agricultural Chemicals in Department of Conservation and Environment*, Report.

336 Department of Conservation and Natural Resources, 1993, *Occupational Health and Safety Policy*, Memorandum.

337 Department of Conservation and Natural Resources, 1993, *Occupational Health & Safety Policy - Reissue and Update,* Memorandum.

338 Forests Commission, 1970, *Safety Precautions in the use of all chemicals and pesticides*, Manual.

339 CSIRO, 1976, *Code of Practice for Safe Use of Pesticides, Safety Booklet No. 3, CSIRO Melbourne*, Booklet.

Year	Policy
1980	Australian Government, *A manual of Safe Practice in the Handling and Use of Pesticides*[340]
1982	Forests Commission, *Pesticide Manual*[341]
1983	Victorian Government, *Safe Working in State Government Employment, Code of General Principles*[342]
1986	Public Service Board, *Policy Statement for OHS in the Victorian Public Service*[343]

Table 8.5 Summary of past policies on the safe handling, storage and use of pesticides

Policy	1965 to 1976	1976 to 1981	1982 to 1995
Policies relating to handling storage and use, of 2,4-D and 2,4,5-T.	Safety policy was not integrated into strategic plans and staff roles[344] and focused on accident prevention (e.g. vehicle accidents, lifting injury, slips, contact with spray drift).[345] From 1972, worker health protection gained more emphasis in policy, [346] though also in 1972 workers received mixed messages about taking precautions: 'prolonged inhalation of fumes and sprays is normally harmful, so use a mask'[347] but 'all pesticides recommended in this book are relatively safe'.[348] All staff, supervisors in particular, were responsible for safety.[349]	The risk of pesticide use was recognised, particularly handling the concentrate, however, 2,4-D and 2,4,5-T were considered relatively safe if precautions were taken. Workers were supplied with basic PPE including overalls, rubber boots and gloves and were advised to wear face shields or respirators but were not forced to wear PPE.	Workers could be dismissed for not complying with instructions, including wearing PPE. Risks of pesticides and required safety measures were clearly communicated including that gloves and face shield should be worn when handling concentrate. Publication of the Department's *Pesticide Manual* in 1986 and the *OHS Manual* in 1989 were a watershed for the communication of clear policy.

[340] Department of Primary Industry, 1980, *A Manual of Safe Practice in the Handling and Use of Pesticides,* Australian Government Publishing Service, Manual.

[341] Forests Commission, 1982, *Pesticide Manual,* Manual.

[342] Victorian Government, 1983, *Safe Working in State Government Employment: Code of General Principles*, File Note.

[343] Public Service Board of Victoria, 1986, *Policy Statement for OHS in the Victorian Public Service,* File Note; Public Service Board of Victoria, 1986, *Circular No. 6 of 1986, 20 March, 1986,* Circular.

[344] Vermin and Noxious Weeds Destruction Board, 1972, *Statement of the Objectives of the Vermin and Noxious Weeds Destruction Board*, Report; Vermin and Noxious Weeds Destruction Board, 1974, *Duties of a Senior Inspector*, Report.

[345] Department of Crown Lands and Survey, 1969, *Circular 75/69 Observation of Safety Precautions*, Circular; Department of Crown Lands and Survey, 1967, *Occupational Safety in Government Undertakings - Study Conference* - 30/11/1972, Letter; Department of Crown Lands and Survey, 1969, *Circular No. 1969/379 - Occupational Safety*, Circular.

[346] Keith Turnbull Research Institute, 1972, *Noxious Weeds - Recommendations for Control, Bulletin No. 3c*, Publication; Department of Crown Lands and Survey, 1975, *Circular No. 115/75 - Mixing Procedures for* Herbicides, Circular;Keith Turnbull Research Institute, 1970,

Findings

- In the 1960s there was a lack of awareness about the risks of herbicides as opposed to fumigants or poisonous baits.
- Department policies described 2,4-D and 2,4,5-T as relatively safe throughout the 1960s and 1970s and into the early 1980s, and did not emphasise any potential long-term health impacts.
- Policies shifted between being mandatory to optional and back again, and lagged behind similar organisations by many years.
- In 1986 the Department finally had a comprehensive policy on the safe use of pesticides.

WORKPLACE PRACTICES

The evidence of documented workplace practices (job descriptions, daily work programs, and manuals) was sparse, with the inference that verbal communication was the key method to communicate between the inspectors and the sprayers. Workers learned Department work practices through work programs prepared and implemented by their leading hands and overseen by inspectors (later renamed land management officers) and workers did not generally question instructions. This is illustrated by comments received in the interviews and submissions including:

> *I was raised In Ballarat in a working-class family. I was taught to be grateful for any job I was fortunate enough to have, and to do as I was told … At that time it would not have even occurred to me to question a directive from my employer.*[350]

> *We always said to the bosses, this stuff is terrible, and they would say, it won't hurt you,' he says. You had no choice if you wanted a job. You had to work there and use it.*[351]

> *I was only a kid working with two older blokes, I didn't ask any questions about anything much, I did as I was told.*[352]

Evidence of work programs

The inspectors and leading hands gave work programs and instructions to sprayers. These were probably verbal as there are few examples of written programs or references to work programs and those the Inquiry did find (not within the Ballarat region) didn't include any safety precautions.[353]

Supervision

The supervisory roles relevant to the field workers were the senior inspector, inspector, assistant inspector and leading hand.

Senior Inspector

In September 1974, the 'Duties of a Senior Inspector' are outlined for field, office and district duties. The duties relating to safe pesticides use included:

- Visit inspectors, paying particular attention to assisting and advising newly appointed personnel.

Noxious Weeds - Recommendations for Control, Bulletin No. 3b, Publication]; Department of Crown Lands and Survey, 1972, *Circular No. 57/72 - Safety & Pesticides*, Circular.

347 Department of Crown Lands and Survey, 1972, *Circular No. 57/72 - Safety & Pesticides*, Circular.

348 Keith Turnbull Research Institute, 1972, *Noxious Weeds - Recommendations for Control, Bulletin No. 3c*, Publication.

349 Department of Crown Lands and Survey, 1968, *Circular No. 78/68 - Workers Compensation and Safety on the Job*, Circular; Department of Crown Lands and Survey, 1971, *Circular No. 5/71 - Workers Compensation and Safety on the Job*, Circular.

350 Written submission 010.

351 Written submission 026, case study 07.

352 Written Submission 026, case study 09.

353 Department of Crown Lands and Survey, 1977, *Work Program for the 9/5/1977 to 20/5/1977*, Plan; Department of Crown Lands and Survey, 1977, *Group Payment of Workmen Supervision*, Letter; Department of Crown Lands and Survey, 1977, *Work Program - Bright District*, Letter; Department of Crown Lands and Survey, 1977, *Division of Inspection, Benalla Group Organization*, Memorandum.

- Spending at least two to three days at a time with each inspector in his district to accompany the inspector on inspections of trouble spots in his district.
- Inspect plant in operation and check on efficiency of workmen and the whole operation.
- Poisons checked to see they are locked in suitable containers, and that first aid outfits are adequate and maintained in good order.
- Check offices and depots and see they are being well maintained in every way.[354]

Inspector

In 1977, the *Inspectors' Manual* outlined an inspector's obligations as follows:

> *There is an obligation upon senior inspectors and inspectors to see that all equipment is maintained in a safe working condition and that working practices in the field do not unnecessarily increase the risk of injury."*[355]

Instructions that 'should be adhered to' included some pertaining to the safe use of equipment and vehicles, and safe travelling practices, e.g. don't ride on trailers. There was one general safety instruction:

> *If an employee persists in a practice which the Inspector has forbidden, disciplinary action is to be taken. This situation constitutes in effect, a refusal to carry out an order and as such the employee would be liable to dismissal.*[356]

As the *Inspectors' Manual* stated, the main role of the inspector was to inspect local properties, instruct landholders, serve notices and prepare prosecution applications:

> *Each Inspector selects and engages his own workmen, pays them and trains them in the correct use of sprays and poisons in the field … Any negligence or lack of supervision could result in large compensation claims against the Government.*[357]

The *Inspectors' Manual* then outlined some broader responsibilities such as:

- maintain equipment
- assist Keith Turnbull Research Institute (KTRI) officers in their research
- regulate natural resources removal as Crown Land Bailiffs
- recommend rental for grazing and land use licences.[358]

By 1977, the *Inspectors' Manual* provided instructions on the safe use of pesticides (Table 8.6).

Table 8.6 Extracts from the 1977 Inspectors' Manual[359]

Topic	Instructions
Toxicity of pesticides	*It is stressed that exposure to any pesticide must be kept to an absolute minimum. Clearly there is need for caution, and certainly no place for a 'she'll be right' attitude in dealing with pesticides.* *Arms and legs should be covered while spraying and rubber boots are necessary to prevent absorption through the feet. Rubber boots should be decontaminated regularly both on the inside as well as the outside.* *Protective clothing should be regularly washed. It should be changed immediately if concentrate is spilled on it.*

[354] Vermin and Noxious Weeds Destruction Board, 1974, *Duties of a Senior Inspector*, Report.

[355] Department of Crown Lands and Survey, (unpublished 1977 (est)), *Inspectors' Manual*, Manual, pJ3.

[356] Department of Crown Lands and Survey, (unpublished 1977 (est)), *Inspectors' Manual*, Manual, pJ4.

[357] Department of Crown Lands and Survey, (unpublished 1977 (est)), *Inspectors' Manual*, Manual pI2.

[358] Department of Crown Lands and Survey, (unpublished 1977 (est)), *Inspectors' Manual*, Manual pI3.

[359] Department of Crown Lands and Survey, (unpublished 1977 (est)), *Inspectors' Manual*, Manual pP3-P13.

Topic	Instructions
Safe use of pesticides	Detailed storage instructions included: *Store herbicides in a separate building, or in a section of depot set aside for chemical storage. Keep storage building locked when not in use.* *Wear prescribed clothing when handling pesticides.* *Always store pesticides in original container and avoid damage to labels.* Mixing procedures included: *Read the label and follow directions and precautions given. Follow mixing instructions carefully. Wear clean protective clothing and equipment recommended on label. Use face shield where there is danger of splashing concentrate.* Instructions for the submission of samples of pesticides where the properties are unusual, such as colour or consistency, were included and instructed inspectors to forward the samples to the KTRI. For disposal, the *Inspectors' Manual* refers the inspector to the sheet entitled Disposal of Pesticide Containers and Surplus Pesticide, produced by the Pesticides Review Committee (PRC), EPA and Department of Agriculture.

Leading Hand

Guidance Notes for Lands Department Leading Hands was prepared for inspectors in the late 1960s to distribute to leading hands for implementation. A leading hand was, 'An employee who is required to supervise or direct or be in charge of another employee or other employees.'[360] The guidance stated:

> *It is … essential that leading hands set an example to the workmen under their control. Leading hands are to comply with instructions given to them by the Inspector or Assistant (Inspector) and must ensure that such instructions are carried out by the workmen under their control …*
>
> *SAFETY ON THE JOB*
>
> *As the accident rates in all facets of industry are on the increase it is essential that all forms of safety precautions be observed. The following extracts are taken from Department Circular 78/68 and it is your duty to ensure that these instruction(s) are complied with in all work situations in the field, under your control.*[361]

Neither the guidance notes nor Circular No. 78/68 gave directions about the safe use of pesticides.[362]

Storage

Pesticide storage sheds were basic and not ventilated.[363] There is evidence that the Department pesticide storage facilities in the Ballarat region were basic in the 1960s, and sub-standard, and responses to address issues were often slow to occur in several cases. For example:

- In 1967, the Linton depot did not have a water supply[364], and poisons were not locked up as of 1988.[365]
- At the Scarsdale depot in 1988, it was reported that poisons were stored in the open.[366]
- Poor ventilation was reported at Beaufort up to 1992.[367]

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[360] Department of Crown Lands and Survey, (unpublished 1977 (est)), *Inspectors' Manual,* Manual pJ14.

[361] Department of Crown Lands and Survey, 1971, *Guidance Notes for Lands Department Leading Hands,* Notes, p1.

[362] Department of Crown Lands and Survey, 1968, *Circular 78/68 - Workers Compensation and Safety on the Job*, Circular.

[363] Department of Crown Lands and Survey, 1967, *1080 Mixing Site Depot Site Ballarat Group,* Letter; Department of Conservation and Natural Resources, 1992, *Ballarat Region Occupational Health and Safety Committee - Minutes of Meeting Held on 7 February 1992*, Minutes, p2.

[364] Department of Crown Lands and Survey, 1967, *1080 Mixing Site Depot Site Ballarat Group,* Letter, p2 .

[365] Department of Conservation Forests and Lands, 1988, *Vickers Street Safety Committee Meeting Minutes, 12 August 1988*, Minutes, p2.

[366] Department of Conservation Forests and Lands, 1988, *Vickers Street Safety Committee Meeting Minutes, 12 August 1988*, Minutes, p2.

- It took at least 10 years to address concerns with the relocation of the Bacchus Marsh depot.[368]

The Department had a consistent practice on chemical storage and container handling from 1972. *Bulletin No. 3* states, 'Store the herbicides in their original containers, kept tightly closed, away from seed and feed, and out of reach of children and livestock.' [369]

In 1972, *Circular No. 57/72 Safety and Pesticides*, from the Secretary of the VNWDB to all inspectors restated the *Bulletin No. 3* position.[370]

Prior to 1989, the design of the Department's pesticide storage sheds either did not have ventilation or included small vents on some walls, for example, the 'Nissan' hut, which was in common use, included small vented windows on the front wall.

There is evidence that adequate ventilation was not installed in all Department depots and sheds until about 1991, after which, upgrades to depots were undertaken, driven in part by Australian Workers Union (AWU) complaints. Commenting on new shed and ventilation installation a regional officer observed 'it only took a couple of hours and it is amazing the strong chemical odour doesn't occur now.'[371]

Handling

A consistent practice by the Department from 1965 to 1995 was that workers mixing and spraying pesticides should follow the directions provided on manufacturers' labels. For example:

> *Always read the label before opening the container, noting particularly the warning and cautions, and repeat the process every time, no matter how often you use a herbicide or how familiar you are with the directions. Use the material only in the amounts recommended and at the times specified.*[372]

In the 1960s the safety instructions emphasised use that would avoid damage to crops and other agricultural areas rather than protection of the sprayer. The focus of precautionary instructions issued by the Department were to (a) follow the instructions on the pesticide label and (b) to exercise precautions such as not spraying on windy days to avoid spray and vapour drift.[373] Minimising spray drift was the priority for the VNWDB as evidenced in the 1969 circular titled: *The use of herbicides in the vicinity of susceptible crops*, from the Chair of VNWDB:

> *Every Inspector must adhere to the instructions contained in this circular. It is essential that all Assistants, Leading Hands and Workmen are made aware of the damage that can be caused by the use of herbicides near susceptible crops, and that they are advised of the restrictions contained in this circular.*[374]

A 1972 circular from the Secretary of the VNWDB to all inspectors provided instructions for spills and accidental contamination, based on advice from the Forests Commission.[375]

In 1975, *Circular No. 115/75 Mixing Procedures for Herbicides* instructed all senior inspectors and inspectors on mixing procedures to achieve the best results with the pesticides available.[376]

Personal protective equipment

It was recognised by the Department in 1965 that hormone-weedkillers could cause injury to workmen, and that some workers were more sensitive to the pesticides than others. Respirators were issued for more dangerous substances used for fumigation, such as chloropicrin.[377]

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[367] Department of Conservation and Natural Resources, 1992, *Ballarat Region Occupational Health and Safety Committee - Minutes of Meeting Held on 7 February 1992*, Minutes, p2.

[368] Minister of Lands, 1982, *Bacchus Marsh Depot*, Letter.

[369] Keith Turnbull Research Institute, 1972, *Noxious Weeds - Recommendations for Control, Bulletin No. 3c*, Publication, p4.

[370] Department of Crown Lands and Survey, 1972, *Circular No. 57/72 - Safety & Pesticides*, Circular.

[371] Department of Conservation and Environment, 1991, *Memorandum to Regional Mangers re Ventilation of Weedicide Storage Sheds July 9 1991*, Memorandum.

[372] Keith Turnbull Research Institute, 1972, *Noxious Weeds - Recommendations for Control, Bulletin No. 3c*, Publication, p4.

[373] Vermin and Noxious Weeds Destruction Board, 1969, *The use of herbicides in the vicinity of susceptible crops,* Circular.

[374] Vermin and Noxious Weeds Destruction Board, 1969, *The use of herbicides in the vicinity of susceptible crops*, Circular.

[375] Department of Crown Lands and Survey, 1972, *Circular No. 57/72 - Safety & Pesticides*, Circular.

[376] Department of Crown Lands and Survey, 1975, *Circular No. 115/75 - Mixing Procedures for Herbicides*, Circular.

The Chairman of the VNWDB stated in 1965, in response to the Committee of Enquiry into the Effects of Pesticides that:

> *… there had been a few cases of injury to workmen. These had been caused by the hormone-weedkillers – eyelids had been inflamed … Respirators were supplied for use with the fumigant poisons, but because they were uncomfortable, they were seldom worn.*[378]

It was noted in 1967 that gas masks were not practical for use with highly toxic fumigation gases,[379] suggesting that they may not have been worn. Standard issue PPE was boots and bib-and-brace overalls.[380,381] These were not always available due to lack of budget and use was not enforced.[382]

There is no evidence that prescribed respirators, approved by the Minister for Health, were used by the Department employees for mixing pesticides at any point in time. Even as late as 1979 there was no evidence of a mandatory requirement for respirators when handling concentrate.[383]

In early 1967, it was recommended to the VNWDB that workmen using misting machines should avoid contact with the mist as much as possible and wear a face mask such as the 'Browguard'.[384] In February 1967 the Board agreed to purchase and trial half a dozen protective face masks to be worn when using a misting machine with Tordon.[385]

From 1979, pesticide handling instructions were provided to sprayers about the greater hazard when handling concentrates. This was clearly communicated in Pesticide Information Sheets (see Communication later in this chapter). In 1986 the Department Pesticides Manual instructed that it was essential to wear face shield when handling 2,4,5-T.

In 1979, evidence of standard issue PPE for the handling of pesticides is available. For example, the pesticide information sheet *Safe Use of Herbicides,* was sent to all inspectors and field workers.[386] This contained instructions for handling, mixing, and the necessity for protective clothing.

On 3 March 1983, a circular was issued to all staff listing the PPE that was available for them on requisition, which included:

- Safety helmet plain, safety helmet and ear muffs, safety shield mesh, safety helmet shield frame.
- Gloves PVC long, gloves PVC short, gloves leather, gloves rubber.
- Waterproof coat, waterproof trousers, waterproof sou'wester.
- Overalls (bib-and-brace), boiler suit combination, boots leather safety, rubber knee boots.
- Respirator RQ 3086 (covers nose, mouth & chin only), respirator cartridges for RQ 3086, particle masks (disposable), respirator RFF 20 (covers full face and eyes), respirator canisters for RFF 20.
- Safety goggles.
- Soap, paper towel, water container.[387]

The Department maintained the practice of recommending this more comprehensive suite of PPE from 1983 onwards.

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377 Vermin and Noxious Weeds Destruction Board, 1965, *Report on Interview with the Vermin and Noxious Weed - Destruction Board - 18th March 1965*, Minutes, p1.

378 Committee of Enquiry into the Effects of Pesticides, 1965, *Report on Interview with the Vermin and Noxious Weed - Destruction Board - 18th March 1965*, Report.

379 Department of Crown Lands and Survey, 1967, *Fumigator*, Note.

380 Department of Crown Lands and Survey, 1968, *Avoca Order for Overalls,* File Note; Department of Crown Lands and Survey, 1968, *Avoca Order Overalls,* File Note; Department of Crown Lands and Survey, 1968, *Avoca Order for Overalls*, File Note.

381 Minister of Lands, 1979, *Noxious weed control*, Letter, p2.

382 Department of Crown Lands and Survey, 1971, *(name redacted) Workman Retrenched, (depot redacted)*, Letter.

383 Vermin and Noxious Weeds Destruction Board, 1982, *Extract from Minutes of Meeting held on 15 March 1982,* Extract; Keith Turnbull Research Institute, 1979, *Pesticide Information, No 1.3 Toxicity of Pesticides*, Publication.

384 Vermin and Noxious Weeds Destruction Board, 1967*, Report to Vermin and Noxious Weeds Destruction Board 1967, Use of face guard when using misting machine,* Report.

385 Vermin and Noxious Weeds Destruction Board, *Minutes of Meeting 21 February 1967*, Minutes, p2.

386 Keith Turnbull Research Institute, 1979, *Pesticide Information No. 2.1 Safe Use of Herbicides*, Publication.

387 Department of Crown Lands and Survey, 1983, *Circular No. 8/83 - Safety Clothes*, Circular.

Washing facilities

There is evidence that 'water bags' were provided for pesticide work from the mid-1960s. Receipts for the purchase of water bags (and rubber gloves, rubber boots, and bib-and-brace) at the Avoca depot were available from Department records dated between 1965 and 1968.[388] It can be concluded that this basic safety equipment was available in depots from the early 1960s.

In 1979, in response to AWU lobbying to have spray vehicles equipped with washing facilities, a *Herald* news article reported that the Minister for Health had told the AWU that 'there was no proof that the sprays were injurious to health' and that '… it was simply a matter of personal cleanliness for employees to wash thoroughly after spraying duty'. In response, AWU Organiser Jim Williams, was quoted as saying, 'Yet a large percentage of Lands Department depots do not have a hot water supply and work vehicles do not carry sufficient water and cleaning agents for washing'.[389] The VNWDB response was to seek additional funding via the Department from Treasury[390] and inspectors were advised to provide washing facilities.[391] Anecdotal evidence also noted the lack of washing facilities (see Appendix 3).

In 1983, at a Safety Committee meeting there was discussion that laundering of clothes at depots was ineffective and that the wearing of protective clothing could result in heat fatigue on hot days. It was also discussed that gloves were not always worn when handling concentrates. It was noted that field staff reported that there was a need for a manual on safety and that this would be particularly useful for new workmen.[392]

By the mid-1980s showers were being installed at depots. Shower facilities were not available at the main depot at Vickers Street, Sebastopol until after September 1986, although plans were underway to install them, in line with AWU suggestions.[393] By 1991, Beaufort had shower facilities, although they were in need of repair and maintenance.[394]

Safety committees

A Department safety committee was established in 1971 to reduce accidents within the Department. It met every two months, and at its inaugural meeting the Chair stated:

> *The frequency rate at which accidents occur in our particular section is high. For instance, during the period from 1/1/71 to 30/6/71, six months, a total of 2,228 man-hours were lost. I am aware also that the type of work performed, and the rough nature of the country in which we operate, contributes largely to this.*[395]

Other safety committees were established at the regional and work centre levels from around the mid-1980s. These communicated safety information to regional staff and provided a forum to discuss and resolve field safety issues. While they added a great deal, there was a lack of responsiveness and sluggishness in actioning a number of important safety issues throughout the Period.

There is evidence that Work Centre Safety Committees in the Ballarat region took too long to respond to local issues. One key example was the unsuitability of PPE for Australian weather conditions, which was raised at the Interdepartmental

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388 Department of Crown Lands and Survey, 1969, *Order Water Bags* – Daylesford, Memorandum; Department of Crown Lands and Survey, 1968, *Vermin and Noxious Weeds Branch, 1968, Stores Depot SD No 1444,* Form; Department of Crown Lands and Survey, 1968, *Vermin and Noxious Weeds Branch, Stores Depot SD No 13991,* Form; Department of Crown Lands and Survey, 1968, *Vermin and Noxious Weeds Branch Stores Depot, SD No 12292*, Form; Department of Lands and Survey, 1966, *Stores Depot SD No 9224,* Form; Department of Crown Lands and Survey, 1965, *Stores Depot SD No 8051*, Form.

389 Foley J, 1979, 'Union ban on poison spraying', Herald, 30 January 1979, Newspaper article.

390 Vermin and Noxious Weeds Destruction Board, 1979, *Extract from Board meeting*, 30 January 1979, Extract.

391 Department of Crown Lands and Survey, 1979, *Circular 18/79 -Washing facilities for workman and union ban on poison spraying,* 31 January 1979, Circular.

392 Pesticide Safety Working Party, 1983, *Meeting notes*, *4 November* 1983, File Note.

393 Department of Conservation, Forests and Lands, 1986, *Ballarat Region Occupational Health and Safety Committee, Minutes of Meeting Held 11 September 1986*, Minutes; Department of Conservation, Forests and Lands, 1986, *Ballarat Region Occupational Health and Safety Committee, 1986, Minutes of Meeting Held* 18 March 1986, Minutes.

394 Department of Conservation, Forests and Lands, 1986, *Ballarat Region Occupational Health and Safety Committee, 1991, Minutes of Meeting Held 6 December 1991*, Minutes.

395 Department of Crown Lands and Survey, 1971, *Circular No. 52/71 - Departmental Safety Committee*, Circular.

Committee on Pesticides in 1962 but remained an ongoing issue under consideration by the Department's Safety Committee almost thirty years later.[396] There was also no evidence of other controls being considered.

In March 1993, an internal assessment of Ballarat's OHS management systems reported PPE as an issue that bogged down safety committee meeting time.[397] Issues included problems with work boots, overalls, and a lack of written instruction on the use of PPE.[398] There was evidence that PPE was not always worn[399] or was not suitable.[400] For example, firefighting overalls were said to shrink two sizes after washing.[401]

The lack of suitable PPE and the low use of what there was, were repeatedly raised in the minutes of safety meetings at all levels. Some more specific examples follow:

- Maryborough Work Centre Safety Committee meetings – key pieces of PPE were reported as unsuitable in February 1987 and follow-up was recommended. Five months later, however, no progress had been made.[402]
- Vickers Street (Sebastopol) Work Centre Safety Committee meetings – major facilities issues, like a pit for disposing of 1080, were carried over from one meeting to the next for 18 months. And no action was taken over four months on simple but important tasks like checking helmet expiry dates.[403]

Table 8.7 illustrates the timeframe for the establishment and restructure of the Department safety committees over time. Extensive records indicate that safety committee meetings were held during the Period.

A significant evolution in the safety committee membership began in 1985 to increase representation of regional staff viewpoints, and to involve AWU and Victoria Public Service Association (VPSA) members. At the Maryborough Work Centre Safety Committee meeting on 22 November 1985, the Regional Safety Representative was elected by ballot. The membership of the Avoca and Maryborough Work Centre Safety Committees were elected, with one member from the VPSA and AWU on each.[404]

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396 Department of Conservation Forests and Lands and Wells, G J, 1988, *Review of the Use of Pesticides in the Department of Conservation, Forests and Lands*, Report, p 67; Interdepartmental Committee on Pesticides, 1962, *Minutes of the 30th Meeting 23rd July 1962*, Minutes.

397 Department of Conservation and Natural Resources, 1993, *Assessment of Occupational Health and Safety Management Systems - Ballarat Region*, Report.

398 Department of Conservation and Natural Resources, 1993, *Assessment of Occupational Health and Safety Management Systems - Ballarat Region*, Report; Department of Crown Land and Survey, 1983, *Minutes of the Departmental Safety Committee, 9 May 1983*, Minutes; Department of Crown Lands and Survey, 1984, *Safety Boots 21 March 1983*, Letter; Department of Crown Lands and Survey, 1984, *Safety Boots 19 March 1984,* Letter; Department of Crown Lands and Survey, 1984, *Safety Boots, 13 March 1984,* Letter.

399 Department of Conservation Forests and Lands, 1987, *Maryborough Works Centre Safety Committee, Meeting Minutes 17 July 1987*, Minutes; Department of Conservation Forests and Lands, 1988, *Creswick Work Centre Safety Committee, Meeting Minutes 13 April 1988*, Minutes.

400 Interdepartmental Committee on Pesticides, 1965, *Report of Interview with the Vermin and Noxious Weeds Destruction Board, 18 March 1965*, Report; Department of Conservation Forests and Lands, *1986, Ballarat Region Occupational Health and Safety Committee, Minutes of Meeting 11 September 1986,* Minutes; Department of Conservation Forests and Lands, 1988, *Ballarat Region Occupational Health and Safety Committee Minutes of Meeting 9 November 1988,* Minutes; Department of Conservation Forests and Lands, 1988, *Ballarat Region Occupational Health and Safety Committee Minutes of Meeting 17 August 1988*, Minutes.

401 Department of Conservation and Natural Resources, 1993, *Memorandum RE: OHS Management Assessment-Ballarat,* Memorandum and attachment; Department of Conservation and Natural Resources, 1993, *Assessment of Occupational Health and Safety Management Systems - Ballarat Region*, Report.

402 Department of Conservation Forests and Lands, 1987, *Maryborough Works Centre Safety Committee Minutes of Meeting 13 February 1987*, Minutes; Department of Crown Lands and Survey, 1987, *Maryborough Works Centre Safety Committee Minutes of Meeting 17 July 1987*, Minutes.

403 Department of Conservation Forests and Lands, 1987, *Vickers Street Work Centre Safety Committee Minutes of Meeting 13 February 1987*, Minutes; Department of Conservation Forests and Lands, 1988, *Vickers Street Work Centre Safety Committee, 1988, Meeting Minutes 12 April 1988*, Minutes; Department of Conservation Forests and Lands, 1988, *Vickers Street Work Centre Safety Committee, 1988, Meeting Minutes 12 August 1988*, Minutes. [Note: The Ballarat Safety Committee did not table Work Centre Safety Committee meetings in a timely manner. The issues raised in 1987 at the Maryborough Work Centre Safety Meetings were not heard until August 1988. (Department of Conservation Forests and Lands, 1988, *Ballarat Region Occupational Health and Safety Committee, 1988, Meeting Minutes 17 August 1988,* Minutes.)]

404 Department of Conservation Forests and Lands, 1985, *Maryborough Work Centre Safety Committee Meeting Minutes 22 November 1985*, Minutes.

Table 8.7 Overview: Occupational Health and Safety Committees and representatives.

Year	1971	1984	1986	1990	1995
Department Safety Committee	→	→	→	→	→
Department Safety Officer	→ Chair of Department Safety Committee proxy Safety Officer[405]	→ Safety Officer appointed[406]	→	→ Designated Work Group Reps appointed[407]	→
Work Centre Safety Committee	Work Centre Safety Committee From 22 November 1985, members had to include an AWU and a VPSA member.[408]	→	→	→	→
Regional OHS Committee		Ballarat Region OHS Committee 19 February 1986[409] – meetings quarterly.[410]	→	→	→

[405] Department of Conservation Forests and Lands, 1983, *Notes of Meeting on the Setting up of Safety Committees in the Department,* Minutes.

[406] Department of Conservation, Forests and Lands, 1984, *Divisional Health and Safety Committee 12 June 1984*, Letter.

[407] Department of Conservation and Environment, 1994, *Area Occupational Health & Safety Committee Structure,* Report.

[408] Department of Conservation Forests and Lands, 1985, *Maryborough Work Centre - Safety Committee - Minutes of Meeting Held on 22 November 1985*, Minutes.

[409] Department of Conservation Forests and Lands, 1986, *Ballarat Region Occupational Health and Safety Committee - Minutes of Meeting Held on 19 February 1986,* Minutes.

[410] Department of Conservation Forests and Lands, 1986, *Ballarat Region Occupational Health and Safety Committee - Minutes of Meeting Held on 19 February 1986*, Minutes.

In 1988, the Department commissioned an independent *Review of the Use of Pesticides in the Department of Conservation, Forests and Lands*[411] (see Chapter 10 for more detail), which found:

- Workers' concerns with OHS are handled by various departmental safety committees.
- Every work centre has a safety committee.
- An elected representative attends monthly meetings of the regional committee.
- The chairman responds to issues raised at the meetings, and the committees provide adequate communication channels should workers make use of them. In addition, management should make their own enquiries as some issues, like the absence of training, are being missed.

Table 8.8 provides an summary of past workplace practices over the Inquiry Period.

Table 8.8 Summary of past workplace practices.

Policy	1965 to 1976	1976 to 1981	1982 to 1995
Workplace practices for storage, handling, PPE and washing facilities for 2,4-D and 2,4,5-T.	**Storage** Pesticide storage sheds were basic and not ventilated. Ex-army Nissan huts used as storage sheds in some areas. **Handling** Handling instructions emphasised minimisation of spray drift rather than worker safety. **PPE** Standard issue PPE was boots and bib-and-brace overalls. It was not always available due to a lack of budget and use was not enforced. **Washing** Temporary or mobile water and washing facilities such as 'water bags' provided but some depots were without running water or washing facilities.	**Storage** Pesticide storage sheds built without ventilation. General conditions were poor with evidence of sheds without security and mixing facilities. **Handling** No requirement for respirators when handling concentrate. **PPE** A comprehensive suite of PPE was available on requisition by inspectors for sprayers. It was not always worn and poorly designed for hot conditions. **Washing** Showers and washing facilities not installed in many depots until the 1980s.	**Storage** Pesticide storage sheds were retrofitted with ventilation or built new with ventilation, though some sites were sub-standard. **Handling** Handling and PPE standards included instructions for mixing, storage and accidental spills. **PPE** PPE was generally worn by workers. **Washing** Showers were installed at depots and washing facilities were provided for field work.

[411] Department of Conservation Forests and Lands and Wells, G J, 1988, *Review of the Use of Pesticides in the Department of Conservation, Forests and Lands,* Report, p 54.

Findings – Workplace Practices

Roles and supervision

- Early duty statements covering supervisory roles didn't specifically refer to worker safety.
- The leading hand managed crews, provided work instructions and oversaw field work. By 1977, the Inspectors' Manual obliged them to maintain safe workplaces and gave instructions on the safe use of pesticides.
- The lack of written evidence of daily work indicates work programs were probably issued verbally.

Storage

- Storage sheds were basic and often unventilated.
- In the 1960s and 1970s ex-army Nissan huts were used for storage.
- In the early 1980s many sheds were still not secure.
- By the late 1980s storage sheds were being retrofitted with ventilation.

PPE

- Early PPE was basic bib-and-brace overalls and, due to budget issues, often in limited supply.
- By the early 1980s comprehensive PPE was available, however, use was not always enforced, supply was a problem and it was often not designed for the prevailing conditions.
- By the late 1980s most workers were wearing PPE.

Handling

- Policies and practices for handling pesticides were not well communicated until 1986.

Washing facilities

- Water bags were provided in the 1960s in some areas, however, showers and washing facilities were not installed in many depots until the early 1980s.

Safety committees

- A Department Safety Committee was established in 1971.
- Up until the early 1980s regional safety committees were often slow to respond to local issues.
- The lack of suitable PPE equipment and its low use were issues.
- A significant evolution in the safety committee membership began in mid-1985 to increase representation of regional staff viewpoints.

COMMUNICATIONS

Throughout the Period, safety matters were communicated in written communiqués, training and verbal briefings. The safety committees also provided an important forum for discussing and resolving issues raised in the field.

This section addresses written communiqués, while training is addressed later in this chapter. Verbal briefings are not specifically addressed as evidence suggests they were informal and ad hoc.

Written communiqués

From 1972, the content and distribution of bulletins, circulars, information sheets and memorandums reflected a growing emphasis on the provision of chemical safety information. Prior to 1972, safety advice was communicated briefly via the *Noxious Weed Recommendations for Control Bulletins*, a key publication series of the VNWDB that drew on the research and extension work of the Department officers.[412] It was first published in 1963, then revised and re-published in 1970,

[412] Keith Turnbull Research Institute, 1963, *Noxious Weeds - Recommendations for Control, Bulletin No. 3*, Publication.

1972, 1975, 1977 and 1983. These publications were aimed at landholders and the communication of research and advice about the control of weeds. They did, however, include safety instructions, with evidence of this increasing over time. Hardcopies were distributed broadly and staff were encouraged to follow them.[413]

From the early 1960s, the over-riding instruction was to keep spray vapour and drift away from damaging agricultural crops and orchards[414] and to follow instructions on the pesticides container label.[415]

Circulars, pesticide information sheets and memorandums provided more detailed, day-to-day directions.

Circulars/Memorandums

Circulars from the superintendent to both senior inspectors and inspectors provided directions on various policy, administrative and operational matters, to implement in the field and communicate to workers. Over the Period there were several hundred circulars produced. A number of circulars included information on pesticides safety or worker safety and policy, including the following.

- 1968 *Circular No. 78/68 Workers Compensation and Safety on the Job* – this circular gave directions to senior inspectors and inspectors on procedures for workers compensation, and their responsibilities to oversee field safety. It stated:
  - There should be a constant awareness by all staff and employees of the necessity to maintain a 'safety-first' attitude on the job.
  - There is an obligation upon senior inspectors and inspectors to see that all equipment is maintained in a safe working condition and that working practices in the field do not unnecessarily increase the risk of injury to employees.
  - If an employee persists in a practice which the inspector has forbidden, disciplinary action is to be taken. This situation constitutes, in effect, a refusal to carry out an order and, as such, the employee would be liable to dismissal.[416]
- 1971 *Circular No. 5/71 Safety Policy* – this circular conveyed to inspectors the information to be communicated to staff regarding the Department's safety policy and outlined specific instructions for inspectors, including:
  - Ensuring each supervisor (any person in charge of others) is responsible for the safety and safe working environment of all employees under his control.
  - Insisting all employees observe (*sic*) safety rules and regulations.
  - Taking disciplinary action against any employee who, by refusal or neglect, fails to observe safety requirements.
  - That it is the inspector's responsibility to see that all employees are instructed in the use of safety equipment and told what precaution it is necessary to take at all times when using Department plant and equipment.[417]
- 1972 *Circular No. 57/72 Safety and Pesticides* – this circular provided precautionary advice and general guidance for the safe use, handling and storage of pesticides, including:
  - The pesticides in common use by the Board are of relatively low hazard to the users. Notwithstanding this, persons using pesticides regularly, even at low concentrations, must safeguard themselves against the possibility of chronic effects. It is stressed that exposure to any pesticide must be kept to an absolute minimum. Clearly, there is a need for caution, and certainly no place for a 'she'll be right' attitude, in dealing with pesticides.
  - Follow the safety directions exactly as set out on the labels.
  - Make sure that correct protective clothing as specified on the label is used and is in good condition.
  - Wash thoroughly after using pesticides and always before eating.[418]

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413 Department of Conservation Forests and Lands, 1983, *Circular No. 87/83 - Recommendation Bulletin 3F,* Circular.

414 Keith Turnbull Research Institute, 1963, *Noxious Weeds - Recommendations for Control, Bulletin No. 3,* Publication; Keith Turnbull Research Institute, 1970, *Noxious Weeds - Recommendations for Control Bulletin No. 3b,* Publication; Keith Turnbull Research Institute, 1972, *Noxious Weeds - Recommendations for Control Bulletin No. 3c*, Publication; Keith Turnbull Research Institute, 1975, *Recommendations for Control of Noxious Weeds, Bulletin No. 3D*, Publication; Keith Turnbull Research Institute, 1977, *Recommendations for Control of Noxious Weeds, Bulletin No. 3E*, Publication; Keith Turnbull Research Institute, 1983, *Recommendations for Control of Noxious Weeds, Bulletin No. 3F,* Publication.

415 Keith Turnbull Research Institute, 1972, Noxious Weeds - Recommendations for Control Bulletin No. 3c, Publication.

416 Department of Crown Lands and Survey, 1968, *Circular No. 78/68 - Workers Compensation and Safety on the Job,* Circular.

417 Department of Crown Lands and Survey, 1971, *Circular No. 5/71 - Workers Compensation and Safety on the Job*, Circular.

418 Department of Crown Lands and Survey, 1972, *Circular 57/72 - Safety & Pesticides,* Publication.

- 1982 *Circular No. 90/82 Future Use of 2,4,5-T* – this circular outlined the State Government's policy on 2,4,5-T, the steps the Department was taking to comply[419] and also included the government's policy statement. It provided:
  - An eight-page summary of two Pesticides Review Committee (PRC) reports (1979 and 1981) on 2,4,5-T. It referred to restrictions on 2,4,5-T in the US, Sweden, Holland, Italy and Australia, and 2,4,5-T health risk studies.
  - The 1979 PRC report stated that, 'there is no evidence whatsoever to connect the normal use of 2,4,5-T with human birth abnormalities (or, for that matter, any other health problem apart from dermatitis and allergies).' The 1981 PRC report concluded that 'it is the unanimous view of the Pesticides Review Committee that there is no scientific justification for discontinuing the use of 2,4,5-T in Victoria'.[420]
- 1983 *Circular No. 8/83 Safety Clothes* – this circular quoted from the *Industrial Safety, Health and Welfare Act 1981*.
  - *Industrial Safety, Health and Welfare Act 1981* s 14:

    > *It shall be the duty of every person employed in or on a workplace: (a) to take reasonable care for the safety and health of himself and of other persons who may be affected by his acts or omissions in or on the workplace.*

  - It then stated:

    > *… Departmental Safety Committee is of the opinion that: 'Under the present legislation, an employee cannot be forced to wear protective clothing and equipment but it is the employer's responsibility to make the equipment available and to urge the employee to use it.' Staff were then provided with a long list of safety clothing and equipment available on request.*[421]
- In 1984 the Department's position changed, after receiving advice from the Crown Solicitor. *Circular No. 6/84 Compulsory Use of Safety Clothing and Equipment*, dated 17 January, 1984, stated:

  > *If a Crown employee were employed in or on a workplace to use, for instance, sprays, fumigants, chemicals, poisons etc …* [and] *… he did not wear a protective mask and protective clothing which were readily available for him to wear, he would contravene the Act.*[422]
- 1985 *Memorandum Storing of Hazardous Materials* – this memorandum was sent to all regional managers. It outlined the provisions of the Dangerous Substances (Placarding of Workplaces) Regulations *1985*, and the subsequent requirement to install placards (signs with symbols to demonstrate the presence of dangerous goods) in depots. It further stated, 'it is assumed regions will act independently to meet the new regulations by the prescribed date'.[423]
- 1990 Memorandum *Dangerous Goods Act 1985* – this memorandum was sent to all divisional directors and regional managers about the provisions of the new Dangerous Goods (Storage and Handling) Regulations 1989, and the requirement for a licence to keep substances covered by the regulations. It stated, 'Regions are required to be conversant with these new regulations concerning dangerous goods and take the appropriate action to conform to the storage and handling of dangerous goods'.[424]

Pesticide information sheets

KTRI prepared a series of pesticide information sheets in 1979, following a request from the Departmental Safety Committee for better communications.[425] Their purpose was to provide readily accessible information on the safe use of pesticides for both inspectors and workmen. They were periodically updated and new ones were released until 1985, with

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[419] Department of Crown Lands and Survey, 1982, *Circular No. 90/82 - Future Use of 2,4,5-T,* Circular.

[420] Department of Crown Lands and Survey, 1982, *Some Information on 2,4,5-T*, Report.

[421] Department of Crown Lands and Survey, 1983, *Circular No. 8/83 - Safety Clothes*, Circular.

[422] Department of Conservation Forests and Lands, 1984, *Circular No. 6/84 – Compulsory Use of Safety Clothing and Equipment,* Circular.

[423] Department of Conservation Forests and Lands, 1985, *Storing of Hazardous Materials,* Memorandum.

[424] Department of Conservation and Environment, 1990, *Dangerous Goods (Storage and Handling) Regulations 1989*, Memorandum; Department of Conservation and Environment, 1990, *Dangerous Goods Act 1985,* Memorandum.

[425] Keith Turnbull Research Institute, 1979, *Pesticide Information Sheets*, Memorandum.

over 30 produced in this time.[426] Information sheets were circulated by the VNWDB with instructions that, 'copies of the sheets should be made available to all workmen'.[427]

They provided both general guidance on the safe use of pesticides and specific information on the safety precautions for individual herbicides in common use by the Department, including 2,4-D and 2,4,5-T.[428] Some examples of both are provided below.

- 1979 *Pesticide Information No 1.3 Toxicity of Pesticides* – this provided general information on how toxicity is measured and lists toxicity data (LD_{50}) for various pesticides, including 2,4-D and 2,4,5-T. It also provided general information on how pesticides enter the body and how to avoid this. For example:
  - Avoid skin contact wherever possible and provide protection for body surfaces. Extra care is necessary if wounds are present as entry is faster where skin is broken.
  - PVC or rubber gloves **may** be used when handling concentrates.
  - Where splashing of liquid concentrates **may** occur a clear plastic face shield is **recommended**. Many formulations may irritate or damage eyes.
  - Arms and legs **should** be covered while spraying and rubber boots are necessary to prevent absorption through the feet. A wide brimmed hat or PVC sou'wester will help keep spray mist off the face and neck. Avoid working in and breathing the spray mist.
  - Protective clothing **should** be regularly washed.
  - Rubber boots **should** be decontaminated regularly both on the inside as well as the outside.[429] [emphasis added]
- 1979 *Pesticide Information No. 2.1 Safe Use of Herbicides* – this provided instructions on the use, handling and storage of herbicides. For example:
  - Any special warning instructions on labels must be followed.
  - Wear prescribed protective clothing when handling herbicides.
  - Do not store herbicides (or empty containers) near food or drink.
- 1979 and 1982 *Pesticide Information No. 4.2, 2,4-D Ester Formulations* – this information sheet provided common trade names for 2,4-D ester formulations, gave advice on safety precautions and described the Department's main uses of the formulation. Examples of safety precautions included:
  - Read and follow instructions on the product label.
  - Avoid contact with the skin and eyes to prevent possible irritation.
  - Avoid working in and breathing spray mist.
  - Wash exposed parts of the body after use and before eating, drinking or smoking.[430]
- 1979 *Pesticide Information No. 4.3, 2,4-D Amine Formulations* – this provided common trade names for 2,4-D amine formulations, described the Department's main uses of the formulation, and provided advice on safety precautions (which were the same as for the ester formulations outlined above).[431]
- 1979 and 1982 *Pesticide Information No. 4.4, 2,4,5-T Ester Formulations* – this provided common trade names for 2,4,5-T ester formulations, described the Department's main uses of the formulation, and provided advice on safety precautions (which were also the same as for the above 2,4-D ester formulations). Both the 1979 and 1982 editions also contained a statement on TCDD. 1982's follows:

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[426] Keith Turnbull Research Institute, 1982, *Pesticide Information - No 1.1 - September 1982*, Publication.

[427] Keith Turnbull Research Institute, 1979, *Pesticide Information - No. 1.1 Introduction*, Publication; Keith Turnbull Research Institute, 1982, *Pesticide Information - No 1.1 - September 1982*, Publication.

[428] Keith Turnbull Research Institute, 1982, *Pesticide Information - No 1.1 - September 1982,* Publication.

[429] Keith Turnbull Research Institute, 1979, *Pesticide Information - No. 1.3 Toxicity of Pesticides*, Publication.

[430] Keith Turnbull Research Institute, 1982, *Pesticide Information - No 1.1 - September 1982,* Publication.

[431] Keith Turnbull Research Institute, 1979, *Pesticide Information No. 4.3 - 2 4-D Amine Formulations*, Publication.

> *Commercial formulations of 2,4,5-T contain traces of TCDD (a dioxin) which is an extremely toxic substance. By regulation the maximum permissible level in 2,4,5-T was 0.1 ppm. In Victoria this level was reduced to 0.01 ppm in August 1982. With normal usage this presents no hazard to the operator or the environment.*[432]

- 1981 *Pesticide Information No. 4.12 2,4-D Sodium Salt* – this provided common trade names for 2,4-D sodium salt formulations, described the Department's main uses of the formulation and provided safety advice. For example:

> *2,4-D, like any herbicide, could be dangerous if swallowed, inhaled or absorbed through skin. Wear rubber gloves when handling the concentrate. If splash of the concentrate occurs wash from skin and eyes immediately. Avoid working in and breathing the spray mist. Wash exposed parts of the body after spraying and before eating, drinking or smoking.*[433]

In addition, information sheets were also published in 1982 and 1984 outlining the government's 2,4,5-T[434] policy.

Findings Communication

While the Department took many steps to communicate its safety policy to staff, there were many failings and an 'all care, no responsibility' attitude pervaded. These failings included:

- **No checks and balances on inspectors implementing safety policy**: For example, circulars communicating safety directions from the superintendent to inspectors were generally supposed to be explained to workers (e.g. wear PPE). There's no evidence, however, of any formal process of this happening (e.g. minutes of meetings etc.), and no evidence to suggest the Department had any checks and balances in place to ensure it did.
- **Important safety information was not available to workmen in the workplace**: Although the 1988 Wells Review found that ***Bulletin No. 3*** and **pesticide information sheets** were available to staff and up-to-date[435], in 1989 the Departmental OHS Committee was concerned that, 'there appears to be instances where pesticide users were not provided with all information that could be useful to them even though that information is available'. Regional managers were therefore requested to ensure that 'pesticide manuals and training notes … are not only available in regional offices but are available and known to be available to pesticide users in work centres …'[436].
- A 1993 internal assessment of OHS management systems in Ballarat found that the Health and Safety Policy was not clearly displayed at any work site.[437]

There were conflicting safety messages at all levels: Staff were instructed to follow label instructions but were allowed not to in the field. For example, in 1973, for economic and efficacy purposes, inspectors often mixed Tordon 50-D (2,4-D 20%) with 2,4,5-T. Directives regarding PPE ranged from command and control in 1971 (i.e. wear it)[438] to optional only in 1982 (i.e. you decide).[439] 1972 and 1979 directives insisted workers wear the PPE specified on the label, yet often labels didn't specify any PPE. For example, see labels in Figure 8.1, '**Butoxone' 80** label[440] and Figure 8.2, **Low Volatile Ester 40 Herbicide**, circa 1987.[441] Neither detailed any PPE.

