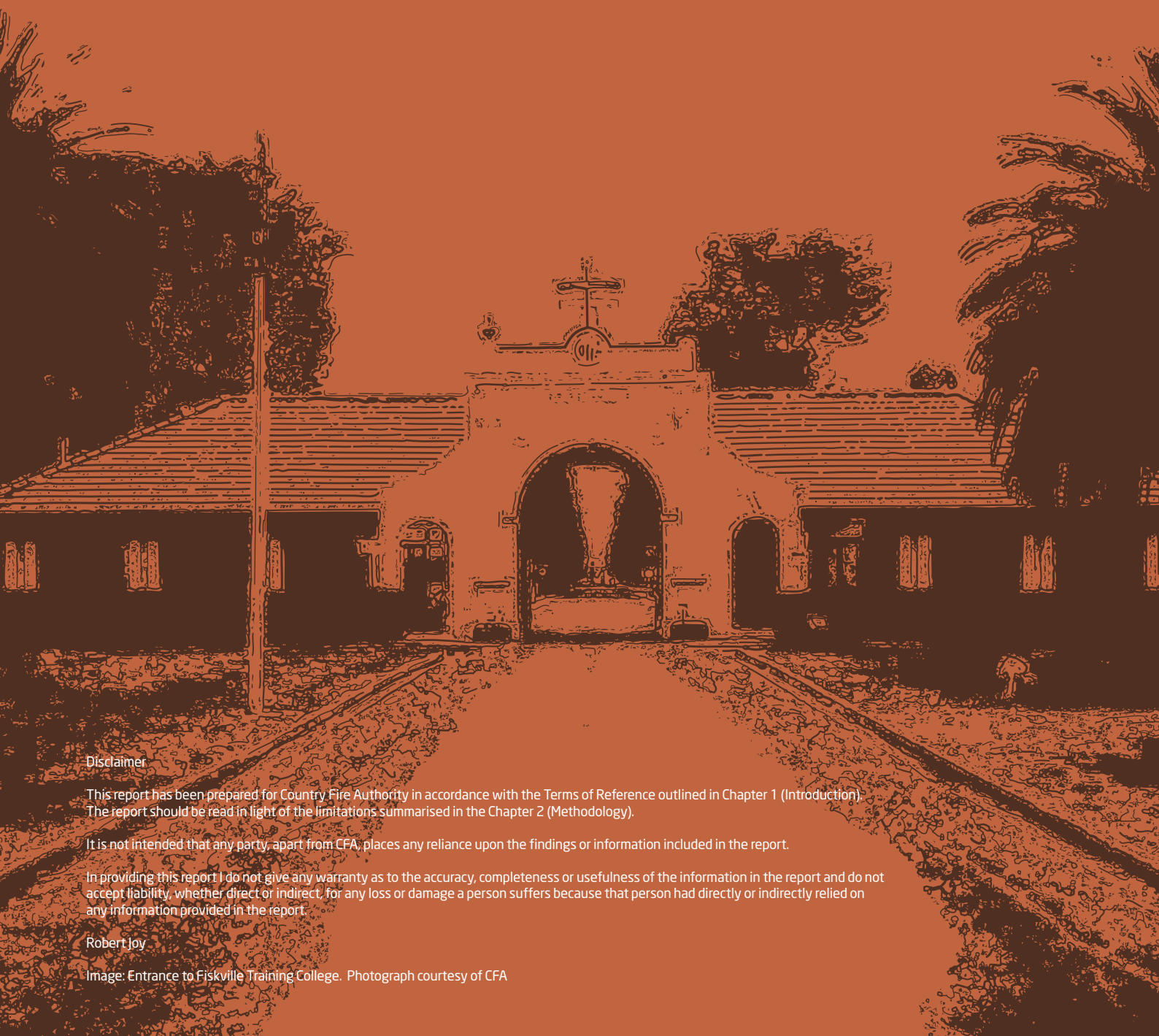
Fiskville

Understanding the Past to Inform the Future

Report of the Independent Fiskville Investigation

June 2012



Disclaimer

This report has been prepared for Country Fire Authority in accordance with the Terms of Reference outlined in Chapter 1 (Introduction). The report should be read in light of the limitations summarised in the Chapter 2 (Methodology).

It is not intended that any party, apart from CFA, places any reliance upon the findings or information included in the report.

In providing this report I do not give any warranty as to the accuracy, completeness or usefulness of the information in the report and do not accept liability, whether direct or indirect, for any loss or damage a person suffers because that person had directly or indirectly relied on any information provided in the report.

Robert Joy

Image: Entrance to Fiskville Training College. Photograph courtesy of CFA

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Independent Fiskville Investigation

28 June 2012

Mr Mick Bourke
Chief Executive Officer
Country Fire Authority
8 Lakeside Drive
BURWOOD EAST VIC 3151

Dear Mr Bourke

The Report of the Independent Fiskville Investigation is forwarded herewith in accordance with the Terms of Reference.

The Report is essentially historical in nature. It focuses on materials and practices employed in live fire exercises at CFA's Fiskville training centre over a period of some three decades from 1971. It seeks retrospectively to assess the likely risks to human health and the environment associated with these materials and practices and to evaluate potential contemporary risks arising from areas of residual contamination.

Given its historical focus and recognising the major reductions in risks to health, safety and environment that flowed from the redevelopment of live fire training facilities in 1998 and 1999, the Report's recommendations do not address current materials used in training or training practices. Rather they deal with legacy issues, such as the possibility that drums remain buried at the site.

Nevertheless, I believe that some of the lessons drawn from this historical investigation may be relevant to CFA today. Here I am thinking in particular of the importance of holistic, systematic approaches to achieving sustained improvements in the areas of health, safety and the environment. In this context, I understand that CFA has implemented AS4801 as its occupational health and safety (OHS) system. I believe that adoption of a complementary environmental management standard (EMS) such as ISO 14001 2004 could prove (despite the initial costs) to afford long term benefits. Such benefits could be maximized if the EMS were to be closely coupled with CFA's OHS system.

I commend the report to you and to the CFA Board.

Yours sincerely

Robert Joy
Investigation Chair

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ACKNOWLEDGEMENTS

Over the past six months, many people contributed to this complex, sensitive and substantial investigation and I take this opportunity to gratefully acknowledge their assistance.

Firstly, I wish to thank the 324 people who voluntarily participated in the Investigation by sharing their knowledge and experiences of historical CFA training practices openly and generously. In some cases people shared sensitive, personal matters with our investigators. In others, people were courageous in talking about their part in the practices under consideration. Participants were clearly motivated by the desire to contribute to a full, public understanding of what occurred at Fiskville. I would also like to thank the family members and friends who supported so many participants through the Investigation.

Secondly, I want to thank all my staff who have worked so tirelessly as part of the Investigation team. This included specialists and professionals in the fields of administration, analysis, research, investigations, interviewing, data collection, document management and executive management.