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[432] Keith Turnbull Research Institute, 1979, *Pesticide Information No. 4.4 - 2,4,5-T (Ester Formulations),* Publication; Keith Turnbull Research Institute, 1982, *Pesticide Information No. 4.4 - 2,4,5-T (Ester Formulations),* Publication; Keith Turnbull Research Institute, 1979, *Pesticide Information No. 4.4 - 2 4 5-T,* Publication.

[433] Keith Turnbull Research Institute, 1982, *Pesticide Information - No 1.1 - September 1982,* Publication.

[434] Keith Turnbull Research Institute, 1979, *Pesticide Information No. 1.1 Introduction*, Publication; Keith Turnbull Research Institute, 1984, *Revised 4,5-T Policy,* Publication.

[435] Department of Conservation Forests and Lands and Wells GJ, 1988, *Review of the Use of Pesticides in the Department of Conservation, Forests and Lands*, Report.

[436] Department of Conservation Forests and Lands, 1989, *Access to Pesticide Information*, Memorandum.

[437] Department of Conservation and Natural Resources, 1993, *Assessment of Occupational Health and Safety Management Systems - Ballarat Region*, Report.

[438] Department of Crown Lands and Survey, 1971, *Circular No. 5/71 - Workers Compensation and Safety on the Job*, Circular; Department of Crown Lands and Survey, 1968, *Circular No. 78/68 - Workers Compensation and Safety on the Job*, Circular.

[439] Department of Crown Lands and Survey, 1983, *Safety Clothing and Equipment,* Memorandum.

[440] Imperial Chemical Industries (ICI), 1965 (est*), Butoxone 80,* Label.

[441] Nufarm Chemicals Pty. Ltd, 1987, *Low Volatile Ester 40 Herbicide*, Label (Note assumed date stamped on label 4/87).

SAFETY TRAINING

While the interviewees indicated that they received brief informal training on the job, the first formal safety training for workers was from early 1972, and pesticide safety training from 1976. Below is a chronological history of evidence of safety training provided throughout the Period of Inquiry, and some other key points. Table 8.9 details training provided by the Department in the Ballarat region by time period.

1970s

- **Annual 1-Day Safety Courses**: These were run for all regional staff from 1972 to 1978, excluding 1975. The early ones provided general safety instruction and were not specific to the safe use of pesticides for vermin and noxious weed control. There is evidence these addressed 'accident prevention and investigation[442], for which there was a policy in place.[443] Courses between 1976 to 1978 did address the safe handling and use of pesticides and provided information on associated health risks. There is evidence that *Bulletin No. 1 Chemicals Used in Weed Control* (July 1970) was used as training material in 1978–79[444].
- **Safety in the Use of Pesticides – Talks to Workmen**: These were run in 1976 in Ouyen, Horsham and Hamilton for inspectors and workmen from districts within the Ballarat area including Maryborough, Dunolly and Avoca. It is not clear if these extended to all districts in the Ballarat area and elsewhere around the state. Content of the talks included:
  - how pesticides enter the body
  - how to prevent pesticides from entering the body, e.g. handling techniques, protective clothing
  - spillages.[445]

1980s

- There were no formal training courses between 1980 and July 1982 while the Departmental Safety Committee on new methods of coordinating training courses.[446]
- From May 1982 the Victorian Government announced a requirement that all users of 2,4,5-T undertake training in its correct handling and use. The announcement was followed by a directive from the Superintendent in September 1982, that the Department should not use any 2,4,5-T until training sessions had been held in October that year.[447]
- **Training Courses for Herbicide Users**: These were run in October and November 1982 for all inspectors and workmen across the state. Content included:
  - safe handling, use, storage and disposal of herbicides
  - specific information on 2,4,5-T, including health risks.[448]
- **Annual 1-Day Safety Courses**: These were re-instigated in 1983 and 1984 for inspectors and workmen and seem to have only been run in the north east of the State (9 out of 18 Senior Inspectorate Groups).[449]
- **1-Day Herbicide Training**: This was held in Bacchus Marsh in 1985. It is not known if both inspectors and workmen attended or if it was a local or statewide initiative. Training included handling and using herbicides and the associated health risks, with a particular focus on 2,4,5-T.
- **A 2-Day OHS Seminar**: This was held in 1987 for 'Snr Managers, Branch Heads and Supervisors'[450], and covered general OHS content. It was not specific to the safe handling, use, storage and disposal of chemicals.

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[442] Department of Crown Lands and Survey, 1972, *Appendix A - Safety Course - Colac - 11 December 1972*, Agenda.

[443] Department of Crown Lands and Survey, 1968, *Circular 78/68 - Workers Compensation and Safety on the Job*, Circular.

[444] Department of Crown Lands and Survey, *Division of Inspection and Vermin and Noxious Weeds Destruction, 1978, Divisional Safety Committee*, Letter.

[445] Department of Crown Lands and Survey, 1976, *Safety in the Use of Pesticides - Talks to Workmen*, Memorandum.

[446] Department of Crown Lands and Survey, Division of Inspection and Vermin and Noxious Weeds Destruction*, 1982, Departmental Safety Committee*, Memorandum.

[447] Department of Crown Lands and Survey, 1982, *Circular No. 76/82 - 2,4,5-T & 1080*, Circular.

[448] Department of Crown Lands and Survey, 1984, *Training Courses for Herbicide Users - October 1982*, Report.

[449] Department of Crown Lands and Survey, 1983, *Safety Courses - Program,* Agenda.

- The **Wells Review**[451] in 1988 examined the Department's use of pesticides and recommended more adequate staff training.
- **A 4-Day Train the Trainer Course – OHS (VNWDB)**: This was run in 1988 in response to the **Wells Review**. Graduates would then be able to roll out regional training programs for all staff on the handling, storage, use and disposal of pesticides. However as part of a resolution to an industrial dispute with the AWU it was rolled into a joint training initiative with the Victorian Trades Hall Council (VTHC).[452]

1990s

- The Department of Labour provided training on the new Dangerous Goods (Storage & Handling) Regulations of 1990. It was attended by two Department representatives and covered the regulatory requirements for storing and handling of dangerous goods (including pesticides). It was followed by a Department-wide hazard assessment (refer to Chapter 9 for further details).
- Resolution of the AWU pesticide dispute in 1990 resulted in an AWU request for a VTHC-approved training course for all AWU employees using pesticides.[453]
- **1-Day Pesticide Use Course**: This was 'urgently' delivered to all regional staff in 1990 as an interim measure while a joint initiative with the VTHC was being developed.
- **VTHC-approved training on the Safe and Effective Use of Pesticides**: This was delivered in 1991 and included a five-day Regional Instructors Workshop (a 'train-the-trainer' initiative) followed by the delivery of a series of three-day training courses for the Department's AWU employees. Content covered pesticide handling, use, storage and disposal.
- **Draft Policy on the Safe Use of Herbicides**: Released in 1992, this required safety training for all staff using herbicides.[454]
- **Spray Information Day**: This was held in Ballarat in 1993 for land protection officers (formerly inspectors) and spray crews within the Beaufort and Maryborough Districts. It was in response to an observed resistance to safe work practices and the findings of a Department survey of spray crews, which identified the Ballarat region as having, 'significant problems with regard to irrational and fearful attitudes towards herbicides and spraying safety'. The day's aim was to reduce this resistance and attendance was strictly limited to 'only those personnel prepared to spray'.[455]

Training reviews and record keeping

Evaluating and revising training programs was routine from the 1970s. Feedback was sought from participants and courses were modified accordingly or new ones developed in response to changes in government policy and/or union demands.[456]

- Minutes of a KTRI meeting held to review the 1982 Training Courses for Herbicide Users stated that technical content could be 'above the heads of some workmen'. However, it was agreed that 'it would not be possible to further simplify and still maintain the integrity of the information'.[457]

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[450] Department of Conservation Forests and Lands, 1987, *OH&S Training Venues,* Memorandum; Department of Conservation Forests and Lands, 1987, *OH&S Training Venues, Note*.

[451] Department of Conservation Forests and Lands and Wells GJ, 1988, *Review of the Use of Pesticides in the Department of Conservation, Forests and Lands*, Report.

[452] Department of Conservation Forests and Lands, 1988, *Participant list (Regions only) for OHS-VNW Course - KTRI May/June 1988,* List; Department of Conservation Forests and Lands, 1988, *Training Course - OHS, Vermin and Noxious Weeds (VNW),* Memorandum.

[453] Australian Workers Union, 1990, *AWU Demands on Pesticides Dispute,* Report.

[454] Department of Conservation and Environment, Vermin and Noxious Weeds Branch, 1992, *Safe Use of Herbicides - Draft Policy*, Memorandum.

[455] Department of Conservation and Natural Resources, 1993, *Spray Information Day at Ballarat, 22 April 1993*, Letter; Department of Conservation and Natural Resources, 1993, *Spraying Information Day Vickers St Depot 22 April 1993,* Memorandum.

[456] Department of Crown Lands and Survey, 1974, *Departmental Safety Course Ballarat Centre, 26 August, 1974,* Letter; Department of Crown Lands and Survey, 1974, *Reference Safety Course Conducted by Departmental Safety Committee and Department of Labour and Industry,* Memorandum; Department of Crown Lands and Survey, Division of Inspection and Vermin and Noxious Weeds Destruction, 1978, *Safety Courses*, Note; Department of Crown Lands and Survey, 1972, *Safety Course - Colac, 11th December 1972,* Note; Department of Crown Lands and Survey, 1984, *Implementation of Victorian Government Decisions on 2,4,5,T May 1982,* Notice; Department of Crown Lands and Survey, 1969, *Circular No. 1969/379 - Occupational Safety*, Circular; Department of Agriculture and Rural Affairs, 1989, *Questionnaire - Attachment to Memo to Regional Managers and other officers RE: Evaluation of Chemical Awareness Week,* Memorandum.

- The Victorian Trades Hall Council (VTHC) was also provided with the opportunity to comment on this training course and was highly critical of the content on the health hazards associated with the use of 2,4-D and 2,4,5-T[458], stating that their research officer found them to be 'biased' and 'grossly misleading'. The Department considered the VTHC's feedback in detail and strongly refuted these comments.[459]
- A Department review of the 1991 ***Safe and Effective Use of Pesticides*** training courses stated that, 'in the recent past (1985 -1990) staff training in pesticide handling and use has been given a relatively low priority'.[460] VTHC feedback on the course was that: 'the course appears to be widely accepted by participants with largely positive feedback'…. 'many workers, including health and safety representatives, have previously not been provided with information and training of this nature … the course has been long overdue.'[461]

  There is some evidence the Department recorded the number of staff in attendance at safety training and was aware that some were not participating. However, there's no evidence that detailed attendance records were kept for individual training courses or used to ensure all staff attended.
- A review by the KTRI of the 1982 Training Courses for Herbicide Users noted 1,500 employees had attended courses from across government, predominantly from the Department.[462]
- The Ballarat Region OHS Committee raised concerns in 1991, 1992 and 1993 that not all Beaufort personnel were attending and, in 1994, discussed the need to train supervisors about the OHS Act and their responsibilities. No action was taken to enforce attendance, even when staff members were known to have not attended, e.g. Safety Committee minutes on Beaufort personnel.[463]

Table 8.9 Training in Ballarat region by time period.

Policy	1965 to 1976	1976 to 1981	1982 to 1995
Training	Annual 1-Day Safety Courses were run from 1972 but didn't include chemical safety training. *Safety in the Use of Pesticides – Talks to Workmen* to all staff in 1976. In-service training introduced to standardise and substantially increase the minimum level of competency for the appointment of inspectors.	Annual 1-Day Safety Courses run 1976 to 1978 included chemical safety training. No other evidence of safety training found. From 1976, Certificate of Applied Science was proposed as a minimum requirement for appointing inspectors.	Training Courses for Herbicide Users run in 1982 in response to the government's 2,4,5-T policy. 1-Day Herbicide Training Day held in Bacchus Marsh in 1985. 1-Day Pesticide Use Course (1990) and a 3-Day Safe and Effective Use of Pesticides Course (1991) introduced following AWU dispute. A Spray Information Day held in Ballarat in 1993 in response to concerns raised by the region's sprayers.

[457] Department of Crown Lands and Survey, 1982, *Herbicide Safety Courses Review - Minutes of Meeting Held on 1 December 1983*, Minute; Department of Crown Lands and Survey, 1984, *Implementation of Victorian Government Decisions on 2,4,5,T May 1982*, Notice.

[458] Victorian Trades Hall Council, 1983, *Feedback on Training Courses for Herbicide Users*, Letter.

[459] Vermin and Noxious Weeds Destruction Board, 1983, *Correspondence from Victorian Trades Hall Council*, Letter.

[460] Department of Conservation and Natural Resources, 1993, *Safe Use and Handling of Pesticides - Course Review,* Report.

[461] Victorian Trades Hall Council, 1991, *Training course on pesticides*, Letter.

[462] Department of Crown Lands and Survey, 1982, Herbicide Safety Courses Review - Minutes of Meeting Held on 1 December 1983, Minute.

[463] Department of Conservation and Natural Resources, 1993, *Ballarat Region Occupational Health & Safety Committee - Minutes of Meeting Held on 4 June 1993*, Minute; Department of Conservation and Natural Resources, 1992, *Ballarat Region Occupational Health and Safety Committee - Minutes of Meeting Held on 14 August 1992*, Minute; Department of Conservation and Natural Resources, 1992, *Ballarat Region Occupational Health and Safety Committee - Minutes of Meeting Held on 7 February 1992*, Minute.

Findings Training

The Department provided formal training in the safe use of pesticides from 1976 and more specifically 2,4,5-T training from 1982. There's evidence of many failings, with the Department admitting in 1991 that staff pesticide training had been a low priority and an 'all care, no responsibility' attitude pervaded. Key points to note are:

- Department reviews in 1982 (KTRI), 1988 (Wells) and 1991 (Department of Conservation and Natural Resources) highlighted serious flaws, e.g. content was above the workers' heads.
- The VTHC gave a scathing review of the 1982 training courses for herbicide users, particularly regarding how it conveyed 2,4,5-T information.
- The Department considered the VTHC's feedback in detail but strongly refuted it.
- There is no evidence the Department kept staff attendance records, even in 1982 when the training was mandatory for all workers using 2,4,5-T.
- No action was taken to enforce attendance, even when it was known staff members didn't attended.

In 1991 feedback from the AWU showed largely positive feedback but long overdue.

Chapter 9: Handling, storing and use of 2,4-D and 2,4,5-T

TERMS OF REFERENCE

As part of its Terms of Reference, the Former Lands Department Chemical Inquiry was asked to:

> *… assess, to the extent possible, whether the policies and practices of the former Victorian Department of Crown Lands and Survey (and its successor departments) adhered to those regulations, laws and Australian Standards.*

Key Messages

- From the mid-1980s, the Department largely met its OHS requirements. This included having:
  - safety policies and procedures
  - manuals and information sheets
  - safety training
  - safety committees and health monitoring.
- Many of these, however, lacked appropriate consistency, timeliness and follow-up to ensure implementation and compliance.
- In early years, the Department did not consistently meet its statutory obligations in relation to storage and safe work practices for pesticides.
- Bringing sites up to standard was slow and inconsistent and prioritised new sheds over upgrading existing structures.
- The use and availability of suitable PPE was a key area of non-compliance, with important related issues remaining unresolved for a long time. Worker dissatisfaction with PPE made enforcing compliance difficult.

INTRODUCTION

This chapter outlines the extent to which the Department adhered to the regulations, laws and Australian Standards for land management, fungicides and pesticides, OHS, workers compensation, public service and record retention throughout the Period. A broad and complex detailed assessment of the Department's compliance with every Act, Regulation and Australian Standard isn't warranted or practical. The Inquiry has, however, assessed adherence to relevant statutory obligations and outlined findings below. This chapter compares actual experiences reconstructed from documentary searches, interviews and written submissions, and compares them to the statutory obligations in Chapter 7. In assessing adherence the Inquiry has:

- compared policies and procedural documentation (where found) against the legislative requirements
- identified if training content was consistent with obligations
- validated that training happened and was timely
- reviewed job descriptions and work instructions, and particularly the requirement to follow safety directions on labels
- assessed the standards of depot facilities
- assessed record keeping
- analysed information via interviews and submissions.

In the absence of records, the Inquiry made assumptions on behaviour patterns based on interviews and submissions.

Tables 9.1 to 9.10 in this chapter set out an assessment of compliance with laws and regulations, and describe the type of evidence on which the assessments are made. Four categories have been used to describe the level of compliance:

- Yes – where robust evidence is available to support compliance with the regulations.
- No – where robust evidence is available to demonstrate non-compliance with regulations.
- Partial – where evidence of compliance and non-compliance exist over time.
- Unknown – where insufficient or no evidence was found to make an assessment.

LAND MANAGEMENT

The Department administered responsibilities under the *Vermin and Noxious Weeds Act 1958* (and subsequent amendments in 1959, 1970, 1979, 1983 and 1985). The Act required the Department to 'destroy and suppress noxious weeds'.[464] Initially, this power was extended to un-alienated Crown land and lands owned or occupied by the Board of Land and Works and other Boards and Commissions where agreements were in place to do so, e.g. State forests and national parks (s 13(c)). Its jurisdiction was then extended under the *Vermin and Noxious Weeds (Amendment) Act 1979* to all state-managed land (s 3), including certain roads (s 6(4)). The Department undertook its responsibilities in earnest, particularly during the 1960s and 1970s, in what was often referred to as the 'war against weeds'.[465]

The Act also allowed the Department to destroy and suppress noxious weeds on other lands (s 13). It exercised this right via inspections and issuing notices to landholders to control their vermin and noxious weeds.[466] The Department also undertook 'entry work', either forced or by agreement, where landholders were either unwilling or unable control weeds.[467]

The Act included other discretionary provisions for the Department to help landholders meet their *Vermin and Noxious Weeds Act 1958* obligations by:

- providing advice (s 37)[468]
- subsidising herbicides purchased or selling discounted herbicides (s 25)[469]
- hiring out equipment (s 27)[470]
- providing loans to assist with vermin and noxious weed control (s 28).[471]

Evidence shows the Department did use these powers comprehensively throughout the Period.

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[464] *Vermin and Noxious Weeds Act 1958* s 6 (1).

[465] The Herald, 1960, *Board Declares War on Choking Thistle*, 20 October 1960, Newspaper Article; Dandenong Journal, 1965, *A War of Science on Noxious Weeds*, 7 December 1965, Newspaper Article; Weekly Times, 1973, *New Discovery will Aid War on Weeds,* Newspaper Article, 16 March 1973; *Vermin and Noxious Weeds Destruction Board*, Department of Crown Lands and Survey, 1974, *War Declared on Blackberries*, Notice to landholders; Weekly Times, 1975, *New Gangs Will Speed War on Vermin Weeds*, 19 February 1975, Newspaper Article; The Age, 1977, *State goes to War on Noxious Weeds*, 4 February 1977, Newspaper Article.

[466] Vermin and Noxious Weeds Destruction Board, 1967, *Notice - Simultaneous Destruction of Paterson's Curse* , Notice; Department of Crown Lands and Survey, 1969, *To All Inspectors - Circular 6/69 - Disposal of Completed Notice Books*, Memorandum; Department of Crown Lands and Survey, 1971, *Notice Forms Part 1 - Form 1, Sections 6 and 8 - Notice Forms Part 1 - Form 9, Sections 6 and 13*, Notice; Department of Crown Lands and Survey, 1979, *Circular No. 115/79 - Entry Work Procedures under Notice and Proclamation*, Circular; Department of Crown Lands and Survey, 1981, *Circular No. 110/81 - Use of Notices under Vermin and Noxious Weeds Act*, Circular; Department of Conservation and Natural Resources, 1992, *Vermin and Noxious Weeds Act 1958*, New Notices, Memorandum.

[467] Department of Crown Lands and Survey, Vermin and Noxious Weeds Destruction Board, 1975, *Standard Charge for Cape Tulip Entry Work*, Memorandum; Department of Crown Lands and Survey, Vermin and Noxious Weeds Destruction Board 1983, *Circular No. 72/83 - Entry Work Charges - August 1983*, Circular; Central Advisory Council 1985*, Report of Working Party on Entry Work - Meeting held 1 August, 1985 - Appendix I*, Minutes; Department of Conservation and Environment, 1991, *Entry Work Charges-Full Cost Review*, Memorandum; see also Annual Reports.

[468] Department of Crown Lands and Survey, 1971, *Press Release: Paterson's Curse*, Memorandum.

[469] Castlemaine Mail, 1977, *Fight Against Weed Increase*, 23 March 1977, Newspaper Article; Department of Conservation, Forests and Lands, *Annual Report 1983-84*, Report; Vermin and Noxious Weeds Destruction Board, *Annual Reports* 1965 to 1983, Report.

[470] Department of Crown Lands and Survey, Vermin and Noxious Weeds Destruction Board,1973, *Table A - Vermin and Noxious Weeds Destruction Board: Equipment Available for Hire Direct to Landholders - Effective from 10th July 1973*, Table; Minster for Lands, 1975, *Departmental Fees and Charges, Letter*; Department of Crown Lands and Survey, 1979, *Recommendations for the hire of Departmental equipment*, Memorandum; Department of Crown Lands and Survey, 1982, *Hire Spray Units/Equipment*, Memorandum.

[471] Department of Crown Lands and Survey, 1975, Circular No S10/75 - *Blackberry Proclamation*, Circular.

The *Vermin and Noxious Weeds Act 1958* was eventually superseded by the *Conservation and Land Protection Act 1994* (s 96) resulting in little change to the Department's responsibilities.

Table 9.1 Assessment of adherence to land management laws.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown)	Evidence
Vermin and Noxious Weeds Act 1958 **(and subsequent amendments)**		
6. (1) Subject to this Act it shall be the duty of the Board of Land and Works to take sufficient reasonable action to destroy and suppress all vermin and noxious weeds on and to keep clear and free of vermin and noxious weeds – *(a) unalienated lands of the Crown;* *(b) lands owned or occupied by the Board of Land and Works;* *(c) subject to any agreement between the Board of Land and Works and the relevant corporation hereinafter referred to, lands owned or occupied by any Authority within the meaning of the Water Act 1958 (including water and drainage easements of any such Authority), the Forests Commission, the Housing Commission, the Soldier Settlement Commission, the Victorian Railways Commissioners, and the State Electricity Commission of Victoria or any municipality …*[472]	Yes	The Act prescribed the duties of the Board of Land and Works in 1958.[473] Subsequently, responsibility was assigned to the Department and its successors. Extensive annual programs were undertaken and are described in Annual Reports.

FUNGICIDES AND PESTICIDES

Department use

Under the *Poisons Act 1962* (s 11 (1)) the Department required a permit to buy and use certain poisons. Corporations were required to nominate a responsible person to hold the permit under the Poisons Regulations No. 1 1963.[474] The Department acted as if they were a corporation but did not legally need to do so. The *Drugs Poisons and Controlled Substances Act 1981* (s 21(1)(a)) replaced the *Poisons Act 1962* and the permit requirements were removed until the new Act was amended in 1983, and the permit requirements were re-introduced.

The Department held permits under the *Poisons Act 1962* (by the VNWDB) and under the *Drugs Poisons and Controlled Substances Act 1981* (by the Keith Turnbull Research Institute, KTRI and the Marine Science Laboratories.)[475] Inspectors were generally nominated as the responsible persons for these permits.

[472] Note that 13(c) was extended under the *Vermin and Noxious Weeds (Amendment) Act 1979* to include all state managed land including certain roads.

[473] *Vermin and Noxious Weeds Act 1958.*

[474] *Poisons Regulations No.1 1963* reg 6 and reg 7.

[475] Victorian Parliament, Victoria Gazette, No. P14, 1 August 1988, p11 and p15.

Table 9.2 Summary of compliance – poisons' legislation.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
Poisons Act 1962		
s 11(1) The Chief Health Officer may permit fit and proper persons to purchase or otherwise obtain from manufacturers or wholesale dealers poisons or deleterious substances for use for industrial educational advisory or research purposes but not for resale.	Yes	VNWDB periodically updated its list of responsible persons for Poisons to accompany the Board's poisons permits.[476] Permit issued to Ministry for Conservation, National Parks Service.[477]
Poisons Regulations 1963 No. 1		
6. Subject to the provisions of the Act and these regulations the Chief Health Officer may issue licences or permits in the categories set forth in regulations 10 to 15 of these regulations to any fit and proper person who proposes to conduct a bona fide business or activity in the category to which the said licence or permit relates.	Yes	Inspectors and their assistants were generally appointed as responsible persons. Regulations governing poisons were distributed to inspectors in circulars.[478]
7. Where the applicant for a licence or permit is a corporation, such applicant shall state in the application the name of a natural person who, in respect of the premises named in the application, shall be responsible for carrying out the provisions of the Act and the regulations made thereunder.	Yes	Despite not being a corporation, inspectors were advised to strictly observe the Regulations.[479] VNWDB kept Schedules listing responsible persons in connection with permits under the Poisons Act.[480]

[476] Department of Crown Lands and Survey, 1968, *To All Inspectors - Circular No 81/68 - RE The Boards Poisons Permit*, Memorandum; Department of Crown Lands and Survey, 1969, *To All Inspectors - Circular No 81/69 - RE The Boards Poison Permit*, Memorandum; Department of Crown Lands and Survey, 1970, *To All Inspectors - Circular No 80/70 - RE The Boards Poison Permit*, Memorandum.

[477] National Parks Service, 1978, *Permits to Purchase Use and Hold Poisons*, Memorandum; National Parks Service, 1978, *Confirmation of holding Poisons*, Memorandum; Department of Health 1974, *Permit to Purchase Use and Hold Poisons issued to Ministry of Conservation*, National Parks Service, Permit.

[478] Department of Crown Lands and Survey, 1969, *To All Inspectors - Circular No 80/69 - Use of 1080 Poison (Sodium Fluroacetate),* Memorandum.

[479] Department of Crown Lands and Survey, 1969, *To All Inspectors - Circular No 80/69 - Use of 1080 Poison (Sodium Fluroacetate),* Memorandum.

[480] Department of Crown Lands and Survey, 1978, *Schedule of Depots and Responsible Persons in Connection with Permit Under the Poisons Act 1962*, Table.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
Drugs Poisons and Controlled Substances Act 1981		
s 21(1) The Commission may permit fit and proper persons – *(a) to purchase or otherwise obtain from manufacturers or wholesale dealers poisons or controlled substances, other than hazardous substances and industrial and agricultural poisons, for use for industrial purposes but not for the purpose of resale; or* *(b) to purchase or otherwise obtain from manufacturers or wholesale dealers poisons or controlled substances other than hazardous substances and industrial and agricultural poisons, for use for educational, advisory or research purposes or for the purpose of the provision of health services within the meaning of the Health Commission Act 1977, but not for the purpose of resale.*	Yes	Evidence of updating the list of responsible persons was found in several years. Inspectors and their assistants were generally appointed as responsible persons with leading hands able to be appointed in their absence.[481] Educational permits were issued to the Marine Science Laboratories and KTRI in 1988.[482] The instructions for approved purchasing practices were set out in an *Inspectors' Manual.*[483]
27. A person (not being a manufacturer or wholesale dealer) shall not sell or supply any poison or controlled substance other than a hazardous substance unless he is authorized by or licensed under this Act so to do.	Yes	Refer above[481]

In Victoria it was mandatory for any herbicide containing 2,4-D or 2,4,5-T to comply with the proclaimed standards pursuant to the *Pesticides Act 1958*. In 1975, Victorian law required any herbicide containing 2,4-D or 2,4,5-T to comply with the Australian Standard *(AS) N50-1965 Hormone Weed Killers of the Phenoxyacetic Acid Type*. In 1977, Victorian law required any herbicide containing 2,4-D or 2,4,5-T to comply with AS 1175-1976 *Herbicides of the Phenoxyacetic Acid Type*.[484] AS 1175-1976 introduced an upper limit of 0.1 mg/L (i.e. 0.1 ppm) 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) of total acid content and, in 1982, the proclaimed standard under the *Agricultural Chemicals Act 1958* further reduced this limit to 0.01 mg/kg (i.e. 0.01 ppm). While compliance with these standards was primarily the responsibility of the wholesale dealer,[485] measures were also taken by the State Tender Board to ensure accountability by including the standards in state tender specifications for procurement of these products.

Under the *Pesticides Act 1958* (s 17), and later the *Agricultural Chemicals Act 1958* (s 17), the Department had the right to test the pesticides, herbicides and weedicides purchased on its behalf by the State Tender Board. While not a mandatory requirement, this provision gave the Department the option to confirm that the quality of the products it used (and on-sold) were as-advertised and complied with the relevant standards of the day.

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[481] Department of Crown Lands and Survey, 1982, *Circular No 85/82 - Poison Permit - 1983*, Circular; Division of Inspection and Vermin and Noxious Weeds Destruction, 1980, *Circular No. 100/80 - The Board's Poison Permit - 1981*, Circular; Department of Conservation, Forests and Lands, 1983, *Circular No 90/83 - Poison Permit - 1984*, Circular; Department of Crown Lands and Survey, 1981, *Circular No. 128/81 - Increased Wages and Allowances*, 2 December 1981; Legislative Assembly of Victoria 1981, *Drugs, Poisons and Controlled Substances Act 1981* - 9719, Report.

[482] Victorian Parliament, *Victoria Gazette*, No. P14, 1 August 1988. p11 and p15.

[483] Department of Crown Lands and Survey, 1977, *Inspectors' Manual*, Manual.

[484] Victorian Parliament, *Victoria Gazette*, No. 58, 6 July 1977, p2212, Re: Proclamation pursuant to the Pesticdes Act 1958 Standards for Pesticides.

[485] 'Wholesale dealer' was defined as the manufacturer, importer or other person who was primarily responsible for placing the chemical on the market in Victoria (*Agricultural Chemicals Act 1958,* definitions).

Evidence exists to confirm that the Department did in fact exercise its right to test the pesticides, herbicides and weedicides procured on its behalf. This was achieved through an organised system of sampling, certification and fault testing, as outlined below:

- **Tender samples** – Suppliers or manufacturers, who applied for State Tender, were asked to furnish two samples of the product they were selling along with a current label. One sample was sent to the Chief Chemist (Department of Agriculture) for constituent parts analysis and one retained by the Department for physical tests. Samples of 2,4-D and 2,4,5-T were regularly tested for acid equivalence and other physical parameters such as colour, odour, cold temperature stability or water hardness stability.
- **Random Sampling** – Similar tests were undertaken on samples of 2,4-D and 2,4,5-T after purchase. Samples were collected by inspectors twice a year and sent to the VNWDB or to KTRI for testing.
- **National Association of Testing Authorities.(NATA) Certification** – After 1979, sampling and testing regimes were replaced by the requirement for suppliers to obtain NATA[486] certification for each batch of product supplied, confirming compliance with the quality standards outlined in the tender specification.
- **Fault Testing** – If any products were suspected of being 'faulty' by field staff, inspectors were asked to return them for testing. The main reasons that chemicals failed were due to physical parameters such as crystallisation and cold temperature stability.

Testing and monitoring for the presence of TCDD did not appear[487] to be undertaken regularly by the Department. However, the Victorian Department of Agriculture reported that they monitored TCDD content in agricultural chemicals manufactured and sold in Victoria from the mid-1970s onwards.[488] The Australian Technical Committee on Agricultural Chemicals (TCAC) coordinated a national program to monitor dioxins in retail 2,4,5-T from 1975 to 1985, and the Commonwealth Department of Primary Industry monitored every batch of 2,4,5-T manufactured in Australia or imported into Australia from 1982-1983.[489]

Testing of samples against tender specifications

Tenderers were required, as a condition of tendering, to provide samples of their chemicals for testing. Under an arrangement with the Chief Chemist in the Department of Agriculture,[490] tests on tender samples would be undertaken. Inspectors were advised on how to take samples as follows:[491]

> *It is recommended that four senior inspectors obtain one sample of each of the three herbicides twice per year. One of the two samples will be sent to the Division of Agricultural Chemistry, Department of Agriculture, one sample to be retained at the Keith Turnbull Research Station*.

The Keith Turnbull Research Institute would undertake 'physical' property tests on the chemicals while the Chief Chemist would undertake 'chemical' analysis to ascertain the percentage of active constituent.[492]

Random sampling and testing on products reported to have faults

Inspectors were encouraged to provide feedback on batches of chemicals where field staff discovered faults. They were also required to assist with random sampling of batches of herbicides where faults had been reported. In fact, a random sampling regime was outlined for inspectors in 1970, 'It is recommended that four senior inspector's obtain one sample of

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[486] National Association of Testing Authorities, Australia.

[487] Department of Agriculture 1978, *TCDD* in 2,4,5-T, Letter.

[488] Keith Turnbull Research Station, 1978, *Special Meeting of the Board Held on 21 April 1978,* Minutes.

[489] Expert Medical Panel, 2003, Final *Report of the Expert Medical Panel to Evaluate Recommendationa of the Kimberley Chemical Use Review*, Report, p22.

[490] Keith Turnbull Research Institute, 1965, *Letter to the Chief Chemist requesting him to undertake acid equivalence tests 19 May 1965, Letter .*

[491] Department of Crown Lands and Survey, 1970, *Procedure for Testing of Tender Samples of Herbicides Procedure for sampling of chemicals sold on contract to Board,* Memorandum.

[492] Keith Turnbull Research Institute, 1969*, Tenders for Chemicals 1969/71*, Letter.

each of the three herbicides twice per year'. One of the two samples would be sent to the Division of Agricultural Chemistry, Department of Agriculture, and one sample would be retained at the Keith Turnbull Research Institute.[493]

Test results that were obtained in this period tested for percentage of acid equivalence and other physical parameters such as cold temperature or water hardness stability.[494] Until the late 1970s there was no evidence, however, of any testing for dioxin content as a routine part of the random sampling tests.

If a test failed in the tender phase the product would be returned to the tenderer and advised of the failure.[495]

If a random sample was found to be faulty or the packaging defective, the product and its batch was returned to the manufacturer and a replacement batch was sought.[496]

If an inspector suspected a fault they would send a sample to KTRI for testing and hold that batch in stock until advised by the Department of Agriculture of the results.[497]

Table 9.3 Summary of compliance – chemical quality testing.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown)	Evidence
***Pesticides Act 1964* (and subsequent amendments)**		
s 17 Any person who has bought any fungicide insecticide, vermin destroyer or weed destroyer shall on complying with the requirements of this Act and the regulations be entitled to have a sample of the fungicide insecticide, vermin destroyer or weed destroyer so bought analysed by an analyst and to receive from him a certificate of the result of the analysis.	Yes	Testing procedures were specified and the VNWDB submitted samples for testing. Based on results, recommendations were made for awarding contracts for supply.[498] Random samples from depot stores were also submitted for analysis.[499]
Proclaimed Standards		
Proclaimed Standard pursuant to the *Pesticides Act 1958* – Victoria Gazette No. 91, 12 November 1975 *Any pesticide used as a herbicide which contains as the only active constituent 2,4-D as sodium salt, ester or amine salt or 2,4,5-T as an ester.* *Every such pesticide shall comply with the appropriate*	Partially	Samples of herbicides were submitted to the State Tender Board for testing (note: Standards for TCDD content were first set in 1976[501] when the limit was 0.1mg/L).[502]

493 Department of Crown Lands and Survey, 1970, *Procedure for Testing of Tender Samples of Herbicides*, Memorandum.

494 Department of Agriculture, 1970, *Report on 6 Samples of Herbicide,* Memorandum; Department of Agriculture, 1970, *Samples of Amine 2,4-D Submitted to Department of Agriculture and Nufarm Chemicals Pty. Ltd*., Extract; Department of Agriculture, 1970, *Samples of Amine 2,4-D Submitted to Department of Agriculture and Nufarm Chemicals Pty. Ltd*., Extract.

495 Department of Crown Lands and Survey, 1978, *Weedicides - Quality Control*, Memorandum; Secretary to the State Tender Board, 1977, *Schedule No. 1/03 - Item No. 2,4,5-T*, Letter.

496 Department of Conservation, Forests and Lands, Land Management, 1984, *Supply of faulty Drums,* Letter; Nufarm Chemicals Pty Ltd 1979, *Failed Samples*, Letter.

497 Keith Turnbull Research Institute, 1980, *Faulty Herbicide Batch*, Memorandum.

498 Department of Crown Lands and Survey, 1970, *Procedure for Testing of Tender Samples of Herbicides*, Memorandum; Department of Crown Lands and Survey, 1965, *Request for equivalence determinations on samples*, Letter; Department of Agriculture, 1964, *Report on Analysis of 8 Herbicide Samples*, Memorandum; Department of Agriculture, 1970, *Report on 6 Samples of Herbicide,* Memorandum; Department of Agriculture, 1970, *Samples of Amine 2,4-D Submitted to Department of Agriculture and Nufarm Chemicals Pty. Ltd*., 1970, Extract; Department of Crown Lands and Survey, 1973, *Tenders for Chemicals 1973-5 - Schedule No. 25,* Memorandum.

499 Department of Agriculture, 1970, *Samples of Amine 2,4-D Submitted to Department of Agriculture and Nufarm Chemicals Pty. Ltd*., October 30th, 1970, Extract; Department of Crown Lands and Survey, 1969, *Tenders for Chemicals 1969/71*, Letter.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown)	Evidence
clause(s) of section 3 the Australian Standard Specification for Herbicide of the Phenoxyacetic Acid Type AS N50-1965.[500] *Any pesticide used as a herbicide which contains as an active constituent one or more of 2,4-D as sodium salt ester or amine salt, or 2,4,5-T as an ester, or any salt of MCPA;* *The pesticide shall be prepared from a technical product that complies with the appropriate clause of section 2 the Australian Standard Specification for Herbicide of the Phenoxyacetic Acid Type AS N50-1965.*		The Department did not routinely test for TCDD. To ensure compliance, inspectors were advised only to sell weedicides in original manufacturers packaging.[503]
Proclaimed Standard pursuant to the *Pesticides Act 1958* – Victoria Gazette No. 58, 6 July 1977 *Any pesticide used as a herbicide which contains as an active constituent(s) one or more of 2,4-D as sodium salt, ester or amine, 2,4,5-T as ester amine or MCPA as sodium potassium salt or amine* *(a) Any such pesticide which is an unformulated product shall comply with the appropriate clause of section 2 the Australian Standard Specification for Herbicide of the Phenoxyacetic Acid Type AS 1175-1976* *(b) Any such pesticide which is a formulated product shall be manufactured from a technical product that complies with the appropriate clause(s) of section 3 the Australian Standard Specification for Herbicide of the Phenoxyacetic Acid Type AS 1175-1976* Set a standard for the maximum concentration of TCDD as 0.1 mg/L of total acid content.	Yes	Instances of non-conforming products detected by the testing regime were quickly withdrawn from use.[504] All items shall be supplied in accordance with the specifications available from the State Tender Board.[505] Specification for any additional chemicals were drafted and circulated to the State Tender Board by VNWDB.[506]

[501] Standards Association of Australia, Australian Standard 1175-1976, *Herbicides of the Phenoxyacetic Acid Type,* Report, p8.

[502] State Tender Board, 1979, *Tender Samples of Herbicides,* Letter; Victorian Parliament, *Victoria Gazette*, No. 58, 6 July 1977, p2212, Proclamation pursuant to Pesticides Act 1958, Standards for Pesticides.

[500] Standards Association of Australia, Australian Standard N50-1965, *Hormone Weed Killers of the Phenoxyacetic Acid Type,* Report.

[503] Department of Crown Lands and Survey, 1977, *Circular No. 105/77 - Weedicide Supply Scheme - Weedicides to Be Sold Only in Original Unopened Containers*, Circular.

[504] Keith Turnbull Research Institute, 1980, *Faulty Herbicide Batch*, Memorandum.

[505] State Tender Board, 1981, *State Tender Board - Specifications - Schedule No. 1/03 - Chemicals, Etc.* - Index, Report; State Tender Board, 1978, *Draft Specifications for Supply of Additional Chemicals* 1978-79, Report.

[506] Department of Crown Lands and Survey Victoria, 1978, *Specifications for Additional Herbicides to be Obtained Under Contract,* Memorandum; State Tender Board, 1981, *State Tender Board - Specifications - Schedule No. 1/03* - Chemicals, Etc. - Index, Report.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown)	Evidence
Proclaimed Standard pursuant to the *Agricultural Chemicals Act 1958* – Victoria Gazette No. 80, 11 August 1982 *Any product used as a herbicide which contains as an active constituent(s) one or more of 2,4-D as sodium salt, ester or amine, 2,4,5-T as ester or amine or MCPA as sodium or potassium salt or amine* (a) *In any such product containing 2,4,5-T as an ester or salt, the TCDD content shall not exceed 0.01 mg/kg of the total acid content* *(b) Any such pesticide which is an unformulated product shall comply with the appropriate clause of section 2 the Australian Standard Specification for Herbicide of the Phenoxyacetic Acid Type AS 1175-1976* *(c) Any such pesticide which is a formulated product shall be manufactured from a technical product that complies with the appropriate clause(s) of section 3 the Australian Standard Specification for Herbicide of the Phenoxyacetic Acid Type AS 1175-1976.*	Yes	The State Tender Board specified TCDD content for products containing 2,4,5-T to not exceed 0.01 mg/kg of the total acid content and this was specified in tender documents. Any items not otherwise specified were to be in accordance with AS 1175-1976.[507] As above

Herbicides for sale or resale

Under the *Poisons Act 1962* the Department was required to hold a licence to sell herbicides that were also classified as poisons (s 10(1) and s 18), and under the Poisons Regulations 1963 (1) (s 6 and s 7) it was also required to keep records showing the quantities of these products received, disposed, sold and distributed.[508] Department records provide evidence to confirm that these requirements were complied with on both accounts.

Table 9.4 Summary of compliance – sales

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
***Poisons Act 1962* (and subsequent amendments)**		
10. (1) Subject to this Act and the regulations the Chief Health Officer may license fit and proper persons – *(a) to manufacture any poison or deleterious substance;*	Yes	VNWDB regularly updated the schedule of responsible persons supporting the Board's poisons permit. Inspectors and their

[507] State Tender Board, 1982, *Specifications - Schedule No 1/03 - Chemicals Etc*, Report; State Tender Board, 1981, *State Tender Board - Specifications - Schedule No. 1/03* - Chemicals, Etc. - Index, Report; State Tender Board, 1978, *Draft Specifications for Supply of Additional Chemicals 1978-79*, Report.

[508] Form PD 6 of the Poisons Regulations 1963, *Licence To Sell Poisons Or Deleterious Substances By Wholesale, conditions c) and d).*

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
(b) to manufacture and distribute or sell by wholesale any poison or deleterious substance ; *(c) to sell by wholesale any poison or deleterious substance; or*		assistants were generally responsible persons for the custody of poisons.[509]
(d) to sell by retail any poison or deleterious substance specified in Schedules Two, Five, Six, and Seven to this Act.	Yes	The National Parks Service reported on poisons purchased, used or held under permits issued under the Act.[510]
s 18. No person shall sell or supply any poison or deleterious unauthorized substance unless he is authorized by or licensed under this Act to do so.	Yes	Inspectors and their assistants were generally responsible persons for the custody of poisons.[511]
Poisons Regulations 1963 (2)		
reg 19. No label attached to the immediate container, primary pack or secondary pack of any poison or deleterious substance shall be attached to such container or pack in such a manner as to obscure – *(a) any expression required by these Regulations to be written on such container or pack; or* *(b) any of the embossed points, ridges, flutes or stars referred to in Regulation 21 hereof.*	Yes	Requirements for durable labels were specified, information was circulated and the condition of containers delivered were monitored and problems raised with suppliers.[512] The Minster of Health reported that where small quantities were stored in isolated districts, they were stored as required by all Acts and Regulations.[513]
reg 28. No poison or deleterious substance shall be stored or left in any place (whether such place is ordinarily accessible to others or not) unless the immediate container and the labelling thereof comply with the provisions of these Regulations.	Partially – improved over time	
reg 8. Every person who holds a licence as a general dealer	Partially –	The Department kept chemical stock

[509] Department of Crown Lands and Survey, 1968, *Circular No 81/68 - The Boards Poisons Permit*, Memorandum; Department of Crown Lands and Survey, 1971, *Circular 78/71 - The Board's Poison Permit*, Circular; Department of Crown Lands and Survey, 1969, *Circular No 81/69 - The Boards Poison Permit*, Memorandum; Department of Crown Lands and Survey, 1970, *Circular No 80/70 - The Boards Poison Permit*, Memorandum.

[510] National Parks Service, 1978, *Permits to Purchase Use and Hold Poisons*, Memorandum; National Parks Service, 1978, *Permits to Purchase Use and Hold Poisons*, Memorandum; Department of Health, 1974, *Permit to Purchase Use and Hold Poisons issued to Ministry of Conservation, National Parks Service*, Permit.

[511] Department of Crown Lands and Survey, 1969, *Circular No 81/69 – The Boards Poison Permit*, Memorandum; Department of Crown Lands and Survey, 1968, *Circular No 81/68 - The Boards Poisons Permit*, Memorandum; Department of Crown Lands and Survey, 1971, *Circular 78/71 - The Board's Poison Permit*, Circular.

[512] Keith Turnbull Research Institute, 1982, *Pesticide Information - No 1.2 - June 1979*, Publication; Keith Turnbull Research Institute, 1982, *Pesticide Information - No 2.1 - June 1979*, Publication; State Tender Board, 1978, *Draft Specifications for Supply of Additional Chemicals 1978-79,* Report; Dow Chemical (Australia) Pty Ltd, 1983, *Problems Associated with Containers Packers Labels Etc of Weedicides Supplied to Field Staff*, Memorandum; Department of Crown Lands and Survey, 1977, *Circular No. 105/77 - Weedicide Supply Scheme - Weedicides to Be Sold Only in Original Unopened Containers,* Circular.

[513] Minster of Health, 1978, (Est) *Draft Response to Legislative Assembly - Notice Paper (Q. 714),* Report; Legislative Assembly, 1978 (Est), *Extract, Legislative Assembly*; Notice, Extract.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
in poisons or a licence to sell poisons listed in Schedule Five or Schedule Six to the Poisons Act 1962 – *(a) and who has in his possession any of the poisons or deleterious substances referred to in Schedule Seven to the Act or Regulation 6 of these regulations shall provide a poisons book and a poisons cupboard at the premises named in such licence;* *(b) shall keep locked in the poisons cupboard such of the poisons or deleterious substances in his possession as are referred to in paragraph (a) hereof.*	improved over time	records at depots from the late 1950s and inspectors submitted monthly reports on the type of work done and chemical type and quantities used.[514] Inspectors were to require landholders to sign sales dockets certifying that the weedicide purchased were for noxious weed control only.[515] The Minster of Health reported that where small quantities were stored in isolated districts, they were stored as required by all Acts and Regulations.[516] In 1971 the Forests Commission began keeping records of all issues regarding 'poisons or deleterious substances'.[517] By 1977 the VNWDB set-up a committee to oversee proper administration (purchase, distribution, storage and resale) and financial control over the Landholder Weedicide Sale Scheme.[518] In the late 1970's facilities in Ballarat were considered low standard for storage of materials and works were implemented. As late as 1988 the OHS Committee reported that some depots were not complying and this was referred to the Regional Manager.[519] KTRI pesticide information sheets distributed in 1979 covered storage and labelling.[520]
reg 11. (1) Every person who discharges or disposes of any poison or deleterious substance into any road street channel	Unknown	From 1975, policy included instructions for workers and the general public for disposal

[514] Department of Crown Lands and Survey 1959, *Poisons Spraying Materials, Stock Book, Avoca District No. 2*, Report; Department of Crown Lands and Survey 1959, *Poisons Spraying Materials, Stock Book*, *Avoca District No. 2*, Report.

[515] Department of Crown Lands and Survey, 1976 (Est) *Landholder Weedicide Supply Scheme Details*, Report.

[516] Minster of Health, 1978 (Est) *Draft Response to Legislative Assembly - Notice Paper (Q. 714),* Report; Legislative Assembly 1978 (Est) *Extract, Legislative Assembly*; Notice, Extract.