The Investigation has been well supported by expert and practical advice from its legal counsel King & Wood Mallesons. I am also grateful to our key consultants Golder Associates and KordaMentha for their important contributions to our work. The Investigation also benefited from the valuable advice provided by the members of a small expert panel who participated in a workshop with our staff and commented on a draft of the report.

A number of organisations, including the Environment Protection Authority, WorkSafe Victoria, the Department of Education and Early Childhood Development, the Volunteer Fire Brigades Victoria and the Fire Protection Association Australia generously sought to assist and share information with the Investigation.

I would like to thank the current CFA members and staff at regional training grounds and most particularly at Fiskville itself, who have worked cooperatively to facilitate document searches, site assessments, hygienist reviews and visits from a range of parties assisting the Investigation, while continuing to train Victorian firefighters. Finally, I would like to thank the Board and Chief Executive of CFA for respecting the independence of the Investigation and giving it their full support. In that context, I gratefully acknowledge the support from CFA liaison staff who assisted with matters such as accessing CFA documents, ensuring privacy matters were understood and addressed and that secure IT support was provided.

TERMS OF REFERENCE

FOR THE INDEPENDENT INVESTIGATION INTO THE CFAFACILITY AT FISKVILLE (1971-1999)

1. **The role of the Chair is to investigate and provide an independent report to the Board and the Chief Executive Officer (CEO) of CFA. The investigation and subsequent report is to:**

   a. examine and consider the historical facts relating to the nature, acquisition and use of liquids, gases or solids (with particular emphasis on flammable substances and extinguishing agents, including but not limited to water, foam and dry powders) for live firefighting training at Fiskville. In doing so, the report is to set out a chronology of events, reports and documents about the management of the site at Fiskville, along with a listing of the identified flammable substances and extinguishing agents;

   b. identify and list any documents or reports that contain comments on or recommendations about the use and disposal of flammable substances and extinguishing agents used for live firefighting training at Fiskville and on the management of fire water generated in such training; to the extent that it can be determined, report on how effectively each comment or recommendation was acted upon; and, where no action was taken, comment on the reasons for and implications of such lack of action;

   c. identify the origins of the flammable substances (paying particular attention to the likelihood of the substances being contaminated with material such as heavy metals and persistent organic pollutants, e.g. polychlorinated biphenyls); report on how they were stored, used and disposed of; and assess the likelihood of the use and management of flammable substances and extinguishing agents having led to the contamination of air, land or groundwater at, under or beyond the Fiskville facility;

   d. identify the nature and extent of exposure to the flammable substances (and their combustion products),extinguishing agents and fire water of persons on-site and in surrounding areas that could have potentially been impacted by contaminated runoff or wind drift; and, to the extent practicable, list persons who may have been exposed;

   e. on the basis of available information, assess the risk that there are buried flammable substances drums and/or other related contaminants on the site; where possible identify the location of such materials and make recommendations about any clean up and remediation required; identify where information is considered to be inadequate to enable a risk assessment and recommend action to improve the information base (which may include carrying out exploratory sampling of soils).

2. **The Chair will have open access to all documents, systems and studies held or accessible to CFA; access to all people employed or associated with CFA or the site, past and present (subject to their willingness to participate in the investigation); and access to all CFA resources necessary to thoroughly investigate and provide the report to fulfil these Terms of Reference (including the procurement of specialist and any other external resources as required).**

3. **The report is to be completed and submitted to the Board and CEO of CFA by 30 June 2012 *[amended reporting date]* and following consideration by the Board and the CEO of CFA, the report will be made public.**

4. **These Terms of Reference may be expanded to include other training sites if deemed necessary.**

EXECUTIVE SUMMARY

This executive summary seeks to outline the key content and findings of the report. Detail on each of these issues, including supporting evidence and references, is found in relevant chapters and appendices.

Part 1 - Introduction, Methodology, Background (Chapters 1, 2 and 3)

In December 2011 and January 2012, the Herald Sun newspaper published a series of investigative reports raising serious concerns about the possible health impacts of training practices at the Country Fire Authority Fiskville training centre dating from the 1970s. Immediately following the first of these reports, CFA initiated an independent investigation into the materials and practices used at Fiskville, chaired by the former Deputy Chairman of the Victorian Environment Protection Authority and Adjunct Professor at RMIT, Robert Joy. The Investigation's Terms of Reference were made public on 14 December and the Chair began the recruitment of staff and establishment of an office over the Christmas - New Year period. As the size of the Investigation became clearer, in March, at the request of the Investigation Chair, CFA agreed to extend the length of the Investigation from three to six months, with a revised reporting date of 30 June 2012. In accordance with the Terms of Reference, CFA provided all necessary resources to the Investigation and ensured open access to documents and personnel. However, the Investigation was carried out at arms' length from the CFA and with complete independence.

This report seeks to synthesise and summarise accurately, in a balanced fashion, the wide variety of information collected during the Investigation and to place it in the context of the regulations and common practice of the day. While key practices, incidents, reports and actions have been scrutinised, it needs to be acknowledged that accurately reconstructing and understanding in forensic detail events and practices 30 to 40 years in the past is fraught with difficulty. The fact that much of the report's analysis and many of its conclusions are framed in general terms reflects this situation as well as the time constraints within which the report was prepared.

The Investigation is not a health study. As a consequence, some people will be disappointed by its findings, in particular, by the fact that it does not draw conclusions about possible linkages between past training practices and ill health experienced by some of those who trained, worked or lived at Fiskville. The Investigation was never intended to address such issues. Rather, it provides the background and context for any future health study. As its Terms of Reference demonstrate, the Investigation sought to identify what is known about the nature and use of chemicals in training at Fiskville and regional training grounds, the exposure risks of different groups of people on and off-site, the potential for on-going risks due to possible site contamination and CFA's knowledge of and response to such risks in the period 1971-1999.

In January 2012, the Chair called publicly for input from people who believed they or a colleague, friend or family member may have been affected by training activities at Fiskville. It is notable that a substantial majority of the 324 people who generously shared their experiences with the Investigation initiated the contact. About a quarter of interviews were initiated by the Independent Fiskville Investigation (IFI) and in only a very small number of cases did individuals decline to participate. The goal of the interview process was to ensure people were able to share the information as they wished. The team took great care to keep the interview process secure and confidential, particularly as people shared personal issues and long standing concerns.

As well as contacting former and current paid and volunteer CFA members, the Investigation sought input from businesses and government agencies whose staff had trained at Fiskville, from regulators and from firms believed to have donated fuels to Fiskville.

In January 2012, the IFI retained KordaMentha to undertake an independent search of CFA documents (both physical and electronic). KordaMentha searched an estimated four million records at 18 CFA sites, the Public Records Office

and third party document stores. Record keeping practices varied across these sites, but were generally poor, with very limited and inaccurate cataloguing. One benefit of the Investigation has been to provide the CFA with an electronic catalogue and copies of a large body of records, many of which could not be reviewed within the timeframe of the Investigation.

In the time available, the Investigation undertook a targetted review of some 30,000 documents with about 8,000 assessed as most relevant reviewed more closely. The Investigation used e-document search tools and analysis software to import, classify and query information. Experienced analysts and investigators then evaluated information and developed rigorous lines of argument and conclusions.

Over the course of the Investigation, a number of studies were commissioned to support the work of the IFI. Three were carried out by Golder Associates - a *Preliminary Site Assessment of the Fiskville training centre*, a contextual study of *Health Hazards of fuels and Possible Combustion Products* and a *Preliminary Site Assessment of CFA Regional Training Grounds* (RTGs). A further study was undertaken focusing on the current state and historical usage of the six RTGs by a CFA officer seconded to work with the IFI.

To assist the Investigation team, the Chair appointed a small expert panel to advise on matters such as chemical properties of flammable materials and contaminants and occupational exposure hazards. The Panel members were: Honorary Professorial Fellow at Melbourne University, Ian Rae an expert on chemicals in the environment; Associate Professor Susanne Tepe, an occupational health specialist at RMIT University; and Dr Heather Wellington, a medical practitioner and lawyer. The panel's role was purely advisory in nature, operating at arms' length from the Investigation, providing a fresh, expert perspective on the information available and on emerging conclusions.

While the Chair considers a thorough investigation has been conducted in response to the Terms of Reference, the following need to be acknowledged as factors affecting the final report: the short time frame for the Investigation relative to its complexity; the lack of powers to compel witnesses or evidence; the extensive, complex nature of the document search; the size and sensitivity of the interview program; the difficulty of seeking to reconstruct events and practices which occurred up to four decades ago; the lack of documentation of informal and historical practices.

Over the years, Fiskville's training facilities have evolved through a series of incremental changes and major restructures. The initial development of physical facilities at Fiskville took place in the 1970s. The practical area for drills (PAD) was completed in 1974 and included the flammable liquid and gas training props and structural fire attack building. Each prop was designed to simulate potential emergencies that a firefighter may encounter. The development during this early period set the general pattern for practical training for the next 25 years. Training with props focused on teaching fire attack techniques with a range of extinguishing agents

In the 1970s, there was a rudimentary system for collection and treatment of firewater runoff generated in exercises on the PAD. This firewater would have been contaminated by products of combustion, unburnt flammable liquids and fire suppression materials such as foam. Collected runoff was directed via a small, undersized triple interceptor trap to a dam which ultimately drained into a manmade lake – Lake Fiskville. An initial phase of PAD re–development in 1990 enlarged the interceptor trap and established a secondary dam. A second PAD redevelopment completed in 1999, involved sealing of the PAD surface and a shift away from flammable liquids to liquefied petroleum gas (LPG) for approximately 70% of drills on the PAD, and construction of a third dam. While unleaded petrol and diesel are still used to fire individual training props, the quantities involved have been reduced and their bulk storage and handling meet dangerous goods regulatory requirements.

It is evident that instructors' experience and attitudes to risk and safety varied and influenced the approaches to practical fire training. Up to the mid–1990s, many of the approaches to safety on the PAD would not be considered acceptable by today's standards. In its early days, many of the activities commonly undertaken at Fiskville such as landfilling a variety of wastes and chemicals storage and handling were largely unregulated. Awareness of the hazards of chemicals to humans and the environment was a developing issue. Training and safety in many industries was ad hoc. However, over time, community concern and debate grew and were reflected in new regulations and significant pressures to improve health, safety and environment practices across Victoria.

By the early 1990s, evidence indicates Fiskville was not in compliance with a range of regulatory requirements and increasingly out of step with wider community expectations and practice in other

sectors or even some other firefighting agencies.

Health, safety and environment protection were not a focus of culture, practice or systems at Fiskville. Indeed the firefighting culture, particularly in the 1970s and 1980s, was 'can do' and paramilitary. Firefighters were encouraged to be uncomplaining, brave, and to follow orders. This has strengths in firefighting situations, but may have contributed to a failure to recognise or address unnecessary risks during training.

Part 2 - Terms of Reference

Chapter 4 outlines the Investigation's approach to the Terms of Reference. Term of Reference 1b relates to the effectiveness of CFA management's response to any comments or recommendations about use of chemicals in training at Fiskville. Early in the Investigation it was decided that it would aid the logical flow of the Report to deal with this Term of Reference after addressing the other Fiskville related Terms of Reference (i.e. 1a – 1e). Term of Reference 4 deals with the six Regional Training Grounds and was dealt with last. Terms of Reference 2 and 3 relate to access by the Chair to people and other resources and to the reporting date.

Term of Reference 1a - Acquisition, Nature and Use of Materials (Chapter 5)

Fiskville purchased supplies of petrol and diesel fuels for hot firefighting training. These were delivered in bulk and stored in above ground tanks. Although LPG was used from the early 1970s to fuel a few of the props on the PAD, it was not the primary source of fuel for hot fires until the late 1990s. From very early on in its operation, Fiskville staff sought to augment these fuels, with "donations" of used flammable liquids such as sump oil, waste solvents and paints. While used oil was mainly collected in bulk by Fiskville staff in a tanker truck (the "muck truck,") other donated flammables were supplied in 44 gallon (200 litre) drums, the exact contents of which were generally not known, certified or tested. A number of former Fiskville staff volunteered terms such as solvents, paint thinners and paints to describe the contents of some drums brought to Fiskville. Other liquid fuels, including off-spec and expired material, such as Avgas, kerosene and other aircraft fuels were also reported. Solid fuels were also donated to Fiskville, including vehicles, pallets, other wood and tyres.

Not surprisingly, given that the supply of these donated materials was essentially ad hoc in nature and lacked any financial component, the Investigation has found few documentary records of the practice. Consequently, knowledge of the origin and nature of materials used at Fiskville from its inception until the mid-1990s is derived almost exclusively from interviews conducted with former Fiskville staff and trainees. Some forty businesses were mentioned by participants as potentially supplying fuels to Fiskville. A small number of these were identified by a large number of participants. These were large companies, which would be expected to have significant volumes of flammable waste, including Alcoa, Dulux, ICI, Monsanto and Shell. However, in many cases, drums with a proprietary label will have passed from the original supplier through other firms before being supplied to Fiskville. Along the way they may have been emptied and used to store material, including mixed wastes, unrelated to the original product label.

In addition to direct supply arrangements between businesses and Fiskville staff, interviewees reported that some private sector and government bodies using Fiskville on a commercial basis for hot fire training supplied their own flammable materials. This may have been in order to reduce costs or in some cases because of the need to train on fires involving specialised materials of direct relevance to the individual firms. Such firms reportedly left unused fuels and foams at Fiskville.

Based on the intrinsic hazards of the various categories of commercially supplied and donated fuels and the ways in which they were stored and handled, the Investigation developed a qualitative assessment of the relative risks associated with their use. Overall the lowest risk was associated with petrol and diesel stored and handled principally in bulk and the highest risk with solvents stored in drums and handled manually.