[517] Forests Commission Victoria, 1971, *Safety Precautions in the Use of Chemicals and Pesticides*, Report.

[518] Department of Crown Lands and Survey, 1977, *Bulk Purchase of Weedicide and Re-Sale to Landholders*, Letter.

[519] Keith Turnbull Research Institute, 1982, *Pesticide Information - No 1.2 - June 1979*, Publication; Safety Committee, 1988, Vickers St *Work Centre - Safety Committee Meeting* - 12 August 1988, Minutes; Department of Crown Lands and Survey, 1978, *Works and Services Program 78/79 - Ballarat and Bacchus Marsh Depot Complexes*, Memorandum.

[520] Keith Turnbull Research Institute, 1979, *Pesticide Information*, Publications.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
sewer drain or water-course without having first obtained the consent in writing of the municipality in which such road street channel sewer drain or water-course is situated shall be guilty of an offence against these Regulations. *(2) Every person who discharges or disposes of any poison or deleterious substance as aforesaid shall first take reasonable precautions to safeguard the public and any animal from danger or injury from such poison or deleterious substance.* *(3) In this Regulation "reasonable precautions" shall include adequate publicity in local newspapers, prominent printed notices surrounding the area warning that a poison or deleterious substance is being used or laid, advising owners of adjoining properties, or fencing off the area.*		of chemicals and containers. [521]
reg 12. Every person who carelessly leaves any poison or deleterious substance in any place easily accessible to others shall be guilty of an offence against these Regulations. For the purposes of this Regulation "any place easily accessible to others" means a place where articles of food or drink are usually kept, or a mantelpiece, windowsill, ledge, shelf or similar place to which access may be easily obtained.	No	KTRI pesticide information sheet published in 1979 advised of requirements to store herbicides securely in a separate building, or in a section of the depot.[522] Worker submissions and interviews include instances where lunches were stored next to the chemicals and pesticide containers disposed of in mine shafts.[523]

Under the provisions of the *Pesticides Act 1958*, and later the *Agricultural Chemicals Act 1958*, the Department was required to ensure that herbicides offered for sale were registered, correctly labelled and met the relevant standards for quality (s 5(1), s 10(1) and s 11). While the actual registration, labelling and quality of pesticides was the responsibility of the wholesale dealer,[524] these statutory requirements were included in the State Tender specifications to ensure that all products supplied to, and then on-sold by, the Department met the relevant statutory requirements.

[521] Department of Crown Lands and Survey, 1975, *Bulletin 3D, Recommendations for Control of Noxious Weeds in Victoria*, Bulletin.

[522] Keith Turnbull Research Institute, 1979, *Pesticide Information*, Publications.

[523] See Appendix 3.

[524] 'Wholesale dealer' was defined as the person (or company) who was primarily responsible for placing the product on the market in Victoria.

Table 9.5 Summary of compliance – registration and labelling.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown)	Evidence
Agricultural Chemicals Act 1958 **(and subsequent amendments)**		
5 (1) When a standard for any agricultural chemical has been prescribed as aforesaid a person shall not sell any of such agricultural chemicals which is not in accordance with the standard so prescribed and for the time being in force.	Yes	All items shall be supplied in accordance with the specifications available from the State Tender Board.[525] It was agreed by the State Tender Board that chemical specification certification by manufacturers would be sufficient.[526] VNWDB Laboratory Test Certification was implemented from 1 July 1978.[527]
10(1) When any person ***sells any agricultural chemical he shall brand or stamp upon*** *or durably affix to or cause to be branded or stamped upon or durably affixed to every package containing any of such agricultural chemical an approved label bearing the following particulars –* *(a) the distinguishing name of such agricultural chemical;* *(b) the constituents which are claimed to be active constituents and the proportion (expressed as prescribed) or (in the case of a prescribed product or class of products) title, quantity of each such constituent contained therein, or (if a standard has been prescribed and is in force for such agricultural chemical) –* *(i) where the proclamation prescribing the standard specifies any constituent or constituents in relation to the agricultural chemical, the proportions or quantities of those constituents contained in the agricultural chemical; or* *(ii) in the case of a prescribed agricultural chemical or class of agricultural chemicals, the words "Conforms with Standard";* *(c) such other statements as are prescribed.*	Yes	The Department only resold chemicals in their original containers and inspectors were instructed in the care of containers and labels.[528] There was evidence that issues with labels were taken up with suppliers.[529] Department of Agriculture inspectors had access to the depots where chemicals were sold to enable them to provide advice and, if necessary, report any anomalies that may occur so that the necessary corrective action could be put in motion.[530]

[525] State Tender Board, 1981, *State Tender Board - Specifications - Schedule No. 1/03 - Chemicals, Etc. - Index*, Report; State Tender Board, 1978, *Draft Specifications for Supply of Additional Chemicals 1978-79*, Report.

[526] Department of Crown Lands and Survey, 1977, *Schedule No. 1/03 (25) - Chemicals, Letter*.

[527] Department of Crown Lands and Survey, 1978, *Contact - Chemicals Schedule No 1/03 - 1st July 1977 to 30th June 1978*, Letter.

[528] Department of Crown Lands and Survey, *1977, Circular No. 105/77 - Weedicide Supply Scheme - Weedicides to Be Sold Only in Original Unopened Containers*, Circular.

[529] Dow Chemical (Australia) Pty Ltd, 1983, *Problems Associated with Containers Packers Labels etc. of Weedicides Supplied to Field Staff*, Memorandum.

[530] Department of Agriculture Victoria, 1977, *Pesticides Act 1958*.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown)	Evidence
11 (1) Every person who sells any fungicide insecticide vermin destroyer or weed destroyer and – *(a) causes or permits any particulars as aforesaid with respect to or of such fungicide insecticide vermin destroyer or weed destroyer to be false in any material particular; or* *(b) fails to brand or stamp upon or durably affix to any package containing any of such fungicide insecticide vermin destroyer or weed destroyer the distinguishing name particulars or label required by this Act – shall be guilty of an offence against this Act.* *(2) Every person who sells any fungicide insecticide vermin destroyer or weed destroyer which –* *(a) is not in accordance with the particulars required by this Act to be branded stamped upon or durably affixed to the package containing such fungicide insecticide vermin destroyer or weed destroyer (as the case may be); or* *(b) is not registered under this Act – shall be guilty of an offence against this Act.*	Yes	All chemicals were purchased through the state tender process and therefore only registered chemicals with correct labelling would have been purchased as stipulated by the tender specifications.[531] The VNWDB also defined a procedure for testing tender samples to ensure they complied with their label.[532] Inspectors were instructed by circular that chemicals were only to be sold in their original containers and not to be decanted for on-selling.[533] Random sampling of drums at various depots throughout the state for testing by the Department of Agriculture and NuFarm Chemicals Pty Ltd.[534]
Drugs Poisons and Controlled Substances Act 1981		
s 27 A person (not being a manufacturer or wholesale dealer) shall not sell or supply any poison or controlled substance other than a hazardous substance unless he is authorized by or licensed under this Act so to do.		Permits were held under the *Poisons Act 1962* by the VNWDB and under the *Drugs Poisons and Controlled Substances Act 1981* by KTRI and the Marine Science Laboratories.[535]

[531] State Tender Board, 1981, *State Tender Board - Specifications - Schedule No. 1/03 - Chemicals, Etc. - Index,* Report.

[532] Department of Crown Lands and Survey, 1970, *Procedure for Testing of Tender Samples of Herbicides,* Memorandum; Department of Crown Lands and Survey, 1965, Letter; Department of Crown Lands and Survey, 1969, *Tenders for Chemicals 1969/71,* Letter.

[533] Department of Crown Lands and Survey, 1977, *Circular No. 105/77 - Weedicide Supply Scheme - Weedicides to Be Sold Only in Original Unopened Containers*, Circular.

[534] Department of Agriculture, 1970, *Samples of Amine 2,4-D Submitted to Department of Agriculture and Nufarm Chemicals Pty. Ltd., October 30th, 1970,* Extract.

[535] Victorian Parliament, Victoria Gazette, No. P14, 1 August 1988, p11 and p15.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown)	Evidence
Drugs Poisons and Controlled Substances Regulations 1981		
Pesticides Regulations 1966 and 1976 – label requirements for selling (part of regulation 15)		
reg 15. Each label shall have legibly and indelibly written or printed thereon (in addition to the words prescribed by or under any other Act) the following – (a) *The distinguishing name of such pesticide* *(b) The names of the active constituents* *(d) In the case of pesticides containing substances listed in any part of the Seventh Schedule, the safety directions set down in that part of the schedule …* *Seventh Schedule Part 12* *The following substances and their salts and esters:* *4-CPA* *2, 4-D* *2, 4-DB* *2, 4-DES* *dicamba* *2, 2-dichloropropionic acid* *do dine* *fenoprop* *MCPA* *MCPB* *mecoprop* *2, 4, 5-T* *2, 3, 6-trichlorobenzoic acid* *2, 3, 6-trichlorophenylacetic acid* *Safety Directions* *Avoid contact with skin and eyes to prevent possible irritation. Wash concentrate from skin and eyes immediately. Avoid working in and breathing spray mist. Wash exposed parts of the body after use and before eating, drinking or smoking. If swallowed seek medical advice*.	Yes	Inspectors were advised by circular that chemicals were only to be sold in their original containers and not to be decanted for on-selling.[536] All registered chemicals purchased for resale were purchased through the State Tender Board according to their specifications.[537] State Tender Board specifications included labelling requirements.[538] Regulations governing the poisons were distributed to inspectors by circular.[539]

[536] Department of Crown Lands and Survey, 1977, *Circular No. 105/77 - Weedicide Supply Scheme - Weedicides to Be Sold Only in Original Unopened Containers*, Circular.

[537] State Tender Board, 1978, *Draft Specifications for Supply of Additional Chemicals 1978-79*, Report; , Keith Turnbull Research Institute, 1978, *Specifications for Additional Herbicides to be Obtained Under Contract,* Memorandum.

[538] State Tender Board, 1981, *State Tender Board - Specifications - Schedule No. 1/03 - Chemicals, Etc.* - Index, Report.

[539] Department of Crown Lands and Survey, 1969, *Circular No 80/69 - Use of 1080 Poison (Sodium Fluroacetate),* Memorandum.

Storage requirements for herbicides and pesticides

Prior to 1985, the Department responsibilities for storage of pesticides lay in requirements to handle and store poisons, as defined in the *Poisons Act 1962* and the Poisons Regulations 1963 (No 1), (No 2) and (No.3). After 1985 the requirements were under the Dangerous Goods (Storage and Handling) Regulations 1989.

Poisons Act 1962

In 1972, by proclamation, 2,4-D became a Schedule 5 poison and 2,4,5-T a Schedule 6 poison[540] thus giving the Department additional obligations under the Act with regard to the purchase, storage, handling and sale of both these chemicals.[541]

Permit conditions also required that the responsible person under the permit ensure the safe custody of the poisons and ensure that they were stored in accordance with the Act and Regulations.[542]

Poisons Regulations 1963 No. 2, Regulation 8 required that the Department keep poisons in a poisons cupboard at the premises named in the licence. These regulations applied to Schedule 5 and Schedule 6 poisons such as 2,4-D and 2,4,5-T and also Schedule 7 poisons.[543]

Evidence

There is evidence that the Department pesticide storage facilities in the Ballarat region were basic in the 1960s,[544] and standards were low in several cases.[545]

- In 1967, the Linton depot did not have a water supply.[546]
- The standard of depot workshop at the Ballarat depot was low and inadequate in 1978–79.[547]
- The Bacchus Marsh depot was recognised as inadequate in 1982.[548]
- Poisons were not locked securely at Linton and Scarsdale depots as at 1988.[549]
- There was poor ventilation in the Beaufort chemical store in 1992.[550]

In 1978, it was reported to the Legislative Assembly that the VNWDB stored poisonous chemicals to the required standard. 'Schedule 7 poisons, stored and used as required under the *Vermin And Noxious Weeds Act 1958* are kept in locked cupboards in locked depots throughout the State.'[551]

However, in 1978, a number of weaknesses in the Department depot facilities were listed by the VNWDB in relation to policy on 2,4-D and 2,4,5-T. The VNWDB recommended that the 'Minister for Lands supports a submission to Treasury for adequate funding to finance higher standards' for storage, equipment and amenities for employees who handle weedicides.[552]

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[540] Victorian Parliament, *Victoria Gazette*, No. 97, 15 November 1972, p3603, RE amendment to schedules by proclamation pursuant to *Poisons Act 1962*.

[541] Victorian Parliament, *Victoria Gazette*, No. 97, 15 November 1972, p3603, RE amendment to schedules by proclamation pursuant to *Poisons Act 1962*.

[542] *Poisons Act 1962* s 14 (1).

[543] *Poisons Regulations 1963, No.2, reg 12*.

[544] Department of Crown Lands and Survey, 1967, *I080 Mixing Site, Depot Site,* Ballarat Group, Letter.

[545] Safety Committee, 1988, *Vickers St Work Centre - Safety Committee Meeting - 12 August 1988*, Minutes; Department of Crown Lands and Survey, 1978, *Works and Services Program 78/79 - Ballarat and Bacchus Marsh Depot Complexes,* Memorandum.

[546] Department of Crown Lands and Survey, 1967, *I080 Mixing Site, Depot Site, Ballarat Group*, Letter.

[547] Department of Crown Lands and Survey, 1978, *Works and Services Program 78/79 - Ballarat and Bacchus Marsh Depot Complexes*, Memorandum.

[548] Minister for Lands' 1982 (Est), *Bacchus Marsh Depot*, Letter.

[549] Safety Committee, 1988, *Vickers St Work Centre - Safety Committee, Meeting Held on 12 August 1988*, Minutes.

[550] Department of Conservation, Forests and Lands, 1992, *Ballarat Region Occupational Health and Safety Committee, Meeting Held on 7 February 1992*, Minutes.

[551] Minster of Health, 1978 (Est), *Response to Legislative Assembly - Notice Paper (Q. 714),* Report.

[552] Department of Crown Lands and Survey, 1978 (Est.), *Policy on 2,4-D and 2,4,5-T*, Memorandum.

In 1980, a memorandum to VNWDB members and to the Department's Depot Committee indicated that purchase of amenity blocks and pesticide storage sheds were recognised by Treasury as a necessity, and that these be included as part of the specifications of new depot complexes, but funds would be allocated, if available, and that, if unsuccessful, funding requests should be submitted to future budget submissions.[553]

However by the early 1990s the chemical storage situation had improved greatly. An internal assessment was conducted of OHS management systems in Ballarat and no major chemical issues were reported except for drums being stored on the floor of chemical sheds at two of the depots.[554]

Policies

- *Circular No. 57/72 Safety and Pesticides,*[555] dated 20 September 1972 stated, 'Storage: Always store under lock and key, away from foodstuffs and well away from children's reach. Keep all pesticide concentrates in original containers with labels intact.'
- Instructions from VNWDB Pesticide Information, *Safe Use of Pesticides*[556] stated, 'Store herbicides in separate building, or in a section of depot set aside for chemical storage. Keep storage building locked when not in use.'
- *Pesticides Information No. 4.12 2,4-D Sodium Salt, dated June 1981*[557] stated, 'Store away from seeds, fertilizers, fungicides and insecticides.'

Table 9.6 Summary of compliance – storage

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
***Poisons Act 1962* and Regulations**		
Poisons Regulations 1963 No 3		
reg 8. Every person who holds a licence as a general dealer in poisons or a licence to sell poisons listed in Schedule Five or Schedule Six to the Poisons Act 1962 – *(a) and who has in his possession any of the poisons or deleterious substances referred to in Schedule Seven to the Act or Regulation 6 of these Regulations shall provide a poisons book and a poisons cupboard at the premises named in such licence;*	Partially – improved over time	The Department kept chemical stock records at depots from the late 1950s and inspectors submitted monthly reports on the type of work done, and chemical type and quantities used.[558]

[553] Department of Crown Lands and Survey, 1978, (Est.) *Policy on 2,4-D and 2,4,5-T*, Memorandum; Vermin and Noxious Weeds Destruction Board, 1980, *Works and Services 1980/81 - Treasury Discussion 29 May 1980*, Memorandum.

[554] Department of Conservation and Natural Resources, 1993, *OHS Management Assessment-Ballarat*, Memorandum; Department of Conservation and Natural Resources, 1993, *Assessment of Occupational Health and Safety Management Systems - Ballarat Region - Department of Conservation and Natural Resources - March 1993*, Report.

[555] Department of Crown Lands and Survey, 1972, *Circular 57/72 - Safety & Pesticides*, Circular.

[556] Keith Turnbull Research Institute, 1979, *Pesticide Information,* Publications.

[557] Keith Turnbull Research Institute, 1982, *Pesticide Information - No 1.1 - September 1982*, Publication.

[558] Department of Crown Lands and Survey, 1959, *Poisons Spraying Materials, Stock Book, Avoca District No. 2,* Report; Department of Crown Lands and Survey, 1959, *Poisons Spraying Materials, Stock Book, Avoca District No. 2*, Report.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
(b) shall keep locked in the poisons cupboard such of the poisons or deleterious substances in his possession as are referred to in paragraph (a) hereof.		In the 1970s circulars and information sheets included 'secure storage' instructions for pesticides.[559] In 1978 a response to the Legislative Assembly, prepared for the Minister for Health, confirmed the Department stored poisons in locked cupboards across the state.[560] There is evidence that not all depots in the Ballarat area were compliant in the 1980s before facilities were upgraded, with some chemicals kept unsecured or in the open.[561] VNWDB regularly updated the schedule of responsible persons supporting the VNWDB's poisons permit. Inspectors and their assistants were generally responsible persons for the custody of poisons.[562] Circulars and pesticide information sent to inspectors included conditions for resale imposed by the Regulations and instruction on pesticide safety including labelling, storage, PPE and disposal.[563]

Dangerous Goods (Storage and Handling) Regulations 1989

The Dangerous Goods (Storage and Handling) Regulations 1989 came into effect, in part, on 1 June 1990. In April 1990, several memoranda were circulated to divisional directors and regional managers outlining the requirements for signage and placarding at depots and on vehicles carrying certain quantities of goods.[564]

As required, the Department undertook a self-assessment program to determine risk levels and storage and handling requirements for each of its depots under the new Regulations. Each depot was assessed for the type and quantity of

[559] Department of Crown Lands and Survey, 1972, Circular 57/72 - *Safety & Pesticides,* Circular; Keith Turnbull Research Institute, 1979, *Pesticide Information,* Publications.

[560] Minster of Health, 1978 (Est), *Response to Legislative Assembly - Notice Paper (Q. 714),* Report.

[561] Safety Committee, 1988, *Vickers St Work Centre - Safety Committee Meeting, Meeting Held on 12 August 1988,* Minutes.

[562] Department of Crown Lands and Survey, 1978, *Schedule of Depots and Responsible Persons in Connection with Permit Under the Poisons Act 1962*, Table; Department of Crown Lands and Survey, 1970, *Circular No 80/70 - The Boards Poison Permit,* Memorandum; Department of Crown Lands and Survey, 1969, *Circular No 81/69 - The Boards Poison Permit*, Memorandum; Department of Crown Lands and Survey, 1968, *Circular No 81/68 - The Boards Poisons Permit*, Memorandum; Department of Crown Lands and Survey, 1971, *Circular 78/71 - The Board's Poison Permit*, Circular.

[563] Department of Crown Lands and Survey, 1972, *Circular 57/72 - Safety and Pesticides,* Circular; Department of Crown Lands and Survey, 1977, *Circular No. 105/77 - Weedicide Supply Scheme - Weedicides to Be Sold Only in Original Unopened Containers*, Circular; Keith Turnbull Research Institute, 1979, *Pesticide Information No. 2.1 - Safe Use of Herbicides*, Publications; Keith Turnbull Research Institute, 1982, *Pesticide Information - No 1.1 - September 1982,* Publication.

[564] Department of Conservation and Environment, 1990, *Dangerous Goods (Storage and Handling) Regulations 1989*, Memorandum; Department of Conservation, Forests and Lands, 1990, *Dangerous Goods Act 1985 (Act No. 10189/1985),* Memorandum.

materials held in store, and rated against a prescribed scoring system.[565] Few changes to Department storage and handling practices were expected, beside bunding for weedicide sheds and signage.[566]

In the Ballarat region only the Sebastopol depot exceeded the self-assessment threshold for dangerous goods, as larger volumes of dangerous goods including 2,4-D 80, 2,4-D 40, pindone, 1080, larvacide, phostoxin, strychnine and fuels were stored.[567]

Status of 2,4,-D esters

In 1990, under the *Dangerous Goods Act (1985)* classification system 2,4-D ester 800 and 2,4-D ester 400 LV were classified as: subsidiary risk class 3.1 (flammable), packaging group II and hazard group 'C'. 2,4-D amine (all forms) was not a prescribed dangerous good.[568]

The Hazard Group Listing circulated for Calculation of Assessment Factors stated:

> *At present 2,4-D ester 800 is only stocked for resale and not used by DCE (the Department). Departmental policy to be implemented during 90/91 is that DCE should only sell products that are used by DCE. Thus stocks of 2,4-D ester 800 will be reduced to zero during the next 12 months.*[569]

Poisons sheds

In 1989 the Department developed 'Guidelines for the Construction of Poison Sheds'. The poison shed was designed[570] to meet the Dangerous Goods (Storage and Handling) Regulations 1989 and *AS 2507-1984 Storage and Handling of Pesticides*.[571]

The guidelines included specifications for the construction of the building, specifications for a spill compound, and the location (away from public places such as houses, schools and hospitals), safety showers, racks for storing packages, lighting and ventilation. The requirements for ventilation were set so as to meet the Dangerous Goods (Storage and Handling) Regulations 1989, Schedule 12, s 6(b) and (c). These Regulations required natural ventilation by a system of vents in pairs in two opposite external walls.[572]

Table 9.7 Summary of compliance – dangerous goods storage and handling

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
Dangerous Goods (Storage and Handling) Regulations 1989		
Part 2 *If the assessment factor for dangerous goods kept at premises is 10 or more, the occupier of the premises must undertake an assessment to ensure that –*	Yes	A statewide review of compliance with the new regulations was conducted.[573] Assessments for the Ballarat group found that only the Sebastopol depot exceeded the risk assessment threshold.[574,]

[565] Department of Conservation and Environment, 1990, *Dangerous Goods (Storage and Handling) Regulations*, Memorandum.

[566] Department of Conservation and Environment, 1990, *Dangerous Goods - Depot Assessment*, Memorandum.

[567] Department of Conservation and Environment 1990, *Appendix 3 - Assessment Factor - DCE Premises - Ballarat - Vickers St*, Form.

[568] Department of Conservation and Environment, 1990, *Appendix 2 - Hazard Group Listing for Calculation of Assessment Factors*, Table.

[569] Department of Conservation and Environment, 1990, *Dangerous Goods (Storage and Handling) Regulations*, Memorandum.

[570] Department of Conservation, Forests and Lands, 1988, *Guidelines for the Construction of Poison Sheds*, Manual.

[571] Standards Association of Australia, 1940, *The Storage and Handling of Flammable and Combustible Liquids Known as The SAA Flammable and Combustible Liquids Code as 1940-1982*, Report.

[572] Department of Conservation, Forests and Lands, 1988, *Guidelines for the Construction of Poison Sheds,* Manual.

[573] Department of Conservation, Forests and Lands, 1990, *Dangerous Goods Act 1985 (Act No. 10189/1985),* Memorandum.

[574] Department of Conservation and Environment, 1990, *Dangerous Goods - Depot Assessment* , Memorandum; Department of Conservation and Environment 1990, *Appendix 3 - Assessment Factor - DCE Premises - Ballarat - Vickers St*, Form.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
a) there is compliance with all the requirements of these Regulations; and *b) the hazards associated with the storage and handling of dangerous goods at the premises are identified; and* *c) steps are taken to prevent accidents at the premises and to minimise their consequences to people, property and the environment; and* d) *people working at the premises are provided with the information, training and equipment necessary.*		The Department was advised of dangerous goods training to be conducted by the Department of Labour.[575] Regional Managers were advised of requirements.[576]
Dangerous Goods (Storage and Handling) Regulations 1989 Schedule 12, s 6(b) and (c). *b) ventilation through one external wall which is open, except for covering with chain wire mesh, provided that the length of the open wall is a least twice the distance of the wall from the opposite internal wall; or* *c) if there are 2 opposite external walls, ventilation by a system of vents in pairs that complies with the following –* *(i) for each pair of vents one must be immediately below the ceiling and the other at floor level, or above the upper limit of the spillage compound, if one is installed; and* *(ii) the free area of each vent must be a least 0.1 square metres; and* *(iii) one pair of vents must be located in each 2 metres of all external walls; and* *(iv) each vent must open to the outside of the building which has free air movement, and* (v) *unless otherwise approved, the distance between opposite external walls must not exceed 10 metres.*	Partially – improved over time	Guidelines for construction of poisons sheds were issued in 1985 and 1992, however, there was evidence that not all sheds were compliant for ventilation.[577]

Dangerous Substances (Placarding of Workplaces) Regulations 1985

In 1985, a series of memoranda were posted to managers about the Dangerous Substances (Placarding of Workplaces) Regulations 1985 that placed requirements for installing placards (signs with symbols to demonstrate the presence of dangerous goods.[578] Dangerous substances were defined in 1985 as:

[575] Department of Labour and Industry, 1990, *Public Sector Seminar - Dangerous Goods Regulations*, Letter; Department Of Labour and Industry, 1990, *Public Sector Seminar - Dangerous Goods Regulations*, Agenda.

[576] Department of Conservation and Environment, 1990, *Dangerous Goods (Storage and Handling) Regulations 1989*, Memorandum; Department of Conservation, Forests and Lands, 1990, *Dangerous Goods Act 1985*, Memorandum.

[577] Department of Conservation, Forests and Lands, 1992, *Guidelines for the Construction of Poison Sheds*, Manual; Department of Conservation, Forests and Lands, 1992, *Ballarat Region Occupational Health and Safety Committee 7 February 1992,* Minutes; Department of Conservation, Forests and Lands, 1985, *Storing of Hazardous Materials*, Memorandum.

[578] Department of Conservation, Forests and Lands, 1985, *Storing of Hazardous Materials*, Memorandum.

Substances and articles are considered to be dangerous goods if they are explosive, flammable, poisonous or exhibit chemical or physical properties such as oxidizing properties, radio-activity etc. that are potentially dangerous to people or property.[579]

Table 9.8 Summary of compliance – placarding

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown)	Evidence
Dangerous Substances (Placarding of Workplaces) Regulations 1985		
e) *to ensure the safety of people and property; and appropriate signs and notices are displayed at the premises.*	Yes	Information on the requirements were circulated to regional managers and included in the 1992 guidelines for new constructions.[580]

Health Act 1958 and Regulations

The purpose of the *Health Act 1958* was to promote and protect public health. The Act gave the Minister for Health and the Department of Health, through the Health Commission and the Chief Health Officer, the control over the use of poisons and hazardous substances affecting public health and safety. While the Department had no direct accountability for the legislation, it did have responsibility to comply with it and with the Regulations made under it.

This section of the Report focuses on Regulations made under the *Health Act 1958* in respect to harmful gases, vapours, fumes, mists, smokes and dusts. Chapter 6 of this Report deals with Regulations made under the *Health Act 1958* in respect to the provision of protective clothing and equipment.

From November 1965 it was mandatory under the Regulations for employers to provide adequate ventilation or, as a second preference, respiratory protective equipment where employees were specifically exposed to 2,4-D and 2,4,5-T at concentrations of greater than 10 mg/m^{3}of air.[581]

In 1984, the occupational exposure standard for 2,4-D and 2,4,5-T was again restated in regulations under the *Health Act 1958*, as to not exceed 10 mg/m3 of air.[582] In 1984, the penalty for not complying with the regulations was set at $1,000.[583]

While there may be an argument that, with the doors of the chemical sheds open, the relevant standards may have been met, there was no evidence located during the Inquiry to suggest that air quality testing was conducted during the Period nor were any Department documents uncovered that referred to requirements for these Regulations under the *Health Act 1958*.

The Department had limited policy and practices to minimise worker exposure to chemical vapours from 2,4-D or 2,4,5-T . The design for chemical storage sheds did not include ventilation, however, there is evidence that some storage sheds were being retro-fitted with ventilation post-1991.[584] After 1991, the standard shed design included ventilation.[585]

[579] Department of Conservation, Forests and Lands, 1985, *Dangerous Goods Survey - Explanatory Notes*, Report.

[580] Department of Conservation, Forests and Lands, 1992, *Guidelines for the Construction of Poison Sheds*, Manual.

[581] *Health (Harmful Gases, Vapours, Fumes, Mists, Smokes and Dusts) Regulations 1965*, Schedule.

[582] *Health (Harmful Gases, Vapours, Fumes, Mists, Smokes and Dusts) Regulations 1984*, Schedule.

[583] *Health (Harmful Gases, Vapours, Fumes, Mists, Smokes and Dusts) Regulations 1984*, Reg 7.

[584] Department of Conservation and Environment, 1991, *Ventilation of Weedicide Storage Sheds*, Memorandum.

[585] Department of Conservation, Forests and Lands, 1988, *Guidelines for the Construction of Poison Sheds*, Manual.

In 1967 the VNWDB approved a trial of half-a-dozen face shields for use when using misting machines,[586] noting that respirators were found to be 'too cumbersome and restrictive when working in difficult country and probably would not be worn by our workmen'.[587] While in 1970 the Forests Commission Victoria, Pesticide Manual specified to 'wear repirators to prevent inhalation whenever operators are exposed to LARGE AMOUNTS of diluted pesticidal sprays or dusts'….[588]

A Department information sheet on 2,4,5-T, dated December 1982, noted that following the State Government's recently announced new policy on the use and sale of 2,4,5-T in Victoria that, 'all government workers applying 2,4,5-T have been issued with protective clothing including overalls, rubber boots and gloves, face shields or respirators'.[589] However, it does not appear that wearing face shields or respirators was mandatory in the Department at that time.

The National Occupational Health and Safety Council (NOHSC) noted in 1991 that:

> *… exposure standards are based on time weighted averages that assume exposure occurs over an eight-hour working day, for a five-day working week. It is not acceptable to expose workers to concentrations significantly higher than the exposure standard, though permissible variations are dependent on a range of factors that require expert consideration to assess*.[590]

In summary, no evidence was found that suggests that the Department complied with the *Health Act 1958* Regulations on harmful gases, vapours, fumes, mists, smokes and dusts between 1965 and 1990. Between 1991 and 1995 there was evidence of partial compliance.

Table 9.9 Summary of compliance – Health Act and Regulations

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
Health Act 1958		
Harmful Gases, Vapours, Fumes, Mists, Smokes and Dusts (Amendment) Regulations 1965	1965 to 1983	
1. (2) In these Regulations the Harmful Gases Vapours Fumes, Mists, Smokes and Dusts Regulations are called the Principal Regulations. *2. For the Schedule to the Principal Regulations there shall be substituted the following Schedule –*	Partially – improved over time	As early as 1967 workers were complaining of eye inflammation and this was acknowledged by the VNWDB when the Chairman requested masks to be worn while using misting machines.[591] Complaints were received from staff that respirators were too cumbersome and restrictive to use.[592] By 1975 the VNWDB recommendations for control of noxious weeds included

[586] Vermin and Noxious Weeds Destruction Board, 1967, *Minutes of Meeting Held on 21 February 1967*, Minutes.

[587] Keith Turnbull Research Institute, 1967, *Weedicides Used by the VNWDB,* Memorandum.

[588] Forests Commission Victoria, 1970, Safety precautions in the use of chemicals and pesticides, Manual.

[589] Keith Turnbull Research Institute, 1982, *Information Sheet - No 32 - 2,4,5-T Policy*, Report.

[590] National Occupational Health and Safety Committee, 1991, *Exposure Standards for Atmospheric Contaminants in the Occupational Environment*, Australian Government Publishing Service, Report, p9.

[591] Department of Crown Lands and Survey, Vermin and Noxious Weeds Destruction Board, 1965, *Report on Interview with the Vermin and Noxious Weed - Destruction Board - 18th March 1965,* Minutes; Vermin and Noxious Weeds Destruction Board, Vermin and Noxious Weeds Destruction Board, 1967, *Vermin and Noxious Weeds Destruction Board - Minutes of Meeting Held 21 February 1967*, Minutes.

[592] Keith Turnbull Research Institute, 1967, *Weedicides Used by the VNWDB*, Memorandum.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
Schedule Column One / Column Two / Column Three / Column Four Substances / Volumes of Gas or Vapour per Million Volumes of Air / Milligrams of Substance per Cubic Metre of Air / Particles per Cubic Foot of Air 2,4-D (2,4-dicholorophenoxy-acetic acid) / .. / 10 / .. 2, 4, 5-T (2,4,5-tricholorophenoxy-acetic acid) / .. / 10 / ..		the need to follow protective clothing instructions on product labels.[593] The Department took measures to clarify their authority to enforce the wearing of safety equipment.[594] In 1982 a policy on 2,4,5-T, noted that all workers spraying the chemical had been issued with face shields or respirators, was circulated and the following year a list of safety equipment circulated included the availability of masks and respirators.[595] A memorandum in 1983 reminded staff of their obligations to take reasonable care for their safety and the safety of others.[596]
Health (Harmful Gases, Vapours, Fumes, Mists, Smokes and Dusts) Regulations 1984		
4. (b) … and employer of any person employed in or on any premises, building, house, ship, yard or place of any nature in which the substances set out in Column One of the said Schedule are manufactured, produced or used shall not cause or allow concentrations of the said substances in excess of the quantities set out in Columns Two, Three, Four respectively of the said Schedule to be present in the air likely or liable to be inhaled by person operating or using any equipment or apparatus by person in any way engaged upon or carrying out any process or by persons in the vicinity of that equipment or apparatus or the place where the process is being carried on or performed.	1984 to 1990 No	Although a Pesticides Manual had been in existence in the Forests Commission for a number of years, and evidence indicated it was in circulation more broadly in the Department from 1982, the Department did not formally adopt this manual until 1987.[597] Safety committees were still recommending improvements to ventilation and mixing facilities in poisons sheds in 1988.[598]
(2) (a) An occupier or employer shall install suction exhaust apparatus in connection with any equipment, apparatus or process which would in the absence of that suction exhaust apparatus cause concentrations in excess of the qualities set out in Columns Two, Three or Four of the said Schedule …	1991 to 1995 No	Guidelines for the construction of new poison sheds incorporating compliant ventilation were introduced in 1991, however, it was the Australian Workers Union (AWU) that made

[593] Department of Crown Lands and Survey, Vermin and Noxious Weeds Destruction Board 1975, *Bulletin 3D, Recommendations for Control of Noxious Weeds in Victoria* , Bulletin.

[594] Secretary for Lands, 1983, *Compulsory use of safety clothing and equipment by employees*, Memorandum.

[595] Keith Turnbull Research Institute, 1982, *Information Sheet - No 32 - 2,4,5-T Policy*, Report; Department of Crown Lands and Survey, 1983, *Circular No. 8/83 - Safety Clothes*, Circular.

[596] Department of Crown Lands and Survey, 1983, *Safety Clothing and Equipment,* Memorandum.

[597] Forests Commission Victoria, 1982*, Pesticide Manual*, Manual.

[598] Department of Conservation, Forests and Lands, 1988, *Creswick Work Centre - Safety Committee Meeting, Minutes of Meeting Held 13 April 1988*, Minutes.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
(b) In any case where it is impracticable to install suction exhaust apparatus the occupier or employer, for the purposes of complying with the foregoing provision, shall install a suitable system of ventilation which is approved in writing by the Minister. *(3) (a) Where authorised in writing by the Minister an occupier or employer, in lieu of installing suction exhaust apparatus or a suitable system of ventilation in accordance with the preceding clause of this Regulation, shall provide respirators, distant breathing apparatus or positive pressure air mask for use by all persons operating or using the equipment or apparatus …*		recommendation for a simple retrofit for ventilation to existing sheds.[599] No evidence of application for exemptions was found.
(b) Every person provided with a respirator, distant breathing apparatus or positive pressure air mask shall use that apparatus or mask at all times when operating or using the equipment or apparatus in respect of which such provision is made … *5. Where the length of time in which any person referred to in the preceding Regulation is operating or using any equipment or apparatus, or is in any way engaged upon or carrying out any process, or in the vicinity of such equipment or apparatus or of the place where a process is being carried on or performed, is so short as not to endanger or impair the health of any person the Minister may certify in writing for a specific period of time that it shall not be necessary for the occupier or employer to comply with these Regulations.* *6. Where the installation of suction exhaust apparatus is required by these Regulations the intake hood of that apparatus shall be installed as near as practicable to the source at which the gases, vapours, fumes, mists, smokes or dusts enter the air.* *7. Any person doing any act forbidden to be done or failing to do any act directed to be done by these Regulations shall be guilty of an offence against these Regulations and shall be liable to a penalty of not more than $1,000.*		No evidence that the Department was aware of this Regulation or that there were compliance checks by the Department of Health.

Schedule

Column One	Column Two	Column Three	Column Four
Substances	Volumes of Gas or Vapour per Million Volumes of Air	Milligrams of Substance per Cubic Metre of Air	Particles per Cubic Foot of Air
2,4-D (2,4-dicholorophenoxy-acetic acid)	..	10	..
2, 4, 5-T (2,4,5-tricholorophenoxy-acetic acid)	..	10	..

[599] Department of Conservation, Forests and Lands, 1988, *Guidelines for the Construction of Poison Sheds*, Manual; Department of Conservation and Environment, 1991, *Ventilation of Weedicide Storage Sheds*, Memorandum.

Figure 9.1 Chemical storage at depot within the Ballarat Region (date unknown).[600]

Figure 9.2 Chemical storage at Beaufort Depot in 2015.[601]

OCCUPATIONAL HEALTH AND SAFETY

Under the *Industrial Safety, Health and Welfare Act 1981* the Department (as employer) was required, as far as was reasonably practicable, to provide safe workplaces and systems of work, and to ensure the safety, health and welfare of persons engaged or employed in those workplaces (s 11). That Act was superseded by the *Occupational Health and Safety Act 1985* (OHS Act), which similarly bound the Department to 'provide and maintain, so far as is practicable for employees a working environment that is safe and without risks to health' (s 21). Importantly the provisions of both Acts extended to work undertaken in the field, and the need for workers to also take care of their own health and safety.

The general provisions of each of the Acts are further detailed below. The relevant sections are listed in Table 9.10. No evidence was found of the Department undertaking its own compliance assessment against the requirements during the period.

[600] Photograph supplied by interview participant 064.

[601] Photograph taken by Inquiry team during site visit to Beaufort Depot, July 2015.

Overall it can be said that the Department had in place a range of measures that met (or partially met) the requirements of the *Industrial Safety, Health and Welfare Act 1981* and the OHS Act over time. These included safety policies, procedures, manuals and information sheets, safety training, safety committees and health monitoring, as outlined in Chapter 8. However, many of these lacked appropriate consistency, timeliness and follow-up.[602] For example, the Department did not release its first Occupational Health and Safety Policy until 1988 and its first Occupational Health and Safety (OHS) Manual until 1989.

There are also areas where the Department may not have met its obligations under these Acts at all. Chemical storage was an area of partial non-compliance, as has already been discussed under the *Poisons Act 1962*, Dangerous Goods (Storage and Handling) Regulations 1989 and the *Health Act 1958*.

Another key area of non-compliance relates to a lack of safe work practices for pesticide use, and more specifically, the use and availability of suitable PPE. The latter is a finding of this Inquiry and is discussed in detail below.

Personal protective equipment

From 1965, the Department provided workmen with safety boots and overalls as standard issue PPE and rubber gloves were held at (at least some) depots including in the Ballarat area.[603] However, throughout the Period of Inquiry there were ongoing issues with regard to the suitability of, and access to, key items of PPE.[604]

Issues with the provision of PPE suitable for pesticide spraying date back to the early 1960s. In 1960, and again in 1962, the Victorian Interdepartmental Committee on Pesticides discussed appropriate protective clothing. The Chief Industrial Hygiene Officer, Dr Christophers explained:

> *… at present the provisions of the Use of Pesticides Regulations 1953, relating to protective clothing and respirators were unsuitable for hot Australian summers. The present provisions were adopted from English recommendations as applicable to the cooler climate of England*.[605]

There is ample evidence to suggest that the Department was aware of this issue, and others, and sought to improve the suitability of PPE for the use of pesticides.[606] However, response times were often inadequate and important issues remained unresolved. Some examples are provided below.

- In 1983, an inspector outside the region requisitioned disposable face masks, listed on the Department safety equipment list. His workmen reported they were unsuitable for pesticide spray work and that the package warning read, 'This product is not designed for use as protection against … toxic dusts, fumes, mists, gases and vapours.'[607]
- In 1983 the Pesticide Safety Working Party noted that, 'field staff felt that the wearing of the protective clothing required for the spraying of 2,4,5-T could result in heat fatigue on hot days. The availability and suitability of alternative protective clothing to be examined.'[608]
- In both March and September 1986 the Ballarat Regional OHS Committee noted that boiler suits were too hot for spray work in the summer months and lightweight boiler suits were to be investigated.[609]

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602 Department of Conservation Forests and Lands, 1989, *Access to Pesticide Information,* Memorandum.

603 Department of Crown Lands and Survey, 1969, *Order Water Bags - Daylesford*, Letter; Department of Crown Lands and Survey, 1968, *Stores Depot SD No 14447*, Form; Department of Crown Lands and Survey, 1968, *Stores Depot SD No 13991*, Form; Department of Crown Lands and Survey, 1967, *Stores Depot SD No 12292*, Form; Department of Crown Lands and Survey, 1966*, Stores Depot SD No 9224*, Form; Department of Crown Lands and Survey, 1965, *Stores Depot SD No 8051*, Form.

604 Keith Turnbull Research Institute, 1967, *Weedicides Used by the VNWDB*, Memorandum.

605 Interdepartmental Committee on Pesticides, 1962, *Minutes of the 30th Meeting Held on 23 July 1962*, Minutes.

606 Department of Conservation Forests and Lands, 1984, *Minutes of the Industrial Health and Safety Committee Held 9 April 1984*, Minutes; Department of Conservation Forests and Lands, 1984, *Minutes of the Industrial Health and Safety Committee Held 13 February 1984*, Minutes; Department of Conservation Forests and Lands, 1984, *Minutes of the Industrial Health and Safety Committee Held 4 June 1984*, Minutes; Department of Crown Lands and Survey, 1983, *Agenda for the Departmental Safety Committee held 5 September*, 1983, Agenda.

607 Department of Crown Lands and Survey, 1983, *Safety Clothes, Circular 8/83,* Memorandum.

608 Pesticide Safety Working Party 1983, *Pesticide Safety Working Party - Notes of Meeting Held on 4 November 1983*, Minutes.

609 Department of Conservation, Forest and Land 1986, *Ballarat Regional Occupational Health and Safety Committee, Held on 18 March 186*, Minutes; Department of Conservation, Forests and Lands, 1986, *Ballarat Region: Occupational Health & Safety Committee - Minutes of Meeting held on 11 September 1986*, Minutes.

- In February 1987 alternatives for spray masks were being investigated at the Maryborough work centre and in July 1987 (five months later) resolution of the issue had still not been reached by the Maryborough Work Centre OHS Committee.[610]
- In both August and November 1988, the Ballarat Region OHS Committee resolved that 'current respirators are unsatisfactory and alternatives are to be investigated'.[611] This issue was carried through to 1989 meetings of the same Committee[612] and was considered by the Chemical Use and Safety Working Group throughout 1992, which continued to seek alternative respirators and in April 1992 resolved to train sprayers in the correct fitting of respirators and other safety gear.[613]

It appears that some issues with PPE took many years to resolve. Evidence of this is provided in the findings of two key reviews:

- The 1988 *Review of the Use of Pesticides in the Department of Conservation, Forests and Lands* undertaken by Dr Greg Wells (the Wells Review) reported that there was no commercially available protective clothing that was suitable for spraying pesticides:

  > *As most spraying is done during the warmer months of the year, protective clothing is hot and uncomfortable. All forms of head gear, such as masks, visas and respirators, become stuffy and often fogged up. Lightweight material is easily damaged while the most recently available disposable paper suits are very expensive. Since amalgamation, protective clothing has been pooled and worn by different people … Sharing PPE had led to poor maintenance and poorly fitted clothing*.[614]

- A 1993 internal assessment of OHS management systems in Ballarat reported that PPE was an issue that took up time at safety committee meetings. Examples of issues included problems with work boots, the expense of overalls, and a lack of written instruction on the use of PPE. There is also evidence that PPE was not always worn.[615]
- There is also evidence that the Department considered alternative PPE to attempt to resolve complaints from workers, however, the matter of suitable PPE remained unresolved until at least 1993.[616]

Access to PPE was also an ongoing issue within the Department, including the Ballarat area. Some examples are provided below.

- In 1971, a confidential Circular No. 13/71 was sent to all inspectors requesting close management of the budget. Inspectors were instructed to, 'Reduce personal equipment such as boots, overalls, etc., to immediate necessary requirements'.[617]
- During 1976–77 the AWU position was that respirators were not readily available and that safety equipment needed to be provided for union exempt employees.[618]

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[610] Department of Conservation, Forests and Lands, 1987, *Maryborough Work Centre Safety Committee Minutes of meeting Held 13 February 1987*, Minutes; Department of Conservation, Forests and Lands, 1987, *Maryborough Works Centre Safety Committee - Minutes of Meeting Held 17 July 1987*, Minutes.

[611] Department of Conservation, Forests and Lands, 1988, Ballarat Region Occupational Health and Safety Committee - *Minutes of Meeting Held on 11 September 1988,* Minutes; Department of Conservation, Forests and Lands, 1988, *Ballarat Region Occupational Health and Safety Committee - Minutes of Meeting Held 17 August 1988*, Minutes.

[612] Department of Conservation, Forests and Lands, 1989, *Ballarat Region Occupational Health & Safety Committee - Minutes of Meeting Held 14 February 1989*, Minutes.

[613] Department of Conservation Forests and Lands, *Chemical Use and Safety Working Group, Ballarat Region 1992, Beaufort Meeting Held 28 April 1992*, Minutes.

[614] Department of Conservation, Forests and Lands and Wells GJ, 1988, *Review of the Use of Pesticides in the Department*, Report.

[615] Department of Conservation and Natural Resources, 1993, *OHS Management Assessment-Ballarat*, Memorandum; Department of Conservation and Natural Resources, 1993, *Assessment of Occupational Health and Safety Management Systems - Ballarat Region - Department of Conservation and Natural Resources - March 1993*, Report.

[616] Department of Crown Lands and Survey 1993, *Minutes of the Departmental Safety Committee, 7 February1983*, Minutes; Department of Conservation and Natural Resources, 1993, *Assessment of Occupational Health and Safety Management Systems - Ballarat Region - Department of Conservation and Natural Resources - March 1993*, Report.

[617] Department of Crown Lands and Survey, 1971, *Circular No. 13/71*, Circular.

[618] Department of Crown Lands and Survey, 1978, *450/3/1 - Special Projects 1977/78*, Report.

- In 1992, an action from the Chemical Use and Safety Working Group meeting for the Ballarat group was that personal safety equipment should be made more available and that workers, 'shouldn't have to beg for equipment'.[619]

In January 1982, Circular 90/82, addressing the future use of 2,4,5-T[620], required all Government workers to wear 'boots (rubber boots are preferred to leather because they were less absorbent), overalls, rubber gloves, and a face shield or respirator when using 2,4,5-T.'

In 1983 there was evidence that compulsory use of safety clothing and equipment was being questioned and had been raised with the Departmental Safety Committee[621], who were unable to interpret *the Industrial Safety, Health and Welfare Act 1981* in terms of employer responsibilities for ensuring that employees use the safety clothing and equipment provided on the job.

The Secretary of Lands sought to resolve the matter by seeking advice from both the State Insurance Office (SIO)[622] and the Crown Solicitor.[623] Following their advice, this advice was subsequently conveyed to the Departmental Safety Committee for consideration.[624]

The matter was then clarified in January 1984, in Circular 6/84[625] to all senior land management officers and land management officers, which stated that;

Crown employees would be in contravention of the *Industrial Safety Health and Welfare Act 1981* if 'he did not wear a protective mask and protective clothing which were readily available for him to wear …' and '… every person who contravenes or fails to comply with any of the provision of the Act is … guilty of an offence …'.[626]

Table 9.10 Summary of compliance – OHS

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
Industrial Safety, Health and Welfare Act 1981		
11. (1) The occupier of a workplace shall ensure, so far as is reasonably practicable, the safety, health and welfare of persons employed or engaged in or on that workplace.	Partially	Commencing in the 1970s circulars and pesticide information sheets advised use of PPE when using pesticides.[627]
(2) Without prejudice to the generality of the provisions of sub-section (1), the matters to which that duty extends include in particular –		

619 Department of Conservation Forests and Lands, *Chemical Use and Safety Working Group, Ballarat Region 1992, Beaufort Meeting, Minutes of Meeting Held on 28 April 1992*, Minutes.

620 Department of Crown Lands and Survey, 1982, *Circular No. 90/82, Future use of 2,4,5-T.*, Circular.

621 Department of Crown Lands and Survey, 1983, *Circular No. 8/83 - Safety Clothes*, Circular; Department of Crown Lands and Survey, Departmental Safety Committee, 1983, *Minutes of Meeting Held on 9 May 1983*, Minutes.

622 State Insurance Office, 1983, *Employers Liability Insurance*, Memorandum; Department of Crown Lands and Survey, 1983, *Comments on Occupational Health and Safety Public Discussion Paper March 1983*, Memorandum.

623 Crown Solicitors Office, 1983, *Industrial Safety, Health and Welfare Act 1981; whether employees required by s. 14 to use safety clothing and equipment*, Memorandum.

624 Department of Crown Lands and Survey, 1983, *Comments on Occupational Health and Safety Public Discussion Paper March 1983*, Memorandum.

625 Department of Crown Lands and Survey, 1982, *Circular No. 90/82 - Future Use of 2,4,5-T*, Circular.

626 Department of Crown Lands and Survey, 1984, *Compulsory Use of Safety Clothing and Equipment*, Circular.

627 Department of Crown Lands and Survey, 1972, *Circular 57/72 - Safety & Pesticides,* Circular; Keith Turnbull Research Institute, 1979, *Pesticide Information No. 1.1,* Publications; Keith Turnbull Research Institute, 1981, *Pesticide Information No. 4.12 - 2,4-D Sodium Salt,* Publications.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
(a) the provision and maintenance of plant and systems of work that are, so far as is reasonably practicable, safe and without risks to health;	Partially	Evidence was found to confirm that PPE such as overalls, rubber gloves, boots and water bags were purchased.[628] Chemical safety polices were distributed to staff and landholders through pesticide information sheet issues by VNWDB.[629] The Department took steps to clarify the requirements for PPE and enforce its use.[630]
(b) arrangements for ensuring, so far as is reasonably practicable, safety and absence of risks to health in connection with the use, handling, storage and transport of articles and substances;	Partially	Washing facilities and drainage pits were not in place in depots in 1967.[631] No evidence of ventilation in Weedicide Store Specifications 1980.[632] Workers were supplied with PPE[633] and the Department endeavoured to encourage compliance but struggled to enforce it.[634] The Department took steps to clarify the requirements for PPE and enforce its use.[635]
(c) the provision of such information, instruction, training and supervision as is necessary to ensure, so far as is reasonably practicable, the safety and health of persons employed in or on the workplace;	Partially	It was reported to the Pesticide Safety Committee in 1983 that problems existed communicating new recommendations to workmen. Training 'lacked uniformity' and

[628] Department of Crown Lands and Survey, 1969, *Order Water Bags - Daylesford* , Letter; Department of Crown Lands and Survey, 1968, *Stores Depot SD No 14447*, Form; Department of Crown Lands and Survey, 1968, *Stores Depot SD No 13991,* Form; Department of Crown Lands and Survey, 1967, *Stores Depot SD No 12292*, Form; Department of Crown Lands and Survey, 1966, *Stores Depot SD No 9224*, Form; Department of Crown Lands and Survey, 1965, *Stores Depot SD No 8051*, Form.

[629] Keith Turnbull Research Institute, 1981, *Pesticide Information No. 4.12 - 2,4-D Sodium Salt,* Publication.

[630] State Insurance Office, 1983, Employers Liability Insurance, Memorandum; Department of Crown Lands and Survey, 1983, *Comments on Occupational Health and Safety Public Discussion Paper March 1983*, Memorandum; Crown Solicitors Office, 1983, *Industrial Safety, Health and Welfare Act 1981; whether employees required by s. 14 to use safety clothing and equipment*, Memorandum; Department of Crown Lands and Survey, 1982, *Circular No. 90/82 - Future Use of 2,4,5-T,* Circular; Department of Crown Lands and Survey, 1984, *Compulsory Use of Safety Clothing and Equipment*, Circular.

[631] Department of Crown Lands and Survey, 1967, *I080 Mixing Site, Depot Site, Ballarat Group*, Letter.

[632] Department of Crown Lands and Survey, 1980, *Weedicide Store*, Report.

[633] Department of Crown Lands and Survey, 1965, *Stores Depot SD No 8051*, Form.

[634] State Insurance Office 1983, *Employers Liability Insurance*, Memorandum; Department of Crown Lands and Survey, 1983, *Comments on Occupational Health and Safety Public Discussion Paper*, March 1983, Memorandum; Crown Solicitors Office, 1983, *Industrial Safety, Health and Welfare Act 1981*; *whether employees required by s. 14 to use safety clothing and equipment*, Memorandum; Department of Crown Lands and Survey, 1983, *Comments on Occupational Health and Safety Public Discussion Paper* March 1983, Memorandum; Department of Crown Lands and Survey, 1982, *Circular No. 90/82 - Future Use of 2,4,5-T*, Circular; Department of Crown Lands and Survey, 1984*, Compulsory Use of Safety Clothing and Equipment*, Circular.

[635] State Insurance Office 1983, *Employers Liability Insurance*, Memorandum; Department of Crown Lands and Survey, 1983, *Comments on Occupational Health and Safety Public Discussion Paper* March 1983, Memorandum; Crown Solicitors Office 1983, *Industrial Safety, Health and Welfare Act 1981; whether employees required by s. 14 to use safety clothing and equipment*, Memorandum; Department of Crown Lands and Survey, 1983, *Comments on Occupational Health and Safety Public Discussion Paper* March 1983, Memorandum; Department of Crown Lands and Survey, 1982, *Circular No. 90/82 - Future Use of 2,4,5-T*; Department of Crown Lands and Survey, 1984, *Compulsory Use of Safety Clothing and Equipment*, Circular.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
		'largely depended on the inspectors, assistant, and leading hand'. [636] Evidence showed that the Forest Commission had a Pesticide safety handbook in place in 1970. No evidence of a procedural manual produced by the Department has been found until 1986 although a Forests Commission Pesticide Manual may have been used by the Department since 1982.[637] There is evidence that adequate information was provided to inspectors and senior managers via circulars.[638] 'Bulletin No. 3' provided to workers commencing in 1963 provided instructions for application of pesticides. Until 1972, safety instructions were limited.[639] Pesticide information sheets were available to all workers.[640]
(d) so far as is reasonably practicable as regards a workplace under his control, the maintenance of it in a condition that is safe and without risks to health and the provision and maintenance of means of access to and egress from it that are safe and without such risks;	No	Evidence of below standard storage conditions existed in depots in the Ballarat region.[641]
(e) the provision and maintenance of a working environment for persons employed in or on the workplace that is, so far as is reasonably practicable, safe, without risks to health, and adequate as regards facilities and arrangements for their welfare in or on the workplace;	No	In 1987 Unions instructed workers not to spray unless washing facilities were provided on vehicles.[642]

[636] Department of Crown Lands and Survey, 1983, *Pesticide Safety Working Party - Notes of Meeting Held on 4 November 1983,* Minutes.

[637] Department of Conservation Forests and Lands, 1987, *Covernote to 1987 Reprinting of the Forestry Pesticides Manual,* Memorandum.

[638] Department of Crown Lands and Survey, 1972, *Circular 57/72 - Safety & Pesticides*, Circular; Keith Turnbull Research Institute, 1979, *Pesticide Information*, Publications; Keith Turnbull Research Institute, 1981, *Pesticide Information No. 4.12 - 2,4-D Sodium Salt*, Publications; Keith Turnbull Research Institute, 1979, *Pesticide Information*, Publications.

[639] Keith Turnbull Research Institute, 1946, *Recommendations for the Control of Noxious Weeds in Victoria*, Manual.

[640] Keith Turnbull Research Institute, 1979, *Pesticide Information*, Publications.

[641] Department of Crown Lands and Survey, 1967, *I080 Mixing Site, Depot Site*, Ballarat Group, Letter; Department of Crown Lands and Survey, 1977, *Works Required at Meredith Depot*, Memorandum; Safety Committee, 1988*, Vickers St Work Centre - Safety Committee Minutes of Meeting Held on 12 August 1988*, Minutes; Department of Conservation, Forests and Lands, 1992, *Ballarat Region Occupational Health and Safety Committee Minutes of Meeting Held on 7 February 1992*, Minutes.

[642] The Herald, 1987, *Union Ban on Poison Spraying,* Newspaper Article.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
(f) in such cases as are prescribed the appointment of safety supervisors who shall have such duties as are prescribed.		In 1985 work centre safety representatives were appointed by ballot to represent staff at Regional Committees.[643]
(3) Except as prescribed it shall be the duty of every occupier of a workplace to prepare and as often as may be appropriate revise a written statement of his general policy with respect to the safety and health of persons employed in or on the workplace and the organization and arrangements for the time being in force for carrying out that policy, and to bring the statement and any revision of it to the notice of all persons employed in or on the workplace.	No	A number of policies relating to safe use of pesticides have been cited earlier in this chapter, however, the first evidence of a general policy, the OHS Manual was first prepared in 1989 and revised in 1995.[644]
12. (1) In such cases as are prescribed the occupier of a workplace shall arrange for the election of safety representatives by and from the persons employed in or on the workplace.		The Department Safety Committee was established in 1971 with representatives from Sections of the Department.[645] Election of safety representatives were planned for by the Department in February 1983[646] and there is evidence of elections in November 1985.[647]
Occupational Health and Safety Act 1985		
s21 (1) An employer shall provide and maintain so far as is practicable for employees a working environment that is safe and without risks to health.		
s21 (2) Without in any way limiting the generality of sub-section (1), an employer contravenes that sub-section if the employer fails – *(a) to provide and maintain plant and systems of work that are so far as is practicable safe and without risks to health;*	Partially	Poor stock management lead to rusting and leaking drums in depots.[648] Ventilation for chemical sheds was not specified in estimates in 1981[649] and ventilation improvements in poison sheds were still to be carried out in 1988.[650]

643 Department of Conservation Forests and Land, 1985, *Maryborough Work Centre Safety Committee Minutes of Meeting Held on 22 November 1985*, Minutes.

644 Department of Conservation and Natural Resources,1995, *Occupational Health and Safety Manual,* Manual.

645 Department of Crown Lands and Survey, 1971, *Circular No. 52/71, Departmental Safety Committee* - 19th July, 1971, Circular;

646 Department of Crown Lands and Survey, 1982, *Circular No. 746 Safety, A Summary of Departmental Safety Committee Activities July - December 1982 & Responsibilities of Employees & Supervisors under the Industrial Safety, Health and Welfare Act 1982*, Circular.

647 Department of Conservation Forests and Lands, 1985, *Maryborough Work Centre Safety Committee Meeting Minutes of Meeting Held* on 22 November 1985, Minutes.

648 Dow Chemical (Australia) Pty Ltd, 1983, *Problems Associated with Containers Packers Labels etc. of Weedicides Supplied to Field Staff*, Memorandum.

649 Department of Crown Lands and Survey, 1981, *Vote 450.3.1 Depots 1980/81*, Financial Report.

650 Department of Conservation, Forests and Lands, 1988, *Creswick Work Centre - Safety Committee Meeting Minutes of Meeting Held on 13 April 1988*, Minutes.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
(b) to make arrangements for ensuring so far as is practicable safety and absence of risks to health in connexion with the use, handling, storage and transport of plant and substances; *(c) to maintain so far as is practicable any workplace under the control and management of the employer in a condition that is safe and without risks to health;* *(d) to provide adequate facilities for the welfare of employees at any workplace under the control and management of the employer; or* *(e) to provide such information, instruction, training and supervision to employees as are necessary to enable the employees to perform their work in a manner that is safe and without risks to health.*		Concern over ventilation in shed at Beaufort in 1992.[651] Ballarat depots required compliance works for dangerous goods legislation in 1990.[652] No power connected at Meredith Depot and improved security required in 1977.[653] Arrangements for washing facilities required on trucks were circulated to inspectors in 1979.[654] Unions instructed workers not to spray unless washing facilities were provided on vehicles in 1987.[655] OHS meeting noted AWU employees who used chemicals were to attend a pesticide training course in 1992.[656] Not all staff in Beaufort received training in 1992.[657] OHS Committee plan a Safety Day for Ballarat in 1988.[658]
S21 (4) An employer shall so far as is practicable –		
(a) monitor the health of the employees of the employer;	No	Sebastopol staff raise need for medical examinations for employees using toxic materials in 1988.[659]
(b) keep information and records relating to the health and safety of the employees of the employer;	Yes	From 1969 the Department was implementing AS CZ61-1966, which recommended an approach to recording and measuring work injuries.[660]

[651] Department of Conservation, Forests and Lands, 1992, *Ballarat Region Occupational Health and Safety Committee Minutes of Meeting Held on 7 February 1992*, Minutes.

[652] Dow Chemical (Australia) Pty Ltd, 1983, *Problems Associated with Containers Packers Labels etc. of Weedicides Supplied to Field Staff*, Memorandum.

[653] Department of Crown Lands and Survey, 1977, *Works Required at Meredith Depot*, Memorandum.

[654] Department of Crown Lands and Survey, 1979, *Circular No. 18/79 - Washing Facilities for Workmen and "Union Ban on Poison Spraying"*, Circular.

[655] The Herald, 1987, *Union Ban on Poison Spraying*, Newspaper Article.

[656] Department of Conservation, Forests and Lands, 1992, *Ballarat Region Occupational Health and Safety Committee Minutes of Meeting Held on 7 June 1992*, Minutes.

[657] Department of Conservation, Forests and Lands, 1992, *Ballarat Region Occupational Health and Safety Committee Minutes of Meeting held on 7 June 1992*, Minutes.

[658] Safety Committee, 1988, *Vickers St Work Centre - Safety Committee Meeting Minutes of Meeting Held on 12 August 1988,* Minutes.

[659] Safety Committee, 1988, *Vickers St Work Centre - Safety Committee Meeting Minutes of Meeting Held on 12 August 1988,* Minutes.

[660] Department of Crown Lands and Survey, 1969, *Annual Report 1968-1969*, Report, p10.

Key Employer Responsibilities	Compliant (Yes/No/ Partially/ Unknown	Evidence
(c) employ or engage persons who being suitably qualified in relation to occupational health and safety are able to provide advice to the employer in relation to the health and safety of the employees of the employer;	Yes	A dedicated Safety Officer was appointed by the Department in 1984.[661]
(d) monitor conditions at any workplace under the control and management of the employer; and	Yes	A meeting was held with unions to discuss a safety representation structure for the Department.[662] A Divisional Health and Safety Committee was in place in 1984.[663]
(e) provide information to the employees of the employer, in such languages as are appropriate, with respect to health and safety at the workplace, including the names of persons to whom an employee may make an inquiry or complaint in relation to health and safety.	Yes	In 1985 work centre safety representatives were appointed by ballot to represent staff at regional committees.[664] The first evidence of a general policy, the OHS Manual, was first prepared in 1989 and revised in 1995.[665]

[661] Department of Conservation, Forests and Land, 1984, *Divisional Health and Safety Committee,* Memorandum.

[662] Department of Conservation, Forests and Lands, 1983, *Notes of Meeting on the Setting up of Safety Committees in the Department*, Minutes.

[663] Department of Conservation, Forests and Land, 1984, *Divisional Health and Safety Committee*, Memorandum.

[664] Department of Conservation Forests and Land, 1985, *Maryborough Work Centre Safety Committee Minutes of Meeting Held on 22 November 1985*, Minutes.

[665] Department of Conservation and Natural Resources, 1985, Occupational Health and Safety Manual, Manual.

Findings

The Department largely met the requirements of the *Industrial Safety, Health and Welfare Act 1981* and the *Occupational Health and Safety Act 1985*. This included having:

- safety policies and procedures
- manuals and information sheets
- safety training
- safety committees
- health monitoring.

Many of these, however, lacked appropriate consistency, timeliness and follow-up to ensure implementation and compliance.

The Department may not have met its statutory obligations in relation to storage and safe work practices for pesticide use. The use and availability of suitable PPE was a key area of non-compliance, with important related issues remaining unresolved for a long time.

WORKERS COMPENSATION

The Department was bound by the *Workers Compensation Act 1958* and *Accident Compensation Act 1985*. These set out the rights of workers who were injured or developed diseases as a result of their employment with the Department (including exposure to chemicals). The Department's obligations were non-delegable. Historically, Victorian workers compensation schemes have been no-fault based and have provided a safety net for injured Department employees regardless of any fault by their employer. Key legislation has included:

- *Workers Compensation Act 1958* – This applied between 1958 and 1985 and covered all workers employed by or under the Crown or any government department and required workers to give notice of injuries and claims. All employers had to keep a Notice of Injury book in which to record any particulars at the time the injury happened.
- *Accident Compensation Act 1985* – This enhanced workers' rights and employer obligations for the remainder of the Period.

Three Australian Standards provided advice on recording workplace injury during the Period.

- AS CZ61-1966 outlined the recommended approach to recording and measuring work injuries.
- AS 1339-1974 and AS 2507 (1981 and 1984) included recommendations for recording accidents, conducting investigations into accidents and taking steps to prevent them happening again.

Since 1947, a worker who suffered with *Dermatitis venenata* (which might be able to be linked to 2,4-D and 2,4,5-T exposure) was potentially eligible for workers compensation. The regulations were re-regulated in Accident Compensation Regulations 1990 Schedule 2 and the Workers Compensation Regulations 1995.

The Department had a number of workers compensation and related directives/policies over the Period:

- The Deparment Circular 78/68 *Workers Compensation and Safety on the Job*[666] was sent to senior inspectors and inspectors with specific directives for staff and employees to maintain a 'safety-first' attitude and for inspectors to ensure that all equipment was maintained in safe working condition and practices in the field did not unnecessarily increase the risk of injury to employees.
- The Department Circular 5/71 – *Workers Compensation and Safety on the Job*[667] was sent to all inspectors and summarised the government's 'Safety Policy – State Government Undertakings', and its policy to 'exert every effort to reduce the number of accidents which occur during the course of employment, and, if possible, to eliminate all such accidents and consequent suffering, hardship and loss involved.'

[666] Department of Crown Lands and Survey, 1968, *Circular 78/68 - Workers Compensation and Safety on the Job*, Circular.

[667] Department of Crown Lands and Survey, 1971 (Est.) *Circular 5/71 - Workers Compensation and Safety on the Job,* Circular.

- OHS Manual
- Grievance Review Guidelines (within OHS Manual)

The Department recorded injuries and kept Notice of Injury books during the period so was therefore in compliance with the legislation of the time (see also Chapter 10 Health Concerns). Likewise, there is evidence from 1969 that the Department was implementing AS CZ61-1966, which recommended an approach to recording and measuring work injuries.[668]

Chapter 10 outlines a small number of workers compensation cases during the Period. While privacy provisions restrict access to specific case files, the Inquiry found no evidence of non-compliance.

PUBLIC SERVICE AND RECORD RETENTION

Under the *Public Service Act 1958*, the Secretary was responsible for the working and transactions of the former Department and could delegate to any officer (s 24(3)). While this allowed the Secretary to delegate accountability for statutory compliance to officers in charge of regional areas or to an officer of the VNWDB, there's no documentary evidence to suggest this ever happened. However, numerous circulars from the Superintendent of the VNWDB during the 1960s and 1970s indicated senior inspectors and inspectors were responsible for worker safety. There were also numerous Head Office memoranda during the 1980s and 1990s that seemed to infer that delegation of various statutory responsibilities to the regions were in place. Here are some examples:

> *There is an obligation upon Senior Inspectors and Inspectors to see that all equipment is maintained in safe working condition and that working practices in the field do not unnecessarily increase the risk of injury to employees.*[669]
>
> *It is the Inspector's responsibility to see that all employees are instructed in the use of safety equipment and told what precaution it is necessary to take at all times when using departmental plant and equipment.*[670]
>
> *It is assumed regions will act independently to meet the* [Dangerous Substances (Placarding of Workplaces) Regulations 1985] *by the prescribed date.*[671]
>
> *Regions are required to be conversant with* [the *Dangerous Goods Act 1985*] *and take the appropriate action to conform to the storage and handling of dangerous goods.*[672]

No documentary evidence was found to suggest the Secretary ever sought to ensure compliance with acts and regulations. And while the *1988 Wells review* did consider the Department's statutory obligations, it didn't assess compliance.[673]

Under the *Public Records Act 1973* a public office, like the Department, had to keep full and accurate records of their business and use a record management program in accordance with published standards (s 2 read with s 13). The Department also had to keep a range of records to comply with hazardous substance legislation and codes of practice, OHS and workers compensation laws.

While the Department certainly kept good records, a number of concerns remain. For example the Inquiry found no register of who worked in Ballarat and surrounding areas during the Period so the Inquiry cannot confidently say how many workers are of interest. And, except for a few kept by a former Ararat depot employee, the Inquiry found no inspectors' journals, meaning the Inquiry can't be certain how much 2,4-D and 2,4,5-T particular depots used, which limits the ability to assess worker exposure.

The loss of so many important records may be because the Department had a formal document destruction agreement with the Public Record Office Victoriabut there's no evidence of this.

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668 Department of Crown Lands and Survey, 1969, *Annual Report 1968-1969*, Report, p10.

669 Department of Crown Lands and Survey, 1968, *Circular 78/68 - Workers Compensation and Safety on the Job*, Circular.

670 Department of Crown Lands and Survey, 1971, *Circular 5/71, Workers Compensation and Safety on the Job,* Circular.

671 Department of Conservation, Forests and Lands, 1985, *Storing of Hazardous Materials,* Memorandum.

672 Department of Conservation, Forests and Lands, 1990, *Dangerous Goods Act 1985 (Act No. 10189/1985),* Memorandum; Department of Conservation and Environment, 1990, *Dangerous Goods (Storage and Handling) Regulations 1989*, Memorandum.

673 Department of Conservation, Forests and Lands and Wells GJ, 1988, *Review of the Use of Pesticides in the Department of Conservation, Forests and Lands (unpublished),* Report.

AUSTRALIAN STANDARDS

In 1988, the Australian Government endorsed Standards Australia as a peak body for the establishment of nationwide occupational standards. Australian Standards are a tool used to establish norms for management procedures, and quality expectations for products and services, that provide assurance that they are safe, reliable and fit-for-purpose.[674] The Victorian Government makes some Australian Standards mandatory to implement when stated in law. A broad spectrum of Australian Standards apply to the safe occupational use of pesticides for the period 1965 to 1995 (see Chapter 6 and Appendix 1). Many of these standards are advisory and are not mandated in law, however, in the period 1965 to 1995 the three key Australian Standards the Department had to comply with are described below.

Code of Recommended Practice for Recording and Measuring Work Injury Experience (AS CZ6-1966)

The Code sets out the recommended approach to recording and measuring work injuries, including lost time and serious injuries.

The Standard includes formulas for calculating the incidence of injuries.

Mandatory/advisory: The Department of Labour requested that the Department record workplace injury from 1969. There is evidence that regular reporting occurred from 1969 in accordance with the calculation method.

The Department was compliant with the advisory standard (refer Chapter 10).

Hormone Weed Killers of the Phenoxyacetic Acid Type (AS N50-1965)

From 1958, the Department had a right to test pesticides against quality standards established in law that manufacturers were obliged to comply with. According to the *Pesticides Act 1958*, the Department was 'entitled to have a sample of … the pesticide it had bought … analysed by an analyst and to receive from him a certificate of the result of the analysis (s.17).

AS N50-1965, Hormone Weed Killers of the Phenoxyacetic Acid Type was published. Suppliers were not specifically bound to comply with the Australian Standard by law until 1975. However, the *Pesticides Act 1958* s .8 does imply that standards for active constituents are only mandatory if the standard is prescribed by proclamation and in force for a pesticide.

AS N50-1965 did not include a standard for the maximum concentration of TCDD in 2,4-D and 2,4,5-T. The Standard pertained to qualities such as free phenols, insoluble material, melting point and free acidity.

In 1977, Victorian law made it mandatory for pesticide manufacturers to ensure they complied with AS 1715-1976, which included the quality standard 0.1 mg/kg TCDD.

Compliance with testing requirements, against Australian Standards was primarily the responsibility of the wholesale dealer, however, the Department took measures to ensure compliance by including specification in the relevant state tender specification used for statewide procurement.

The Department was compliant with testing requirements (Table 9.3).

[674] Standards Australia, 2015, *About Us, History,* <www.standards.org.au/OurOrganisation/AboutUs/Pages/History.aspx> [accessed 9 November 2015].

The Storage and Handling of Flammable and Combustible Liquids (AS 1940-1988)

In 1985, 2,4-D and 2,4,5-T were classified in law as dangerous goods, subsidiary risk Class 3.1 (flammable) and Class 6.1 (toxic/harmful).[675]

AS 1940-1988 and AS 1940-1993 set out standards for chemical storage design including requirements for concrete floors, and roof and wall requirements. They include standards for the containment of spills or leaks using design features such as drainage channels to tanks or pits. There are also requirements for ventilation (through two opposite side walls) and fire-rated walls and windows.[676]

From 1989, under Victorian law, the Department had to comply with AS 1940-1988 and AS 1940-1993 for the storage of Class 3.1 and Class 6.1 chemicals, where the volume of chemicals and risk level (class) of the chemicals was assessed as 10 or more.[677] The method to make this assessment is outlined in the Regulations.[678] There is evidence that the Department undertook these assessments in the Ballarat region in 1990.[679] The Vickers Street depot in Ballarat was the only depot in the region with an assessment factor greater than 10.[680] There is evidence that the Department timetable to achieve compliance was agreed with the Department of Labour as June 1990.[681]

It is unknown whether the Department complied with AS 1940-1988.

675 *Dangerous Goods (Prescribed List) Regulations 1985 schedule 1* – Table p 3458; *Dangerous Goods (Prescribed List) Regulations 1986 Schedule 1,* Table, Regulation, p 377.

676 Standards Association of Australia, 1988, AS 1940-1988, *The Storage and Handling of Flammable and Combustible Liquids*, Publication; and the 1993 version that superseded AS 1940-1988; Standards Association of Australia, 1993, AS 1940-1993, *The Storage and Handling of Flammable and Combustible Liquids*, Publication.

677 *Dangerous Goods (Storage and Handling) Regulations 1989*, reg 200, reg 601, reg 902.

678 *Dangerous Goods (Storage and Handling) Regulations 1981*, Schedule 2.

679 Department of Conservation and Environment, 1990*, Dangerous Goods - Depot Assessment,* Memorandum.

680 Department of Conservation and Environment, 1990, *Operations Ballarat, Assessment Factor – DCE Premises*, File Note.

681 Department of Conservation and Environment, 1990, *Dangerous Goods (Storage and Handling) Regulations 31 July 1990*, Memorandum.

Chapter 10: Health concerns

TERMS OF REFERENCE

As part of its Terms of Reference, the Former Lands Department Chemical Inquiry was asked to:

> *Investigate the adequacy of the former Victorian Department of Crown Lands and Survey (and its successor departments) processes and responses to any health concerns raised by employees over the handling, storing and use of 2,4-D and 2,4,5-T between 1965 and 1995 in Ballarat and surrounding areas.*

Key Messages

- Early on in the Period the pesticides were considered low risk. Notwithstanding this, both the Vermin and Noxious Weeds Destruction Board (VNWDB) and the Department did seek timely advice on how to respond to health concerns. From 1980 onwards, the Department supported further research into the health effects of the pesticides and conducted a number of internal reviews.
- The Department's communication to those directly affected was poor.
- If the Department had adopted a more cautious approach it could have responded faster.

INTRODUCTION

This chapter examines how the Department responded to specific employees' health concerns and how it generally dealt with escalating anxieties about the potential health effects of the pesticides. It also examines how it monitored and dealt with these. (As noted in Chapter 3, while inspectors were employees of the Department, under the relevant Public Service Act, other field staff were initially employed under the *Vermin and Noxious Weeds Act 1958,* before the VNWDB was amalgamated into the Department. However, both groups of employees reported under the Vermin and Noxious Weeds and Inspection Branch/Division of the Department).

This is assessed across two separate periods – from 1965 to 1980 and from 1981 and 1995. These were chosen as they correlate with important OHS changes and growing community awareness around health concerns.

Before 1981 there was very little in the way of statutory obligations for staff safety (see Chapters 6 and 7). Notwithstanding this, employers, like the Department still had a common law duty to keep workers safe. The Department would have been expected to listen to any health concerns and use that information to assess the potential dangers it could reasonably address. Any response must be considered in the context of what the Department knew, and should have known about, the possible health effects of chemicals exposure.

Earlier on in the Period, the Department acted on individual cases but by the 1980s the Department had to respond to concerns raised by trade unions, changes in government policy and ever-evolving research.

1965–1980: EARLY PERIOD

Reporting

The *Workers Compensation Act 1958* required employers to keep a Notice of Injury book to record all injuries.[682] It would then be expected that the Department review each incident and work out how to ensure it didn't happen again.

In 1966, the Australian Standard AS CZ6-1966 *Code of Recommended Practice for Recording and Measuring Work Injury Experience* amended the previous 1952 standard.[683] Among other things, the new standard referred to injuries rather than accidents.[684]

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[682] *Workers Compensation Act 1958*, s 45(3).

[683] Standards Association of Australia, 1966, *Australian Standard Code of Recommended Practice for Recording and Measuring Work Injury Experience - AS CZ6-1966*, Publication.

In 1967, after attending an occupational safety conference, a Department employee informed the Secretary of the revised standard and advised that discussions would be needed if the Department was to adopt it.[685] As the employee noted, the Department was complying with its obligation under the *Workers Compensation Act 1958* by keeping accident records in the Inspection Branch for workmen and staff.

Following the tragic death of an employee in a tractor accident, a circular[686] issued to all senior inspectors and inspectors in November 1968 by the VNWDB insisted staff maintain a 'safety-first' attitude and that, 'There is an obligation upon Senior Inspectors and Inspectors to see that all equipment is maintained in safe working condition and that working practices in the field do not unnecessarily increase the risk of injury.'[687]

A Joint Department and VNWDB circular[688] in March 1969 reflected changes by the Department of Labour and Industry, such as reporting injury numbers bi-annually to the Department of Labour and Industry.

In addition, the policy stated:

> *As the compilation of detailed statistics on accidents are completed for each 6 monthly period, it is anticipated that a pattern of accident areas within the Department will emerge. Appropriate instructions on safety measures necessary to eliminate these accidents will be issued from time to time.*
>
> ***In the meantime if any officer or employee is aware of any potential hazards connected with his duties he should feel free to report the circumstances to his supervisor with a view to remedial action being taken, if necessary.'***[689] *(emphasis added)*

The circular noted that for the Inspection Division, a supervisor was the inspector.

The first analysis of injury numbers was published in the 1969 Annual Report.[690] It noted that:

> *… the main problem in safety is that concerning workmen employed on the eradication of vermin and noxious weeds … With a view to lowering the department's accident rate, several Inspectors have been sent to training courses on safety organized by the Industrial Safety Bureau of the Department of Labour and Industry*.[691]

At the start of the Period, documentary evidence indicates the Department complied with formal processes to identify health concerns arising from chemical use.

Injury register

From 1968 to 1977, the Department recorded its injury numbers bi-annually and categorised chemical and herbicide injuries under 'harmful contacts'.

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[684] Standards Association of Australia, 1966, *Australian Standard Code of Recommended Practice for Recording and Measuring Work Injury Experience - AS CZ6-1966*, , Publication, p2.

[685] Department of Crown Lands and Survey, *1967*, *Occupational Safety in Government Undertakings - Study Conference - 30th November 1967*, Memorandum.

[686] Department of Crown Lands and Survey, 1968, *Circular No. 78/68 - Workers Compensation and Safety on the Job*, Report.

[687] Department of Crown Lands and Survey, 1968, *Circular No. 78/68 - Workers Compensation and Safety on the Job*, Report, p2.

[688] Department of Crown Lands and Survey, 1969, *Circular No. 17/69 – Occupational Safety*, Circular.

[689] Department of Crown Lands and Survey, 1969, *Circular No. 17/69 – Occupational Safety*, Circular, p1-2.

[690] Department of Crown Lands and Survey, 1969, *Report for the Financial Year Ended 30th June*, *1969.* Report.

[691] Department of Crown Lands and Survey, 1969, *Report for the Financial Year Ended 30th June, 1969*, Report, p10.

For the years available[692], Table 10.1 identifies the number of chemical related injuries (harmful contacts) for each period and total injuries for the period.

Table 10.1 Reported injuries and chemical related harmful contacts for available periods

Period	Year	Total Injuries	Chemical Related
July – Dec	1968	60	0
Jan – June	1969	46	3
July – Dec	1969	49	2
Jan – June	1970	35	1
July – Dec	1970	NA	NA
Jan – June	1971	NA	NA
July – Dec	1971	40	1
Jan – June	1972	55	0
July – Dec	1972	NA	NA
Jan – June	1973	NA	NA
July – Dec	1973	NA	NA
Jan – June	1974	NA	NA
July – Dec	1974	29	0
Jan – June	1975	64	1
July – Dec	1975	NA	NA
Jan – June	1976	NA	NA
July – Dec	1976	52	3
Jan – June	1977	55	4
July – Dec	1977	39	2

692 Vermin and Noxious Weeds Destruction Board, 1969, *Statistics of injuries to December 1968,* Memorandum; Vermin and Noxious Weeds Destruction Board, 1969, *Circular 75/69 Observation of Safety Precautions, 12 November 1969,* Circular; Vermin and Noxious Weeds Destruction Board, 1970, *Statistics of injuries to December 1969*, Memorandum; Vermin and Noxious Weeds Destruction Board, 1970, *Statistics of injuries to June 1970,* Memorandum; Vermin and Noxious Weeds Destruction Board, 1972, *Statistics of injuries to December 1971,* Memorandum; Vermin and Noxious Weeds Destruction Board, 1972, *Statistics of injuries to June 1972*, Memorandum; Vermin and Noxious Weeds Destruction Board, 1975, *Statistics of injuries to December 1974*, Memorandum; Vermin and Noxious Weeds Destruction Board, 1975, *Statistics of injuries to June 1975*, Memorandum; Vermin and Noxious Weeds Destruction Board, 1977, *Statistics of injuries to December 1976*, Memorandum; Vermin and Noxious Weeds Destruction Board, 1977, *Statistics of injuries to June 1977*, Memorandum; Vermin and Noxious Weeds Destruction Board, 1978, *Statistics of injuries to December 1977,* Memorandum.

As Table 10.1 illustrates, chemical injuries were regular but rare.

In 1977, the Notice of Injury book was replaced with a new accident report form.[693] As the Department memorandum, at the time, stated: 'It is now intended that all accidents will be investigated more closely, and, where possible, action taken to reduce the possibility of a recurrence.'[694]

Knowledge of health concerns at the time

Registered products, like herbicides containing 2,4-D and 2,4,5-T, required approved labels. As an example, here's the label for Tordon 50D that applied in the early 1960s:

> *"HARMFUL IF SWALLOWED, CAUSES EYE IRRITATION, MAY CAUSE SKIN IRRITATION*
>
> *Avoid contact with eyes, skin and clothing*
>
> *In the case of contact flush eyes and skin with plenty of water; for eyes get medical attention. Remove grossly contaminated clothing and wash before re-use.*
>
> *STORE OUT OF REACH OF CHILDREN AND ANIMALS*.[695]

It is worth noting that the Use of Pesticides Regulations 1953 identified particular chemicals that required employers to provide specific 'protective clothing and equipment' for employees but 2,4-D and 2,4,5-T were not prescribed.[696] While these Regulations were amended in 1963,[697] 2,4-D and 2,4,5-T were not added.

It is unclear if the above warning applied just to the concentrate or included dilutions. Regardless, the only real danger appeared to be if it was swallowed. Other risks were irritation of the eyes and possible skin irritation, suggesting a low health risk.

In October 1964, the VNWDB provided its submission to the Committee of Enquiry into the effects of Pesticides in which it stated that:

> *… the Department has been using these materials for 16 years and they have been handled and used by an annual changing population of about 800 members of the field staff. During this time two cases of skin dermatitis have been reported*.[698]

While the terms of reference for this enquiry did not specifically address poisoning concerns, its report ranked, 2,4-D and 2,4,5-T as 'low risk'.[699]

In 1966, the Department of Health advised the VNWDB that, 'as far as it knows, it has not been demonstrated that small doses of any of them [pesticides] over long periods have cumulative effects.'[700]

From 1966, safety directions that had to be stated on 2,4-D and 2,4,5-T were:

> *Avoid contact with the skin and eyes to prevent possible irritation. Wash concentrate from skin and eyes immediately. Avoid working in and breathing spray mist. Wash exposed parts of the body after use and before eating, drinking or smoking.*[701]

Given there were only two reported cases of acute symptoms, the Department may have been confident early on in the Period that it was managing the risk appropriately.

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693 Department of Crown Lands and Survey, 1977, *Accident Report and Notice of Injury*, Memorandum.

694 Department of Crown Lands and Survey, 1977, *Accident Report and Notice of Injury,* Memorandum, p1.

695 Dow Chemical (Australia) Pty Ltd, 1964 (est), *Tordon 50D - Weedkiller,* Manual.

696 *Use of Pesticides Regulations 1953*, reg 5 and First Schedule.

697 *Use of Pesticides (Amendment) Regulations 1963*.

698 Vermin and Noxious Weeds Destruction Board, 1964, *A Submission Prepared by the Vermin and Noxious Weeds Destruction board for the Enquiry into the Effects of Pesticides*, Submission, p3.

699 Committee of Enquiry, 1966, *The effects of Pesticides Melbourne,* Note, p35.

700 Vermin and Noxious Weeds Destruction Board, 1966, *Minutes of Meeting Held on 15 August 1966,* Minutes.

701 *Pesticides Regulations 1966*, Seventh Schedule, p1020; *Pesticides Regulations 1976,* Sixth Schedule, p81.

Isolated health concerns raised

Between 1965 and 1980, the VNWDB and the Department received a few reported cases of workers raising health concerns. Documentary evidence shows the Department acted in a timely manner and sought advice from the Department of Health. Anecdotal evidence, however, suggests workers may have raised other concerns that weren't formally recorded for various reasons (see Chapter 5 and Appendix 3). At the time, the Department of Health confirmed that chemicals were not the cause of the symptoms. While the cases below involve workers outside the region of the Inquiry, they still provide an insight into the Department's and VNWDB's response.

Case 1

In June 1966 the VNWDB wrote to the Secretary of the Department of Health noting it had received correspondence from a treating doctor stating a workman's health had been affected by herbicides.[702] (The covering letter did not identify the health symptoms.) The VNWDB explained that it was taking this into account in making a termination payment and requested a considered opinion from the Department of Health on the, 'known or suspected dangers or the build-up of any undesirable affects in persons handling various weedicides'.[703]

Subsequent VNWDB Minutes from 29 June 1966[704] note, 'Dr Christophers [Chief Industrial Hygiene Officer, Department of Health] be advised that he need only advise that none of the chemicals used as weedicides are considered to cause trouble.' This quote is unclear and it's possible the VNWDB only wanted a limited response from Dr Christophers as verbal advice may have already been provided. Unfortunately, a copy of the letter to Dr Christophers was not found to clarify this.

The VNWDB agreed that for all future cases a proper medical assessment was needed before settling any claims.

Case 2

This process was adopted the following year (1967) when an inspector advised Dr Parsons (Officer in Charge[705], Keith Turnbull Research Institute,) about an operator who was ill (i.e. 'felt ill, which resulted in vomiting and then fainting').[706] It was noted he only wore a t-shirt and a pair of shorts while spraying. Five days later, Dr Parsons referred the matter to the Department of Health for advice.[707]

In December 1967, the Chief Health Officer responded to the VNWDB advising that it was unlikely there was a causal relationship between chemical exposure and the worker's symptoms.[708] Dr Parsons forwarded this advice to the inspector the following day.[709] Interestingly, this communication did not address the fact the worker just wore t-shirts and shorts and, as discussed in Chapter 8, this is another example of lack of appropriate communication about PPE use.

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[702] Vermin and Noxious Weeds Destruction Board, 1966, *Effects of Weedicides on Departmental Workmen,* Letter.

[703] Department of Crown Lands and Survey, Vermin and Noxious Weeds Destruction Board, 1966, *Effects of Weedicides on Departmental Workmen*, Letter.

[704] Vermin and Noxious Weeds Destruction Board, 1966, *Action on Items Discussed at the Last Board Meeting on Friday 24th June 1966*, Memorandum.

[705] At the time, Dr Parsons was also a Senior Research Officer.

[706] Keith Turnbull Research Institute, 1967, *Tordon - Effect to Operator*, Letter.

[707] Keith Turnbull Research Station, 1967, *Possible Tordon effect on [name redacted],* Letter.

[708] Department of Health, 1967, *Use of Tordon Spray*, Letter.

[709] Keith Turnbull Research Station, 1967, *Information from the Department of Health,* Letter.

Case 3

In April 1970, another inspector wrote to Dr Parsons about a worker's symptoms (i.e. 'affecting his throat, head and nose with a heavy choked up feeling').[710] Dr Parsons advised that there had been remarkably few side effects for operators using the pesticides but noted certain individuals can be affected in a peculiar way and so advised that that worker wear gloves, a face shield and wash before eating or smoking. The medical basis for this advice is unclear.

Dr Parsons subsequently wrote to the secretary of the VNWDB informing him that Dr Christophers (Chief Industrial Hygiene Officer, Department of Health) suggested the person be interviewed.[711] After undertaking an investigation, the Department of Health advised the Department in September 1970 that the medical condition was not due to exposure to pesticides.[712]

Case 4

In 1971, as part of a workers compensation claim process, a treating doctor had identified spraying activities as a cause of the injury (i.e. 'severe abdominal pains').[713] The worker's duties were described as fumigating rabbits and cutting Boxthorn. The allegation that PPE was not provided was denied by the inspector in charge. While the Inquiry found no evidence about how this was resolved, it provides evidence that PPE availability was a concern.

As noted in Chapter 5, in November 1969, the US Consulate General wrote to the Victorian Premier advising him that the US was going to restrict the use of 2,4,5-T in response to a study, 'which indicated that offspring of mice and rats given relatively large oral doses of the herbicide during early stages of pregnancy, showed a higher than expected number of deformities'.[714] In January 1970**,** a circular was sent to all inspectors advising them of the Consulate General's advice but added, 'there is no evidence that the present use of 2,4,5-T by this Department is … detrimental to the health of our employees, the public or wildlife', although it did recommend that the, 'workforce be advised to be careful in its use'.[715]

Documents reveal that having 2,4-D and 2,4,5 -T classified as poisons in 1972 did not significantly change the Department's or VNWDB's response to health concerns, as in December 1972 the VNWDB continued to classify them as low risk.[716] In 1974, when the Australian Workers Union (AWU) Construction and Maintenance Award was amended to provide for toxic chemicals allowances, the Acting Secretary of the VNWDB wrote to the Commission of Public Health to clarify what the toxic chemicals were and what protective measures were needed.[717] Unfortunately the Inquiry could not find the response. However, it's worth noting the list of toxic chemicals (1080, strychnine, and cyanide) didn't include 2,4-D or 2,4,5-T, despite them being classified as poisons. Chapter 5 discusses the issue of what is safe in more detail.

The Department continued to refer concerns to the Department of Health and, in May 1976, the Secretary wrote to Dr Christophers (Chief Industrial Hygiene Officer, Department of Health) thanking him for following up a number of complaints.[718]

At the same time (May 1976), the Superintendent was briefed about talks scheduled with workmen around the safe use of pesticides.[719] Topics would include how pesticides can enter the body and how to prevent this through handling techniques and protective clothing. Chapter 8 provides further discussion on the Department's training at the time.

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[710] Department of Crown Lands and Survey, 1970, *Side Effects of Hormone Weedicides*, Letter.

[711] Keith Turnbull Research Institute, 1970, *Herbicide effect on workman – [place redacted],* Letter.

[712] Department of Crown Lands and Survey, 1970*, Herbicide effect on workman – [place redacted]*, Letter.

[713] Department of Crown Lands and Survey, 1971, *Employer's report of Injury Form RE [name redacted] Workers Comp, Claim Etc,* Form.

[714] Consulate General of the USA, 1969, *White House restrictions on 2,4,5-T, 5 May 1969*, Letter.

[715] Department of Crown Lands and Survey, 1970*, Circular No 3/70 - Hormone 2, 4, 5 T Weed Killing Chemical,* Circular.

[716] Keith Turnbull Research Institute, 1972, *Pesticides in the Control of Vermin and Noxious Weeds - Vol. 14, No. 4 - Pamphlet No 39,* Brochure.

[717] Vermin and Noxious Weeds Destruction Board, 1974, *Toxic Substances Provisions,* Letter.

[718] Vermin and Noxious Weed Destruction Board, 1976, *Complaints by workmen*, Letter.

Despite anecdotal evidence that inspectors were not concerned about worker health, in September 1976, a Land Inspectors' Group meeting (made up of inspectors across the state) moved a motion to request an independent specialist on the effect of chemicals on workers.[720] While no documentation was found to determine if this happened, or what the response was, the fact it was raised demonstrates there was concern by some of the inspectors.

The above responses are likely to have occurred as a consequence of what was occurring in Yarram at the time.

In 1976, two doctors in the Yarram district of Victoria raised concerns that 2,4-D and 2,4,5-T spraying could be linked to a cluster of still births and birth abnormalities. This led to the commissioning of the Aldred Report, which was published in September 1978[721] and found:

> … the normal agricultural use of 2,4-D and 2,4,5-T has not been shown to cause birth abnormalities in domestic animals nor is there evidence to connect such use with human birth abnormalities .[722]

As the Yarram Inquiry progressed, the Department briefed the Minister of Lands in February 1978 and included a report titled, *The Present Status of 2,4,5-T in Victoria*[723], which noted the Department's good safety record and that, despite regular worker contact with 2,4,5-T for over 25 years, the only health problem was dermatitis.

Consistent with this report, in April 1978, a press clipping from the *Peninsula Post* quotes Dr Tom Donaldson, a KTRI scientist, as saying that apart from occasional dermatitis, 'we [the Department] have never had any complaints from our own spray gang members about their health being affected.'[724] This broad statement, however, doesn't acknowledge the 1976 request by the Land Inspectors Group for an independent specialist's advice or the workers compensation cases that had arisen in relation to harmful contacts with pesticides discussed at the end of this chapter.

In May 1978, the Pesticides Review Committee (PRC) raised the issue of regular health checks for sprayers[725] and that this should be an agenda item for the next meeting. However, at that meeting, the view was formed that regular health tests weren't required, with the important qualification, 'if sprayers were using proper protective clothing'.[726] Importantly, this is another example of the assumption that workers were wearing proper PPE. Chapter 9 provides further analysis on the Department's compliance at the time.

An updated summary on the present status of 2,4,5-T was later included in a *confidential, not for distribution, internal circular* in July 1978.[727] It is unclear who was to get this but an earlier draft suggests just inspectors.[728] It's possible the Department didn't want this information circulated more widely while the Yarram Enquiry was underway.

In February 1979, four months after the Aldred Report was published, the secretary to the VNWDB issued Circular 26/79 to all senior inspectors and inspectors, providing copies of various documents.[729] There is no specific reference to inspectors having copies of Dr Parsons' statement available for workers (see Figure 10.1). In addition, the circular states that this was provided to the union. On this basis, it can be assumed workers were made aware of the situation at this time.

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719 Keith Turnbull Research Institute, 1976, *Safety in the Use of Pesticides - Talks to Workmen*, Memorandum.

720 Victorian Public Service Association, Land Inspectors' Group, 1976, *Agenda of Annual Meeting scheduled 22 September 1976*, Agenda.

721 Government of Victoria, Consultative Council and Aldred J, 1978, *Report of the Consultative Council on Congenital Abnormalities in the Yarram District,* Report.

722 Government of Victoria, Consultative Council and Aldred J, 1978, *Report of the Consultative Council on Congenital Abnormalities in the Yarram District*, Report, p13.

723 Department of Crown Lands and Survey, 1978, *The Present Status of 2 4 5-T in Victoria*, Report.

724 Peninsula Post [author unknown], 1978, 'Clean Slate for Dioxin on Berries', *Peninsula Post*, Mornington, 5 April 1978, Newspaper.

725 Pesticides Review Committee, 1978, *Minutes of Meeting Held on 19 May 1978*, Minutes.

726 Pesticides Review Committee, 1978, *Minutes of Meeting Held on 23 June 1978*, Minutes.

727 Department of Crown Lands and Survey, Division of Inspection and Vermin and Noxious Weeds Destruction, 1978, *The Present Status of 2, 4-D and 2, 4, 5-T marked Internal Circular Only*, Circular.