Use of unknown flammable liquids on the PAD (e.g. oil collected offsite and unknown fuels delivered in drums) effectively ended with the redevelopment of the PAD in the late-1990s. Since then, use of flammable liquids has been limited to unleaded petrol and diesel.

In addition to liquid, solid and gaseous fuels, chemicals such as aluminium, chlorine, phosphorous, magnesium shavings, sodium (in blocks) and sulfur were stored at Fiskville to facilitate exposure of trainees to emergency

situations involving these materials. From the 1970s to the mid 1990s these chemicals were stored along with explosives and detonators in unsafe conditions together in a shed.

Like flammable substances, the sources and manner of supply of foam concentrates to Fiskville historically is unclear and largely undocumented. Although a couple of documents were found from the 1990s noting product names for some foams, the Investigation did not locate documentary evidence confirming how foam was supplied to Fiskville. Some was likely to have come from commercial suppliers. However, some investigation participants noted that some foams were acquired through donations.

A variety of firefighting foams have been used in training at Fiskville. These include: high expansion foam, designed principally for flooding enclosed spaces and Class B foams used on liquid fires. The second group includes: synthetic aqueous film forming foams (AFFF) and alcohol resistant aqueous film forming foams (AR-AFFF) and fluoroprotein foams (FP), a type of biodegradable foam based on animal or other protein sources with the addition of a fluorinated surfactant. Both AFFF and AR-AFFF contain the fluorosurfactants perfluorooctanoic acid (PFOA) or perfluorooctanesulfonic acid (PFOS). Both of these are readily absorbed by the body after ingestion and are very slowly eliminated. Since the late 1990s, PFOA and PFOS have been a focus of concern over their potentially harmful effects on human health and the environment.

During the 1970s and 1980s, the drum storage area lacked hard standing, protective bunds and overhead cover. Access to this area was not restricted by fencing in the early days, but a fence was erected by 1985.

In the early days of Fiskville, the props were loaded with the primary fuels petrol and diesel, as well as waste oil, stored in overhead tanks near the PAD and in lesser quantities in drums. A series of pipes delivered fuel from these tanks to props on the PAD. To prepare the flammable liquid props for drills on the PAD, high flashpoint fuel (diesel or oil) was poured on top of water in the props, and a low flashpoint fuel (petrol) was added to prime the high flashpoint fuel. Some fuels were transported across the PAD in open containers and added to the flammable liquid props. In the process, the contents of the bucket often splashed the PAD operators and the PAD itself. In addition, in the 1970s and 1980s, flammable liquids were used in exercises involving the foam pits adjacent to the PAD. They were also used frequently in open trays in enclosed space training in the Structural Fire Attack Building.

Beginning in the 1970s, LPG was used on the flammable liquid PAD on the flanges and LPG props. Separate LPG PADs were developed by the early '90s (maybe as early as 1989) which involved props that were plumbed to LPG bullets. Exercises conducted with LPG were cleaner and safer than exercises conducted with flammable liquids. LPG fires produced less smoke and particulate material and therefore lessened risks of inhalation and fall-out on and off-site. PAD operators were also able to control the amount of fuel used for drills from a control booth reducing risks to students and instructors.

Solid flammable substances were burned outside in the open air as well as indoors, mainly in the Structural Fire Attack Building. Outdoor drills involved cars, tyres and piles of wood including stacks of pallets. Enclosed space training occurred in the three story T-shaped fire attack building. Drills were designed to simulate fires likely to occur in industrial, commercial and residential settings. In the early days, smoke was created for the smoke tunnel exercise (breathing apparatus tunnel) using hay and oil later shifting to theatrical smoke generators. The quality of the timber being burned was sometimes questioned.

A safety hose drawing on firewater pumped from Dam 1 was used to direct a spray or fog of water over groups attacking a fire if a hose or pump supplying mains water failed. While this was a relatively unusual event, use of this emergency source of supply would have exposed instructors and trainees to water and aerosols with a range of contaminants - dissolved hydrocarbons, foam breakdown products and suspended fine particles (soot) with a various chemicals adsorbed to their surfaces.

Term of Reference 1c - Contaminants and Contamination (Chapter 6)

The exact nature of many of the flammable liquids brought onto Fiskville will never be known. Nevertheless, some reasonable suppositions can be made about the nature of some of these materials. For example, because materials were being used as fuels for hot fire fighting training, this tends to discount use of materials that didn't burn well, such as persistent organic chemicals (e.g. pesticides such as dichlorodiphenyltrichloroethane (DDT) and dieldrin, as well as polychlorinated biphenyls (PCBs)). However, that does not rule out the possibility of such materials being present in oils or other flammable liquids.

Used motor oils collected in bulk and in drums will have become contaminated with suspended metals such as zinc and phosphate. Adulteration with liquid products such as degreasing solvents, brake fluid and kerosene is also likely. However, as used oil was mainly obtained from automotive sources, it is relatively unlikely to have been a source of persistent organic contaminants, notably PCBs, although this cannot be completely discounted.

Contamination on-site at Fiskville is likely to have arisen from several distinct activities: use of materials for fire training activities on the PAD; storage of fuels and materials used in training; overflow, capture and disposal of wastewater from training; burial of drums, sludge and other material including in on-site landfills; and potential leakage from underground fuel storage tanks.

In 1998, a two-stage remediation plan was implemented. Soil was excavated from the flammable liquids PAD and old fire training pits (i.e. foam pits) and remediated by on-site soil composting in an area immediately to the east and south east of the present PAD. Six months after the completion of bioremediation, total petroleum hydrocarbons (TPH) concentrations were below Victorian EPA clean fill criteria, and no other contaminants of significance were detected.

Targeted sampling of soil, surface water, sediment and vegetation at Fiskville was undertaken for the Investigation by Golder Associates and detected a number of contaminants. Groundwater was not found in any of the existing bores and so could not be tested. In relation to soil, Golder Associates concluded that the majority of the broad suite of compounds which were tested for were present at levels unlikely to impact adversely on human health or the ecosystem. The exceptions were PFOS and 3-and 4-methylphenol (an organic compound found in household cleaners and disinfectants). In the case of PFOS, Golder Associates concluded the levels were unlikely to impact on human health, since the exceedance of the relevant standards was marginal and occurred in a location infrequently accessed by site users. In the case of 3-and 4-methylphenol, Golder Associates concluded the levels did not pose a significant risk of ecological impact due to the conservative nature of the criteria adopted.