728 Department of Crown Lands and Survey, 1978 (est), *Draft Internal Circular - The Present Status of 2 4-D and 2 4 5-T,* Memorandum.

729 Department of Crown Lands and Survey, 1979, *Circular No, 26/79 - Present Controversy on 2,4-D and 2,4,5-T,* Circular.

CIRCULAR NO 26/79

TO ALL SENIOR INSPECTORS AND INSPECTORS

19 February 1979

RE: PRESENT CONTROVERSY ON 2,4-D AND 2,4,5-T

The following documents are enclosed for your information:-

1) Statement by Dr W Parsons on "Present Status of 2,4-D and 2,4,5-T".

2) The National Health and Medical Research Statement on 2,4,5-T dated 16 June 1975.

3) Council of Agricultural Science and Technology report No 77 on "The Phenoxy Herbicides".

Copies of the above, and the report of the Consultative Council on "Congenital abnormalities in the Yarram district" and the Ministerial Statement by the Hon. W V Houghton, MLC, Minister of Health which was issued with the Consultative Council's report have been sent to -

a) District Advisory Committees

b) The Municipal Association of Victoria

c) Provincial Cities and Towns Association of Victoria

d) Country Municipalities

e) Australian Workers' Union

f) Australian Council of Trade Unions

g) The Victorian Branch of the Australian Medical Association

Additional copies of the statement by Dr Parsons are enclosed for distribution to each of your workmen.

M A Cameron
SECRETARY TO THE BOARD

MP

Encl.

Figure 10.1 VNWDB Circular No26/79 – Present controversy on 2,4-D and 2,4,5-T.

Case 5

In January 1977 an inspector advised the VNWDB that another worker (within the region of the Inquiry) was having health concerns (i.e. 'respiratory troubles') and required a protective mask.[730] The inspector noted that the worker's doctor was of the opinion that the fumigants and weedicides were the main contributors. The inspector requested a mask for the worker but noted his concern that other workers could begin to make similar demands for protective masks.

In response, the Superintendent advised the inspector that both paper face masks and canister type masks had been purchased for the worker to try out. However, the memo stated, 'As the officer in charge you must make it very clear to your workforce that we have work for fit men only, should men not be capable of carrying out normal duties then we cannot provide light duties for them.'[731]

It is noted that under workers compensation law, at the time, an employer was not required to provide alternative duties for an employee.[732] However, this harsh message, if communicated more widely, may have discouraged workers raising complaints about their health conditions.

Early urine testing of workers

In November 1978, Dr Parsons (Executive Research Officer, KTRI) informed the Superintendent of two incidents, close to New South Wales (NSW), where the treating doctor had provided workers with medical certificates to take 14 days off work after finding 2,4-D and 2,4,5-T in their blood.[733] It appears the Health Commission of NSW was involved with both cases.[734] Dr Parsons expressed his alarm that all workers would have these chemicals present in their blood and therefore be entitled to leave. He suggested an urgent meeting with the Health Department's, Dr Christophers.

This issue was subsequently discussed at the VNWDB meeting on 4 December 1978[735], where it was agreed that Dr Parsons would organise a meeting between the Secretary of the Department and the Secretary of the Health Commission. Dr Parsons prepared a number of questions about why the Health Commission of NSW was involved and why it was issuing certificates that workmen were unfit for work. The meeting was held with the Victorian Health Commission on 14 February 1979.[736]

In February 1979 the Victorian Trades Hall Council (VTHC) requested regulations be introduced to address the handling and use of pesticides.[737] This included a request that anyone exposed to 2,4-D and 2,4,5-T undergo proper bi-annual medical examinations.[738]

A briefing from the Chairman of the VNWDB to the Minister of Lands addressing the VTHC's requests[739], noted the NSW Department of Health had been carrying out analysis of workers' urine and had set excessive exposure at 100 ppb. The briefing noted that there appears no medical justification for this.

In August 1979, Dr Christophers advised that the NSW Health Commission had written to him to clarify their urine testing protocols.[740] The NSW Health Commission clarified that their limits were not linked to poisoning but an indication that the

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730 Department of Crown Lands and Survey, 1977, *VNW Workman [name redacted] employee at [depot name redacted]*, Letter.

731 Department of Crown Lands and Survey, 1977, *[name redacted] & Doctors Certificate,* Memorandum.

732 Later addressed by the *Workers Compensation (Amendment) Act 1984*.

733 Department of Crown Lands and Survey, 1978, *Use of Herbicides by Departmental Workmen*, Memorandum.

734 Health Commission of New South Wales, Division of Occupational Health and Radiation Control, 1978, *Report on Pesticide Results for [name redacted]*, Report.

735 Vermin and Noxious Weeds Destruction Board, 1978, *Minutes of Meeting Held on 4 December 1978*, Minutes.

736 Department of Crown Lands and Survey, 1979, *Information on Sick Leave in north-eastern Victoria*, Memorandum.

737 Vermin and Noxious Weeds Destruction Board, 1979, *Minutes of Meeting Held on 26 February 1979*, Minutes.

738 Department of Crown Lands and Survey, 1979, *Requests of Trades Hall Council in Respect to Herbicides 2,4-D and 2,4,5-T - Notes for Cabinet*, Report.

739 Department of Crown Lands and Survey, 1979, *Requests of Trades Hall Council in Respect to Herbicides 2,4-D and 2,4,5-T - Notes for Cabinet, Attachment to Letter from Chairman Vermin and Noxious Weeds Destruction Board,* Report.

740 Pesticide Review Committee, 1979, *Extract from Minutes of Meeting Held on 13 August 1979*, Extract.

worker has been careless (i.e. not wearing gloves or other protective clothing). Furthermore, it emphasised that results above the limit did not require leave from work.

RESPONSE TO HEALTH CONCERNS FROM 1980 TO 1995

As discussed in Chapter 5, the general health concerns around pesticide use became more widespread by the early 1980s. A Swedish study had recently been published linking cancer and the use of herbicides plus the *Industrial Safety, Health and Welfare Act 1981* introduced more onerous duties on employers. Given this, it would be expected that the Department's response would also change. However, as the following outlines, while the Department supported more research, it appeared to be defending the continued use of 2,4-D and 2,4,5-T.

At this time, concerns for employee health were also being raised by other advocates. In debating the *Agricultural Chemicals Bill 1980* in March 1980 the opposition's Mr Roper argued sprayers needed more protection.[741] Mr Roper also noted the AWU had undertaken its own studies, and identified ways to reduce the risk of health symptoms. He explained the AWU had written to the Minister of Labour and Industry on 7 June 1980 requesting assistance but there was no follow up.[742] Mr Roper recommended that workers should have access to proper PPE and sufficient water and soap for use after spraying.[743] (Refer to Chapter 9, where the Department's adherence to laws and regulations, including the use of PPE, is analysed.)

In September 1981, the Australian Council of Trade Unions (ACTU) published its review and recommendations for the use of 2,4-D and 2,4,5-T, and highlighted the need for caution:

> *While the laboratory evidence regarding the teratogenic potential of 2,4,5-T and its contaminant* [2,3,7,8-tetracholoradibenzo-*p*-dioxin] *TCDD is reasonably strong, the results of human studies and investigations have largely provided negative findings. However these negative findings are for the most part the result of poorly conceived and conducted investigations. Under no circumstances can the results of these studies be taken as firm evidence supporting a lack of teratogenic activity.* ***More competent studies are required before the very substantial element of doubt is removed, until then considerable suspicion remains. In this light a cautious approach is therefore advocated.***[744] [emphasis added]

It's relevant that the ACTU's review and recommendations included the need to train and alert staff about the hazards of chemical use. It also recommended bi-annual blood and urine tests for staff.[745]

To some extent, both the Department and the VNWDB acknowledged the need for the caution. In April 1982, the VNWDB, on behalf of the Department, prepared a report, 2,4,5-T and Options Available, canvassing options to deal with 2,4,5-T.[746] Regarding operator safety, the report stated the following:

> *(a) Whilst the present recommendations on protective clothing are believed to be adequate they could be made compulsory, and even greater requirements could be imposed, such as the use of rubber gloves, face shields, or respirators.*
>
> *(b) Regular health checks could be made on operators including regular urine sampling and analysis. These checks could be compulsory for Government workers and contractors before, during, and after the spraying season. The tests could be optional for all other workers who sprayed for less than a certain number of hours (say, 40) per year. This would involve a considerable cost in medical services.*[747]

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741 *Victorian Parliament, Parliamentary Debates*, Legislative Assembly, 19 March 1980, vol. 349 p7223 [T. Roper, Shadow Minister for Health].

742 *Victorian Parliament, Parliamentary Debates*, Legislative Assembly, 19 March 1980, vol. 349, p7224 [T. Roper, Shadow Miniter for Health].

743 *Victorian Parliament, Parliamentary Debates*, Legislative Assembly, 19 March 1980, vol. 349, p7225 [T. Roper Shadow Minister for Health].

744 Australian Council of Trade Unions, 1981, *Review and Recommendations for the Use of 2,4-D and 2,4,5-T, Report,* ppii-iii.

745 Australian Council of Trade Unions, 1981, *Review and Recommendations for the Use of 2,4-D and 2,4,5-T, Report*, pvi.

746 Department of Crown Lands and Survey, 1982, *2,4,5-T and Options Available,* Report.

747 Department of Crown Lands and Survey, 1982, *2,4,5-T and Options Available*, Report, p4.

By recommending PPE become compulsory, the Department was acknowledging that workers were not currently wearing PPE at all times.

In June 1982, the VNWDB expressed concern that the Department's Safety Committee had not been operational over the past 12 months, 'particularly with the public sensitivity on herbicide use and other emotive matters.' On 22 June 1982 [748], the VNWDB requested the Department's Secretary set-up the committee given its 'extreme importance'.[749] Minutes from the Safety Committee meeting in February 1983 confirm that it was reconstituted.[750]

In July 1982, a subcommittee of the PRC was set up to assess the relative risks with the use of pesticides.[751] In September 1982, a table of the relative risks of pesticides was initially circulated.[752] Later, a paper on Pesticides and Public Risk was distributed in March 1983[753], and discussed in April 1983.[754] This was redrafted and circulated for discussion at the May 1983 meeting.[755] Essentially, the paper emphasised the importance of being aware of risks so appropriate action could be taken.

Urine testing

After a change in government, Mr Roper, Minister for Health, issued a news release on 10 May 1982 stating all sprayers would have their urine tested.[756]

The government policy made the following reference to urine testing:

> *Regular urine sampling and analysis will be made compulsory for government workers before, during and after the spraying season along the lines employed in N.S.W. Consultation with N.S.W Health Commission on this aspect will be undertaken first*.[757]

In June 1982, the Minister for Lands attended a Central Advisory Council meeting to discuss the government's 2,4,5-T policy and noted the health of workers using it will be monitored.[758]

A working party on the government's policy was set up. At the PRC meeting of 25 June 1982, it was noted that the Industrial Relations Department in NSW had been contacted about its urine testing of workers.[759]

In September 1982, the PRC noted that, 'funds and staff were requested to enable the Occupational Health Service[760] to carry out urine tests for operators.'[761]

In November 1982, a circular[762] to all inspectors and senior inspectors explained the Department's 2,4,5-T policy. It updated staff on the new PPE requirements (i.e. now compulsory), training, and noted that the Health Commission was yet to finalise sampling procedures for urine tests.

> *Operator Safety*
>
> *(i) Protective clothing: All Government workers when using 2,4,5-T are required to wear boots (rubber boots are preferred to leather because they are less absorbent), overalls, rubber gloves, and a face shield or respirator. Rubber*

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[748] Vermin and Noxious Weeds Destruction Board, 1982, *Departmental Safety Committee,* Memorandum.

[749] Vermin and Noxious Weeds Destruction Board, 1982, *Extract from Minutes of Meeting Held on 7 June 1982,* Extract.

[750] Department of Crown Lands and Survey, 1983, *Circular No 17/83 Safety*, Circular.

[751] Pesticide Review Committee, 1982, *Minutes of Meeting Held on 23 July 1982*, Minutes.

[752] Pesticide Review Committee, 1982, *Minutes of Meeting Held on 28 September 1982*, Minutes.

[753] Agricultural and Domestic Chemicals Review Committee, 1983, *Minutes of Meeting Held on 25 March 1983*, Minutes; Pesticide Review Committee, 1983, *Another way of Looking at Pesticide Risk,* Report.

[754] Agricultural and Domestic Chemicals Review Committee, 1983, *Minutes of Meeting Held on 22 April 1983*, Minutes.

[755] Agricultural and Domestic Chemicals Review Committee, 1983, *Minutes of Meeting Held on 27 May 1983*, Minutes.

[756] Minister for Health, 1982, [untitled], *News Release, Minister for Health,* Media Release.

[757] Department of Crown Lands and Survey, 1982, *Circular No. 90/82 - Future Use of 2,4,5-T,* Circular.

[758] Central Advisory Council, 1982, *Minutes of Meeting Held on 9 June 1982,* Minutes.

[759] Pesticide Review Committee, 1992, *Minutes of Meeting Held on 25 June 1992*, Minutes.

[760] The Occupational Health Service was a separate government entity.

[761] Pesticides Review Committee, 1982, *Minutes of Meeting Held on 28 September 1982,* Minutes.

[762] Department of Crown Lands and Survey, 1982, *Circular No. 90/82 - Future Use of 2,4,5-T,* Circular.

gloves, as displayed at the training courses, have already been supplied, and the preferred PVC type will be available shortly. (Kitchen-type gloves are acceptable and, if necessary, can be purchased locally).

Face shields are preferred to respirators and have been, or will be, issued to all workers. The type on issue at present is fitted to a hard-hat but other types may be available in the future. Respirators are available for workers who prefer them to face shields. Inspectors should order any of this equipment which they require.

(ii) urine sampling. Sampling procedures are yet to be finalised by the Health Commission.[763]

Despite this circular, it is worth noting there was still some doubt as to enforceability. For example, in January 1983, Circular 8/83[764] noted that the Departmental Safety Committee felt it could not force an employee to wear PPE. Instead, it was the employer's obligation to make this available. In April 1983, the Department received advice from both the State Insurance Office (SIO)[765] and the Crown Solicitor[766] to clarify this, with copies of this advice sent to the Safety Committee in May 1983.[767] This issue is explored in more detail in Chapter 9.

In December 1982, Minutes from the Recommendations Committee meeting noted the government subcommittee on 2,4,5-T had not met recently so the problem with urine sampling had not yet been considered.[768]

In March 1983, the Secretary wrote to the Health Commission concerned urine sampling was not happening. The Health Commission responded by advising the Secretary of Lands that funds were an issue and that the Commission was seeking government direction[769], which, once received, would be passed on to the Department.

In September 1983, Dr Parsons (Chairman of the VNWDB) noted that he had obtained the costs for implementing the scheme.[770]

Unfortunately, no documents were received from the Department of Health to shed light on why urine testing did not proceed and there are no Department circulars or other documents explaining it.

Only the 1987 *the Wells Review* (discussed below) confirmed urine sampling was not implemented. Given this was government policy, it would be useful to know why.

It is worth noting that urine testing remained an issue. In August 1987, the Ballarat OHS Committee agreed to 'ascertain [the] need and costs of both urine tests and blood tests for spray gang members.' [771] The Inquiry found no evidence as to how this was resolved.

Training

In addition to testing and PPE, training was another way of responding to health concerns. While this is discussed further in Chapter 9 it is worth noting that, at the time, the VNWDB wrote to the Minister for Lands in June 1982 proposing how it would improve training[772], which he accepted.[773] His press release of 19 July 1982 states:

The Government is most concerned because the improper use of herbicides can lead to undesirable side effects, both for the operators and the environment, Mr Mackenzie said.

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763 Department of Crown Lands and Survey, 1982, *Circular No. 90/82 - Future Use of 2,4,5-T,* Circular.

764 Department of Crown Lands and Survey, 1983, *Circular No. 8/83 - Safety Clothes*, Circular.

765 State Insurance Office, 1983, *Employers Liability Insurance*, Letter.

766 Victorian Crown Solicitor's Office, 1983, *Industrial Safety Health and Welfare Act 1981 Whether Employees Required by s 14 to Use Safety Clothing and Equipment*, Memorandum.

767 Department of Crown Lands and Survey, 1983, *Comments on Occupational Health and Safety Public Discussion Paper March 1983*, Memorandum.

768 Recommendations Committee Meeting, 1982, *Minutes of Meeting Held on 10 December 1982*, Minutes.

769 Health Commission of Victoria, 1983, *Urine testing for government workers handling 2,4,5-T,* Letter.

770 Vermin and Noxious Weeds Destruction Board, 1983, *Minutes of Meeting Held 26 September* 1983, Minutes.

771 Ballarat Region Occupational Health and Safety Committee, 1987, *Minutes of Meeting Held on 19 August 1987*, Minutes.

772 Department of Crown Lands and Survey, Vermin and Noxious Weeds Destruction Board, 1982, *Training of Government Operators using 2, 4, 5-T*, Memorandum.

773 Minister for Lands, 1982, *Training of Government Operators using 2,4,5-T,* Memorandum.

The Government's new policy is not designed to prohibit the use of 2,4,5-T but rather to ensure that it is used safely and efficiently. This is what the training courses will be designed to achieve.[774]

Health studies and reviews

As well as the specific measures to reduce exposure, like training and PPE, the Department supported further research, while also undertaking its own studies and internal reviews into the effects of the pesticides. These included:

(a) Phenoxy herbicide and chlorophenols: a case study on soft tissue sarcoma and malignant lymphoma. J.G Smith and A.J Christophers, 1992[775] (**Dr Christophers's cancer study**).

(b) The Worker Health Study – an exposure study involving Victorian workers. Dr John Mathews, unpublished **(The Worker Health Study**).

(c) Occupational exposure to the herbicide triclopyr while spraying blackberry. Frederick Norman Irvine, unpublished Master's thesis, 1985[776](**Occupational exposure study**).

(d) Review into the use of Pesticides in the Department of Conservation, Forests and Lands and Wells GJ, 1988[777] (**The Wells Review**).

(e) Cancer mortality in workers exposed to chlorophenoxy herbicides and chlorophenols. Saracci et al., 1991 (including Dr John Mathews)[778] (**International Agency for Research on Cancer, IARC international cohort study**).

(f) Current serum levels of 2,3,7,8-tetracholoradibenzo-*p*-dioxin in phenoxy acid herbicide applicators and characterization of historical levels, by Dr Parsons and others, published in 1992 [779] (**International blood serum study – TCDD**).

(g) Health Surveillance Report on Pesticide Applicators. Professor John Bisby and Dr Andrew Newmann-Morris, 1992[780] (**the Oxis Study**).

(a) Dr Christophers's cancer study

In June 1980, the PRC noted a Swedish study that linked the incidence of soft tissue sarcomas with phenoxy chemicals.[781] It was later stated that the Swedish study was the first to claim a link between the use of pesticides and cancer in humans.[782] As a consequence, the following motion was seconded, '[t]he Pesticides Review Committee urge the Victorian Health Commission to conduct a study of soft-tissue sarcomas in Victoria in view of the Swedish report which relates this condition to phenoxy chemicals.'[783]

While in October 1980, a subcommittee had drafted a research proposal[784], there were some delays in conducting this study. It would appear that by June 1982, Dr Christophers was in a position to discuss his research proposal. At the PRC

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[774] Minister for Lands, 1982, *Training Courses for Users of 2, 4, 5-T, 19 July,* Media Release.

[775] Smith JG, et al., *Phenoxy herbicides and chlorophenols: a case control study on soft tissue sarcoma and malignant lymphoma.* Study, British Journal of Cancer Vol 65, p442-448, Journal.

[776] Irvine, F, 1985, *Occupational Exposure to the Herbicide Triclopyr while spraying Blackberry* - Unpublished thesis submitted to Monash University.

[777] Department of Conservation, Forests and Lands and Wells GJ, 1988, *Review of the Use of Pesticides in the Department of Conservation, Forests and Lands*, Report.

[778] Saracci R, et al., 1991, *Cancer mortality in workers exposed to chlorophenoxy herbicides and chlorophenols.* Study, Lancet Vol 338, p1027–1032, Journal.

[779] Johnson ES, et al., 1992, *Current serum levels of 2,3,7,8-tetrachlorodibenzo-p-dioxin in phenoxy acid herbicide applicators and characterization of historical levels*. Study, Journal National Cancer Institute, Vol 84, p1648-53, Journal.

[780] Department of Conservation and Environment and Oxis, 1992, *Health Surveillance Report on Pesticide Applicators*, Report, p5.

[781] Pesticides Review Committee, 1980, *One Hundred and Fifty-ninth Meeting of the Pesticides Review Committee Minutes of Meeting Held on 27 June 1980,* Minutes, p2.

[782] Smith JG et al., 1992, *Phenoxy herbicides and chlorophenols: a case control study on soft tissue sarcoma and malignant lymphoma*. British Journal of Cancer Vol 65, p442-448, Journal.

[783] Pesticides Review Committee, 1980, *One Hundred and Fifty-ninth Meeting of the Pesticides Review Committee Minutes of Meeting Held on 27 June 1980*, Minutes, p2.

[784] Pesticides Review Committee, 1980, *One Hundred and Sixty Third meeting of the Pesticides Review Committee Minutes of Meeting Held on 24 October 1980,* Minutes.

meeting, the minutes[785] note under the agenda item, Soft-tissue sarcomas and 2,4,5-T, that Dr Christophers described his research and the Committee Secretary distributed a copy of his report.

The study lasted from 1982 to 1988 and essentially involved interviewing patients with either one of two types of cancers to assess their exposure to chemicals and compare these to control groups i.e. the general public to assess if there was any association. The study was published in the *British Journal of Cancer* in 1992[786] and found no statistically significant association between exposure to phenoxy herbicides or chlorophenols and soft tissue sarcoma and lymphoma.

No documents were found that indicate that staff were advised of the results of this study.

(b) Worker health study

In April 1981, Dr Parsons asked the committee for permission to do a study involving around 2,000 Department staff exposed to 2,4,5-T.[787] Given the number of workers who had sprayed in the Department over time, it was possible to compare staff who had limited exposure to those who had sprayed for a number of years.

The difference with this study was that it would monitor people exposed to pesticides and assess whether any of their deaths were the result of specific cancers. A link could be established if some were more prevalent compared to the general population.

Dr Christophers noted he would include some of these staff in his study. Once this study was finished, Dr Parsons could begin his.

To the Department's credit, it decided not to wait for Dr Christophers's study. In May 1982, the Secretary was advised that Dr Mathews (an epidemiologist at the University of Melbourne) would be able to undertake the study[788], and this was subsequently approved by the Minister.[789] In October 1982, Circular No 30/82[790] told all senior inspectors and inspectors about the health study and asked them to provide further information about former employees.

Three years later, in October 1985, specific staff were finally updated about the study, through Circular No 38/85.[791] These staff included regional managers, assistant regional managers, land management advisory officers and land management officers. The Inquiry was not able to determine how or if field staff were ever informed.

The circular advised of the outcome by reference to what was reported at the Evatt Royal Commission and included the following conclusion:

> *This Victorian study provides strong evidence that exposure to phenoxy herbicides does not increase deaths from cancer in general or from rare forms of cancer such as soft tissue sarcoma or malignant lymphoma*.[792]

The circular explained that the Department wanted to provide the results now rather than waiting for the study to be published. The Department did follow up with Dr Mathews on numerous occasions regarding the publication of this study.[793] It is understood, however, his results were never published but were instead included as part of an international study (IARC, below).[794]

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785 Pesticide Review Committee, 1992, *Minutes of Meeting Held on 25 June1992,* Minutes.

786 Smith JG, et al., *Phenoxy herbicides and chlorophenols: a case control study on soft tissue sarcoma and malignant lymphoma.* Study, British Journal of Cancer Vol 65, p442-448, Journal

787 Pesticides Review Committee, 1981, *One Hundred and Sixty Seventh Meeting of the Pesticide Review Committee Minutes of Meeting Held on 24 April 1981*, Minutes.

788 Vermin and Noxious Weeds Destruction Board, 1982, *Minutes of the Meeting Held on 10 May 1982*, Minutes.

789 Vermin and Noxious Weeds Destruction Board, 1982, *Minutes of the Meeting Held on 10 May 1982*, Minutes.

790 Department of Crown Land and Survey, 1982, *Circular No 30/82 - Survey of Workers Health*, Circular.

791 Department of Conservation, Forests and Lands, 1985, *Circular No. 38/85 - Worker Health Study - Vermin & Noxious Weeds Staff*, Circular.

792 Department of Conservation, Forests and Lands, 1985, *Circular No. 38/85 - Worker Health Study - Vermin & Noxious Weeds Staff*, Circular, p2.

793 Department of Conservation, Forests and Lands, 1987, *Worker Health Study, 13 October 1987*, Letter; Department of Conservation, Forests and Lands, 1988, *Worker Health Study*, Letter; Department of Conservation, Forests and Lands, 1988, *Worker Health Study,* Letter.

794 Parsons, W T, 1988, *Worker Health Study,* Letter.

(c) Occupational exposure study

In February 1984, a separate request was made by a senior researcher at KTRI to the Secretary to undertake research into herbicide exposure on workmen.[795] Funding was approved to allow staff to undertake a specific project referred to as the Operator Contamination when Spraying Project with the objective, 'to assess operator contamination during screening and application of herbicides when using high volume boom sprayers.'[796,797]

The *Wells Review* noted this research was not published. Unfortunately, no reference to the results of this study or what the Department learned were found within the Department files.

The Inquiry was able to obtain a copy of the paper from Monash University. The research was limited to the use of the herbicide triclopyr, which was used a replacement for 2,4,5-T at the time, by 15 workmen who volunteered.[798] The paper concluded that it was unlikely that spraying triclopyr would present either an acute or chronic health hazard.[799] It also noted that most of the exposure was through the hands and suggested that gloves should be a major item of protective clothing.[800]

(d) The Wells Review

In June 1987, the Minister for Conservation, Forests and Lands (CFL) announced a review into the use of pesticides.[801] An internal memorandum noted:

> *The Minister announced recently that a review of pesticide use for the control of vermin and noxious weeds with CF&L would be undertaken.*
>
> *The Department is a major user of agricultural chemicals and the Minister is concerned to ensure that the review examine the impact of pesticide use on the health of workers, farmers and rural communities, economic efficiency and the environment*.[802]

The Review was to be conducted by an independent consultant, Dr Wells. Dr Wells' report (the Wells Review) was published in February 1988, featuring workers concerns.[803] The extract from the report (below) is critical of the Department's response to worker concerns.

> *The main concern expressed by workers was the lack of information available about the pesticides used and the apparent contradictions regarding their safety. Some examples were: CFL and the AWU gave conflicting advice;* ***if pesticides were safe why was protective clothing necessary;*** *the general public had a different view on herbicide safety to that of CFL, and the workers, being part of the community, felt that they were caught in between. On many of the pesticide issues, there was considerable uncertainty in the minds of some workers and their families.*
>
> ***Communication between management and staff on these matters did not appear to be good.*** *Certainly, safety regulations were enforced where possible but, it was claimed, with little explanation to encourage a sensible approach to their adoption. In several cases, information which was readily available to management was not passed on to staff, such as the interim report on the Worker Health Study by Dr W.T. Parsons (Annex 10). It is hard to imagine how information so relevant to the peace of mind of all CFL workers was not given as wide publicity as possible.*

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795 Keith Turnbull Research Institute, 1984*, Workmen's Exposure to Herbicides*. Letter.

796 Department of Crown Lands and Survey, 1982 (est), *Project Description*, Form.

797 The documents note that the staff would be engaged at the KTRI and refers to K. Irvine. It is likely this project was part of Irvine's research.

798 Irvine, F, 1985, *Occupational Exposure to the Herbicide Triclopyr while spraying Blackberry,* Unpublished thesis submitted to Monash University, piii.

799 Irvine, F, 1985, *Occupational Exposure to the Herbicide Triclopyr while spraying Blackberry,* Unpublished thesis submitted to Monash University, piv.

800 Irvine, F, 1985, *Occupational Exposure to the Herbicide Triclopyr while spraying Blackberry,* Unpublished thesis submitted to Monash University, p39.

801 Department of Conservation, Forests and Lands, 1992, *Briefing Note on Minister's meeting AWU*, Report.

802 Department of Conservation, Forests and Lands, 1987, *Pesticide Review,* Memorandum.

803 Department of Conservation, Forests and Lands, 1988 and Wells GJ, *Review of the Use of Pesticides in the Department of Conservation, Forests and Lands*, Report.

In addition, blood and urine tests had been promised to workers engaged in spraying pesticides to relieve their anxiety but nothing had eventuated. *It is true that specific tests for herbicide residues are not as simple as was first thought but this information could have been made known. Some responsibility for the lack of follow-up on these matters might also rest with the regional safety committees. Enquiries on such issues can be passed on to the Departmental Committee which might be more successful in eliciting a response from management or other sources.*

The recent AWU ban on the use of amitrole by CFL workers might have been avoided by a timely and more constructive response by management when initial enquiries were made as to its alleged carcinogenic effects. Although the issue was precipitated by one manufacturer, and the herbicide subsequently cleared by the National Health and Medical Research Committee, much uncertainty remains in many people's minds owing to the way in which CFL handled the matter.

Research results on all pesticide matters should eventually find their way back to the regions, but particularly those results concerned with worker health and safety. About three years ago, some experiments were conducted in the field on the amount of spray material coming into contact with different parts of the body during a normal spray operation. The work was written up for a Master's Degree (but never published) by F. Irvine, a chemist at KTRI (now resigned). With the increasing concern being expressed over the use of pesticides, it is surprising that this sort of information is not made more use of, particularly in relation to the wearing of protective clothing. All workers found protective clothing cumbersome and uncomfortable to wear despite it being of the latest design. Unfortunately, commercially available protective clothing is designed to be multi-purpose and it is ill-adapted to spraying outside in hot weather. Therefore, a most worthwhile research project for CFL would be to design a more appropriate outfit. A joint CFL-DARA initiative on this was submitted for funding two years ago but not approved; in the present climate, it should be resurrected.

A further concern on protective clothing was the perceived risk to their families of workers' contaminated clothes having to be washed at home.

Other concerns expressed by CFL workers were:

i. what were the cumulative effects of pesticide residues in the body

ii. how should herbicide wastes and containers be disposed of

iii. more appropriate first aid kits should be available

iv. some workers experience headaches after using Phostoxin for a full day

v. one worker experienced an allergy to being in contact with Noogoora burr

vi. some fumigation equipment used was not safe.[804] [emphasis added]

In June 1988, the Department circulated this report to various divisional heads and committees[805], with a draft plan to implement the recommendations.[806] There was an opportunity to provide feedback by 30 June 1988 and it was noted that a training program had commenced on 30 May 1988. (Given the short turn-around time for comments, it could be assumed the Department was keen to take initial action.)

It was suggested the KTRI could make research into human health a high priority for the next three years. It was also proposed that the Minister could discuss the monitoring of ongoing international research at Cabinet. It is unclear, however, why this issue required Cabinet-level discussion.

Chapter 9 provides further information about PPE and what work (or not) was undertaken into more suitable PPE, following the Wells Review.

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[804] Department of Conservation, Forests and Lands and Wells GJ, 1988, *Review of the Use of Pesticides in the Department of Conservation, Forests and Lands*, Report.

[805] Department of Conservation, Forests and Lands, 1988, *Pesticides* Review, Memorandum.

[806] Department of Conservation, Forests and Lands, 1988, *Department of Conservation, Forests & Lands - Draft Plan for Implementation of Recommendations in the Report on Use of Pesticides within CFL*, Report.

While there were a number of proposed actions, other than training, there was no evidence on whether these recommendations were implemented. The fact that a further review was required in 1992 (see Oxis Study below) suggests that whatever was implemented didn't adequately address union concerns.

(e) IARC international cohort study

As discussed above (see Worker Health Study), the results from Dr Mathew's study were not published separately but were included as part of an international cohort study in 1991.[807] This study considered close to 20,000 workers across 10 countries to assess if they were more likely to develop specific cancers over time than the general population.

Overall, the study found that the cohort as a whole was twice as likely to develop soft tissue sarcoma but this was not statistically significant. On the other hand, sprayers were almost nine times more likely to develop that type of cancer, and this was statistically significant. It concluded, 'The excess of soft tissue sarcomas among sprayers is compatible with a causal role of chlorophenoxy herbicides but the excess does not seem to be specifically associated with those herbicides probably contaminated by TCDD.'[808]

Given these results, it is disappointing there was no evidence that staff were advised of this study, especially since the Department had previously reported positively on Dr Mathews's results. The results were, however, were acknowledged in the Oxis report, as quoted below:

> *We should recognise that there has been a change in the perception of such risk for some groups of workers applying insecticides. This is contained in a report published in Europe in late 1991 by the International Agency for Research on Cancer (IARC).*
>
> *This report states that there is "limited evidence" for the view expressed by its panel of experts who judged that occupational exposures in spraying and application of non-arsenical pesticides should be classified in Group 2A meaning that "the exposure circumstances entails exposures that are probably carcinogenic to humans"*.[809]

The Inquiry has a copy of the raw data Dr Mathews's provided to the IARC. This raw data has been provided to the Department of Environment, Land, Water and Planning.

It is worth noting that the international cohort study was expanded and updated in June 1997 and made similar conclusions.[810]

(f) International blood serum study – TCDD

In January 1988, Dr Parsons (then retired) was approached by the National Institute of Environmental Health Sciences in the US to assist with another international study.[811] This would involve collecting blood samples from a group of workers with about 15 years' exposure to assess their levels of TCDD and compare this to another group with less than 13 years' exposure (Figure 10.2).[812]

In March, the Department provided approval to assist with this study, subject to conditions, which included it getting the results. Dr Parsons wrote to the study participants in 1992, on behalf of the Department[813] (Figure 10.2) with their results.

The letter explained that, despite some sprayers being significantly exposed to TCDD, there was no definite evidence that this would cause any health problems. The letter did not provide advice on what the participants should do about their results.

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807 Saracci R, et al,1991, *Cancer mortality in workers exposed to chlorophenoxy herbicides and chlorophenols*, Lancet Vol 338, p1027–1032, Journal.

808 Saracci R, et al,1991, *Cancer mortality in workers exposed to chlorophenoxy herbicides and chlorophenols*, Lancet Vol 338, p1027–1032, Journal.

809 Department of Conservation and Environment, 1992*, Health Surveillance Report on Pesticide Applicators, Department of Conservation and Environment, Ballarat Horsham Benalla Kerang*, prepared by John Bisby, Oxis Pty Ltd, Report, p5.

810 Kogevinas M, et al, 1997, *Cancer mortality in workers exposed to phenoxy herbicides, chlorophenols, and dioxins. An expanded and updated international cohort study,* American Journal of Epidemiology Vol 145(12), p1061–1075, Journal.

811 US Department Of Health and Human Services, 1988, *Health study,* Letter.

812 Parsons, W T, 1988, *Worker Health Study*, Letter.

813 Keith Turnbull Research Institute, 1992, *Early results from the study on blood levels of contaminants of phenoxy acid herbicides (2,4-D. 2,4,5-T and MCPA),* Letter.

The study was later published in 1992.[814]

Department of Conservation & Environment

Your Ref.
Our Ref.
Date

13 August 1992

Keith Turnbull Research Institute
P.O. Box 48
Ballarto Road Frankston
Victoria 3199 Australia
Telephone (03) 785 0111
Fax (03) 785 2007

[redacted]

Dear [redacted]

This letter gives you early results from the study on blood levels of contaminants of phenoxy acid herbicides (2,4-D, 2,4,5-T and MCPA) in which you kindly co-operated some time ago. I am writing this letter in two parts, the first gives the results obtained so far in general terms, and the second are the results from your own blood sample.

The main aim of the study was to determine the level of TCDD in the blood of workers who had been exposed to phenoxy acid herbicides in the past. TCDD is one of the group of chemicals called dioxins and is produced as a by-product of combustion i.e. from fires, barbecues, car exhausts and industrial processes. Consequently, we are all exposed to it, and so it may occur at some level in our bodies. It is known from other studies that levels of up to 20 parts per trillion (ppt) occur in the general population, with most levels occurring between 4 and 7 ppt. An additional source of TCDD is the herbicide 2,4,5-T and it would be expected that people who regularly used the herbicide would have a greater level of TCDD in their bodies than those who did not.

It is known that TCDD is not rapidly broken down or excreted from human bodies, it takes about seven years from the time an individual was last exposed to the chemical for the level in his/her body to be halved.

The scientist designing the present study, Dr E. Johnson of the National Institute of Environmental Health Sciences in North Carolina, USA, wanted to analyse blood from groups of people known to be exposed to 2,4,5-T and 2,4-D at various times in the past and who then ceased to be exposed. He asked me if I could identify from old Lands Department records a group of sprayers who had commenced with the Department before 1965 and who had ceased work also before 1965; another group who had commenced and ceased between 1965 and 1975; and a third group who had commenced work after 1975 and who might or might not be still employed as sprayers by the Department. Then, he wanted each of these sprayers matched by age and location with a non-sprayer who is currently employed by the Department. It is interesting to note that there would be very few places in the world where such a study could be carried out because it relies on records being available of people who were employed as sprayers over 30 years ago. Fortunately, the records of the old Lands Department are still retained.

It was only in the late 1960s that the presence and significance of TCDD as a contaminant in 2,4,5-T became known and steps were then taken to reduce its concentration (it is impossible to remove it altogether). Thus it is assumed that those who sprayed pre-1965 and between 1965 and 1975 were exposed to much higher levels of TCDD than those who commenced spraying after 1975.

TCDD is important because it is an extremely toxic compound, and there is evidence that it is carcinogenic (cancer causing) in experimental animals such as rats and mice at tissue levels as low as 540 ppt at the end of exposure, but there is no definite evidence as yet that it is carcinogenic to humans at comparable levels, although excess human cancers have been reported in one study in

[814] Johnson ES, et al., 1992, *Current serum levels of 2,3,7,8-tetrachlorodibenzo-p-dioxin in phenoxy acid herbicide applicators and characterization of historical levels,* National Cancer Institute Vol 84, p1648-53, Journal.

which workers' had blood TCDD levels of up to 32000 ppt. Certain groups of humans, particularly the Ranch Hand sprayers of Agent Orange in the Vietnam War, are known to have accumulated TCDD levels of up to 1530 ppt in their bodies without demonstrating a risk to any form of cancer attributable to TCDD.

TCDD is only one of a group of 75 dioxins but it is the most toxic and the one being studied first. In addition, there is also a group of 135 closely related chemicals known as furans and some of these will also be studied eventually.

Dr Johnson has had difficulty in completing the study, mainly due to budget problems and has had to curtail some of the analyses. The plan was to analyse the blood of sprayers first and then do the non-sprayers. The budget problems arose after all but four of the sprayers had been analysed for TCDD and when only two non-sprayers had been completed. Dr Johnson is making all endeavours to obtain funds so that the study can be completed as originally planned. An additional problem, which is disappointing, is that not all blood analyses gave a valid result in that, for some unknown reason, the analysis of these samples was not up to standard. It should be appreciated that the tests involved to detect these chemicals at the part per trillion level must be extremely sensitive (1 ppt is one part in 1 million million parts which is equivalent to 1 cm in the distance travelled in making 13 trips to the moon and back). Also in some samples the analysis did not give a definite figure but could only say that the level was "less than a certain figure". This is of limited value because such a result could really mean zero or any value between zero and the figure quoted. The best it does is determine an upper value.

Of the sprayers in this study for whom definite levels were obtained, the highest TCDD level was 33.7 ppt, the lowest was 2.1 ppt and the average 6.9 ppt. Except for the sprayer with the level of 33.7 ppt, all others were less than 20 ppt. It is of interest that with the one exception the TCDD blood level of former sprayers is within the range normally found in the general population (i.e. less than 20 ppt). In this study the two controls analysed had levels of 1.6 ppt and "less than 15.7 ppt".

For sprayers first exposed before 1975, appreciable time had elapsed between when they last sprayed and when the blood sample was taken, and, therefore, their blood TCDD level at the time of blood draw is not a good indicator of the degree of past exposure. Obviously, a better indication is the blood TCDD level at the time of ceasing spraying. These levels can be estimated for the sprayers in this study using an estimated rate of loss of TCDD from human bodies calculated from other studies. If these estimates are correct it appears that workers in this study who sprayed before 1975 could have had, at the time they stopped spraying, blood TCDD levels as high as 329 ppt, and possibly higher if they were exposed for many years during this period. On the other hand, those who first sprayed after 1975 all had levels below 20 ppt which is comparable with levels found in the general population.

As a general conclusion, it can be said that our sprayers who applied phenoxy acid herbicides prior to 1975 could have been significantly exposed to TCDD, giving a level at the time greater than that found in the general population. However, there is no definite evidence that this increased level has caused health problems. The lower TCDD levels found in sprayers first exposed after 1975 suggests that action in the early 1970s to reduce the level of TCDD contamination of 2,4,5-T was effective in reducing the level appearing in the blood of these sprayers.

Dr Johnson is preparing this material for publication in a scientific journal and I will send you a copy when to appears. He is also endeavouring to obtain further funds to complete the study along with the original lines. I will keep you informed of any new results as soon as I obtain them.

Both Dr Johnson and I are disappointed that it has taken so long to get these results to you.

Thank you again for your willing co-operation in the study.

Yours sincerely,

W.T. PARSONS

Your own results: The TCDD concentrations in your blood serum was 2.8 ppt.

Figure 10.2 Letter to participants of international blood serum study – TCDD.

(g) Oxis study

In early 1992, a meeting was scheduled between the Minister and Dr Yossi Berger (AWU) where Dr Berger raised these eight specific concerns[815], including the medical testing and monitoring by the Department.[816]

While an earlier briefing was dismissive of the value of medical testing, the Department was later supportive of engaging Professor John Bisby from Oxis Pty Ltd to undertake further health surveillance of Department staff.

Published in September 1992, Professor Bisby's *Health Surveillance Report on Pesticide Applicators*, involved 53 workers. With respect to health effects, his report noted that, 'the employees at the Ballarat depot in particular expressed a high degree of concern and anxiety about the health effects of chemical exposures at work.'[817]

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[815] 1. Chemical safety; 2. Differences in philosophy (scientific proof) compared to sufficient doubt (death while waiting); 3. Medical testing and monitoring by the department; 4. Work in unventilated sheds; 5. A.W.U difficulties in respect to negotiations with the Department; 6. Requirement of a permanent register of injury and disease; 7. Research in terms of contamination monitoring and epidemiology, etc; 8. Ongoing training.

[816] The Australian Workers' Union,1992, *Meeting between the Minister for Conservation & Environment & Dr. Yossi Berger, Industrial Officer (Health & Safety), A.W.U. Occupational Health and Safety Unit – 14 February 1992,* Agenda.

It was also noted that the Ballarat group presented the highest rate of symptoms and it was recommended follow-up to determine why. The Inquiry was unable to find any later documents that analysed this. The most reported complaint was headaches.

On 5 November 1992, a staff member provided his views on the report noting, 'it is not unreasonable to suggest that the surveyed sample is indicative of the population of DCNR Award Staff'.[818] He recommended relevant staff meet to discuss the report, the Department meet with the AWU, and that an abridged version of the study go to staff and Award employees.

The Department's Safe Use and Handling of Pesticides course was scheduled for various locations across the regions in November 1992[819] and trainers were provided a copy of the Oxis Report to consider. The AWU was involved in delivering specific modules of the course.

An internal review of this course was finalised in April 1993.[820] By that time, 800 staff had undertaken the three-day course.

The report recognised the continuing obligation to train staff in pesticide use. Of relevance the review noted that:

> *The issue of chemical safety is extremely important to the Department as a whole. In the recent past (1985–1990) staff training in pesticide handling and use has been given a relatively low priority. Much of our equipment is outdated while the storage and handling techniques can be markedly improved. One way to achieve this is to instil in regional staff the seriousness of the pesticide issue and the high priority it commands in relation to work and public safety*.[821]

Chapter 8 provides further analysis of the Department training programs.

INJURY REPORTING IN THE 1980S

While limited documents were available to assess injuries reported in the 1980s the *Wells Review* made a number of observations regarding reporting of injuries, which are of assistance.[822] For example, only three claims for headaches and dermatitis were made in 1986–87. In addition, it stated:

> *Strategies for minimizing work injuries are developed and there has been no claim for long term years or serious injury for over 10 years*.[823]
>
> *The Review considers that these channels of communication are adequate if workers wish to make use of them but, to ensure good staff relationships, management would be advised to make enquiries of their own*.[824]

Additionally, there were other specific health concerns raised that were addressed. For example, in September 1992 there was concern expressed at a Dandenong Regional OHS meeting about pregnant workers spraying chemicals.[825] It was decided that, even though the chemicals weren't unsafe, they would not be required to spray.[826]

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817 Department of Conservation and Environment, 1992, *Health Surveillance Report on Pesticide Applicators, Department of Conservation and Environment, Ballarat Horsham Benalla Kerang*, prepared by John Bisby, Oxis Pty Ltd, Report.

818 Department of Conservation and Natural Resources , 1992, *Health Surveillance Examination Report,* Memorandum, p3.

819 Department of Conservation and Natural Resources, 1992, *Review of the Safe use and Handling Course*, Memorandum.

820 Department of Conservation and Natural Resources, 1993, *Safe Use and Handling of Pesticides Course Review – April 1993*, Report.

821 Department of Conservation and Natural Resources, 1993, *Safe Use and Handling of Pesticides Course Review – April 1993*, Report, p3.

822 Department of Conservation, Forests and Lands and Wells GJ, 1988, *Review of the Use of Pesticides in the Department of Conservation, Forests and Lands,* Report p54-55.

823 Department of Conservation, Forests and Lands and Wells GJ, 1988, *Review of the Use of Pesticides in the Department of Conservation, Forests and Lands*, Report, p55.

824 Department of Conservation, Forests and Lands and Wells GJ, 1988, *Review of the Use of Pesticides in the Department of Conservation, Forests and Lands*, Report, p55.

825 Department of Conservation and Environment, 1992, *Dandenong Regional Occupational Health and Safety Meeting Minutes of Meeting Held on 3 June 1992*, Minutes, p1.

826 Department of Conservation and Environment, 1992, *Departmental OHS Committee Minutes of Meeting Held on 25 June 1992,* Minutes.

WORKERS COMPENSATION CASES

Over the period of review, there were a number of workers compensation claims and the Department accepted liability for acute conditions in some cases.

As part of the Inquiry process, both the Victorian Managed Insurance Authority (VMIA), which is the successor in law to the SIO, and WorkSafe Victoria, provided the Chair information about previous claims. Unfortunately, a number of the VMIA's pre-1999 claim files had been 'destroyed' so it could only provide limited information.[827] The VMIA was able to identify eight claims lodged between 1983 and 2013, of which three specifically identified 2,4,-D and 2,4,5-T as a cause of injury. None of the eight claims were within the Ballarat region areas.

Fortunately, the Department had previous SIO correspondence from 1982, identifying nine injury claims arising wholly or in part from contact with herbicide sprays between 1972 and 1981.[828] Liability was accepted for three of these, for skin rash, and one for toxic effects that led to three weeks in hospital. Liability was denied in the other five cases. The records provided do not specify where in Victoria these workers were based.

WorkSafe Victoria was able to advise that they were aware of one claim from the Ballarat region in 1989.[829]

Findings

1965 to 1979

- Both the science of the time, and advice from the Department of Health maintained that the pesticides presented a low risk.
- There were few reported cases of pesticide-related injuries over the Period.
- The Department responded to these cases in a timely manner.
- The Department didn't enforce PPE use. However, this was understandable given its knowledge at the time, and the low numbers and types of injuries.

1980 to 1995

- The Department was made aware of possible links to cancer of 2,4-D and 2,4,5-T.
- The Department supported further research in the 1980s but could have better communicated the results to staff. It appears that information passed on to inspectors was assumed to be passed on to sprayers.
- There was some delay in making PPE compulsory after the Department became more aware of the risks.
- The Department undertook internal reviews on pesticide use but there is limited evidence on how of if it implemented any recommendations.
- It's unclear why the Department of Health did not implement a Cabinet decision to provide staff urine testing to monitor sprayers' health.

[827] Victorian Managed Insurance Authority, 2015, *Former Lands Department Chemical Inquiry,* Letter.

[828] State Insurance Office, 1982, *Workers' Compensation Claims – Herbicides, 3 December 1982,* Letter.

[829] WorkSafe Victoria, 2015, *Former Lands Department Inquiry*, Email.