Similarly, the majority of analyses of surface water and sediment from Lake Fiskville reported levels well below drinking water quality criteria, with the exception of analyses for PFOA and PFOS. The lake is not used as a source of drinking water and Golder Associates concluded that the risk posed to human health was low. Levels of copper and zinc in the lake water and sediments exceeded the ecological assessment criteria. The Investigation believes these may be associated with background levels in the basalt rocks that underlie the area. Levels of dioxins and furans (PCDD/Fs) exceeded the adopted Canadian environmental quality guidelines by a factor of three. Golder Associates note that "the criteria are considered to be conservative and an exceedance of this type does not necessarily demonstrate evidence of an adverse impact." Nevertheless, they also recommend that an assessment of the ecological condition of the Lake be undertaken – a recommendation adopted by the IFI.

Testing of the water and sediment in a number of dams that comprise the firewater treatment system yielded similar results to Lake Fiskville. With the exception of PFOA, PFOS and TPH in Dams 1 and 2, analytical results for the water samples were below the drinking water criteria. The IFI has adopted Golder Associates' recommendation that suitable procedures should be put in place to protect the health of personnel potentially exposed to these waters and sediments.

Combustion of petrol, diesel and used oil produces environmental contaminants. In the open, as is the case on the flammable liquids PAD, fires involving petrol, diesel and oil have a ready supply of oxygen. While such fires will reach high temperatures, combustion is likely to be incomplete producing significant smoke and particles. The surfaces of these particles may carry contaminants – some of which are known or suspected carcinogens and tend to persist in the environment.

Variables that would affect the risks of contamination through fallout of combustion products onsite include: how hot the fires were and therefore how complete the combustion; the size and duration of fires; local wind speed and direction and local barriers to smoke such as windbreaks. In some cases, wind conditions may have favoured the rapid fallout of particles and associated pollutants onto paddocks and buildings at Fiskville, possibly resulting in their deposition in domestic rainwater tanks. Under different conditions, the plume may have retained its integrity until well away from the property, in which case fallout could have occurred over a wide area downwind.

During the first two decades of the operation of the flammable liquids PAD, a risk of off-site contamination from Fiskville related to the discharge of partially treated firewater via Lake Fiskville to Beremboke Creek, which is part of the upper reaches of the Moorabool River catchment. By the late 1990s, this risk had been significantly reduced due to the conversion of the PAD to LPG as the primary fuel and the progressive upgrade of the firewater treatment system.

It is to be expected that PFOS and PFOA residues will have moved off-site via Lake Fiskville, particularly in the years prior to the upgrade of the treatment system. However, these residues would be subject to significant dilution as they moved downstream. Given this and the conclusions summarised above in relation to the relatively low level of risk to human health posed by the recorded levels of PFOS and PFOA, the Investigation believes offsite risks associated with these waterborne contaminants are low to very low. Nevertheless, the Investigation has adopted Golder Associates' recommendations to better quantify the potential risks to human health downstream taking into account dilution, environmental fate and transport mechanisms and to investigate and potentially reduce sources of PFOA and PFOS discharges into Lake Fiskville.

Residual contaminants in sediment or soils at Fiskville do not present an off-site risk. However, as outlined above, the characteristics, flow and quality of groundwater beneath Fiskville are not known. To address this, the IFI has adopted Golder Associates' recommendation that groundwater quality be assessed at a number of locations at Fiskville.

Term of Reference 1d - Exposure of People On and Off-site (Chapter 7)

The Investigation assessed the relative risks of exposure of different groups of people at and near Fiskville to flammable liquids, extinguishing foams, products of combustion and recycled firewater. Consideration of the risks of these exposures includes acute and chronic exposures and cumulative risk.

The group identified as most at risk of exposure to flammable materials was the PAD supervisors and operators. The role of PAD supervisors and operators included handling concentrated chemical materials. These workers were responsible for setting up the props and for filling foam pits for training drills and for periodically cleaning out the accumulated sediment and solids from the bottom of the flammable liquid props and the drainage system. Consequently, they were far more exposed on a more regular basis to direct chemical contact than any other group. The primary exposure pathway is likely to have been inhalation, particularly when hot weather promoted the generation of fumes from poorly sealed drums and open containers.

The group most exposed to combustion products, foams and recycled firewater was the instructors appointed to Fiskville who worked at the location on a full time basis. Unlike PAD operators, instructors' duties did not generally include transporting drums to the PAD or transferring the flammable contents to fuel the props or the foam pits. As a result, their direct or acute exposure to concentrated chemical products was significantly lower than that of the PAD workers.

Due to the full-time nature of their appointment, the cumulative exposure of Fiskville instructors would have been greater than that of part-time instructors who were drawn from regional staff and volunteers, and substantially greater than trainees. On a typical practical training weekend an instructor would have spent a period of 6-8 hours supervising 4 or 5 drills per hour. The primary exposure pathway for instructors was inhalation of smoke and liquid aerosols.

The types of exposure risk faced by regional instructors, including both paid staff and volunteers, are considered to be essentially the same as those described above for instructors appointed to Fiskville. Regional instructors were only occasionally called on to teach at Fiskville, so the frequency of their exposure to combustion products, foam and firewater was substantially less than their full-time colleagues, as would have been their long term cumulative exposure. However, many of these personnel would also have experienced some exposure to fuels and combustion products when conducting training back in their own regions and at Regional Training Grounds.

Like their full and part-time instructors, trainees were exposed to combustion products, foam and firewater. The frequency of exposure varied through time and between different groups of trainees. The cumulative frequency and hence the chronic risk of such exposures would have been far less than those experienced by a full-time instructor and probably less than those of most regional instructors.

Other Fiskville employees and residents have been treated as a single group as their exposure risks were similar. The key risk to this group was occasional short duration exposure to smoke. Given that members of this group would have been unlikely to be near the flammable liquids PAD or foam pits during exercises, it is unlikely they would have come into contact with foam or contaminated liquid aerosols. Any such exposures would have been infrequent and of low duration. It is possible that residents' children playing on-site may have occasionally been exposed to low levels of contamination through contact with water and sediments in Lake Fiskville, despite site rules prohibiting children from this area.

The Fiskville Primary school, which was closed in 1993, was a small school located some 660 metres east of the PAD behind a tall windbreak and adjacent to the Ballan to Geelong Road. The key exposure route for students and teachers would have been inhalation of smoke. Interviews with families who sent children to the school, ex-pupils and two past principals have provided no evidence that the school experienced problems with smoke or fall out of particles.

Not all Fiskville trainees were involved in practical firefighting training utilising flammable liquids. While trainees who were not involved in practical training exercises may have been exposed to smoke or spray drift during their attendance at Fiskville, it is likely such exposures would have been infrequent and of short duration.

One of the reasons CFA chose the Fiskville site in 1971 was its rural setting and the presence of only a handful of residences within a several kilometre radius. That situation has changed little. Neighbours may have been exposed to smoke from fires on the PAD. A lower risk is ingestion or dermal contact with low levels of contaminants in water and sediment moving downstream and offsite via Lake Fiskville. The likelihood of either of these routes leading to significant exposure of people off-site is extremely low. There is no evidence that groundwater at Fiskville is a source of contamination in surrounding areas. Even if groundwater were contaminated, the likelihood of exposure to groundwater contaminants is seen as being very low, whether via ingestion or dermal contact, since the groundwater in the area is slightly saline and is not generally used for domestic or agricultural purposes.

An extensive search of CFA's occupational health and safety incident reports for the period 1970-1999 did not reveal a single incident relating to exposure of 'chemicals' or 'hazardous materials' or 'fumes' at CFA training grounds. Three acute incidents were identified during interviews and from other documentary sources, but none was reflected in formal occupational health and safety reports.

The first acute incident identified by the Investigation, involved exposure of a staff member to chlorine gas during a training demonstration, sometime between 1976 and 1977. The Officer suffered immediate acute effects that were serious enough for him to be given oxygen and be taken to Ballarat Hospital for a period reported as less than a week. He returned to duties at Fiskville where he continued to work as a PAD instructor until 1977.

The second incident followed a fire in the drum storage area at Fiskville in December 1982. The fire was quickly controlled and the following day the OIC tasked three officers to remove the fire-affected drums from the area and bury them. During that operation, one of the officers was temporarily overcome by fumes from a black substance that had leaked from one of the drums. The other officers were not affected. There is no evidence of the fire, the acute exposure incident and the drum burial being reported to CFA head office at the time. Several years later, this incident was raised with CFA senior corporate management by the affected Officer as the possible cause of a range of illnesses from which he was then suffering. His concerns and CFA management's responses are examined below and in Chapter 9.

The final incident occurred early in 2002 and involved an independent contractor using heavy machinery to rip lines for the establishment of a tree plantation to the south of the airstrip. During the operation, a number of buried drums were caught on the ripper and brought to the surface. The contractor reportedly came into contact with liquid from the drums and was dry retching, apparently as a result of exposure to the fumes. Fiskville staff rendered first aid and the contractor insisted on completing the job. The PAD operator and another staff member reported using five or six tanker loads of water to clean the machine. Some days later, 56 drums, 136 tonnes of contaminated soil and approximately 2,940 litres of product were removed from the site by the waste management firm Chemsal. No incident report appears to have been completed for this incident. This was inconsistent with CFA policy. There is also no evidence a report was made to the relevant statutory authority as required under the *Victorian Occupational Health and Safety (Incident Notification) Regulations* 1997.

Term of Reference 1e - Buried Drums (Chapter 8)

The practice of burying drums at Fiskville originated locally and was almost completely undocumented. This makes confirming the location, timing or numbers of drum burials and exhumations very difficult. Most of what the Investigation understands of drum burials has come from interviews. A small number of documents were located, including EPA waste transport certificates, recording the removal of drums and contaminated soil from Fiskville in 1991 and 2002.

Two situations characterise the on-site burial of drums at Fiskville. The first involved the routine burial of small batches in either or both of two landfills near the south-western corner of the property. While the drums were reported to be empty, in practice many are likely to have contained solidified residues. The second involved mass burials of drums, most of which were probably full. These mass burials took place into pits or trenches at different locations on the property.

The Investigation is reasonably confident that three such mass burials took place in the 1980s and it is possible that an earlier burial took place in the late 1970s. As noted above, in the case of two of these burials, there is documentary evidence that all or most of the drums were subsequently exhumed and transported off-site for disposal.

The Investigation found no documentary or anecdotal evidence of action to retrieve the drums that were periodically crushed and dumped in the two landfills. While it is uncertain when this practice was discontinued, use of the older of the two landfills probably stopped with the establishment of the landfill by CFA in 1984. This landfill ceased taking all forms of waste in 1996, when EPA advised a licence would be required for it to continue operating. This prompted CFA to close and subsequently cap the landfill.

In light of the above, and given the length of time since either landfill has been used, it is unlikely they pose a significant on-going risk to human health or to the surface environment. However, they may pose a residual risk to the environment through groundwater contamination. Consideration of the need for further remediation, if any, of these landfills should follow further assessment of the potential for soil and groundwater contamination at the site.

First mass burial 1979-80: The Investigation has no evidence to suggest that any of drums reported as being buried in the vicinity of the two old landfills were ever retrieved and disposed of off-site. If the burial did take place, it is likely any migration of contaminants away from the site will have already taken place, possibly impacting on surface and groundwater.

Second mass burial 1982-83: From information supplied by a number of those who were involved in the burial, it appears most likely that 20-30 fire affected drums were buried directly north of the administration building. The Investigation has no evidence these drums were ever removed.

Third mass burial 1983-86: It appears likely that some 100 drums were buried some time during this period, but the location is uncertain. Some of these drums appear likely to have been those that were uncovered, sampled and reburied by consultants A.S. James in 1988. The Investigation believes that these were the drums that were eventually removed for disposal off-site in January 1991.

Fourth burial 1984-85: It is reasonable to conclude that an unknown number of drums were buried in trenches to the south of the airfield in an area that is now a plantation. It is likely that these were the drums that were exhumed and removed for disposal off-site in 2002 after an incident in which some drums were brought to the surface during tree planting operations.

The full facts about drum burial and exhumation at Fiskville are likely never to be known, due to the almost complete lack of contemporary documentation and people's imperfect recollections of events that occurred up to thirty years ago. The Investigation's best endeavours (including a search of prospective burial sites using ground penetrating radar) have failed to locate any buried drums. While that does not rule out that possibility, the risks associated with any remaining drums are likely to be limited and to relate primarily to groundwater. To address this residual risk, the Investigation has recommended that assessments of soil and groundwater be undertaken at each of the possible burial sites discussed above.

Term of Reference 1b - Management Response (Chapter 9)

Fiskville operated through the period of the Investigation, 1971-1999, with a relatively high degree of isolation and autonomy. It was not part of an operational region, reporting directly to a Deputy Chief Officer in headquarters. Long term planning for training at Fiskville and Regional Training grounds did not emerge until 1990. As CFA grew, demand for training, including for a large volunteer workforce, grew. Furthermore, there was strong corporate encouragement to grow commercial or third party training to help bring in revenue. Some of these drivers arguably contributed to poor health, safety and environment practices, such as seeking or accepting potentially hazardous or unknown quality fuels and foams because they were free of charge. Over time in CFA there was a focus on improving firefighting training and the safety of operational response to fires. However, any focus on safety does not appear to have extended to considering health, safety and environment aspects of training itself.

In 1980, Fiskville's Officer in Charge wrote to the Chief Officer raising concerns about possible contamination of donated fuels with polychlorinated biphenyls. Following research, it was recommended that waste oils be accepted only when certified PCB- free. There is limited evidence of the follow up on this. A year later, in 1981, an instructor raised concerns over the poor state of a number of drums of flammable liquid, part of a large consignment that had been donated to Fiskville. Inquiries about possible commercial disposal routes led nowhere because the flashpoints were too low. There is no evidence to suggest that these concerns were raised beyond Fiskville.