Chapter 11: Exposure and potential health risks

TERMS OF REFERENCE

As part of its Terms of Reference, the Former Lands Department Chemical Inquiry was asked to:

> *Investigate the likely exposures of employees of the former Victorian Department of Crown Lands and Survey (and its successor departments) to 2,4-D and 2,4,5-T between 1965 and 1995 in Ballarat and surrounding areas to understand the potential health risk.*

Key Messages

- It's impossible to calculate individual exposure to risk due to incompleteness of the data. Using an independent expert, however, the Inquiry was able to estimate exposure scenarios based on the best available evidence and applying conservative assumptions to ensure that exposures were not underestimated.
- Evidence on potential health effects is ambiguous but, given the estimated exposures, the Inquiry makes the following conclusions:
  - Exposure to 2,4-D is unlikely to be linked to cancer or illness other than dermatological.
  - Exposure to TCCD (through it being a contaminant of 2,4,5-T) was in excess of today's exposure standard during the spraying seasons before 1981.
  - It is plausible that sprayers (pre-1981) who contracted soft tissue sarcomas or non-Hodgkin lymphoma may have contracted these cancers from their exposure to TCDD.
- While possible, there is insufficient data/evidence to conclude TCDD exposure caused any other cancers.

INTRODUCTION

This chapter considers the potential health risks to the Department's employees as a result of their exposure to the chemicals 2,4-D and 2,4,5-T (including its contaminant TCDD).

In order to assess a potential human health hazard, data are required on both the toxicity of the chemicals used and the level of exposure of the individual workers to those chemicals. In order to assess the potential health risk associated with the use of 2,4-D and 2,4,5-T by the employees of the Department, the Inquiry would ideally have identified the quantity and quality of each of the chemicals used in each of the depots' functions, *viz* storage, handling, mixing and spraying. However, the necessary records were not available for the establishment of such a comprehensive data set. Instead, the Inquiry has relied on:

- work examples from within the Ballarat region
- inspector's monthly usage reports
- documentary evidence of Department work practices
- work examples from other districts and work centres
- examples of entry work and spray programs addressing similar weed programs
- interviews and submissions.

While there were a lot of records available, most of these covered Department purchases and sales and were not in the level of detail required for exposure calculations. Most of the data we found lacked either one or more of the crucial elements – spray method, time spent spraying, weather conditions, mix ratio, if they were mixing or spraying – needed to accurately calculate actual exposures. Even where detailed records of chemical volumes used were available, it's still not possible to establish:

- how exposure impacted on individuals
- what their susceptibility was

- how each individual approached chemical management and PPE use.

The best available information was monthly inspector records for the Ararat depot available for calendar years between 1965 and 1981. An independent expert was commissioned to use the data for 1967–68 and 1975–76 to estimate exposure rates for the period to 1981, and to extrapolate these to form estimates for the period 1982 to 1995.

Even so, much of the data is either anecdotal or based on reports of group activities. Accordingly, the Inquiry conclusions are generally qualitative, rather than quantitative, with potential adverse health outcomes only to be stated in terms of risk rather than causation. Given the limited information, the estimates of exposure are approximate only. These are set out in Tables 11.1 and 11.2 and discussed further, below.

EXPOSURE CALCULATIONS

Exposure calculations were developed for the following three periods:

- 1965 to 1975 (there were no Australian Standards/laws for the level of TCDD in 2,4,5-T)
- 1975 to 1981 (Australian Standards/laws specified a maximum limit of 0.1 ppm of the TCDD in 2,4,5-T)
- 1982 to 1995 (Australian Standards/laws specified a maximum limit of 0.01 ppm of the TCDD in 2,4,5-T)

The assumptions for these three periods make no allowance for the use of stock from prior periods. If this did occur, it is probable that it was small quantities.

To arrive at estimates of exposure of workers to herbicides and the impurities they may contain for each of these periods a number of assumptions have to be made. Conservative assumptions have been made and the reasons for the making these assumptions are provided in the following sections.

The starting points for the assessments that follow are the volumes of herbicides sprayed by an average worker. The averages are calculated from data reported by inspectors. While the average is a useful quantity it does not allow the exposure estimate to account for possible impacts on sprayers who were exposed to a greater or lesser extent. Accordingly, the assessment also includes estimates of high and low exposure scenarios.

To support the exposure calculations, the following criteria were used:

Three levels of exposure (no distinction between mixers or sprayers) per year:

- average
- high (worst case scenario)
- low (best case scenario).

Where average is based on:

- number of workmen and spray volumes used
- average working days per year
- 20 days spraying per month
- most common dilution factor recommended by the VNWDB for the period
- assuming 0.1% of the volume sprayed by a worker comes into contact with skin
- TCDD concentration in 2,4,5-T herbicides was ≤0.1 ppm up to 1981 and ≤0.01 ppm thereafter
- approximately 3% of TCDD contacting skin is absorbed into the body.

High estimates take into account larger than average spray volumes and scenarios where there is:

- more spraying days and hours than average and with stronger solutions
- TCDD concentration above regulatory limits
- above-average exposure via spills or leaks or greater skin absorption
- less use of PPE or less effective PPE
- variations in work practices
- longer periods between washing or change of clothing that prolonged contact with the herbicide.

Low estimates cover situations where contacts are below average and there are:

- fewer spraying days/hours per year
- weaker solutions
- below average exposure to spills and leaks and less skin absorption
- more effective PPE and more frequent use
- more frequent washing and change of clothing.

Weeds sprayed – the most significant ones were:

- Blackberry bramble
- Furze (Gorse)
- Sweet briar
- Ragwort
- Variegated thistle.

Where the targeted weed in a spray calculation is not known, assumptions in the calculations are based on the most common chemical dilution rates at that time.[830] These input assumptions were provided to an independent expert to calculate the likely exposures of employees to 2,4-D and 2,4,5-T, and to identify the potential health risks associated with that exposure (see Appendix 4 and 5 for full reports).

Data validation

To validate the information provided to the independent expert for input into calculating volumes of diluted spray (Litres/man/day) used for the exposure estimates in Tables 11.1 and 11.2, the assumptions were stress-tested against additional data. Annual volumes reported for the Ballarat district were found for some years (four years for 2,4-D and five years for 2,4,5-T) and the Inquiry examined the most recent full year of Ararat data for 1980–81.

Results from the data validations provide the necessary assurance that the assumptions used in the exposure calculations are robust.

Using the Ballarat district annual data, where only total volumes were known, calculations assumed that all chemicals used were of the 80% ester (highest acid content and volatility) and that recommended mixing ratios were used. This means all calculations err on the high side.

Although it is known that in some years there were additional workers employed through various employment schemes (e.g. RED scheme, Labour Pool, Special Entry Scheme and Mobile Gangs) to deal with the high seasonal demand (see Chapter 3), the records did not specifically identify these. Therefore for the four and five years, respectively, volumes were divided by 42 employees – the only accurate number available to the Inquiry for 1980. By excluding any additional workforce in these calculations, it produced numbers higher than reality but despite this, the results fell within the exposure ranges in the tables.

Calculating an additional year of 1980–81 data from the Ararat monthly inspectors reports, when pre-mixed products were included (i.e. Tordon 50D with a 2,4-D content of 75%) the calculations assumed 100% 2,4-D content. Although this overstated the reality of the chemical content for 2,4-D, all the averages calculated for it fell within the high and low ranges in Table 11.1.

For 2,4,5-T all calculations were well within the high and low value exposure range in Table 11.2 for all periods.

TCDD concentrations over the period of the Inquiry varied over time as knowledge about herbicides and the ability to measure contaminant levels increased. By drawing on international assessments and data collected between 1965 and 1969, TCDD concentration in commercial 2,4,5-T formulations is estimated to have been 0.5–0.1 ppm and between 1970 and 1974 it is assumed the contamination level dropped to, or below, 0.1 ppm.

By the mid-1970s, Australian law required the TCDD content in 2,4,5-T to not exceed 0.1 ppm, by the 1980s this was reduced to 0.01 ppm. These standards have been used by the independent expert for exposure calculations.

[830] Refer Appendix 6.4 and 6.5 for full detail of Assumptions

Table 11.1 Exposure to 2,4-D herbicides

	Period 1965 to 1974	1975 to 1981	1982 to 1995
Common dilution	1:400	1:300	1:300
Volume of diluted spray L/man/day	High 40 Average 18 Low 6	High 110 Average 47 Low 12	High 110 Average 47 Low 12
Quantity of herbicide g/man/day (0.2% solution)	High 80 Average 36 Low 12	High 220 Average 94 Low 24	High 220 Average 94 Low 24
Skin contact g/man/day	High 0.08 Average 0.036 Low 0.012	High 0.22 Average 0.094 Low 0.022	High 0.22 Average 0.094 Low 0.022
2,4-D absorbed µg/kg/bw/day 80kg person	High 0.03 Average 0.013 Low 0.0045	High 0.0825 Average 0.035 Low 0.00825	High 0.0825 Average 0.035 Low 0.00825

The average level of exposure to 2,4-D in the first decade is approximately the same as the reference dosage (RfD) or acceptable daily intake (ADI) published by the US EPA[831] and three-times that level in the subsequent decades. It is eight times greater in the high exposure scenarios. This nevertheless equates to one-tenth the no observed adverse effect level (NOAEL) also published by the US EPA and, as such, is below the level where there has been any adverse effects noted in the research.

Table 11.2 Exposure to 2,4,5-T herbicides and TCDD

	Period 1965 to 1974	1975 to 1981	1982 to 1995
Diluted spray volume L/man/day	High 300 Average 96 Low 10	High 350 Average 120 Low 30	High 350 Average 120 Low 30
Quantity of herbicide sprayed g/man/day (0.2% solution)	High 600 Average 192 Low 20	High 700 Average 240 Low 60	High 700 Average 240 Low 60

[831] US EPA, 2015, *Integrated Risk Information System, 2,4-Dichlorophenoxyacetic acid (2,4-D) (CASRN 94-75-7).* <http://www.epa.gov/iris/subst/0150.htm> [accessed 9 November 2015].

	Period 1965 to 1974	1975 to 1981	1982 to 1995
Skin contact 0.1% of sprayed solution mg/man/day*	High 600 Average 192 Low 20	High 700 Average 240 Low 60	High 700 Average 240 Low 60
Expected TCDD content in 2,4,5-T	≤ 0.1 ppm	≤0.1 ppm	≤0.01 ppm
TCDD exposure ng/man/day*	High 60 Average 19 Low 2	High 70 Average 24 Low 6	High 7 Average 2.4 Low 0.6
TCDD absorbed through skin ng/man/day	High 1.8 Average 0.57 Low 0.063	High 2.1 Average 0.72 Low 0.18	High 0.21 Average 0.072 Low 0.018
TCDD intake pg/kg bw/month* (80 kg person spraying for 20 days/month)	High 450 Average 144 Low 15	High 525 Average 180 Low 45	High 52.5 Average 18 Low 14.5

*note change of limit

The results of the exposure scenarios to 2,4,5-T and its contaminant TCDD in Table 11.2 need to be considered against today's acceptable standards for the tolerable monthly intake.

Tolerable monthly intake (TMI) and tolerable daily intake (TDI) for TCDD

The health risks posed by exposure to dioxins were studied for many years before regulatory authorities in the US began recommending limits on TCDD contamination levels in 2,4,5-T in 1971.[832] The TMI for dioxins recommended by Australian Authorities in 2002 (reported in the National Dioxin Study 2004) was 70pg/kg bw/month based on International Agency for Research on Cancer (IARC) published examples from 1997. Community exposures at the time were not greater than 15 pg/kg bw/month but sprayers probably experienced greater exposure.

Comparing estimated exposure figures with the TMI is probably valid for months where exposure occurred on all 20 working days. However, this is a quite conservative approach, since the TMI is based on an estimated continuous exposure over a lifetime. It may be just as appropriate to compare the TMI, to an exposure estimate adjusted by averaging the four to six months of the year that spraying actually occurred, with a further adjustment averaging the exposure over a lifetime. This would be achieved by multiplying the exposure estimates by 0.5 (6–12 months spraying) and 5/70 years (the average proportion of the lifespan that spraying occurred). Such an approach would be consistent with an assumption that intermittent exposure would be less harmful than sustained exposure over a lifetime.

[832] US EPA, 1971, *Report of the Advisory Committee on 2,4,5-T to the Administrator of the US EPA,* Report.

Findings

- The exposure to 2,4-D, while higher than the ADI in the later years and in the high scenarios, was well below the NOAEL for the whole Period.
- In the first two decades of the Period, the TMI of TCDD in Table 11.2 was 2 to 2.5 times Australia's current TMI during the spraying season (70 pg /kg bw/month) and substantially below the TMI in 1982–1995.
- The estimated high exposure scenarios result in a TCDD TMI of six to eight times the TMI in the early years, and well below the TMI from 1982.

POTENTIAL HEALTH RISKS

Because sprayers were exposed to 2,4-D and 2,4,5-T there is potential for their health to be affected in ways described in the scientific literature. This assessment of potential health risk is based on today's knowledge. Understanding of the potential health effects has increased over time as international concern over the toxicity of herbicides has grown.

The value of epidemiological studies and the difficulty of drawing direct causal links was addressed by Dr J.D. Mathews of the Menzies School of Health Research in the Northern Territory:

> *Although a chemical exerts its effect at the time of exposure, the recognition of the effect may be delayed over time. If any exposure is suspected of causing an increased risk of a disease which is also frequent in the unexposed, then it is almost invariably difficult to be sure whether there is a real increase in those who have been exposed. Even if a real increase is apparent in those exposed, it may be difficult to decide whether the increase was actually caused by the exposure in question, or whether it might have been due to some (other) unrecognised difference between the exposed and unexposed*.[833]

This difficulty establishing links between cause and effect for cancer was noted in a report by the Australian Institute of Health and Welfare, Cancer in Australia: an overview 2010.[834]

> *It should be noted that having a risk factor does not mean that a person will develop cancer. Many people have at least one cancer risk factor but will never get cancer, while others with this disease may have had no known risk factors.*

The recent decision by the IARC in 2015 to classify 2,4-D as 'possibly carcinogenic to humans', draws attention to possible chronic health impacts of exposure to this herbicide.[835]

2,4,5-T is no longer used as a herbicide in most countries and therefore less data is available today. The latest IARC Monograph[836], in 1986 concluded that there was 'limited evidence that occupational exposures to chlorophenoxy herbicides are carcinogenic to humans'. (The main emphasis for toxicity of 2,4,5-T has been on the contaminant TCDD.) Some health outcomes experienced by sprayers have, from time to time, been linked to exposure to particular chemicals, however, skin complaints such as chloracne are the only ones for which a firm connection has been established to the TCDD impurity in 2,4,5-T.[837]

TCDD has been classified as 'carcinogenic to humans' by the IARC since 1997 although some questions remain about the strength of evidence of association between exposure to TCDD and the range of health outcomes stated.[838]

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[833] Mathews, J, 1989, *Pesticides – Are they a threat to our Health?*, Weed Society of Victoria Inc., The Role of Epidemiology, Menzies School of Health Research, Casurina, Northern Territory, Seminar Proceedings, p12.

[834] Australian Institute of Health and Welfare, 2010, *Cancer in Australia: an overview 2010. Cancer series no. 90. Cat. no. CAN 56. p3, <http://www.aihw.gov.au/publication-detail/?id=6442472459>* [accessed 14 October, 2015].

[835] Loomis, D. et al., 2015, *Carcinogenicity of Lindone, DDT and 2,4-dic hlorphenoxyactic acid*, Lancet Oncology vol 16(8), p891-892, Journal.

[836] International Agency for Research on Cancer, 1986, *Monograph No. 41*, Monograph.

[837] Refer Appendix 5, Potential Health Risks.

[838] Refer Appendix 5, Potential Health Risks.

While exposures estimated for workers spraying are, for the most part, above the TDI, the TDI contains several 'precautionary' factors. The estimated exposures of the sprayers are probably low when compared to those of workers involved in the manufacture of 2,4,5-T included in the TDI assessment.

Because of uncertainties in the data available, a conservative approach has been taken on the assumptions and inputs in calculating exposure to ensure that exposures were not underestimated.

Findings

2,4-D:

- Although exposure may have given sprayers skin and eye irritations, their exposure levels were probably well below that of the production workers who triggered the IARC to classify 2,4-D as possibly carcinogenic to humans. The conclusion there was a link to non-Hodgkin lymphoma which based on mixed results that indicate a low potential for cancer formation.

2,4,5-T:

- Sprayers may have experienced irritation to skin and eyes from inadvertent exposure. Evidence of 2,4,5-T's carcinogenicity is lacking so no conclusion can be reached about chronic effects of exposure to it.

TCDD:

- Exposure to 2,4,5-T and its dioxin TCDD present the potential for sprayers to contract soft tissue sarcoma or non-Hodgkin lymphoma.
- The potential health risk would have been greater before TCDD levels in 2,4,5-T were reduced in 1982.
- Due to its contamination with TCDD, it's plausible that a number of years spent spraying 2,4,5-T could contribute to soft tissue sarcoma or non-Hodgkin lymphoma.
- The data isn't strong enough to conclude that exposure may lead to other cancers.

Recommendations

- Update the 1982 epidemiological study of the Health Effects of Workers of sprayers between 1951 and 1970 to better estimate the health outcomes for a longer latency period.
- Check sprayers for a history of chloracne and the incidence of soft tissue sarcoma and non-Hodgkin lymphoma.

Part 4: Appendices

Appendix 1: Acts, Regulations and Australian Standards reviewed or referenced in Chapter 6

Bolded entries denote Principal Acts

Appendix 1.1: Land management acts and regulations

Land Act 1958

Vermin and Noxious Weeds Act 1958

Vermin and Noxious Weeds Act 1959

Vermin and Noxious Weeds Act 1970

Vermin and Noxious Weeds (Amendment) Act 1971

Vermin and Noxious Weeds (Amendment) Act 1979

Vermin and Noxious Weeds (Amendment) Act 1983

Vermin and Noxious Weeds (Amendment) Act 1985

Vermin and Noxious Weeds (Poison Baits) Act 1992

Conservation, Forests and Lands Act 1987

Appendix 1.2: Fungicides and pesticides acts and regulations

Aerial Spraying Control Act 1966

- *Aerial Spraying Control Regulations 1966*
- *Aerial Spraying Control (Amendment) Regulations 1968*
- *Aerial Spraying Control (Amendment) Regulations 1971*

Health Act 1928 and Health Act 1953

- *Pesticide (Manufacture and Preparation) Regulations 1953*

Health Act 1958

- *Pesticides (Use Of) Amendment Regulations 1963*
- *Harmful Gases, Vapours, Fumes, Mists, Smokes and Dusts (Amendment) Regulations 1965*
- *Pest Control Operators Regulations 1972*
- *Health (Harmful Gases, Vapours, Fumes, Mists, Smokes and Dusts) Regulations 1984*
- *Health (Pesticide Manufacture and Preparation) Regulations 1984*

Fungicides Act 1916

Fungicides Act 1928

Fungicides Act 1935

Fungicides Act Proclamation 1936

Fungicides Act 1958

- *Fungicides Registration (Amendment) Regulations 1964*

Pesticides Act 1958

- *Pesticides Regulations 1966*
- *Pesticides (Amendment) Regulations 1965 (No. 1)*

Pesticides Act 1964

- *Pesticides (Amendment No. 1) Regulations 1968*
- *Pesticides (Amendment) Regulations 1973*
- *Pesticides Regulations 1976*

Pesticides (Amendment) Act 1967

Pesticides (Proclamations) Act 1968

Pesticides (Amendment) Act 1972

Pesticides (Amendment) Act 1974

Pesticides (Amendment) Act 1976

Agricultural Chemicals Act 1958

Agricultural Chemicals Act 1980

- *Agricultural Chemicals Regulations 1981*
- *Pesticides (Amendment) Regulations 1982*

Agricultural and Veterinary Chemicals Act 1992

- *Agricultural Chemicals (Amendment) Regulations 1994*
- *Agricultural and Veterinary Chemicals (Infringement Notices) (Amendment) Regulations 1995*
- *Agricultural and Veterinary Chemicals (Infringement Notices) (Further Amendment) Regulations 1995*

Agricultural and Veterinary Chemicals (Control of Use) Act 1992

Agricultural and Veterinary Chemicals (Victoria) Act 1994

Poisons Act 1962

- *Poisons Regulations 1963 (No. 1)*
- *Poisons Regulations 1963 (No. 2)*

Poisons Act 1962 Proclamation of 1979

Drugs, Poisons and Controlled Substances Act 1981

Drugs, Poisons and Controlled Substances (Amendment) Act 1994

Appendix 1.3: Occupational health and safety acts and regulations

Labour and Industry Act 1958

Labour and Industry Act 1965

Labour and Industry Act 1977

Labour and Industry Act 1978

Industrial Safety Advisory Council Act 1960

Industrial Safety, Health and Welfare Act 1981

Occupational Health and Safety Act 1985

Occupational Health and Safety (Miscellaneous Amendment) Act 1990

Occupational Health and Safety (Miscellaneous Amendment) Act 1993

Inflammable Liquids Act 1966

Dangerous Goods Act 1985

- *Dangerous Substances (Placarding of Workplaces) Regulations 1985*
- *Dangerous Goods (Storage and Handling) Regulations 1989*
- *Pathology Services Accreditation (General) Regulations 1990*

Poisons Act 1962

- *Poisons Regulations 1963 (No. 1)*
- *Poisons Regulations 1963 (No. 2)*

Health Act 1958

- *Harmful Gases, Vapours, Fumes, Mists, Smokes and Dusts (Amendment) Regulations 1965*
- *Health (Harmful Gases, Vapours, Fumes, Mists, Smokes and Dusts) Regulations 1984*

Appendix 1.4: Commonwealth legislation and codes

Agricultural and Veterinary Chemicals (Administration Act) 1992 (Cth)

Agricultural and Veterinary Chemicals Act 1994 (Cth)

Agricultural and Veterinary Chemicals Code Act 1994 (Cth)

National Code of Practice for the Control of Workplace Hazardous Substances 1994 (Cth)

Trade Practices Act 1974 (Cth)

Appendix 1.5: Workers compensation acts and regulations

Workers Compensation Act 1958

Workers Compensation (Amendment) Act 1965

Workers Compensation Act 1973

Workers Compensation (Amendment) Act 1975

Workers Compensation (Amendment) Act 1978

Workers Compensation (Special Provisions) Act 1978

Workers Compensation (Miscellaneous Provisions) Act 1979

Workers Compensation (General Amendment) Act 1980

Workers Compensation (Actions) Act 1981

Workers Compensation (Amendment) Act 1981

Workers Compensation (Amendment) Act 1982

Workers Compensation (Benefit Rates) Act 1982

Workers Compensation (Amendment) Act 1984

- *Workers Compensation Regulations 1995*

Accident Compensation Act 1985

Accident Compensation (Amendment) Act 1986

Accident Compensation (Amendment) Act 1987

- *Accident Compensation Regulations 1990*

Accident Compensation (Workcover) Act 1992

Accident Compensation (Further Amendment) Act 1992

Accident Compensation (Workcover Insurance) Act 1993

Accident Compensation (Amendment) Act 1994

Appendix 1.6: Civil proceedings

Limitation of Actions Act 1958

Limitations of Actions (Personal Injury Claims) Act 1983

Wrongs Act 1958

Appendix 1.7: Public service and record retention legislation

Public Service Act 1958

Public Records Act 1973

Appendix 1.8: Australian Standards

Year	Standard
1951	AS B99-1951 *Part 1-Personal eye and face protectors for occupational applications*
1952	AS Z4-1952 *Specification for industrial leather gloves and mittens*
1952	AS CZ5-1952 *General principles for safe working in industry*
1960	AS CZ11-1960 *Code of recommended practice for respiratory protective devices*
1963	AS Z18-1963 *Respiratory protective devices*
1963	AS Z4-1963 *Specification for industrial safety gloves and mittens of leather, PVC and rubber excluding electrical and medical gloves*
1964	AS CA18-1964 *Australian standard rules for the maintenance of portable fire extinguishers and fire hose reels*
1965	AS N50-1965 *Hormone weed killers of the phenoxyacetic acid type*
1966	AS CZ6-1966 *Standard code of recommended practice for recording and measuring work injury experience*
1966	AS L26 to L30-1966 *Men's industrial clothing made from pre-shrunk cotton cloth* AS L26-1966 *Men's work trousers made from pre-shrunk cotton cloth* AS L27-1966 *Men's bib and brace overalls made from pre-shrunk cotton cloth* AS L28-1966 *Men's coveralls made from pre-shrunk cotton cloth* AS L29-1966 *Men's dustcoats made from pre-shrunk cotton cloth* AS L30-1966 *Men's workshirts made from pre-shrunk cotton cloth*
1967	AS K159-1967 *Recommended common names for pesticides*
1967	AS Z7-1967 *Specification for personal eye protectors*
1967	AS CZ7-1967 *Code of recommended practice for industrial eye protection*
1968	AS Z18-1968 *Specification for respiratory protective devices*
1968	AS CZ5-1968 *General principles for safe working in industry*
1968	AS C11-1968 *Code of recommended practice for respiratory protective devices*
1968	AS Z3-1968 *Safety boots and shoes fitted with protective steel toe-caps*
1973	AS 1470-1973 *General principles for safe working in industry*

Year	Standard
1974	AS 1337-1974 *Eye protectors for industrial applications*
1974	AS 1339-1974 *Manual handling of materials*
1975	AS 1715-1975 *Code of practice for respiratory protection*
1975	AS 1716-1975 *Specification for respiratory protective devices*
1975	AS 1719-1975 *Recommended common names for pesticides*
1976	AS 1175-1976 *Herbicides of the phenoxyacetic acid type*
1976	AS 1216-1976 Part 1-*Safe handling of dangerous goods, Part 1 – Classification and class labels for dangerous goods*
1976	AS 1216.1-1976 *Class labels for dangerous goods*
1978	AS 2161-1978 *Industrial safety gloves and mittens (excluding electrical and medical gloves)*
1980	AS 2375-1980 (in part) *Guide to the selection, care and use of clothing for protection against heat and fire*
1980	AS 2210-1980 *Safety footwear (incorporating amendments 1 and 2)*
1981	AS 1719-1981 *Recommended common names for pesticides*
1981	AS 1337-1981 *Eye protectors for industrial applications*
1981	AS 2507-1981 *The storage and handling of pesticides*
1981	AS 1216.1-1981 *Classification, hazard identification and information systems for dangerous goods. Part 1 – Classification and class labels for dangerous goods*
1981	AS 1216.2-1981 *Classification, hazard identification and information systems for dangerous goods – HAZCHEM emergency action code (withdrawn)*
1981	AS 1216.3-1981 *Classification, hazard identification and information systems for dangerous goods – NFPA hazard identification system (withdrawn)*
1981	AS 1216.4-1981 *Classification, hazard identification and information systems for dangerous goods – UN substance identification numbers (withdrawn)*
1981	AS 1216.1-1981 *Classification, hazard identification and information systems for dangerous goods – Classification and class labels for dangerous goods*
1982	AS 1336-1982 *Recommended practices for eye protection in the industrial environment*
1982	AS 1715-1982 *Selection, use and maintenance of respiratory protective devices*

Year	Standard
1982	AS 1716-1982 *Respiratory protective devices*
1984	AS 1716-1984 *Respiratory protective devices*
1984	AS 2507-1984 *The storage and handling of pesticides*
1984	AS 1337-1984 *Eye protectors for industrial applications*
1984	AS 1216.1-1984 *Classification, hazard identification and information systems for dangerous goods – Classification and class labels for dangerous goods*
1985	AS 1678.10.001-1985 *Emergency Procedure Guide – transport 10.001 – pesticides*
1986	AS 1470-1986 *Health and safety at work – principles and practices*
1986	AS 2508.10.001-1986 *Safe storage and handling information card – pesticides*
1988	AS 1940-1988 *The storage and handling of flammable and combustible liquids*
1990	AS 3765.1-1990 *Clothing for protection against hazardous chemicals. Part 1: Protection against general or specific chemicals*
1990	AS 3765.2-1990 *Clothing for protection against hazardous chemicals. Limited protection against specific chemicals*
1991	AS 1716-1991 *Respiratory protective devices*
1991	AS 1715-1991 *Selection, use and maintenance of respiratory protective devices*
1992	AS/NZS 1337-1992 *Eye protectors for industrial applications*
1993	AS 1940-1993 *The storage and handling of flammable and combustible liquids*
1994	AS 1719-1994 *Recommended common names for pesticides*
1994	AS/NZ 1716-1994 *Respiratory protective devices*
1994	AS/NZS 1715-1994 *Selection, use and maintenance of respiratory protective devices*
1994	AS/NZS 2210.1-1994 *Occupational protective footwear – Guide to selection, care and use* This joint standard combines revised versions of AS 2210-1980 and NZS 5845-1989.
1994	AS/NZS 2210.2-1994 *Occupational protective footwear – specification*
1994	AS/NZS 1337/Amdt 1/1994-09-19 *Eye protectors for industrial applications*
1995	AS 1216-1995 *Class labels for dangerous goods*

Appendix 2: Summary of regulators

OCCUPATIONAL HEALTH AND SAFETY

Table A2.1 Summary of Victorian State regulators of occupational health and safety

Date	Organisation
1953 – 1985	**Department of Labour and Industry (DLI)** *(administered the Labour and Industry Act and later the Industrial Safety Health and Welfare Act)*
1985 – 1991	**Occupational Health and Safety Commission (OHSC)**, Department of Employment and Industrial Affairs (DEIA) and successor departments, formed when DLI merged with the Ministry of Employment and Training and the Ministry of Industrial Affairs *(administered the Occupational Health and Safety Act)*
1991 – 1995	**Occupational Health and Safety Authority** (**OHSA**), formerly the OHSC, initially within the Department of Labour then the Department of Business and Employment from 1992 *(administered the Occupational Health and Safety Act)*
1995 – 1996	**Health and Safety Organisation (HSO)**, formerly the OHSA, Department of Business and Employment *(administered the Occupational Health and Safety Act)*
1996 – present	**Victorian WorkCover Authority (VWA)** formed when HSO merged with existing VWA, now known as **WorkSafe Victoria** *(administered the Occupational Health and Safety Act)*

Table A2.2 Summary of Victorian State regulators of poisons and dangerous substances

Date	Organisation
1962 – 1978	**Chief Health Officer, Department of Health** *(administered the Health Act and the Poisons Act and associated amendments and regulations)*
1978 – 1985	**Health Commission of Victoria (HCV)**, formerly the Department of Health *(administered the Health Act and the Poisons Act (later the Drugs, Poisons and Controlled Substances Act) and associated amendments and regulations)*
1985 – present	**Health Department**, formerly the HCV and successor departments, now known as the Department of Health and Human Services *(administered the Health Act and the Drugs, Poisons and Controlled Substances Act and associated amendments and regulations)*
1985 – 1996	**Department of Employment and Industrial Affairs** and successor departments *(administered the Dangerous Goods Act)*
1996 – present	**Victorian WorkCover Authority** now known as **WorkSafe Victoria** *(administered the Dangerous Goods Act)*

WORKERS COMPENSATION

Table A2.3 Summary of Victorian State regulators of workers compensation

Date	Organisation
1965 – 1985	Privately underwritten *(administration of the Workers' Compensation Act 1958)*
1985 – 1992	**Accident Compensation Commission** *(administered and regulated WorkCare through the Accident Compensation Act 1985)*
1992 – present	**Victorian WorkCover *Authority*** *was established by the Accident Compensation (WorkCover) Act 1992. The Accident Compensation Commission and the Victorian Accident Rehabilitation Council were abolished by the 1992 legislation.*

CHEMICAL REGISTRATION, APPROVAL AND CONTROL OF USE

*Table A2.4 Summary of Victorian State regulators of chemical registration, approval and control of use**

Date	Organisation
1958 – 1985	**Department of Agriculture** *(responsible for registration and control of use of pesticides under the Pesticides Act after informal (non-statutory) clearance from the Commonwealth from 1969)*
1985 – 1995	**Department of Agriculture and Rural Affairs** and successor departments *(responsible for registration and control of use of pesticides under the Agricultural Chemicals Act and later the Agricultural and Veterinary Chemicals Act after clearance from the Commonwealth (statutory from 1988))*
1995 – present	**Department of Agriculture, Energy and Minerals** and successor departments, now known as **Department of Economic Development, Jobs, Transport and Resources** *(responsible for controlling pesticide use after sale under the Agricultural and Veterinary Chemicals (Control of Use) Act)*

* See also regulators of poisons and dangerous substances.

Table A2.5 Summary of Commonwealth regulators of chemical registration and approval

Date	Organisation
1969 – 1988	**Technical Committee on Agricultural Chemicals** *under the* Standing Committee on Agriculture *(non-statutory role in clearance of pesticides prior to state-based registration)*
1989 – 1992	**Australian and Veterinary Chemicals Council** *(statutory role in clearance of pesticides under the Commonwealth Agricultural and Veterinary Chemicals Act)*
1992 – 2003	**National Registration Authority for Agricultural and Veterinary Chemicals** now known as **Australian Pesticides and Veterinary Medicines Authority** *(responsible for clearance and registration of chemicals nationally under the Commonwealth Agricultural and Veterinary Chemicals (Administration) Act)*

Appendix 3: Summary of written submissions and interviews – process and content

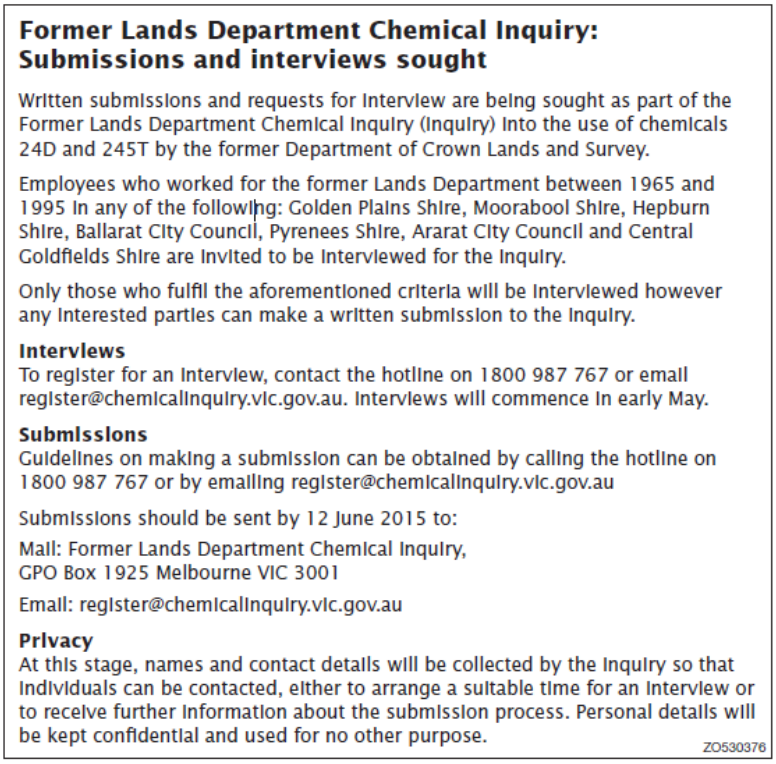
THE PROCESS

The Terms of Reference required the Inquiry to seek information from the community. The Inquiry did this in the following two ways:

1. **One-on-one interviews**: Eligible Department employees or family members were offered a private interview by an organisation specialising in sensitive investigative services. In addition to collecting demographic data, interviewees were asked about their role, the chemicals used, how they were handled and about training, equipment and health. Interviewees were asked only to impart information that they were comfortable providing.
2. **Written submissions**: People were invited to make a written submission. Guidelines (featured at the end of this Appendix) were offered as were the Inquiry's Terms of Reference.

The community was invited to participate in this process in three ways.

- **Public information sessions**: Led by the Chair, sessions in Ballarat, Ararat and Maryborough in March 2015 outlined the Inquiry's Terms of Reference, methodology and timeframes and identified how people could participate.
- **Newspaper advertisements:** Statewide and local paper ads were (see picture) in April 2015 placed in *Herald Sun*, *The Age*, *The Weekly Times*, *Golden Plains Miner*, *Ballarat Courier*, *Ararat Advertiser*,*Stawell Times News*, *Castlemaine Mail*, *The Maryborough District Advertiser* and *Midland Express*.
- **Communications by DELWP:** The Department of Environment, Land, Water and Planning (DELWP) explained the Inquiry and encouraged participation by its staff. It also invited around 500 former staff, who worked in Ballarat and surrounding areas in the late 1980s and 1990s, to participate.



Former Lands Department Chemical Inquiry: Submissions and interviews sought

Written submissions and requests for interview are being sought as part of the Former Lands Department Chemical Inquiry (Inquiry) into the use of chemicals 24D and 245T by the former Department of Crown Lands and Survey.

Employees who worked for the former Lands Department between 1965 and 1995 in any of the following: Golden Plains Shire, Moorabool Shire, Hepburn Shire, Ballarat City Council, Pyrenees Shire, Ararat City Council and Central Goldfields Shire are invited to be interviewed for the Inquiry.

Only those who fulfil the aforementioned criteria will be interviewed however any interested parties can make a written submission to the Inquiry.

Interviews
To register for an interview, contact the hotline on 1800 987 767 or email register@chemicalinquiry.vic.gov.au. Interviews will commence in early May.

Submissions
Guidelines on making a submission can be obtained by calling the hotline on 1800 987 767 or by emailing register@chemicalinquiry.vic.gov.au

Submissions should be sent by 12 June 2015 to:

Mail: Former Lands Department Chemical Inquiry,
GPO Box 1925 Melbourne VIC 3001

Email: register@chemicalinquiry.vic.gov.au

Privacy
At this stage, names and contact details will be collected by the Inquiry so that individuals can be contacted, either to arrange a suitable time for an interview or to receive further information about the submission process. Personal details will be kept confidential and used for no other purpose.

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Anyone interested could register either through a dedicated email address or 1800 number. Eligible Department employees or family members were invited to participate in a private interview. Interested parties outside the Inquiry's Terms of Reference were invited to make a written submission.
To fall within the scope of the Inquiry's Terms of Reference you had to have:

- worked inside the geographic area of interest between 1965 and 1995
- worked for the Lands Department or its successor Departments.

Community members wishing to participate but who had difficulties providing a written submission were invited to sit for a private interview. The interviews and written submissions provided great insights into the work and conditions of the day. Some people also provided copies of personal documents such as diaries, work records and photographs, which proved invaluable.

In accordance with Victorian privacy laws, confidentiality was paramount. All personal information has been de-identified and personal and health information provided by participants will not be used for any other purpose.

Much of the information provided to the Inquiry is based on memories and recollections, often decades after events. However, the Inquiry has, wherever possible, corroborated provided information with evidence from Department and other documents and records of the day.

INTERVIEWEE AND WRITTEN SUBMISSIONS DEMOGRAPHICS

The Inquiry conducted 76 interviews with members of the community. Sixty-six were within the scope and 10 were not. The Inquiry Chair also interviewed three former sprayers from the region.

Interviewees were a mix of former department employees or family members of deceased workers. The former employees were sprayers, leading hands, assistant inspectors, inspectors, drivers and mechanics involved in servicing spray equipment. Thirteen had experience with the Forestry Commission and four were employed through the Government's Regional Employment Development (RED) Scheme in the 1970s. Some started working with the Department in the 1960s, but most commenced in the 1970s or early 1980s.

The Inquiry received twenty-nine written submissions. Twenty-six were from individuals and three from a union, industry or other interested parties. One of these three submissions contained a further twenty-six written case studies of current or former sprayers.

Of the twenty-six written submissions from individuals and twenty-six case studies, ten were within scope of the Inquiry's Terms of Reference and forty-two were not. The remaining were from union, industry or other interested parties and are not summarised in this Appendix.

OVERVIEW OF INFORMATION PROVIDED BY FORMER EMPLOYEES (OR FAMILY MEMBERS OF FORMER EMPLOYEES) WHO WERE WITHIN THE SCOPE OF THE INQUIRY'S TERMS OF REFERENCE

There were seventy-six former employees (or family members of former employees) who participated. Sixty-six volunteered for an interview and ten provided a written submission. The average age of eligible living employees was 66.

Below is a high-level summary of the information provided by the participants. Their recollections and anecdotes are also featured in this report.

Exposure

Chemicals used by the participants included 2,4-D, 2,4,5-T, Tordon, 1080, larvacide and others. The spraying period varied and generally started in spring for three to six months, sometimes for up to nine months in weed-favourable conditions. Most remarked that they did not spray in windy or wet conditions, but a small number sprayed in all conditions.

Some noted specific instances of abnormal exposure like when the spraying hoses broke and they got doused with chemicals. Some reported being wet with chemicals after spraying. One interviewee reported being regularly covered in spray drift from the wind.[839] Several reported that backpacks used to carry and dispense chemicals would sometimes leak down their back, with one participant recalling that '… you'd put the knapsacks on and they all leaked and you always ended up, you know, from your shoulders down virtually pretty wet'.[840] Another interviewee recalled that while sprayers would get damp, it was not damp enough to wring out their clothes.[841] Another commented that spray guns sometimes played up, leaking chemicals over his hands.[842]

A number of participants commented on the strong smell, with one recalling that 'the stench on workers' clothes was well known. Everyone knew when someone had been spraying'.[843] One commented on the proximity of food to the chemicals

[839] Interview participant 088.

[840] Interview participant 068.

[841] Interview participant 090.

[842] Interview participant 059.

[843] Written submission 026, case study 05.

noting that '… we'd just put our lunches on the back of the truck, alongside the chemical drums and things, in a bag or whatever we'd have'.[844]

Occupational health and safety policies and procedures

Many commented on contemporary OHS policies and procedures including training, guidance and personal protective equipment (PPE) access. Most reported receiving and wearing overalls and some wore their own clothes during warm weather. There were mixed comments about the supply of PPE with many stating it was not provided but others recalling it was. One participant said 'There was no safety training, no protocols and no protective clothing. They were the days when dictatorial supervisors did not look kindly on health concerns. They used to say you could drink it'.[845] Interviewees who commenced spraying in the 1980s recalled wearing goggles, gloves and masks when provided. Some said it was too hot to wear gloves or their masks would steam up. Many acknowledged that PPE provision did improve over time.

One senior officer reported that he expected his subordinates to pass on information about wearing appropriate clothing and to read the chemical labels, but was not sure if this actually occurred.[846]

Many workers did not embrace PPE in the early years. One recalled a safety meeting in the 1980s in which PPE was explained and encouraged.

> *There was a very big reluctance by the works crews to use the safety gear. I can just really recall that whole sitting there through, you know, this – this is ridiculous we've used this like this for years, you know, how do you expect us to use coveralls on hot days and gumboots and all that. It was very hard for them to take it – to change their culture*.[847]

Many participants reported receiving very basic initial on-the-job training, often by the leading hand, assistant inspector or a more experienced employee. One participant claimed he was shown 'the job in ten seconds'.[848] However, others acknowledged that the technical training was sufficient as it was 'common sense'.[849] A small number received information guides and booklets in the 1980s and recalled seeing usage information on drums to guide their work. Some noted that training opportunities increased from the late 1980s, including chemical-handling certificates.

Handling, purchase, storage, mixing and disposal of chemicals

Participants have differing recollections of mixing and preparing. Some poured chemicals directly into water, others used measuring jugs, some wore gloves, others did not. One participant reported that no one used the mixing ratios, another reported that ratios were followed. Some reported mixing chemicals with their hands, others used sticks or shovels. Two participants recalled staff mixing the chemicals together, with one participant recalling that in the late 1960s 'the use of cocktails was common. The superiors would often try experiments by mixing 2,4-D, 2,4,5-T and Amitrol, Tordon and other weedicides to see what results they could obtain'.[850]

Participants reported that chemicals were generally stored in separate sheds at the depot that were not initially well ventilated. One participant recalled that 'they had a shed and it was a concrete floor in the shed, and they [chemicals] were put on benches. But with the 2,4,5-T, they used to leak and it was stinking'.[851] Others noted that drums would sometimes leak and that empty containers would be taken to local tips or disposed of down mine shafts.

Health concerns

While some participants considered themselves in good health, the majority reported health problems either at the time or after, including cancer (skin, bowel, stomach, oesophageal, pancreatic), headaches, skin conditions, nausea, Parkinson's Disease, bowel problems, respiratory problems, diabetes, heart and blood pressure problems, nervous conditions, depression.

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[844] Interview participant 047.

[845] Written submission 026, case study 16.

[846] Interview participant 063.

[847] Interview participant 020.

[848] Interview participant 002.

[849] Interview participant 069.

[850] Interview participant 014.

[851] Interview participant 008.

A number also expressed concern about the health of family members (e.g. birth defects and disabilities, asthma, miscarriage) and attributed these to their own use and exposure to chemicals.

About a quarter of the participants reported no concerns using the chemicals. A small number did not wish to raise concerns at the time as they were fearful of losing their jobs or were just happy to have a paid job. One recalled 'you didn't want to lose your government job. I mean, if you get a government job … you're a pretty lucky boy and you'd want to hang on to it'.[852] Another reported 'I was raised in Ballarat in a working-class family. I was taught to be grateful for any job I was fortunate enough to have, and to do as I was told … At that time it would not have even occurred to me to question a directive from my employer'.[853] He says he was always wary about the effect the chemicals may be having on crews. 'We always said to the bosses, this stuff is terrible, and they would say, it won't hurt you,' he says. 'You had no choice if you wanted a job. You had to work there and use it'.[854]

Department responses to health concerns

Some participants reported that they or workmates had raised concerns with supervisors about the smell, exposure to skin and clothes, leaking backpacks, clothing, handles coming off chemical containers and the lack of washing facilities. One submitter related:

> *I was only a kid working with two older blokes, I didn't ask any questions about anything much, I did as I was told. The smell of 2,4-D and 2,4,5-T was overwhelming and workers asked if a washing machine could be bought to launder clothes at the depot rather than having to take them home. They said, 'oh yeah we can get a washing machine but it will cost one man his job'.*[855]

Those who noted that they or their workmates had raised concerns reported that while supervisors were responsive, their concerns were mostly brushed off.

One participant recalled a senior officer saying 'you're bloody weak'.[856] However, one participant who began in the 1990s noted that any concerns were quickly addressed to his satisfaction.[857]

One participant recalled that hand-washing facilities first appeared in the 1980s[858] and others recall PPE improvement began at the same time. Another recalled that a commercial laundry was laundering overalls.[859]

One participant recalled having a blood test for chemical levels, but did not recall ever hearing the results.[860]

OVERVIEW OF INFORMATION PROVIDED BY FORMER EMPLOYEES (OR FAMILY MEMBERS OF FORMER EMPLOYEES) WHO WERE OUTSIDE THE SCOPE OF THE INQUIRY'S TERMS OF REFERENCE

Fifty-two participants were outside the scope of the Inquiry's Terms of Reference (10 interviews, 42 written submissions). Most were sprayers who worked outside the geographic Terms of Reference and covered a wide area of Victoria including the Mallee, Gippsland and Wimmera regions.

Other information was considered out of scope because it contained experiences from family members of former Department employees from pre-1965 or from people who did not work for the Department.

Most participants commenced their careers in the 1970s and had worked for the Department for most of, or a large part of their careers, more than half for over 20 years. The average age of employees outside the scope (who disclosed their age) was 62.

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[852] Interview participant 005.

[853] Written submission 010.

[854] Written submission 026, case study 07.

[855] Written submission 026, case study 09.

[856] Interview participant 018.

[857] Interview participant 030.

[858] Interview participant 054.

[859] Interview participant 026.

[860] Interview participant 019.

This out-of-scope information allows us to compare the typical experiences of those in the Ballarat and surrounding areas with other Victorian regions. The paragraphs below provide a high-level summary only.

Exposure

Participants reported that spraying work involving 2,4-D and 2,4,5-T was usually undertaken in small teams of three to four men, often consisting of a leading hand, driver and sprayers. Most of this was with backpack spray units or truck-mounted equipment. Often participants did not distinguish between exposure to 2,4-D, 2,4,5-T and other commonly used chemicals such as chloropicrin, larvicide, 1080, Amine and Tordon. Teams also undertook other work like fumigating or baiting rabbits and foxes.

Many participants commented about the extent of exposure, chemical use and their work program and reported exposure to the chemicals through the skin and inhalation, including through clothing that was wet from leaking equipment. One participant reported 'we would be out there spraying blackberries, one on either side of the truck; it would spray back all over you. Half the time you couldn't see the vapour but you could taste it in your mouth'.[861]

Many reported clothes smelling strongly, with one participant saying 'at the end of a day's work you could walk into any pub and easily get a beer simply because no [sic] would stand near you because of the chemical smell'.[862] A small number of participants reported being doused during aerial spraying as they served as markers, and eating or drinking near chemicals. One participant recalled that 'we used to have morning and afternoon tea … in the back of the truck, we would use the spray tank as a serving table and rest our cups of tea on the tank rim'.[863]

Occupational health and safety policies and procedures

Most participants commented on the OHS policies and procedures of the time including training, guidance and access to PPE. There were common reports of limited training and induction and a lack of protective clothing, particularly before the mid-1980s. One participant reported that 'the only protective clothing we were given was gum boots and bit and brace overalls, no masks, no goggles'.[864] One participant reported, 'I can remember crew spraying in shorts and singlets during summer with no PPE as it was not issued; this did change later when staff received formal OHS training, inductions, chemical use qualifications and the issue of appropriate PPE'.[865] Another noted that 'there was no training in safe handling, there was no safety gear and there were no cautions'.[866] Many participants reported receiving PPE equipment from the mid-1980s.

A number of participants commented on the culture of the workplace at the time being directive, hierarchical and very different to health and safety today. 'Those were the days where you done [sic] what you were told to do …' one participant commented.[867] Other participants recalled being assured by supervisors that the chemicals were safe. One participant recalled that 'the standard statement was that it was so safe you could drink it'.[868] Another participant recalled 'there was talk between the staff that the bosses would say if they were to get more safety equipment that one of us would have to leave'.[869]

Handling, purchase, storage, mixing and disposal of chemicals

Participants reported a variety of experiences outlining how chemicals were handled. Recollections included storing in leaking or rusted drums, in unlabelled drums, cleaning equipment in a creek or river water and disposing used drums at local tips or down rabbit/wombat holes.

Many reported mixing chemicals on-site with creek or river water and chemicals not being mixed in accordance with label instructions or combined to make a 'stronger application'. 'A lot of time we mixed two chemicals together so it would save

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[861] Written submission 026, case study 09.

[862] Written submission 011.

[863] Written submission 023.

[864] Written submission 020.

[865] Written submission 009.

[866] Written submission 026, case study 18.

[867] Written submission 003.

[868] Written submission 026, case study 17.

[869] Written submission 005.

time on spraying different weeds', one participant recalled. 'We were told by the boss to add more chemicals so the plants would die sooner; that meant the chemicals [sic] were used off label'.[870] Another observed that 'chemicals were mixed on-site or at the depot before leaving and as I observed not always mixed to label or manufacturer's specifications; in some cases diesel being added as well as wetter'.[871] Other comments included '[name redacted] and his crew did believe the chemical cocktail they were using was dangerous. They were told to leave if they didn't like it. 'We stayed because we wanted the jobs, we liked the jobs.'[872] Another reported, 'When the regional inspector came up from Geelong I asked him about the mixing of 2,4-D and 2,4,5-T together – what were the dangers of it? – and he said eating too much salt was more dangerous'.[873]

Another common concern was proximity to food. One participant commented, 'poisons were carried in the back of the work vehicles, along with our lunches and drinks'.[874] Another noted that, 'the sprays were stored in a room at the [redacted] depot where the men had their morning tea and lunches'.[875]

Some participants observed that the work practices and culture were not as focused on safety as they are today. One revealed, 'we used to have water fights with it. We'd be mixing it from the drums and then sitting on the drums to have our lunch. They told us that it couldn't hurt us'.[876]

Health concerns

Three quarters of the participants raised health concerns suffered either during or after their employment. Former employees most commonly reported cancer (skin, bowel, stomach, lung, prostate, brain and kidney), skin problems, anxiety, depression, headaches, migraines and respiratory problems. Many believed that their health problems were linked to their use of chemicals or wondered if there was a link.

A number of participants were concerned about the possible health impacts on family members, for example asthma and miscarriage. Some questioned if there was a link between family health problems and the residual chemicals on clothing washed by spouses.

A small number of participants noted a pattern of colleagues dying or contracting cancer at similar times.

Department responses to health concerns

Around a third of participants provided general comments on the Department's responses to health issues. A number of these reported a culture that did not encourage raising concerns or asking questions. A common perception was that you would be better 'keeping quiet' or you could lose your job. 'You have to remember', recalled one participant 'that in those days they were worried about losing their job and nobody wanted to say anything much about it because of that'.[877] Another participant recalled that concerns raised with senior officers received the response that, 'we could drink the chemicals without them doing us any harm'.[878]

Two participants reported instances of families being contacted by the Department after their husband or father's death. The calls surprised their families and were not followed up or explained.

A small number of participants reported that employees received health tests but that these were one-off or ad hoc. For example, one participant recalls having a urine sample taken without any follow-up.

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[870] Written submission 004.

[871] Written submission 027.

[872] Written submission 026, case study 03.

[873] Written submission 019.

[874] Written submission 030.

[875] Written submission 029.

[876] Written submission 026, case study 04.

[877] Written submission 026, case study 17.

[878] Written submission 030.

SUMMARY OF THEMES ARISING FROM INTERVIEWS AND WRITTEN SUBMISSIONS

Participants expressed satisfaction at being able to their story and be heard with many wanting to know if exposure to chemicals has contributed to their and/or their family members' ill health. The ongoing grief and loss for families providing information on behalf of a deceased family member was palpable. The strong bond between employees was often expressed through concern for ill or deceased colleagues as much as for themselves.

Other themes arising include:

- Exposure was mostly through clothing or directly onto skin.
- Faulty equipment sometimes increased exposure, for example, leaking backpacks.
- The strong smell is a persistent memory.
- Limited training and PPE were provided until the 1980s.
- Some employees worried about their exposure at the time, some didn't.
- Some employees were concerned that complaining or raising concerns may jeopardise their job.
- Some supervisors were more responsive than others to employee concerns.
- The work culture at that time was less focused on health and safety than today.
- Supervisors told employees the chemicals were 'safe'.
- The common health complaints were skin problems, anxiety or other 'nervous' complaints, headaches, nausea and cancer.

What is evident is a strong consistency of experience between employees within the Ballarat region between 1965 and 1995 and those outside it. This suggests that the working conditions and health and safety culture of the sprayer was likely to be similar across Victoria, with some variations depending on individual supervisors.

Guidelines for Written Submissions

Inquiry into the use of chemical substances by employees of the former Victorian Department of Crown Lands and Survey (and its successor departments)

Inquiry overview

The Victorian Government is conducting an independent inquiry into the use of chemical substances 2,4,5-T and 2,4-D by the former Victorian Department of Crown Lands and Survey (and its successor departments) for weed and pest control between 1965 and 1995 in Ballarat and surrounding areas. Ballarat and surrounding areas refers to the following Local Government Areas: Golden Plains Shire, Moorabool Shire, Hepburn Shire, Ballarat City Council, Pyrenees Shire, Ararat Rural City Council and Central Goldfields Shire
This inquiry has been established as a result of concerns raised by former employees of the Victorian Department of Crown Lands and Survey (and its successor departments) in 2014 in the geographical area cited above. Terms of Reference are attached for your information.

Who should consider making a submission?

- Current and former employees (or their family members, friends or colleagues on their behalf) who believe they may have been exposed to the pesticides 2,4,5-T and 2,4-D in the course of their work with the Victorian Department of Crown Lands and Survey and its successor departments, including sub-contractors and participants in the volunteer Regional Employment Development (RED) scheme.
- Anyone with a specific interest or direct knowledge/experience relating to past use, handling, storage, ordering, and disposal of the pesticides 2,4,5-T and 2,4-D by the Department of Crown Lands and Survey and its successor departments.

What should be included in submissions?

A written submission can be any length, depending on what you want to say or the information you have. Any information, recollections , or experiences you have are important and the inquiry is keen to hear your story.

If you have relevant documents or records you wish to provide to support your submission, please provide copies of these – either in hard copy or as electronic scans. Please do not send original documents. The copies you send will be retained by the Inquiry.

A number of questions are provided below as prompts - however these are only to assist you, and you can provide any information you consider important. Submissions are not limited by these questions.

- **Tell us about your position and role in the Department as a former or present employee.** *For example briefly describe where you worked (ie depot(s)) , your position, when you worked there, your team, your day to day activities or responsibilities.*

- **Tell us what you recall about the ordering, storage, use, sale and disposal of 2,4,5-T and 2,4-D in your role or at your workplace?** *For example, briefly describe your role and your colleagues' roles in the storage, handling, use and disposal 2,4,5-T and 2,4-D.*

- **Tell us if you had any concerns about the Department's use of the chemicals.** *Do you recall any events or incidences involving the pesticides that concerned you at the time. Did you raise these concerns with anyone at the time? If you did, what was the response?*

- **Tell us about any other concerns or information that you wish to provide to the inquiry.** *We encourage you to provide any other information you consider relevant.*

How do I make my submission?

Submissions can be made via email or in writing, and must be provided to the Inquiry by 12 June 2015. Submissions should be sent to the following:

Mail: Former Lands Department Chemical Inquiry, GPO Box 1925, Melbourne VIC 3001
or
Email: register@chemicalinquiry.vic.gov.au

Please note that we may contact you after you lodge your submission to clarify any information you provide in your submission.

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Appendix 4: Exposure technical paper

BACKGROUND

This Appendix deals with the exposure of sprayers to the chlorophenoxyacetic acid herbicides 2,4-D and 2,4,5-T as well as to the 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) impurity in 2,4,5-T. To arrive at estimates of exposure of workers to herbicides and the impurities they may contain, a number of assumptions have to be made. Conservative assumptions have been made and the reasons for making these assumptions are provided in following sections.

A significant issue is that of the possible exposure of workers to 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), which is known to have been present in samples of 2,4,5-T herbicides in varying concentrations. A national study of dioxin levels in Australia (Dioxins in Australia: a summary of the findings of studies conducted from 2001 to 2004) showed that levels in the blood fats of Australian residents were low by international standards. Levels increased steadily with age, from about 6 pg TEQ/g lipid for children under 16 years of age, to about 22 pg TEQ/g lipid for people over 60. The quantity (TEQ, see Appendix 4.5) is calculated from actual amounts of polychlorinated dibenzo-dioxin and –furan congeners multiplied by their relative toxicities. The main source of exposure to dioxins in Australia is the diet, with emphasis on animal products. The estimated intake, low by world standards, was 3.7-15.6 pg/kg body weight/month, well below the estimated tolerable monthly intake of 70 pg/kg body weight/month.

WORKFORCE

There were about 12 crews operating from the depots in the Ballarat district, each crew consisting of two to four men who would spend five to six hours per day spraying. Spraying occupied about 12 to 26 weeks of the year with periods in both spring and autumn. Because of the variation in hours and days that a worker might be spraying, and because periods of employment would also vary, the approach taken is to estimate the daily exposure of an 'average sprayer' and allow for above-average and below-average exposures as described below.

DILUTION

Both 2,4-D and 2,4,5-T herbicides were received at the depot as liquid concentrates. These were diluted before use, according to instructions supplied on the labels and probably well known to regular users so as to achieve final concentrations of the active ingredient of typically 0.5-2.0 g/L (0.05-0.2% solutions). For dilution, the required volume of concentrate would be measured out in a calibrated jug and poured into the spray tank, following which the water was added and the mixture stirred to promote mixing. The usual dilution procedure, occupying perhaps 15 minutes, could be carried out indoors at the depot with limited ventilation of the work area. Workers would have noted the odour of the concentrate and thus been exposed to a small extent, especially to the hydrocarbon liquids that had been used in the ester emulsions. Dilution could also be done in the field when a tank needed refilling and water was available, so there would be no return to the depot where washing facilities would have been available.

DETERGENT

Amine salts of the 2,4-D and 2,4,5-T acids are water soluble and available as solutions that may have also contained detergents (also referred to as surface-active agents, surfactants, or wetting agents) that improved their effectiveness. Alternatively, detergent would be added during the dilution process. The commercial detergents used in herbicide spraying were either non-ionic or anionic detergents of the type also found in consumer products for personal hygiene or laundry uses. The detergents employed as wetting agents in the spray solution would come into contact with the skin when spray solution was spilled or leaked. This would not pose a risk although contact with strong solutions of some detergents could cause skin irritation.

The 2,4-D and 2,4,5-T esters are not water soluble and would usually be supplied as oil-water emulsions with the herbicide present in the oil phase (a petroleum fraction like kerosene) and the emulsion stabilised by means of a surface-active agent. As well as stabilising an emulsion, a detergent in the spray mixture facilitates wetting of plant surfaces. Many plant surfaces are covered with wax layers that minimise wetting. Water does not spread evenly across the surface but forms isolated droplets, a phenomenon that is familiar because it produces the 'sparkling' effect of sunlight on wetted plant material.

The presence of a surfactant not only assists in the wetting of vegetation and retention of the herbicide on the surface but it also increases the herbicidal activity, as has been demonstrated for the triethanolamine salt of 2,4-D which increases the herbicidal activity of the mixture [879] and is probably a general phenomenon.

MULTIPLE CHEMICALS

Spraying was not confined to the use of 2,4-D and 2,4,5-T since a range of other herbicides and pesticides were used in the Lands Department work. Over time a sprayer might have been exposed not just to the two chlorophenoxyacetic acids and their salts and esters, plus impurities such as TCDD, but also at other times to herbicides such as Picloram, Glyphosate, Atrazine, arsenicals and others. Herbicide mixtures were only occasionally used. In the case of 2,4-D, the most common co-component was Picloram (4-amino-3,5,6-trichloropicolinic acid).

SPRAYING

A variety of spray equipment was used, including knapsacks, spot sprayers, mistblowers and controlled droplet applicators. The attention paid to droplet size and consequent spray drift would have increased during the period covered by the Inquiry. Most often, major volumes of diluted herbicide were taken to work sites in truck-drawn tanks (initially metal but later plastic) and from there pumped through hoses to sprays wielded by workers. Given the variety of equipment, the sprayers would have been exposed to the herbicides in different ways and for different periods.

AWARENESS

Attitudes towards chemicals of all kinds have changed a lot since 1965. Behaviour that we would now regard as careless or at least over-confident was common half a century ago, and it is a mistake to judge what we know of practice in the 1960s and 1970s by modern standards and with modern concerns in mind. Attitudes and behaviours improved steadily throughout the study period. The awareness of the toxicity of chemical substances being handled by the workers varied considerably from chemical to chemical. Among the herbicides, the arsenicals would have been recognised as dangerous, as would the rodenticides aluminium phosphide, strychnine, calcium cyanide, and 1080 (sodium monofluoroacetate). In general, anything known to be toxic to animals would have been accepted as likely to be toxic to people, but chemicals directed against plants would be seen as presenting fewer toxic threats to people handling the chemicals.

Initially 2,4-D and 2,4,5-T were regarded as safe. From the early 1970s the presence of the dioxin (TCDD) impurity in the latter became a cause for concern but pressure on manufacturers to reduce the TCDD content of their products, and emphasis on good practice in the use of the herbicides, was felt to afford sufficient protection. As far as can be ascertained, the awareness of risk was most evident in the ranks of senior employees such as inspectors, but is unlikely to have affected the behaviour of sprayers very much until the late 1980s – that is, late in the period subject to the Inquiry.

Awareness of risk, on behalf of managers and sprayers, would have increased steadily during the study period, leading to the introduction of more effective PPE and more appropriate use of the available PPE.

NATURE OF EXPOSURE

Workers could be exposed to herbicides in a number of ways. Instant contact with skin could result from spills or splashes during the dilution of concentrate to the normal spraying concentration, from leakage of equipment during spraying, from exposure to the spray caused by wind gusts or ‘bounce-back’ from sprayed vegetation. There is anecdotal evidence that leakage from knapsack sprays was more common than other leakages, for example from burst hoses, but the knapsack spray was not the main equipment used.

Where contact occurred at the depot there would be facilities for washing the affected skin but this is less likely to be the case in the field unless running water or pooled water were readily accessible. Opportunities for washing would have been available in the lunch break if that involved return to the depot. Failure to wash any affected skin, particularly hands and face, could expose workers to herbicides when eating or smoking.

[879] L.L. Jansen 1964, *Surfactant Enhancement of Herbicidal Entry*, Weeds 12: 251-255.

Delayed contact with skin could happen when solutions contacted clothing and damp spots came into contact with skin. The Inquiry understands that sprayers were issued with overalls and gloves but both were uncomfortable in hot weather and may not have been used on every occasion. Prolonged skin contact with damp clothes would have been hard to avoid once wetting had occurred since changes of clothing would not have been readily available in the field. So although the Inquiry was informed that such contamination resulting from accidental releases of herbicide spray solutions was rare, there could have been exposure over several hours after incidents that did occur. Laundering of clothing was the responsibility of the wearer, who might not have had the opportunity to wash clothes between shifts although it is likely that work clothing would be laundered once or twice a week.

While the most significant exposure would have been to liquids, the herbicide spray mist could be breathed in. Workers could also be exposed to the vapours of the more volatile esters but the extent of such exposure would be very low because the common esters have very lower vapour pressures. This means that the concentration of herbicide vapour in the air while spraying was being conducted, would be low. It helps to contrast this with the behaviour of familiar substances like camphor or naphthalene that have much higher vapour pressures (Appendix 4.1) so much so that their odours are readily detected in air.

ABSORPTION OF HERBICIDE AND ITS CONTAMINANT FROM THE SKIN

When the skin is wetted with a spray solution, how much of the herbicide, and in the case of TCDD-contaminated 2,4,5-T, how much of the TCDD would be absorbed into the skin and then into the body? The amine or other salts of the acids are water soluble and would be less easily absorbed by the body than the fat-soluble esters of 2,4-D and 2,4,5-T. The estimates in the tables below are based on the 'worst case' – that is, that volumes used in the estimates are volumes of esters. Very few data are available to help in making an assessment of the extent to which herbicide in contact with the skin would be absorbed, but literature data (Appendix 4.2) suggest that the proportion would not exceed 15%. The significance of such absorption is not known.

For the TCDD impurity in 2,4,5-T herbicides, a Dermal Absorption Factor of 0.03 (3% absorbed) is generally recognised by health authorities and this figure has been adopted in forming the estimates shown in Table A4.2.

ACCOUNTING FOR THE RANGE OF EXPOSURES

The starting points for the assessments that follow are the volumes of herbicide sprayed by an average worker. The averages are calculated from data reported by inspectors. While the average is a useful quantity, it does not allow the exposure estimate to account for possible impacts on sprayers who were exposed to greater or lesser extents. Accordingly, in the tables that follow, included with the average figures, are estimates of 'high' and 'low' exposures. For example, in one set of 25 reported volumes, only 4 of them were below 6 L, and only 2 were near 40 L and so extremes were excluded but the figures adopted still provide a reasonable estimate of what could be accepted as low and high volumes. Similar judgements were applied to other data sets to establish 'low', 'average' and 'high' values.

The 'average' is based on:

- daily spray volumes per man
- most common dilution factor
- the assumption that 0.1% of the volume being sprayed by a worker comes into contact with skin
- the TCDD concentration in 2,4,5-T herbicides was ≤0.1 ppm until about 1981 but regulations limited this to ≤0.01 ppm thereafter
- approximately 3% of TCDD contacting skin is absorbed into the body
- 20 days/month spraying.

The 'high' estimates allow us to take into account not only larger than average spray volumes but also:

- spraying for more days and hours
- spraying with stronger solutions (lower dilution factors)
- possible slightly higher dioxin levels in 2,4,5-T
- above-average exposure via spills or leaks

- less effective personal protective equipment (PPE) or less frequent use of PPE
- slower washing or change of clothing that prolonged contact with the herbicide
- greater absorption through the skin.

In contrast, the 'low' estimates cover situations where contacts are below average due to circumstances and good practice:

- spraying for fewer days and hours
- spraying with weaker solutions (higher dilution factors)
- below-average exposure to spills and leaks
- more effective PPE and more frequent use of PPE
- more frequent washing and change of clothing
- less absorption through the skin.

EXPOSURE TO 2,4-D

Records of 2,4-D spraying conducted by workers at the Ararat depot were available for calendar years between 1965 and 1981. Data for two representative years, 1967–68 and 1975–76, were used in making the exposure estimates.

In the first period, esters of 2,4-D comprised about two thirds of the material, with amine salts making up the remainder. Dilutions were most commonly 1:400 (19 of 25 instances), leading to 0.2% concentration of the active ingredient. While this was the general practice, other dilutions were used for some weed species, for example 1:266 for St John's Wort, 1:500 for Spiny Rush, and sometimes 1:600 for Cape Tulip. The volume of diluted spray mixture per man varied widely, from 0.84 to 253 L, with the average 18.4 L; 1:400 is assumed as the dilution factor, 18 L as the average, 6 L as the low value and 40 L as the high.

In the later period, dilution at the rate of 1:400 comprised only half of the instances, while another third had dilutions of 1:100-200). Again the spray volume ranged widely, from 4.54 to 129 L/man/day with the average 47.4 L. This exposure assessment took 1:300 as the dilution factor, 47 L as the average volume, 12 L as the low value and 110 L as the high.

It has been assumed that direct contact with the skin was the most important type of exposure. It is extremely difficult to know the extent to which a sprayer might have had exposure to the herbicide solution. While exposure to small quantities of dilute herbicide solution during normal operations would be frequent, occasional accidental releases would be less common. A reasonable estimate of ongoing exposure might be 0.1% of the volume of solution being handled. Finally, a reasonable estimate is that 3% of the herbicide in contact with the skin would be absorbed by the body.

Drawing on these data, the following table was constructed, extrapolating information from the mid-1970s to the 1982–1995 period.

Table A4.1 Exposure to 2,4-D herbicides

	Period 1965–1974	1975–1981	1982–1995
Common dilution	1:400	ca 1:300	ca 1:300
Volume of diluted spray L/man/day	High 40 Average 18 Low 6	High 110 Average 47 Low 12	High 110 Average 47 Low 12
Quantity of herbicide g/man/day (0.2% solution)	High 80 Average 36 Low 12	High 220 Average 94 Low 24	High 220 Average 94 Low 24

	Period 1965–1974	1975–1981	1982–1995
Skin contact g/man/day	High 0.08 Average 0.036 Low 0.012	High 0.22 Average 0.094 Low 0.022	High 0.22 Average 0.094 Low 0.022
2,4-D absorbed µg/kg/bw/day 80kg man	High 0.03 Average 0.14 Low 0.0045	High 0.0825 Average 0.035 Low 0.00825	High 0.0825 Average 0.035 Low 0.00825

The impact on these estimates of the use of Personal Protective Equipment (PPE) are hard to gauge, but it is likely that its use and effectiveness would have increased over the study period so the figures, at least in the right-hand column of Table A4.1, may over-estimate the exposures. The average level of exposure in the first decade is approximately the same as the Reference dosage (RfD) published by the US EPA[880] and three times that level in the subsequent decades. It is eight times greater in the high exposure scenarios. This equates to one tenth the NOAEL also published by the US EPA.

The herbicide 2,4-D has been used since 1945 and is generally regarded as of low toxicity, both acute and chronic (such as carcinogenicity) as seen in the Material Safety Data Sheet provided (a legal requirement) by an Australian manufacturer of a 2,4-D amine salt. It is described as (slightly) toxic if swallowed and irritating to skin and eyes.[881] The safety of the herbicide is vigorously defended by an industry body representing manufacturers.[882]

However, the International Agency for Research on Cancer (IARC) recently concluded that 2,4-D is 'possibly carcinogenic to humans'.[883] The evidence supporting 2,4-D's classification in IARC Group 2B derived mainly from increased risk of non-Hodgkin lymphoma to people in the highest exposure group of workers manufacturing the herbicide. Given that there are possible associations between non-Hodgkin lymphoma and occupational exposure to several herbicides of different chemical types, it is possible that such associations are attributable to formulation components such as solvents and surfactants rather than to the active herbicidal ingredients. Full details of the assessment, including the levels of exposure, will become available in a forthcoming publication (Volume 113 of IARC Monographs). The Agency (IARC) is not a regulatory body but its classification (see Appendix 4.3) of the likelihood that an agent can cause cancer in humans can be the basis for regulatory action.

EXPOSURE TO 2,4,5-T AND TCDD

The exposure of a worker involved in spraying 2,4,5-T is important because of the presence in the herbicide of the contaminant TCDD that is classified by the International Agency for Research on Cancer (IARC) as a Group 1 carcinogen in humans (see Appendix 4.3). To estimate the exposure of a sprayer, the following inputs are needed:

- the quantity of herbicide solution sprayed per worker
- the quantity of herbicide sprayed per worker
- the dioxin content of the herbicide
- an estimate of the exposure of the worker to the contaminated herbicide
- an estimate of the exposure to TCDD
- an estimate of the amount of TCDD likely to be absorbed in a given period.

880 US EPA, 2015, Integrated Risk Information System, 2,4-Dichlorophenoxyacetic acid (2,4-D) (CASRN 94-75-7). Available at: <http://www.epa.gov/iris/subst/0150.htm>

881 Material Safety Data Sheet 2,4-D amine 625 2008, . Accessed 29/10

882 www.201324DNufarmFactsheetPUBLIC.pdf

883 Dane Loomis and others, 2015 *Carcinogenicity of lindane, DDT and 2,4-dichlorophenoxyacetic acid*', *Lancet Oncology 16(8): 891-892.*

The information available to the Inquiry was limited and so estimates of exposure by sprayers to herbicides can only be very approximate. In selecting inputs to the estimate, a conservative approach has been taken and the allowance is made for low and high extremes as well as the averages.

Records of 2,4,5-T spraying conducted by workers at the Ararat depot were available for calendar years between 1965 and 1981 and we have chosen two representative years: 1967–68 and 1975–76. The 2,4,5-T ester herbicides were received as 80% concentrates and diluted for use against particular weed species. In 1967–68 the dilution of 1:600 was most common (13 of 16 instances), but it was 1:800 for *Acacia amata* and 1:400 for briar. Each litre of the common 1:600 dilution contained 1.33 g of herbicide. In 1975–76 the most common dilution was 1:600 (14 of 20 instances). Dilution of 1:1200 (the next most common, 5 instances) was used when blackberry bramble was the target weed species. These differences in exposure resulting from differences in dilution are allowed for by the high/average/low estimates shown in Table A4.2.

The volume sprayed per man per day varied considerably from day to day but the daily average did not vary much from year to year. In 1967–68, for example, the daily volume varied from 6 to 360 L/man with an average volume of 96 L/man. In 1975–76 the range was 30 to 400 L/man and the average was 120 L/man. The average values were used in the estimate of exposure and are shown in the table below while values closer to the extremes were used in estimating the high and low exposures.

We have assumed that direct contact with the skin was the most important type of exposure. It is extremely difficult to know the extent to which a sprayer might have been directly exposed to the contaminated herbicide solution. Exposure to small quantities of dilute herbicide solution during normal operations would be frequent, and occasional accidental releases to larger quantities would be less common. A reasonable estimate of such exposure might be 0.1% of the volume of solution being handled. No specific information is available about the use of Personal Protective Equipment (PPE), nor about how effective this equipment might have been in preventing skin contact. The actual figures for the last period are likely to be less than those for earlier years because of improved (and improved use of) PPE. The calculated average skin contact with herbicide, as a result of spills and splashes, is 192 or 240 mg/man/day.

Dioxin concentrations in the first decade covered by this study are uncertain but we do know that by the mid-1970s, Australian regulations required that the TCDD content of 2,4,5-T should not exceed 0.1 ppm. By the 1980s this figure had been reduced tenfold, to 0.01 ppm. Adopting these two contaminant levels, the average TCDD exposure can be calculated and of this quantity we assume that 3% (see Appendix 4.2) is actually absorbed by the body.

The data used in successive stages of the estimate are shown in the table below.

Table A4.2 Exposure to 2,4,5-T herbicides and TCDD

	Period 1965–1974	**1975–1981**	**1982–1995**
Diluted spray volume L/man/day	High 300 Average 96 Low 10	High 350 Average 120 Low 30	High 350 Average 120 Low 30
Quantity of herbicide sprayed g/man/day (0.2% solution)	High 600 Average 192 Low 20	High 700 Average 240 Low 60	High 700 Average 240 Low 60
Skin contact 0.1% of sprayed solution mg/man/day*	High 600 Average 192 Low 20	High 700 Average 240 Low 60	High 700 Average 240 Low 60
Expected TCDD content in 2,4,5-T	≤ 0.1 ppm	≤0.1 ppm	≤0.01 ppm

	Period 1965–1974	1975–1981	1982–1995
TCDD exposure ng/man/day*	High 60 Average 19 Low 2	High 70 Average 24 Low 6	High 7 Average 2.4 Low 0.6
TCDD absorbed through skin ng/man/day	High 1.8 Average 0.57 Low 0.063	High 2.1 Average 0.72 Low 0.18	High 0.21 Average 0.072 Low 0.018
TCDD intake pg/kg bw/month* (80 kg man spraying for 20 days/month)	High 450 Average 144 Low 15	High 525 Average 180 Low 45	High 52.5 Average 18 Low 14.5

*Note change of unit.

HOW DANGEROUS WAS IT?

Lacking details of the levels of exposure to 2,4-D that led to the IARC classification of this substance as possibly carcinogenic to humans, it is not possible to make a firm conclusion about the risk faced by sprayers who were exposed to this herbicide. The IARC risk assessments do not take into account the exposures, only the strength of the evidence for a positive association with cancer. However, the IARC assessors commented on the high exposures experienced by workers during the manufacture of 2,4-D herbicides. These exposures are likely to be greater than those experienced by sprayers.

The intakes of TCDD, an impurity in the 2,4,5-T herbicides, for a day of spraying were calculated with reasonable assumptions and shown in the bottom cells of Table A4.2. They should be compared with Australia's tolerable monthly intake (TMI) of dioxins (see Appendix 4.4), which is 70 pg/kg/month. The TMI is an advisory figure, not a regulation. It is based on continuous exposure, mainly from food. Comparison of the estimated figures with the TMI is probably valid for months when spraying occurred and exposure could have occurred on 20 days of the month. However, this is a quite conservative approach, since the TMI is based on an estimated continuous exposure over a lifetime. It may be just as appropriate to compare to the TMI, an exposure estimate adjusted by averaging the four to six months of the year that spraying actually occurred, with a further adjustment averaging the exposure over a lifetime. This would be achieved by multiplying the exposure estimates by 0.5 (6/12 months spraying) and 5/70 (the average proportion of the lifespan that spraying occurred). Such an approach would be consistent with an assumption that intermittent exposure would be less harmful than sustained exposure over a lifetime.

Two qualifications are necessary. Firstly, although the TMI has been established only in comparatively recent times, there is no reason to think that greater or lesser tolerable figures would have been relevant in previous years. Secondly, the tolerable daily intake (TDI) is expressed as the toxicity equivalent quantity (TEQ) that takes into account the contributions to overall toxicity by various polychlorodibenzodioxin and polychlorodibenzofuran congeners (see (Appendix 4.5). 2,3,7,8-tetrachlorodibenzodioxin (TCDD), the only dioxin considered in the present study, has Toxicity Equivalence Factor (TEF) = 1 so the mass of TCDD comprises the TEQ.

The assessment is that in the first two decades under consideration, the average monthly intakes were 2 to 2.5 times the Australian TMI of 70 pg TEQ/kg bw/month, but substantially below the TMI in 1982–95. The estimated 'high' values are substantially above the TMI in the early years but well below that figure in the last period. The estimated average intake for a sprayer is above the average community exposure of 15 pg/kg bw/month (see Appendix 4.4), which is not unexpected for people possibly exposed to TCDD in the workplace. Although the estimates are based on very conservative assumptions they do indicate that exposures due to spraying 2,4,5-T herbicides could possibly be significant, at least for the more-exposed workers.

Appendix 4.1: Vapour pressures

The isopropyl ester of 2,4-dichlorophenoxyacetic acid (2,4-D) has vapour pressure at 25^{o}C of 10.5 x 10^{-3} mm Hg [J.D. Fryer and S.A. Evans, eds. *Weed Control Handbook. Vol I: Principles* (Blackwell, Oxford and Edinburgh, 1970), 5th edition revised reprint, pp 268-269.] and the n-butyl ester of 2,4,5-trichlorophenoxyacetic acid is 9.97 x 10^{-6} mm Hg at 25^{o}C (www.lookchem.com/). These values are well below the vapour pressures at this temperature of familiar substances such as camphor, 0.65 mm Hg (A.H. Jones, *Journal of Chemical and Engineering Data* 5: 196-200 (1960)), and naphthalene, 8.5 x 10^{-2} mm Hg (D. Ambrose, J.H. Ellender, C.H.S. Sprake and R. Townsend, 'Thermodynamic Properties of Fluorine Compounds. Part 15', *Journal of the Chemical Society Faraday Transactions 1* 71: 35-41 (1975)). Less volatile substances such as the 2-ethylhexyl esters of 2,4-D and 2,4,5-T would have even lower vapour pressures.

Appendix 4.2: Skin absorption

The question of the absorption of chemical substances into and through the skin is covered in an extensive review (J. Kielhorn, S. Mulching-Kollmuss and I. Mangelsdorf, *Dermal Absorption* (Environmental Health Criteria 235, World Health Organization, 2006). Very few data are available for the chlorinated phenoxyacetic acid herbicides but one review study included the dimethylamine salt of MCPA (2-methyl-4-chlorophenoxyacetic acid) that is closely related to 2,4-D and 2,4,5-T. (R.P. Zendzian, 'Pesticide Residue on/in the Washed Skin and its Potential Contribution to Dermal Toxicity', *Journal of Applied Toxicology* 23: 121-136 (2003).) When dilute solutions were applied to the skin of rats, absorption increased with exposure time but reached a maximum of about 5% of the applied substance. A study with other pesticides (J.B. Nielsen, F. Nielsen and J. Sorensen, 'In Vitro Percutaneous Penetration of Five pesticides – Effects of Molecular Weight and Solubility Characteristics', *Annals of Occupational Hygiene* 48: 697-705 (2004)) showed greater penetration by those that were fat soluble but none exceeded 15% penetration after 48 hours.

A Dermal Absorption factor of 0.03 (3% absorbed) was originally developed to estimate dermal absorption of TCDD from soils in risk assessment for contaminated sites. This Factor is still used by the US EPA, and was endorsed in 2004 guidance from the Australian Department of Health Office of Chemical Safety and the 2012 enhealth guidance. It is based primarily on animal studies in which dermal absorption ranged from 1% to 40%. The variability is in part due to solvent effects on skin absorption, and the binding effects of soil that prevent the release of TCDD and so limit absorption. The dermal absorption issue is very complex. There is no direct measure of dermal absorption from pesticide formulations and so the default US EPA value of 3% is usually adopted.

Appendix 4.3: IARC classifications

The International Agency for Research on Cancer (IARC) has established the following system for evaluation of the carcinogenicity of agents to humans.

Group	Description	Definition
Group 1	Carcinogenic to humans	• Sufficient evidence of carcinogenicity OR • Evidence of carcinogenicity in humans is less than sufficient but there is sufficient evidence of carcinogenicity in experimental animals and strong evidence in exposed humans that the agent acts through a relevant mechanism of carcinogenicity
Group 2A	Probably carcinogenic to humans	• Limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals OR • Inadequate evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals and strong evidence that the carcinogenesis is mediated by a mechanism that also operates in humans OR • Limited evidence of carcinogenicity in humans, but belongs, based on mechanistic considerations, to a class of agents for which one or more members have been classified in Group 1 or Group 2A
Group 2B	Possibly carcinogenic to humans	• Limited evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals OR • Inadequate evidence of carcinogenicity in humans but sufficient evidence of carcinogenicity in experimental animals OR • Inadequate evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals, but with supporting evidence from mechanistic and other relevant data
Group 3	Not classifiable as to its carcinogenicity to humans	• Evidence of carcinogenicity is inadequate in humans and inadequate or limited in experimental animals OR • Evidence of carcinogenicity is inadequate in humans but sufficient in experimental animals, but strong evidence that the mechanism of carcinogenicity in experimental animals does not operate in humans OR • Agents that do not fall into any other group Agents in Group 3 are not determined to be non-carcinogenic or safe overall, but often means that further research is needed.
Group 4	Probably not carcinogenic to humans	• Evidence suggesting lack of carcinogenicity in humans and in experimental animals OR Inadequate evidence of carcinogenicity in humans but evidence suggesting lack of carcinogenicity in experimental animals, consistently and strongly supported by a broad range of mechanistic and other relevant data

Appendix 4.4: Tolerable daily intake

The health risks posed by exposure to dioxins had been studied for some years before regulatory authorities were able to recommend levels of exposure that would not represent threats to human health. Examples published in the IARC (1997) review are shown below.

Date	Recommended limit pg TEQ/kg bw/day*	Jurisdiction
1988	5 total	Sweden
1991	10 from food	World Health Organization, Japan
1993	10	Canada
2000	1-4	World Health Organization
2001	2	UK
2002	A figure of 2.3 can be calculated from the published Tolerable Monthly Intake of 70 pg TEQ/kg bw/day	Australia

*The limit is set for the total dioxins and furans and, in later years, the planar molecules of the polychlorobiphenyl series that are known to exhibit similar toxicities.

At the time that the Tolerable Monthly Intake of 70 pg/kg bw/month was recommended by Australian Authorities in 2002 (reported in the National Dioxin Study (2004)), community exposures were not greater than 15 pg/kg bw/month.

Appendix 4.5: Relative toxicities of polychlorinated dibenzodioxins and dibenzofurans

The molecules of dibenzodioxin and dibenzofuran are planar and each has eight positions where a chlorine atom could take the place of the hydrogen atom that occupies that position in the parent molecule. There are many ways in which the chlorine atoms can be placed on the parent molecules, which means there are 75 members of the polychlorinated dibenzodioxin family, and 135 members of the polychlorinated dibenzofuran family, a greater number because the dibenzofuran molecule is less symmetrical and there are more substitution patterns possible.

The members of these chemical families, known as congeners, vary in toxicity and since exposure is normally to mixtures of congeners, a way has been found to assess the human health risk posed by the mixture. The most toxic congener, 2,3,7,8-tetrachlorodibenzo-dioxin, is assigned relative toxicity 1 and the toxicities of other congeners are expressed relative to this as Toxicity Equivalence Factors (TEF). This approach has led to the concept of toxicity-weighted masses for mixtures of dioxins and furans and the calculation of a Toxicity Equivalence Quantity (TEQ). The TEQ can be calculated for a mixture by multiplying the concentration of each congener by its TEF, and adding up the numbers.

TEQ = Σ (concentration of congener x TEF for that congener)

A selection of the largest of the TEFs established by the World Health Organization are shown in the table below (www.who.int/ipcs/assessment/tef_update/en/).

Chlorine substitution pattern	Toxicity Equivalence Factor Dibenzodioxin	Dibenzofuran
2,3,7,8- tetrachloro	1	0.1
2,3,4,7,8-pentachloro	1	0.3
1,2,3,7,8-pentachloro	1	0.03
1,2,3,4,7,8-hexachloro	0.1	0.1
1,2,3,4,7,8,9-heptachloro	0.01	0.01

Appendix 5: Potential health impacts

This Appendix summarises what is known about the health effects of the herbicides 2,4-dichlorophenoxy acetic acid (2,4-D) and 2,4,5-trichlorophenoxy acetic acid (2,4,5-T) and the contaminant in the latter, 2,3,7,8-tetrachlorodibenzodioxin (TCDD). Since sprayers were exposed to some or all of these substances there is the potential for their health to be affected in the ways described in the scientific literature and advisory documents issued by authorities.

This assessment of potential health risk is based on today's knowledge. This knowledge has accumulated over the years as international concern over the toxicity of herbicides grew, leading to investigations of health outcomes through clinical studies and epidemiological (population-based) studies. These in turn led to improved practice in the chemical industry as contamination levels were reduced, and to the development of regulations and advisory documents. None of this information would have been available in the 1960s but a good deal is now accessible from reliable sources. Scientific information about the non-cancer impacts of chemical substances, for example on the immune system and the endocrine system, are ongoing but they are still in their early stages. They could lead to further information about herbicides in the future.

The value of epidemiological studies was addressed by Dr JD Mathews of the Menzies School of Health Research in the Northern Territory, speaking at a symposium at Monash University in March 1989:

> *Chemical exposures can also cause harmful effects', he said, but although a chemical exerts its effect at the time of exposure, the recognition of the effect may be delayed over time. If the disease outcome is very uncommon in an unexposed people, and very common in those who were exposed then it is usually a simple matter to make a causal inference between the exposure and the outcome. The converse situation is much more difficult – if any exposure is suspected of causing an increased risk of a disease which is also frequent in the unexposed, then it is almost invariably difficult to be sure whether there is a real increase in those who have been exposed. Even if a real increase is apparent in those exposed, it may be difficult to decide whether the increase was actually caused by the exposure in question, or whether it might have been due to some (other) unrecognized difference between the exposed and unexposed. If the maximum credible effect is small (and hence difficult to detect), then society may make a value judgment that it is prepared to accept a theoretical risk, provided that its magnitude is small in relation to the risks that are readily accepted.*[884]

When they were interviewed, workers involved in spraying herbicides commonly raised questions about long-term skin problems; asthma; neurological conditions such as nervousness, anxiety and depression; miscarriages and birth deformities. Some of these health outcomes have from time to time been linked to exposure to particular chemical substances. Skin complaints such as chloracne are the only ones for which a firm connection has been established, and that is to the TCDD impurity in the 2,4,5-T herbicides.

2,4-DICHLOROPHENOXY ACETIC ACID (2,4,D)

A good place to start is the Material Safety Data Sheet for mixed amine salts of 2,4-D acid (www.herbiguide.com.au/MSDS/M24DAM625_61896-0308PDF.pdf). It includes the following Risk Phrases:

- R-22 Harmful if swallowed
- R-25 Toxic if swallowed
- R-36 Irritating to eyes
- R-38 Irritating to skin.

These lead to some obvious Safety Phrases, including S36/37/39 Wear suitable protective clothing, gloves, and eye/face protection. Overall the 2,4-D is reported to have 'slight to moderate acute toxicity' with LD_{50} values in the range of 300 to 1500 mg/kg for several small animal species.

Adding to this concern about the effects of contact of the herbicide with skin or eyes, is a concern about cancer formation (carcinogenesis). The recent decision by the International Agency for Research on Cancer (IARC) (Dana Loomis and others,

[884] J.D. Mathews 1989, The Role of Epidemiology, Menzies School of Health Research, Casurina, Northern Territory page 12. Proceedings of a seminar – *Pesticides – Are they a threat to our Health?* Weed Socie ty of Victoria Inc.

Lancet Oncology 16(8), 891-892 (2015) and forthcoming as IARC Monograph No. 113) to classify 2,4-D as 'possibly carcinogenic to humans' (Group 2B) has drawn attention to possible chronic health impacts of exposure to 2,4-D herbicides. Members of the working group that considered the question were divided as to the strength of evidence for such classification. The strongest evidence concerned the incidence of non-Hodgkin lymphoma in workers manufacturing 2,4-D but analysis of other experimental data from other over-exposed populations did not reveal an association. There was limited evidence of carcinogenicity in animals.

Scientific studies of non-cancer outcomes from 2,4-D exposure were also examined by the IARC working group, which concluded that 'mechanistic studies provided strong evidence that 2,4-D induces oxidative stress that can operate in humans, and moderate evidence that 2,4-D causes immunosuppression, based on *in-vivo* and *in-vitro* studies'.

Conclusion

Sprayers may have experienced irritation to skin and eyes from inadvertent exposure to 2,4-D herbicides. Concerning chronic effects, the levels of their exposure are probably well below those of production workers that triggered the IARC classification of 2,4-D as possibly carcinogenic to humans. The evidence, drawn from manufacturing workers and sprayers, linking 2,4-D with non-Hodgkin lymphoma was quite weak. Only a minor group within the working party considered that the evidence was even as much as 'limited', while the majority concluded that the evidence was 'insufficient'. The conclusion that there was a link was thus based on mixed results. Based on this, it can be said that there is a low potential for cancer formation but without access to the data on which the IARC assessment was based, this can only be a qualitative conclusion.

2,4,5-TRICHLOROPHENOXY ACETIC ACID (2,4,5-T).

Since 2,4,5-T is no longer used as a herbicide, at least in most countries, fewer relevant data are available. However, the MSDS for the potassium salt shows that it has similar properties to those of the 2,4-D salts – low acute toxicity but irritating to skin and eyes (www.rpicorp.com/templates/products_documents/T23020%20MSDS.pdf). 2,4,5-T was assessed by the IARC (IARC Monograph No. 15, 1977) without a conclusion being reached but a later assessment of a number of chlorophenoxy herbicides including 2,4,5-T (IARC Monograph No. 41 (1986)) concluded that there was 'limited evidence that occupational exposures to chlorophenoxy herbicides are carcinogenic to humans'. The main emphasis in other reports concerning the toxicity of 2,4,5-T has been on the contaminant 2,3,7,8-tetrachlorodibenzodioxin(TCDD).

Conclusion

Sprayers may have experienced irritation to skin and eyes from inadvertent exposure to 2,4,5-T herbicides. Evidence of carcinogenicity of 2,4,5-T is lacking so no conclusion can be reached about chronic effects of exposure to the herbicide.

2,3,7,8-TETRACHLORODIBENZODIOXIN (TCDD)

Drawing on findings of the Agency for Toxic Substances and Diseases Registry (ATSDR) in 2000, the US EPA identified the major short-term and chronic effects of exposure to high concentrations of TCDD as chloracne (www.epa.gov/airtoxics/hlthef/dioxin.html). TCDD was classified in Group 2B as a probable human carcinogen to which lung cancer, soft tissue sarcoma, lymphomas and stomach cancers can be attributed. There was no consistent relationship between increased dioxin exposure or body burden and the incidence of malignant lymphoma. The IARC has made several evaluations of TCDD as more evidence became available. In 1997 (IARC Monograph No. 69, 1997) the epidemiological evidence for carcinogenicity in humans was judged to be limited. It was not possible to establish a dose-response relationship between cancers and the background levels of TCDD in the population but there was a strong association for highly exposed workers and cancer mortality. Both the 1997 and 2012 IARC re-evaluations concluded that TCDD is Category 1 'carcinogenic to humans', not 2B as in earlier (1982 and 1987) evaluations. Similar progression of concern over the health impacts of TCDD has also been a feature of conclusions reached by the US EPA.

A number of studies have implicated exposure to dioxins, and TCDD in particular, as human carcinogens causing soft tissue sarcoma and non-Hodgkin lymphoma (see Appendix 5.1). The most important of these for the present Inquiry is a review prepared by an Australian group for the Government of Western Australia that was conducting an inquiry into the health impacts of contaminated herbicides (C. Gaus and others, 'Literature Review on the Human Health Effects Associated with Exposure to the Herbicides 2,4,5-T and 2,4-D, and Dioxins', prepared for the Department of Health, Government of Western Australia, August 2003). The authors reviewed five key documents published between 1997 and 2002 and also the

subsequent updates that together assessed the data in many scientific contributions. The aim was to reach an overall evaluation on the strength of the association between exposure to 2,4-D, 2,4,5-T and the TCDD impurity in the latter and a number of health endpoints. The strength of evidence of association between exposure to the chemical substances and a range of health endpoints were as follows:

- Established causal link: chloracne
- Probable causal link: total cancer, soft tissue sarcoma, non-Hodgkin lymphoma
- Possible causal link: laryngeal cancer, lung cancer, prostate cancer, Hodgkin disease, multiple myeloma, chronic lymphoid leukemia, immune system disorders, diabetes, lipid-lipoprotein disorders, porphyria cutanea tarda
- Insufficient evidence to establish a link: heptobiliary cancer, cancers of the head and neck, bone cancer, skin cancer (melanoma and non-melanoma), testicular cancer, urinary bladder cancer, renal cancer, leukemia (other than CLL), neurobehavioural disorders, respiratory disorders, male reproductive disorders, thyroid homeostasis, circulatory disorders, gastrointestinal disorders
- No causal link: gastrointestinal cancer, brain tumours.

The Gaus report sounded a note of caution, commenting that 'overall, the patterns of diseases, signs and symptoms summarised portray a broad picture of potential disorders and conditions that may be experienced after exposure to 2,4,5-T, 2,4-D and/or 2,3,7,8-TCDD'. However, 'conclusions on a causal link between patterns of disease, signs and symptoms and exposure to the compounds of interest cannot be drawn from descriptive studies'.

The exposures estimated for workers spraying 2,4,5-T herbicides are for the most part above the Tolerable Daily Intake (TDI). We need to keep in mind that the TDI contains several 'precautionary' factors that may amount to several powers of 10, but exceedance of the TDI is always a warning signal that should be heeded. On the other hand, the estimated exposures of the sprayers are probably low when compared to those of workers involved in the manufacture of 2,4,5-T herbicides.

It is known that there can be a long latency period before a cancer attributable to a particular exposure becomes evident. This has made it very difficult to establish cause-and effect relationships by epidemiological studies. Over a period of 30 years or so, a person may have been exposed to a number of carcinogens and moreover may be unaware of the exposure or unable to recall exactly what kind of exposure might be identified as the ultimate cause of the cancer.

It is not clear from the scientific literature whether the concentrations of TCDD – always described as 'high' – that produce chloracne are the same as those that are carcinogenic. However, it is likely to be the case that chloracne occurs soon after exposure, while cancers appear possibly many years later.