In 1987, the Officer who had been exposed to chemicals following the drum fire at Fiskville in 1982 wrote to the CFA Chairman. The Officer advised that he was absent from work following an illness and outlined the circumstances in which he had been exposed to chemicals at Fiskville. Over the next five years, the Officer pursued his concerns over the nature of the chemicals and their possible role in his illness. On two occasions, the United Firefighters Union wrote to the CFA Chair in support of the Officer and pointed out that the burial of the drums posed "further environmental problems".

In 1988, CFA employed A.S. James Pty Ltd to temporarily exhume the drums and have samples of their contents analysed. The consultant's report described the contents as: *resins or solvents [that] may include benzene, toluene, xylene and phenol".* The report further noted that: "*Materials of this type are only slowly biodegraded and their presence would normally constitute an environmental problem".* With respect to the risks associated with the buried drums, the consultant warned that, even if an impermeable barrier were placed around the burial, there was still a risk that over time leachate could reach groundwater. The consultant concluded that if that risk was not acceptable, the materials should be removed and disposed of appropriately. In September 1988, the Deputy Chief Officer (Operations Services) sent a memo to the Acting Chief Officer noting that EPA had advised that, due to the doubtful integrity of the drums, the low flash point of the materials and their possible toxicity, they could not be disposed of to landfill. As a consequence, the DCO recommended that the burial site remain undisturbed.

Some two years after receiving the A.S. James report, in October 1990, CFA provided the Officer with a copy of the report on a confidential basis. The following month, the Officer responded to the CFA Human Resources Manager expressing concern that if these materials were likely to pose a health risk, others who might be affected should be informed. There is nothing in the records

examined by the Investigation to indicate that CFA did this, and interviews confirm that none of the others involved in the incident on 23 December 1982 was advised about the materials by CFA.

In January 1991, at the direction of the CFA Chairman who had been appointed in 1989, some 75 drums and 253 tonnes of contaminated soil were removed from Fiskville by Australian Waste Processors Pty Ltd. There is no record in the CFA Board minutes that the Board was made aware of the original incident, the drum burial or the consultant's report until the Chairman conveyed his decision to dispose of the drums. According to the Chairman, some members of the Board disagreed with his decision.

By the mid 1990s, a number of staff at Fiskville and in corporate roles that focused on dangerous goods recognised that Fiskville was not in compliance with regulatory requirements, particularly for dangerous goods. CFA officers with delegated dangerous goods training and powers audited Fiskville and raised concern. Eventually, in 1996, an Instructor was empowered to undertake a holistic health, safety and environment review of Fiskville. He commissioned a number of further site assessments and audits, and actively engaged regulators including the then Health and Safety Organisation and EPA to ensure corporate response to these issues.

Redevelopment plans for Fiskville – largely responding to increased demand – took some of the health, safety and environment issues into account. For example, underground storage tanks were removed and contaminated soil beneath the flammable liquid pad and old fire training pits (i.e. foam pits) was successfully bioremediated. However, other recommendations such as to clean up Dam 1 and a known drum burial area do not appear to have been actioned.

The Investigation cannot comment fully on broader corporate approaches to health, safety and environment issues through this period as the Investigation focused on training grounds and relevant corporate documentation was not readily evident. However, Fiskville staff did not appear to get advice or support on these matters until CFA dangerous goods staff focused on the site in 1995.

Even after the extensive studies and plans of 1996 and 1997, the response from Fiskville and corporate management appears limited, with no evidence of follow up, review or auditing of previous recommendations. Only some of a large number of recommended actions appear to have been implemented. A systematic approach to considering, implementing and reviewing health, safety and environment recommendations is not clear. The Investigation concludes that a fundamental, lasting cultural shift to considering health, safety and environment issues in planning and operational training practice does not appear to have occurred.

Through most of this period, the CFA Board was a representative board and it is understandable that it did not adopt modern governance practice such as enterprise risk management. However, elsewhere systems approaches to safety and environment issues were being established through the 1980s and 1990s and it is notable CFA did not adopt these approaches at a corporate level. CFA hired its first occupational health and safety manager, for example, in 1994.

Term of Reference 4 - Regional Training Grounds (Chapter 10)

The locations and establishment dates of the Regional Training Grounds (RTGs) are: Gippsland Fire Training Complex ('West Sale') 1986 ; Wangaratta Training Ground 1983; Bangholme Campus 1993; Wimmera Field Training Ground at Longerenong 1994; Northern District Training Ground (Huntly) 1996; and Western District Training Ground (Penshurst) 1993.

As at Fiskville, prior to 1990, in the absence of a centrally allocated budget for purchasing fuels, regional training grounds (particularly those established in the 1980s) were dependent on limited local budgets and so welcomed donations of sump oil, jet and motor vehicle fuel and solvents from a range of local suppliers. However, the quantities of fuel were significantly lower than at Fiskville, reflecting the smaller number of training activities and participants. As a result, the problems associated with accumulation of large numbers of drums of flammable liquid that occurred periodically at Fiskville were not replicated at the RTGs.

In common with Fiskville, little documentary evidence has been found to identify the exact nature and sources of the donated material. Manual handling of flammable material at some early RTGs employed similar practices to Fiskville. For example, in Gippsland drums were rolled to props. Like Fiskville, the practice of accepting undocumented, unknown fuels appears to have largely ceased by 1996 and RTGs moved to use primarily standardised motor vehicle fuel and LPG.

As at Fiskville, commercial clients and external organisations attended the early RTGs in the 1980s for hot fire training and may have supplied some of their own flammable materials, either to reduce costs or because the training involved specialised substances relevant to the individual industries. Unused flammable liquids or extinguishing agents were left in appreciation for the service and use of the RTG facilities.

A number of factors combine to support the case that the risk of on-site contamination by chemicals is likely to be lower at the RTGs than at Fiskville. Firstly, with the exception of Wangaratta and Gippsland, the RTGs were established in the 1990s when a shift towards less reliance on liquid flammables and increased use of LPG took place. Secondly, even in the early days at Wangaratta and Gippsland, training numbers were much lower than at Fiskville, so the demand for large volumes of material, particularly drummed material, to be stored on site did not arise. Thirdly, with the exception of Wangaratta where an underground fuel storage tank (UST) was removed by 1999 and Wimmera, which still has an UST, there is no record of UST's at the other RTGs, thus removing an important potential source of contamination. Furthermore, with the exception of Penshurst, where part of the site is known to be contaminated with sodium fluoroacetate (1080), there is no knowledge of any significant incidents of fuel or other chemical spills.

Nevertheless as outlined in a Preliminary Site Assessment of RTGs prepared for the Investigation by Golder Associates, with the exception of Bangholme and Gippsland, the majority of each site's fire training area is unsealed. Furthermore, there is visual evidence of hydrocarbon staining of small areas probably due to poor fuel storage and handling practices. These practices create the potential for contamination of soil and ground water.