Conclusion

There was a potential for sprayers to suffer from soft tissue sarcoma or non-Hodgkin lymphoma due to their exposure to 2,4,5-T because of contamination of the herbicide with TCDD. The potential health risk would have been greater before the reduction in the level of the TCDD impurity in 2,4,5-T herbicides dating from about 1981. The data available to the Inquiry are not detailed enough to allow calculation of a relative risk based on the differences in the quantity of herbicide sprayed by a worker and the number of days or weeks in which the worker was spraying the 2,4-D and/or 2,4,5-T herbicides. However, an excess over the rate of diagnosis recorded for members of the general community who are not exposed to the herbicides is definitely a possibility but it is not possible to estimate the magnitude of this excess. Of course, sprayers may have also been exposed to other causes of such cancers, especially non-Hodgkin lymphoma, which is more common than soft tissue sarcoma.

Because of uncertainties in the data available to the Inquiry, much of which is either anecdotal or based on reports of group activities, the general conclusions are qualitative, not quantitative, and can only be stated in terms of increased risk rather than causation.

POSSIBLE FUTURE INVESTIGATION

Taking into account the likelihood that some workers could have suffered from exposure to the herbicides and contaminants, the health status of sprayers could be checked (a) for the occurrence of chloracne and (b) for the incidence of soft tissue sarcoma and non-Hodgkin lymphoma.

APPENDIX 5.1: NATURE OF THE CANCERS

The Cancer Council Victoria (www.cancervic.org.au) has published fact sheets about soft tissue sarcoma and non-Hodgkin lymphoma. Soft tissue sarcoma is rare, with about 178 Victorians diagnosed each year, most often in people aged over 55 years but it can also occur in younger people. There are over 70 types of this cancer but each involves a painless lump in soft tissues such as muscles, fat and blood vessels. The lumps most commonly develop in the thigh, shoulder and pelvis but can grow in the abdomen.

Each year in Australia non-Hodgkin lymphoma is diagnosed in some 3,500 people, mostly (70%) of whom are over 50 years of age. This cancer affects the lymph system, a part of the immune system in which antibodies and specialised white blood cells called lymphocytes circulate. The most common symptom is a firm, usually painless swelling in a lymph node, one of the places where impurities are filtered from the lymph fluid. The affected nodes are most often those in the neck, under the arms or in the groin.

Appendix 6: List of chemicals

Appendix 6.1: List of chemicals in use 1965 to 1975[a]

2,4-D and 2,4,5-T entries are bold

Chemicals In Use	Brand Names	'65	'66	'67	'68	'69	'70	'71	'72	'73	'74	'75
2,4-D	-		✓	✓					✓			
2,4-D ester 40%	-			✓	✓						✓	
2,4-D ester heavy based 40	**Estercide 40**										✓	
2,4-D ester 40% LV	**Ester 400 LV**											
2,4-D ester 80%	**Estercide 80, Ester 800, Farmco D80**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2,4-D ester heavy based 80	**Estair**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2,4-D amine 50%	**Amicide 50, Amine 500, Nufarm DL0500A, Shell Weedkiller Dm, Farmco D-50**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2,4-D amine 50% LV	**Amicide Lo 500, 500 Lo, Amicide Lo 500A, Nufarm DL0500**											
2,4,5-T ester 40% LV	**Low Volatile Five T 40, Agserv, Farmco TLV40**		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2,4,5-T ester 80%	**Triestyl 80, Farmco T-80, Brushtox 80, Five T Brushkiller, Nufarm 5T80**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2,2-D acid sodium salt	Dowpon	✓				✓	✓	✓				
2,3,6-TBA	Trysben 200, Fenac	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2,4-DB	Buticide											
22 DPA	Delapon, Nupon M, Agripon, Propon, Grasskiller	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Aluminium phosphide	Fostoxin, Gastoxin, Phostoxin					✓	✓	✓	✓	✓	✓	✓
Ametryne	Primatol, Flowable Primatol Z											

Chemicals In Use	Brand Names	'65	'66	'67	'68	'69	'70	'71	'72	'73	'74	'75
Aminetriazole	-			✓	✓							
Amitrole	Weedazol 50, Plus, TL Plus, Amitrole T, Amitrolet	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Arsenic liquid pentoxide	-	✓	✓	✓								
Arsenic pentoxide granulated	-	✓										
Atlacide	-											
Atrazine	Flowable Nutrazine, Flowable Gesaprim, Atradex 50, Flosol (Gesatop)								✓	✓	✓	✓
Bromacil	Hyvar X											
Bromoxynil	Bromicide 200, Brominil											
Calcium cyanide flake	Fumoflake	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Calcium cyanide powder	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Chlorinated benzoic acid	-		✓	✓	✓	✓	✓	✓				
Chloropicrin (tear gas)	FumoKill, Larvacide	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dicamba	Banval 200, Dicamba 200, Banex, Lontrel											
Diquat	Reglone											
Diuron	-											
Fenatrole	-											
Fosamine	-											
Frenock	-											
Glyphosate	Roundup											
Hexazinane	Velpar L											
Krenite												
Maldison bromodionline	-											

Chemicals In Use	Brand Names	'65	'66	'67	'68	'69	'70	'71	'72	'73	'74	'75
2-methyl-4-chlorophenoxyacetic acid	MCPA		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MCPB	-											
Metsulfuron-methyl	Brush-Off	✓										
MSMA	-											
Paraquat	Gramoxone											
Picloram granules	-									✓	✓	✓
Picloram	Tordon, Tordon 50D, Graxon, Tordon 520		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pindone	Warfarin											
Primatol	-											
Sodium borate	Polyborchlorate	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sodium chlorate preparation	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sodium monofluroacetate	1080	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Strychnine	-											
Trichloroacetic acid	TCA Grasskiller	✓		✓	✓				✓	✓	✓	✓
Tetrapion	Frenock											
Triclopyr	Garlon 480, Garlon, Grazon											
Wetting agent	Agral, Plus 50, Tween 20, Comprox, Teepol								✓			

Chemical Mixtures

Grazon	Triclopyr, Picloram
Tordon 520	50g/L Picloram plus 200g/L 2,4,5-T
Vorox AA	Amitrole, Atrazine

Appendix 6.2: List of chemicals in use 1976 to 1985[a]

2,4-D and 2,4,5-T entries are bold

Chemicals In Use	Brand Names	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85
2,4-D	-								✓	✓	✓
2,4-D ester 40%	-	✓	✓	✓	✓	✓		✓	✓		
2,4-D ester heavy based 40	**Estercide 40**			✓					✓	✓	
2,4-D ester 40% LV	**Ester 400 LV**			✓	✓		✓	✓	✓	✓	✓
2,4-D ester 80%	**Estercide 80, Ester 800, Farmco D80**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2,4-D ester heavy based 80	**Estair**										
2,4-D amine 50%	**Amicide 50, Amine 500, Nufarm DL0500A, Shell Weedkiller Dm, Farmco D-50**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2,4-D amine 50% LV	**Amicide Lo 500, 500 Lo, Amicide Lo 500A, Nufarm DLO500**								✓	✓	✓
2,4,5-T ester 40% LV	**Low Volatile Five T 40, Agserv, Farmco TLV40**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2,4,5-T ester 80%	**Triestyl 80, Farmco T-80, Brushtox 80, Five T Brushkiller, Nufarm 5T80**	✓	✓	✓	✓	✓	✓	✓			
2,2-D acid sodium salt	Dowpon						✓	✓	✓		
2,3,6-TBA	Trysben 200, Fenac			✓	✓	✓	✓				
2,4-DB	Buticide			✓	✓	✓	✓	✓	✓	✓	✓
22 DPA	Delapon, Nupon M, Agripon, Propon, Grasskiller		✓	✓	✓	✓	✓	✓	✓	✓	✓
Aluminium phosphide	Fostoxin, Gastoxin, Phostoxin	✓		✓	✓	✓	✓	✓	✓		✓
Ametryne	Primatol, Flowable Primatol Z				✓	✓	✓	✓	✓	✓	✓
Aminetriazole	-										
Amitrole	Weedazol 50, Plus, TL Plus, Amitrole T, Amitrolet	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Chemicals In Use	Brand Names	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85
Arsenic liquid pentoxide	-										
Arsenic pentoxide granulated	-										
Atlacide	-		✓				✓	✓			
Atrazine	Flowable Nutrazine, Flowable Gesaprim, Atradex 50, Flosol (Gesatop)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bromacil	Hyvar X	✓	✓	✓	✓	✓	✓	✓	✓		
Bromoxynil	Bromicide 200, Brominil			✓	✓	✓	✓	✓	✓	✓	✓
Calcium cyanide flake	Fumoflake	✓		✓	✓	✓	✓	✓	✓		✓
Calcium cyanide powder	-			✓							
Chlorinated benzoic acid	-										
Chloropicrin (tear gas)	FumoKill, Larvacide	✓			✓	✓	✓	✓	✓		✓
Dicamba	Banval 200, Dicamba 200, Banex, Lontrel		✓	✓	✓	✓	✓	✓	✓	✓	✓
Diquat	Reglone				✓	✓	✓	✓			
Diuron	-				✓	✓	✓	✓			
Fenac (2,3,6-T)	-										
Fenatrole	-	✓	✓	✓	✓		✓	✓			
Fosamine	-									✓	✓
Frenock	-							✓			
Glyphosate	Roundup				✓	✓	✓	✓	✓	✓	✓
Hexazinane	Velpar L		✓	✓	✓	✓	✓	✓	✓	✓	✓
Krenite							✓	✓			
Maldison bromodionline	-										
2-methyl-4-chlorophenoxyacetic acid	MCPA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Chemicals In Use	Brand Names	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85
MCPB	-				✓	✓	✓	✓			
Metsulfuron-methyl	Brush-Off										
MSMA	-		✓	✓	✓	✓	✓	✓		✓	✓
Paraquat	Gramoxone				✓	✓	✓	✓			
Picloram granules	-										
Picloram	Tordon, Tordon 50-D, Tordon 520	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pindone	Warfarin										
Primatol	-				✓	✓					
Sodium borate	Polyborchlorate		✓	✓	✓	✓	✓	✓			
Sodium chlorate preparation	-		✓	✓	✓						
Sodium monofluroacetate	1080			✓	✓	✓	✓	✓	✓		✓
Strychnine	-										
Trichloroacetic acid	TCA Grasskiller	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tetrapion	Frenock						✓	✓		✓	✓
Triclopyr	Garlon 480, Garlon, Grazon						✓	✓	✓	✓	✓
Triton B	-										
Wetting agent	Agral, Plus 50, Tween 20, Comprox, Teepol		✓	✓	✓	✓	✓	✓			

Chemical Mixtures

Grazon	Triclopyr, Picloram
Tordon 520	50g/L Picloram plus 200g/L 2,4,5-T
Vorox AA	Amitrole, Atrazine

Appendix 6.3: List of chemicals in use 1986 to 1995[a]

2,4-D and 2,4,5-T entries are bold

Chemicals In Use	Brand Names	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95
2,4-D	-	✓							✓	✓	✓
2,4-D ester 40%	-										
2,4-D ester heavy based 40	**Estercide 40**										
2,4-D ester 40% LV	**Ester 400 LV**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2,4-D ester 80%	**Estercide 80, Ester 800, Farmco D80**	✓	✓	✓	✓	✓	✓				
2,4-D ester heavy based	-										
2,4-D amine 50%	**Amicide 50, Amine 500, Nufarm DL0500A, Shell Weedkiller Dm, Farmco D-50**		✓	✓				✓	✓	✓	✓
2,4-D amine 50% LV	**Amicide Lo 500, 500 Lo, Amicide Lo 500A,**	✓	✓		✓	✓	✓	✓			
2,4,5-T ester 40% LV	**Low Volatile Five T 40, Agserv, Farmco TLV40**	✓	✓								
2,4,5-T ester 80%	**Triestyl 80, Farmco T-80, Brushtox 80, Five T Brushkiller, Nufarm 5T80**										
2,2-D acid sodium salt	Dowpon										
2,3,6-TBA	Trysben 200, Fenac										
2,4-DB	Buticide	✓	✓	✓	✓	✓	✓	✓	✓		
22 DPA	Delapon, Nupon M, Agripon, Propon, Grasskiller	✓	✓			✓	✓				
Aluminium phosphide	Fostoxin, Gastoxin, Phostoxin	✓				✓	✓	✓	✓	✓	✓
Ametryne	Primatol, Flowable Primatol Z	✓	✓			✓	✓				
Aminetriazole	-										
Amitrole	Weedazol 50, Plus, TL Plus, Amitrole T, Amitrolet, Vorox AA	✓	✓	✓	✓	✓	✓	✓	✓		

Chemicals In Use	Brand Names	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95
Arsenic liquid pentoxide	-										
Arsenic pentoxide granulated	-										
Atlacide	-										
Atrazine	Flowable Nutrazine, Flowable Gesaprim, Atradex 50, Flosol (Gesatop), Vorox AA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bromacil	Hyvar X		✓		✓	✓	✓				
Bromoxynil	Bromicide 200, Brominil	✓	✓	✓	✓	✓	✓		✓	✓	✓
Calcium cyanide flake	Fumoflake	✓									
Calcium cyanide powder	-										
Chlorinated benzoic acid	-										
Chloropicrin (tear gas)	FumoKill, Larvacide	✓				✓	✓		✓	✓	✓
Dicamba	Banval 200, Dicamba 200, Banex, Lontrel	✓	✓		✓	✓	✓	✓	✓	✓	✓
Diquat	Reglone		✓	✓	✓	✓	✓		✓	✓	✓
Diuron	-		✓		✓						
Fenac (2,3,6-T)	-										
Fenatrole	-										
Fosamine	-	✓	✓								
Frenock	-		✓		✓	✓	✓	✓			
Glyphosate	Roundup	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hexazinane	Velpar L	✓	✓	✓	✓	✓	✓	✓	✓		
Krenite	-		✓	✓		✓	✓	✓	✓		
Maldison bromodionline	-										

Chemicals In Use	Brand Names	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95
2-methyl-4-chlorophenoxyacetic acid	MCPA	✓	✓	✓	✓	✓	✓	✓			
MCPB	-										
Mesulfuron-methyl	Brush-Off			✓	✓	✓	✓	✓	✓		
MSMA	-	✓	✓								
Paraquat	Gramoxone	✓	✓								
Picloram granules	-	✓	✓								
Picloram	Tordon, Tordon 50-D	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pindone	Warfarin					✓	✓				
Primatol	-										
Sodium borate	Polyborchlorate	✓	✓								
Sodium chlorate preparation	-										
Sodium monofluroacetate	1080	✓				✓	✓	✓	✓	✓	✓
Strychnine	-	✓				✓	✓				
Trichloroacetic acid	TCA Grasskiller	✓	✓		✓	✓	✓	✓	✓		
Tetrapion	Frenock	✓	✓								
Tordon 50D	-										
Tordon granules	-										
Triclopyr	Garlon 480, Garlon	✓	✓	✓	✓	✓	✓	✓	✓		
Velpar	-										
Wetting agent	Agral, Plus 50, Tween 20, Comprox, Teepol	✓	✓			✓	✓	✓	✓		

Chemical Mixtures

Grazon	Triclopyr, Picloram
Tordon 520	50g/L Picloram plus 200g/L 2,4,5-T
Vorox AA	Amitrole, Atrazine

NOTE: Evidence of which chemicals were used was not found for all periods.

Appendix 6.4: 2,4-D – Recommended weed treatment for spot spraying, Department of Crown Lands and Survey Bulletins[b]

First preference herbicide treatments used where multiples are recommended.

Year	1963 2,4-D	1972 2,4-D	1977 2,4-D	1983 2,4-D
Acacia hedge				
Amsinckia	0.1–0.2%, 1:800–1:400 of an 80% product	1 pint Tordon 50D/ 100 L water	Bromoxynil	Cultivation
Angeled onion	Not listed	Not listed	800 mL/100 L water if using 50% amine product (1:125)	800 mL/100 L water if using 500 g/L amine
Artichoke thistle	0.2%–0.4%, 1:800–1:400	Picloram 1 gal Tordon 50D/150 L water	330 mL Tordon 50D/100 L water (1:300)	330 mL Tordon 50D/100 L water
Bathurst burr	0.1–0.2%, 1:800–1:400 of an 80% product	0.1–0.2%, 1:800–1:400 of an 80% product	125–250 mL/ 100 L water if using 80% product (1:800–1:400)	250mL–500mL/100 L water if using 400 g/L LV product
Bindweed	0.2%, 1:400	0.2%, 1:250 of a 50% product	2 L Tordon 50D/ 100 L water	2 L Tordon 50D/ 100 L water
Blackberry bramble				
Blackberry Italian or Cut leaf				
Black knapweed	Not listed	0.2%, 1:400 of an 80% product	Picloram 1 L Tordon 50D/ 100 L water	1 L Tordon 50D/ 100 L water
Boneseed	Not listed	0.5% of a 50% product; Undiluted, painted on stumps	1 L/10 L water if using 50% amine product (1:10)	10 L/100 L water if using 500 g/L product; cut stump.
Boxthorn	2%, basal 18 inches	Undiluted, painted on stumps	Undiluted 50% amine product	Undiluted 500 g/L amine product
Buffalo burr	No known effective chemical control	No known effective chemical control	250 mL/100 L water if using 80% product (1:400)	500 mL/100 L water if using 400 g/L LV product

Year	1963 2,4-D	1972 2,4-D	1977 2,4-D	1983 2,4-D
Californian burr	0.1–0.2%, 1:800–1:400 of an 80% product	0.1–0.2%, 1:800–1:400 of an 80% product	125–250 mL/ 100 L water if using 80% product (1:800–1:400)	250–500 mL/ 100 L water if using 400 g/L LV product
Californian thistle	MCPB	MCPB	500mL/100 L water if using 40% product (1:200)	2,4-DB
Caltrop	0.1–0.2%, 1:800–1:400 of an 80% product	0.1–0.2%, 1:800–1:400 of an 80% product	125–250 mL/ 100 L water if using 80% product (1:800–1:400)	250–500 mL/ 100 L water if using 400 g/L LV product
Camel thorn	0.2%, 1:400 of an 80% product	2,3,6-TBA	2l 'Tordon 50D'/100l water	2l 'Tordon 50D'/ 100 L water
Cape broom				
Cape tulip (1- and 2-leaf)	0.2%, 1:400 of an 80% product	0.2%, 1:400 of an 80% product	250 mL/100 L water if using 80% product (1:400)	500 mL/100 L water if using 400 g/L LV product
English broom				
Fennel	Not listed	0.2%, 1:400 of an 80% product	250 mL/100 L water if using 80% product (1:400)	500 mL/100 L water if using 400 g/L LV product
Flax leaf broome				
Furze				
Golden thistle	0.2%, 1:400 of an 80% product	0.2%, 1:400 of an 80% product	250 mL/100 L water if using 80% product (1:400)	500 mL/100 L water if using 400 g/L LV product
Great mullein				
Hardhead thistle	0.2–0.3%, 1:400–1:266	0.2%, 1:400 of an 80% product	Picloram	Lontrel L
Hawthorn	Not listed	Paint undiluted	Paint undiluted 50% amine product	Undiluted 500 g/L amine product
Hemlock	0.2%	0.2%, 1:400 of an 80% product	250 mL/100 L water if using 80% product (1:400)	500 mL/100 L water if using 400 g/L LV product

Year	1963 2,4-D	1972 2,4-D	1977 2,4-D	1983 2,4-D
Hoary cress	0.1–0.2%, 1:800–1:400 of an 80% product	0.1–0.2%, 1:800–1:400 of an 80% product	125–250 mL/100 L water if using 80% product (1:800–1:400)	250 mL–500mL/100 L water if using 400 g/L LV product
Horehound/Noding thistle/Must weed	0.2%, 1:400	0.2%, 1:400 of an 80% product	250 mL/100 L water if using 80% product (1:400)	500 mL/100 L water if using 400 g/L LV product
Illyrian thistle	0.2%, 1:400	0.2%, 1:400 of an 80% product	250 mL/100 L water if using 80% product (1:400)	500 mL/100 L water if using 400 g/L LV product
Mesquite				
Musk weed	0.2%, 1:400	0.2%, 1:400	250 mL/100 L water if using 80% product (1:400)	500 mL/100 L water if using 400 g/L LV product
Nogurra burr	0.1–0.2%, 1:800–1:400 of an 80% product	0.1–0.2%, 1:800–1:400 of an 80% product	125–250 mL/ 100 L water if using 80% product (1:800–1:400)	250–500 mL/100 L water if using 400 g/L LV product
Nut grass	0.2–0.3%, 1:400–1:266	0.2%, 1:400 of an 80% product	250–380 mL/ 100 L water if using 80% product (1:400–1:266)	Glyphosate
Paterson's curse	0.2%, 1:400	0.2%, 1:400 of an 80% product	125–250 mL/ 100 L water if using 80% product (1:800–1:400)	250ml–500 mL/100 L water if using 400 g/L LV product
Poverty weed	0.2%, 1:400	2,3,6-TBA	125 mL/ 100 L water if using 80% product (1:800)	
Prairie ground cherry	Amitrole	Amitrol	Amitrole	Picloram and 2,4-D amine (1 L Tordon 50D/100 L water)
Prickly pear				
Ragweed	0.3%, 1:266 of an 80% product	0.3%, 1:266 of an 80% product	Not listed	
Ragwort	0.2%, 1:400 of an 80% product	0.2%, 1:400 of an 80% product	250 mL/100 L water if using 80% product (1:400)	500 mL/100 L water if using 400 g/L LV product

Year	1963 2,4-D	1972 2,4-D	1977 2,4-D	1983 2,4-D
Saffron thistle	0.05–0.1%, 1:1, 600–1:800	0.05%, 1:400 of an 80% product	65–125 mL/100 L water if using 80% product (1:600–1:800)	Ester: 130–250 mL/100 L water if using 400 g/L LV product
St Barnaby's thistle	0.2%, 1:400	0.2%, 1:400 of an 80% product	250 mL/100 L water if using 80% product (1:400)	500 mL/100 L water if using 400 g/L LV product
St John's wort	0.2–0.3%, 1:400–1:266	0.2%, 1:400 of an 80% product	250–380 mL/ 100 L water if using 80% product (1:400–1:266)	500–760 mL/100 L water if using 400 g/L LV product
St Peter's wort	0.2%, 1:400	0.2%, 1:400 of an 80% product	250–380 mL/ 100 L water if using 80% product (1:400–1:266)	500–760 mL/100 L water if using 400 g/L LV product
Skeleton weed	0.2%, 1:400	0.2%, 1:400 of an 80% product	Picloram 1 L Tordon 50D/ 100 L water (1:100)	Picloram and 2,4-D amine (1 L Tordon 50D/100 L water)
Soldier thistle	0.2%, 1:400	0.2%, 1:400 of an 80% product	250 mL/100 L water if using 80% product (1:400)	500 mL/100 L water if using 400 g/L LV product
Spear thistle	0.05–0.15%, 1:1600–1:1530 of an 80% product	0.05–0.15%, 1:1600–1:1530 of an 80% product	65–190 mL/ 100 L water if using 80% product (1:1600–1:530)	130–380 mL/ 100 L water if using 400 g/L LV product
Spiny broom	Resistant to hormone weedicides	Picloram 1 L Tordon 50D/ 100 L water (1:100)	Picloram 1 L Tordon 50D/ 100 L water (1:100)	Picloram and 2,4-D amine (1 L Tordon 50D/100 L water)
Spiny rush	0.5% oil-based esters	0.5%, 1:70 if using a 35% product	Velpar	Hexazinone
Star thistle/Stinkwort	0.1–0.2%, 1:800–1:400 of an 80% product	0.1–0.2%. 1:800–1:400 of an 80% product	125–250 mL/ 100 L water if using 80% product (1:800–1:400)	250—500 mL/100 L water if using 400 g/L LV product
Stemless thistle	0.2%, 1:400	0.2%, 1:400 of an 80% product	250 mL/100 L water if using 80% product (1:400)	500 mL/100 L water if using 400 g/L LV product

Year	1963 2,4-D	1972 2,4-D	1977 2,4-D	1983 2,4-D
Stinkwort	0.1–0.2%, 1:800–1:400	0.1-0.2%, 1:800–1:400 of an 80% product	125–250 mL/ 100 L water if using 80% product (1:800–1:400)	250—500 mL/100 L water if using 400 g/L LV product
Sweet briar			Picloram 1 L Tordon 50D/ 100 L water, 1:100	Picloram
Tangled hypericum	Not listed		Picloram 1 L Tordon 50D/ 100 L water, 1:100	Picloram and 2,4-D amine (1 L Tordon 50D/100 L water)
Thorn apple	0.2%, 1:400	0.2%, 1:400 of an 80% product	250 mL/100 L water if using 80% product (1:400)	500 mL/100 L water if using 400 g/L LV product
Tufted honeyflower				
Variegated or Spotted thistle	0.1–0.2%, 1:800–1:400	0.05–0.2%, 1:1600–1:1400 of an 80% product	65–250ml/100 L water if using 80% product (1:600–1:400)	130–500ml/ 100 L water if using 400 g/L LV product
Water hyacinth	0.3%, 1:266	0.3%, 1:266 of an 80% product.	380 mL/ 100 L water if using 80% product (1:266)	760 mL/100 L water if using 400 g/L LV product
Wheel cactus				
Silver leaf nightshade/Whitehorse nettle	Amitrole	Bromacil	Picloram 1 L Tordon 50D/ 100 L water (1:100)	Picloram and 2,4-D amine (1 L Tordon 50D/100 L water)
Wild garlic	0.4%, 1:200	0.4%, 1:200 of an 80% product	Picloram 500 mL Tordon 50D/ 100 L water (1:200)	Picloram and 2,4-D amine (1 L Tordon 50D/100 L water)
Wild bitter melon	0.1%, 1:800	Not listed	65 mL/100 L water if using 80% product (1:600)	130 mL/ 100 L water if using 400 g/L LV product
Wild mignonette	0.2%, 1:400	0.2%, 1:400 of an 80% product	250 mL/100 L water if using 80% product (1:400)	500 mL/100 L water if using 400 g/L LV product
Wild teasel	0.1%, 1:800	0.1–0.2%, 1:800-1:400 of an 80% product	125–250 mL/ 100 L water if using 80% product (1:800–1:400)	250—500 mL/100 L water if using 400 g/L LV product

Year	1963 2,4-D	1972 2,4-D	1977 2,4-D	1983 2,4-D
Yellow-leaf amsinckia	0.1–0.2%, 1:800–1:400 of an 80% product	Not listed	Not listed	Not listed

Appendix 6.5: 2,4,5-T – Recommended weed treatment for spot spraying, Department of Crown Lands and Survey Bulletins[b]

First preference herbicide treatments used where multiples are recommended.

Year	1963 2,4,5-T	1972 2,4,5-T	1977 2,4,5-T	1983 2,4,5-T
Acacia hedge	0.1%, 1:800 of an 80% product.	Not listed	125 mL/100 L water if using 80% product (1:800)	250 mL/100 L water if using 400 g/L LV product
Amsinckia				
Angeled onion				
Artichoke thistle				
Bathurst burr				
Bindweed				
Blackberry bramble	0.07%, 1:1200	0.07%, 1:1200 of an 80% product	90 mL/100 L water if using 80% product (1:1200)	170 mL/100 L water if using 400 g/L LV product
Blackberry Italian or Cut leaf	0.1%, 1:800			2 L/100 L water
Black knapweed				
Boneseed				
Boxthorn				
Buffalo burr				
Californian burr				
Californian thistle				
Caltrop				
Camel thorn				
Cape broom	0.1%, 1:800 of an 80% product	0.1%, 1:800 of an 80% product	125 mL/ 100 L water if using 80% product (1:800)	250 mL/100 L water if using 400 g/L LV product
Cape tulip (1- and 2-leaf)				

Year	1963 2,4,5-T	1972 2,4,5-T	1977 2,4,5-T	1983 2,4,5-T
English broom	0.1%, 1:800	0.1%, 1:800 of an 80% product	125 mL/ 100 L water if using 80% product (1:800)	250 mL/100 L water if using 400 g/L LV product
Fennel				
Flax-leaved broom	0.1%, 1:800	0.1%, 1:800 of an 80% product.	125 mL/ 100 L water if using 80% product (1:800)	250 mL/100 L water if using 400 g/L LV product
Furze	0.13%, 1:600	0.13%, 1:600 of an 80% product	170 mL/ 100 L water if using 80% product (1:600)	340 mL/ 100 L water if using 400 g/L LV product
Golden thistle				
Great mullein	0.1%, 1:800	0.1%, 1:800 of an 80% product.	125 mL/ 100 L water if using 80% product (1:800)	250 mL/100 L water if using 400 g/L LV product
Hardhead thistle				
Hawthorn				
Hemlock				
Hoary cress				
Horehound/Noding thistle/Must weed				
Illyrian thistle				
Mesquite			6 L /100 L distillate if using 400 g/L LV product	
Musk weed				
Nogurra burr				
Nut grass				
Paterson's curse				
Poverty weed				
Prairie ground cherry				
Prickly pear	Arsenical weedicides	1.6%, 1:54 (distillate) 3 fl.oz. of an 80% product in 1 gal. distillate	2 L/100 L distillate if using 80% product (1:50)	4 L/100 L distillate if using 400 g/L LV product

Year	1963 2,4,5-T	1972 2,4,5-T	1977 2,4,5-T	1983 2,4,5-T
Ragweed				
Ragwort				
Saffron thistle				
St Barnaby's thistle				
St John's wort				
St Peter's wort				
Skeleton weed				
Soldier thistle				
Spear thistle				
Spiny broom				
Spiny rush				
Star thistle/Stinkwort				
Stemless thistle				
Stinkwort				
Sweet briar	0.2%, applied 1:400 2.0% as a basal spray (1:40)	2.0% applied as a basal spray 1:40 of an 80% product.		
Tangled hypericum				
Thorn apple				
Tufted honeyflower	Not listed	0.1%, 1:800 of an 80% product.	125 mL/ 100 L water if using 80% product (1:800)	250 mL/ 100 L water if using 400 g/L LV product
Variegated or Spotted thistle				
Water hyacinth				
Wheel cactus	Arsenical Weedicides	1.6%, 1:54 (distillate) 3 fl.oz. of an 80% product in 1 gal. distillate	2 L/100 L distillate if using 80% product (1:50)	4 L/100 L distillate if using 400 g/L LV product
Silver leaf nightshade/Whitehorse nettle				

Year	1963 2,4,5-T	1972 2,4,5-T	1977 2,4,5-T	1983 2,4,5-T
Wild garlic				
Wild bitter melon				
Wild mignonette				
Wild teasel				
Yellow-leaf amsinckia				

[a] Reference documents for Appendix 6.1, 6.2 & 6.3

1965-1975

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1976-1985

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1985-1995

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[b] Reference documents for Appendix 6.4 and 6.5

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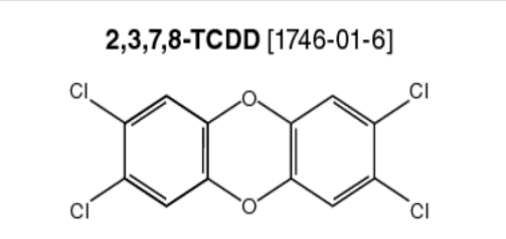
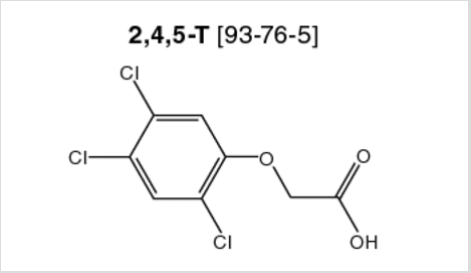
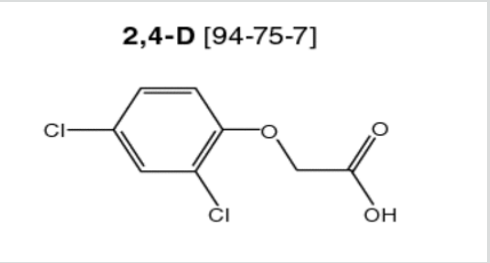
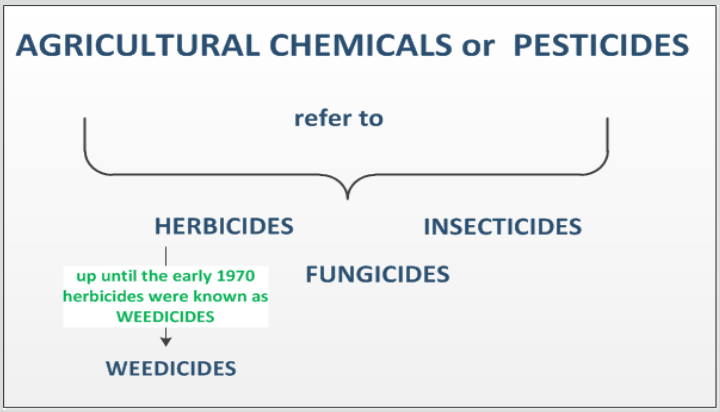
Appendix 7: Key definitions

These definitions have been chosen as the closest fit for the purposes of this Inquiry. Note that several of the terms will have varied or different definitions exist in different contexts.

Word	Definition
2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) 	2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), a known human carcinogen, was a common contaminant by-product in the manufacture of 2,4,5-T and its derivatives. 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) is the most potent of the polychlorinated dibenzo-p-dioxins so it is presumed to be the most problematic of the dioxin-like chemicals contaminating the phenoxy herbicides. *See also:* ***dioxin*** ***Polychlorinated dibenzo-p-dioxins***
2,4-D and 2,4,5-T as 'acid' form	The acid forms of 2,4-D and 2,4,5-T are slightly soluble in water.
2,4-D and 2,4,5-T as a 'salt' form	The amine and alkali metal salt derivatives of 2,4-D and 2,4,5-T are highly soluble.
2,4-D as an 'ester' form	The ester forms of 2,4-D are highly volatile.
2,4,5-T or trichlorophenoxyacetic acid 	2,4,5-T is the common name for 2,4,5-trichlorophenoxyacetic acid, a chlorophenoxy herbicide. The herbicide was also commercially produced as an amine salt, alkali metal salt and ester derivative of 2,4,5-T.
2,4-D or dichlorophenoxyacetic acid 	2,4-D is the common name for 2,4-dichlorophenoxyacetic acid, a chlorophenoxy herbicide. Formulations include esters, acids, and several salts, which vary in their chemical properties, environmental behaviour, and to a lesser extent, toxicity. The salt and ester forms are derivatives of 2,4-D.
acceptable daily intake (ADI)	An estimate of the daily intake of a substance that can occur over a lifetime without appreciable health risk. *See also:* ***tolerable intake*** *definition* The ADI is equivalent in meaning to **reference dose (RfD)** and **tolerable daily intake (TDI).**

Word	Definition
active ingredient/active constituent	The substance or substances in a pesticide product which are primarily responsible for the biological or other effects that make the product work as a pesticide.
acute exposure	A contact between an substance and an organism occurring over a short time, generally less than 14 days, with a single or repeated dose.
Agent Orange	Herbicide mixture of 2,4-D and 2,4,5-T (approximately 1:1) used in the Vietnam conflict for defoliation purposes.
agricultural chemicals (sometime called 'agchems', 'agrochemicals', pesticides or farm chemicals)	A broad term that is used to cover pesticides, plant growth regulators, defoliants and other chemical tools used in improving agricultural production, protecting crops or controlling pest diseases and physiological conditions of crops or plants.  An agricultural chemical or pesticide is a chemical or organism used to eliminate, incapacitate, inhibit growth of weeds or repel pests. Agricultural chemicals or pesticides are normally classified according to their intended target. Examples include herbicides, insecticides and fungicides: **Herbicides:** are designed to kill or control unwanted plants or weeds. **Weedicides:** up until the early 1970s herbicides were more commonly referred to as weedicides. **Insecticides:** are designed to kill insects or arachnids (spiders, ticks and mites). **Fungicides:** are used to protect a crop against attack from fungal diseases.
Amine and sodium salt formulations of phenoxy herbicides	Amine and sodium salt formulations of phenoxy herbicides do not produce volatile vapours at normal application temperatures. An agricultural chemical that cannot produce vapours under normal operating temperatures (such as amine or salt formulations) can only cause droplet drift during spray operations, which is generally limited to relatively short distances of up to a few hundred metres.

Word	Definition
biological monitoring	Measurement of a contaminant, chemical or biological substance in body tissue, fluid, blood or expired air.
cancer	A large group of diseases with the common feature being the rapid creation of abnormal cells that grow beyond the usual boundary and can then invade adjoining parts of the body and other organs after cell division within the same individual.
carcinogen	Chemical, biological or physical cancer-causing substance.
carcinogenicity	A property of a substance that enables it to produce tumours, whether benign or malignant. *See also:* ***genotoxic, mutagenic***
chloracne	A severe skin disease characterised by acne-like lesions. Chloracne generally occurs on the face and upper body, but may occur elsewhere on the body.
chlorophenoxy herbicides	*See* ***phenoxy herbicides*** *definition*
chronic exposure	Contact between a substance and an organism occurring over a continuous or repeated basis for a duration of three months or greater.
cohort	A group of people with a shared characteristic.
cohort studies	Studies that follow groups of individuals, defined in terms of their exposures, over time. The approach is to examine differences in the development of disease or health outcomes in an exposed group, compared to a non-exposed group.
confounding factor	A variable or external influence that distorts the apparent effect or magnitude of the variable being measured in a study. Confounding factors must be controlled in order to obtain an undistorted estimate of the effect under study.
congenital	A medical condition or disease present at birth, whether inherited or not.
conservative approach	A 'conservative approach' is intended to imply a cautious approach to evaluating and managing the uncertainties inherent in a risk assessment, which reduces the probability of harm occurring. A conservative approach is often built into a health assessment by using exposure estimates that represent the upper band of a range of measurements rather than using average or typical values.

Word	Definition
dangerous goods	Substances and articles are considered to be dangerous goods if they are explosive, flammable, poisonous or exhibit chemical or physical properties such as oxidising properties, radioactivity etc. that are potentially dangerous to people or property.
dermal absorption	The absorption of a chemical substance into and through the skin *See also* ***Appendix 4.2 Skin absorption***
dioxins	The term 'dioxins' refers to a group of highly toxic chemical compounds largely produced as by-products of combustion and some industrial processes that include TCDD (a polychlorinated dibenzo-*p*-dioxin (PCDD)). Dioxins are persistent environmental pollutants. They share similar chemical structures and mechanism of toxicity. *See also* ***polychlorinated dioxins (PCDDs)***
epidemiology	The branch of medical science dealing with the incidence and prevalence of disease in large populations. Epidemiological methods compare health outcomes in an exposed population or group, with those in a non-exposed population.
exposure	Concentration or amount of a particular chemical that reaches an organism, or system or (sub)population in a specific frequency for a defined duration.
exposure assessment	The estimation (qualitative or quantitative) of the magnitude, frequency, duration, route and extent of exposure to one or more contaminated substances for the general population, for different sub-groups of the population, or for individuals.
fungicide	*See* ***agricultural chemical*** *definition*
genotoxic carcinogen	A chemical for which there is adequate evidence that the ability to induce tumours is via a mechanism involving direct damage to DNA.
genotoxic chemical	A chemical for which there is adequate evidence of the potential to interact with, and/or modify genetic material.
genotoxic mode of action	A mode of action of a chemical involving direct damage or modification to genetic material.
genotoxicity	A broad term describing the ability to produce damage to the genetic material (DNA) of cells or organisms.
hazard	Inherent property of a substance or situation having the potential to cause adverse effects when a population may be exposed to that substance.

Word	Definition
hazardous substance	Workplace hazardous chemicals are substances, mixtures and articles used in the workplace that can be classified according to their health and physicochemical hazards. Health hazards are hazards like skin irritants, carcinogens or respiratory sensitisers that have an adverse effect on a worker's health as a result of direct contact with or exposure to the chemical, usually through inhalation, skin contact or ingestion.
herbicide	*See **agricultural chemical** definition*
high volatile ester	*See **volatile esters** definition*
Hodgkin lymphoma	A cancer of the immune system that is marked by the presence of a type of cell called the Reed-Sternberg cell. The two major types of Hodgkin lymphoma are classical Hodgkin lymphoma and nodular lymphocyte-predominant Hodgkin lymphoma. *Also known as Hodgkin disease*
IARC Monographs	The IARC Monographs identify environmental factors that can increase the risk of human cancer. These include chemicals, complex mixtures, occupational exposures, physical agents, biological agents, and lifestyle factors.
IARC Monographs Programme	IARC Monographs Programme identifies and evaluates environmental causes of cancer in humans. To date, more than 900 substances have been reviewed. IARC classifies carcinogens in five categories: *Group 1: The substance is carcinogenic to humans* *Group 2A: The substance is probably carcinogenic to humans* *Group 2B: The substance is possibly carcinogenic to humans* *Group 3: The substance is not classifiable as to its carcinogenicity to humans* *Group 4: The substance is probably not carcinogenic to humans.* *See also **Appendix 4.3 IARC classifications***
insecticide	*See **agricultural chemical** definition*
label instructions	The APVMA-approved written or graphic instructions on a label or in a leaflet, pamphlet or booklet provided with a pesticide product. The instructions may provide information on safety, use and disposal of pesticides, along with active constituents and other ingredients.
LD 50	A common measure of acute toxicity is the lethal dose (LD 50) or lethal concentration (LC 50) that causes death (resulting from a single or limited exposure) in 50% of the treated animals.

Word	Definition
low volatile ester	*See **volatile esters** definition*
lowest observed adverse effect level (LOAEL)	The lowest concentration or amount of a substance found by experiment or observation that causes adverse alterations of morphology, functional capacity, growth, development or life span of target organisms.
misting machine	A machine or piece of equipment used for agricultural spraying which uses an air blast or air stream for dispersing the spray.
mutagenic	The ability to produce a permanent change in the amount or structure of genetic material of cells or organisms. *See also: **genotoxic***
Neonate	An infant less than four weeks old.
no observed adverse effects level (NOAEL)	The level of exposure below which there is no appreciable risk of adverse health effects.
non-genotoxic carcinogen	A substance that induces tumours via a mechanism that does not involve direct damage to genetic material (DNA); sometimes referred to as 'epigenetic'.
non-Hodgkin lymphoma	Any of a large group of cancers of lymphocytes (white blood cells). Non-Hodgkin lymphomas can occur at any age and are often marked by lymph nodes that are larger than normal, fever, and weight loss.
occupational exposure	Exposure to substances or mixtures in the workplace. Exposure occurs through inhalation, skin contact or by ingestion and can cause serious health issues.
off-label use	Use of an agricultural chemical in a manner that is not described on the registered label or permit.
personal protective equipment (PPE)	Is the equipment worn by workers to reduce their exposure to hazards; includes protective items for the eyes (goggles, glasses), ears (ear plugs, ear muffs), respiratory system (respirators, face masks, cartridge filters), feet (safety boots), head (hard hats) and body (aprons, safety harnesses).
pest	A living organism that degrades the health, value, utility, condition or amenity of another organism, a structure or a place.
pesticide	*See **agricultural chemical** definition*
phenoxy herbicides	2,4-D and 2,4,5-T form part of a group of chemicals known as phenoxy acetic herbicides used to control unwanted plants. The chemicals are also known as chlorophenoxy herbicides.

Word	Definition
polychlorinated dioxins (PCDDs) or **polychlorinated dibenzo-*p*-dioxins (PCDDs)**	PCDDs are a family of 75 different compounds commonly referred to as polychlorinated dioxins. These compounds have varying harmful effects. The PCDD family is divided into eight groups of chemicals based on the number of chlorine atoms in the compound. TCDD is one of the most toxic of the PCDDs to mammals and has received the most attention. PCDDs with toxic properties similar to TCDD are called 'dioxin-like' compounds. *See also:* ***dioxins, TCDD*** ***See also Appendix 4.5 Appendix 4.5 – Relative Toxicities of Polychlorinated Dibenzodioxins and Dibenzofurans***
reference dose (RfD)	A reference dose is the estimated daily exposure likely to be without appreciable risk of adverse health effects over a lifetime. The RfD is equivalent in meaning to **tolerable daily intake (TDI)** and **acceptable daily intake (ADI).**
risk	The probability that, in a certain time frame, an adverse outcome will occur in a person, group of people, plants, animals and/or the ecology of a specified area that is exposed to a particular dose or concentration of a hazardous substance. Risk differs from hazard primarily because risk considers probability.
soft tissue sarcoma	A cancer that begins in the muscle, fat, fibrous tissue, blood vessels, or other supporting tissue of the body.
TCDD as a contaminant of 2,4,5-T	Small quantities of TCDD (2,3,7,8-tetrachlorodibenzo-*p*-dioxin) are produced as a by-product of manufacture of 2,4,5-T especially when the reaction mixture is overheated, when temperatures are uncontrolled during manufacture.
teratogenic	The ability to produce a structural malformation or defect in an embryo or foetus.
threshold	The lowest dose or exposure level that will produce a toxic effect, and below which no toxicity is observed.
tolerable daily intake (TDI)	An estimate of the daily intake of a substance that can occur over a lifetime without appreciable health risk. The TDI is equivalent in meaning to **reference dose (RfD)** and **acceptable daily intake (ADI).** *See also:* ***tolerable intake*** *definition* *See also* ***Appendix 4.4 Tolerable daily intake***

Word	Definition
tolerable intake (TI)	An estimate of the intake of a substance that over a lifetime is without appreciable health risk. *See also:* ***tolerable daily intake (TDI)*** ***tolerable monthly (weekly) intake (TMI/TWI)***
tolerable monthly (weekly) intake *(TMI/TWI)*	The tolerable intake (TI) expressed as a monthly or weekly amount. *See also:* ***tolerable intake***
tolerable monthly intake (TMI) for TCDD	The current TMI for TCDD is 70pg/kg bw/month That is: 70 picograms per kilogram of body weight per month *See also:* ***measurement units*** Note that Australia did not have an TMI for TCDD until 2002.
toxicity	Inherent property of a chemical to cause an adverse biological effect.
toxicity equivalence (TEQ)	A method of expressing the combined (assumed additive) toxicity of a group of like chemicals that share a common mode of action.
toxicokinetics	Is the description of what rate a chemical will enter the body and what happens to it once it is in the body. It is used primarily for establishing relationships between exposures in toxicology experiments in animals and the corresponding exposures in humans.
volatile ester formulations of phenoxy herbicides **Low Volatile Esters (LVEs)** **High Volatile Esters (HVEs)**	Ester formulations of phenoxy herbicides always produce volatile vapours at normal application temperatures. Herbicides that produce volatile vapours (such as esters) are a risk for spray drift as they produce drift in droplet form like amine and salt formulations; they have an additional 'invisible' form of drift called 'volatile vapour drift' Both High Volatile Esters (HVEs) (ethyl, butyl and isobutyl esters) and Low Volatile Esters (LVEs) (hexyl, octyl esters) are capable of producing volatile vapours, at different scales. *See also* ***Appendix 4.1 Vapour Pressures***
weed	A plant growing where it is not wanted.
weedicide	*See* ***agricultural chemical*** *definition*

Word	Definition
weight-of-evidence assessment	A variety of types of scientific evidence may be available when assessing the risks associated with the use of an agricultural or industrial chemical. Scientists weigh up the quality of each piece of evidence (that is, they must consider the 'weight of evidence') in assessing a chemical's risks and recommending ways to reduce any unreasonable risks. The use of a 'weight of evidence' approach helps to reduce, refine or replace testing on animals, in line with international trends.

Units of measurement

Units of Measurements and Abbreviations

unit	abbreviation	value	relative size
volume measures			
litre	L	1.0	one litre
decilitre	dL	0.1	one tenth of a litre
millilitre	mL	0.001	one thousandth of a litre
weight measures			
gram	g	1.0	one gram
milligram	mg	0.001	one thousandth of a gram
microgram	µg	0.000 001	one millionth of a gram
nanogram	ng	0.000 000 001	one billionth of a gram
picogram	pg	0.000 000 000 001	one trillionth of a gram

Measurement concentrations of a substance or chemical in the body

Levels of a substance in the body

level	description
mg/Kg	milligrams (mg) of chemical per kilogram (kg)
ppm	Parts per million e.g. ug/g (microgram per gram)
ppb	Parts per billion e.g. ng/g (nanogram per gram)
ppt	Parts per trillion e.g. pg/g (picogram per gram)

level	description	relative size
l /man/day	**litres** per **man** per **day**	
g /man/day	**grams** per **man** per **day**	
mg /man/day	**milligrams** per **man** per **day**	a thousandth gram
µg /kg bw/day	**micrograms** per **kilogram** of body weight per **day**	a millionth gram
ng/kg bw/day	**nanograms** per **kilogram** of body weight per **day**	a billionth gram
pg /kg bw/month	**picograms** per **kilogram** body weight per **month**	a trillionth gram

Appendix 8: Bibliography

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