The types of exposure profiled for various groups of people at Fiskville would generally be the same for equivalent groups at RTGs, but with significantly less cumulative exposure risks due to: the lower volumes of materials used; greater use of known fuels and LPG; lower frequency of hot fire training; and more rotation of people for shorter durations working directly with flammable materials on PADs. In addition, a number of groups relevant to Fiskville are not relevant to all of the RTGs such as full-time instructors, non-operational staff, on-site residents, and teachers and students. RTGs, until the late 1990s, had either casual, part-time or volunteer PAD Operators and Instructors used in accordance with the level of activity of training. All RTGs now have permanent PAD Supervisors and the Northern District Training Ground and Bangholme have permanent PAD Operators.

The Wangaratta, Gippsland, Northern District, Wimmera and Bangholme RTGs are all located away from normal residential areas. Potential effects from smoke or other offsite impacts are therefore not seen as significant. Assessment of potential risks associated with contamination of groundwater and surface water from activities at RTGs is explored in a preliminary site assessment of regional training grounds prepared for the Investigation by Golder Associates. Wangaratta Training Ground, due to its proximity to the Three Mile Creek (or Fifteen Mile Creek), has modified training scenarios (e.g. no foam and minimal flammable liquid use) to ensure that no contaminated water discharges off site.

The Investigation has not identified any evidence to suggest that drums containing fuel or other chemicals, or empty drums, were ever buried at any of the RTGs. CFA members associated with RTGs from their inception consistently stated that they had no knowledge of such practices during their tenure.

Part 3 - Conclusions and Recommendations (Chapters 11 and 12)

Conclusions to the Investigation are provided in Chapter 11 and recommendations are discussed in Chapter 12.

The Investigation's Terms of Reference do not include considering current materials used in training or training practices. Rather they focus on legacy issues such as possible site contamination that may pose an on-going risk to human health or the environment. Consequently, these are the areas which the Investigation's recommendations address.

SUMMARY OF RECOMMENDATIONS

Recommendation 1

That soil and groundwater quality be assessed in areas where fuel storage tanks are currently located or have been located in the past both above and below ground.

Recommendation 2

That groundwater investigations be undertaken in the vicinity of: the historical flammable liquids PAD, the fuel mixing area, the historical foam training pits, the prop storage area and the area used to rehabilitate contaminated soils in 1998.

Recommendation 3

That further investigation be undertaken into surface waters in and discharging from Lake Fiskville to:

- *better quantify the risk to downstream human health receptors, taking into account downstream dilution and environmental fate and transport mechanisms;*
- *investigate potential sources of PFOA and PFOS discharges to Lake Fiskville and discharging off site, if the potential risk of adverse impact on downstream human health receptors is found to be unacceptable;*
- *collect surface water samples at a representative location to assess whether the reported copper and zinc concentrations are consistent with background levels; and*
- *assess the ecological condition of Lake Fiskville.*

Recommendation 4

That any electrical transformers located at any CFA training site be inspected by an independent hygienist and, if not able to be certified as PCB-free under the National Polychlorinated Biphenyls Management Plan 2003, that it be treated as a scheduled waste and disposed of in accordance with the provisions of the Plan.

Recommendation 5

That any subsequent study of possible linkages between exposure of persons during training at Fiskville to materials such as flammable liquids and health effects evaluate the usefulness of the qualitative assessment of relative risk of exposure of different groups developed in Chapter 7.

Recommendation 6

That procedures be put in place to protect the health of personnel potentially exposed to waters and sediments in Dams 1 and 2 of the firewater treatment system and, in particular, to manage the risks to individuals who have the potential to come into contact with sediments in the dams during routine maintenance.

Recommendation 7

That soil and groundwater quality be assessed in the following areas that were not examined during the site investigation stage of the Preliminary Site Assessment of Fiskville: (Figure 8.1)

- *Part of Drum Burial Area 1 (south of the Airstrip and south of Deep Creek Road);*
- *Drum Burial Area 2 (north of the Administration Building);*
- *Drum Burial Area 3 (east of the Administration Building)*
- *Historical landfills 1 and 2.*

Recommendation 8

That historical landfill 1 which has been disturbed by the construction of a walking track needs to have its extent clearly identified, have an appropriate impermeable and properly drained cap constructed and be revegetated with shallow rooting species that will not compromise the integrity of the cap. This should ensure the safety of any people using the walking track.

Recommendation 9

That any decision on the future management of historical landfill 2, including possible exhumation of buried rums and further site rehabilitation, await the results of soil and groundwater quality assessment at the site (Recommendation 7).

Recommendation 10

That the site specific recommendations of the Golder Associates' Preliminary Site Assessment - CFA Regional Training Grounds be adopted including recommendations to:

- *Undertake targeted soil and groundwater investigations at sites where possible sources of contamination have been identified;*
- *Assess firefighting water quality for contaminants associated with flammable liquids and extinguisher foams;*
- *Assess water quality where discharges occur to the environment.*

The Golder Associates' preliminary site assessment of RTGs makes a recommendation that consideration be given to the development of an overall environment management plan for RTGs which sets standard design and operational procedures. While this addresses current practice and is strictly beyond the Investigation's Terms of Reference, the Investigation supports the adoption of this recommendation.

The Regional Training Ground Report makes a range of detailed recommendations in relation to health, safety and environment at the regional training grounds. While these deal with current matters and are strictly beyond the Investigation's Terms of Reference, the recommendations are informed by the Investigation's review of past practices. The Investigation supports their adoption.

PART ONE
CONTEXT

INTRODUCTION

1

On 6 December 2011, the Herald Sun newspaper published an investigative report raising concerns about the safety of training practices at the Country Fire Authority's (CFA) Fiskville training centre dating from the 1970s.[1] The report included interviews with former and current CFA members and their families focusing on the use of chemicals to light fires for training, how hazardous materials including drums were managed, and allegations that CFA management failed to respond to and share concerns about safety at Fiskville. The Herald Sun contacted the families of "more than 15 people" who suffered serious illness or died since the 1990s. A number of these peoples' experiences were profiled. Other media outlets picked up the Herald Sun report and the newspaper published further stories on this matter in the following weeks.

Flammable liquid fire training at Fiskville, 1990, photograph courtesy of CFA

TERMS OF REFERENCE

FOR THE INDEPENDENT INVESTIGATION INTO THE CFA FACILITY AT FISKVILLE (1971-1999)

1. **The role of the Chair is to investigate and provide an independent report to the Board and the Chief Executive Officer (CEO) of CFA. The investigation and subsequent report is to:**

   a. examine and consider the historical facts relating to the nature, acquisition and use of liquids, gases or solids (with particular emphasis on flammable substances and extinguishing agents, including but not limited to water, foam and dry powders) for live firefighting training at Fiskville. In doing so, the report is to set out a chronology of events, reports and documents about the management of the site at Fiskville, along with a listing of the identified flammable substances and extinguishing agents;

   b. identify and list any documents or reports that contain comments on or recommendations about the use and disposal of flammable substances and extinguishing agents used for live firefighting training at Fiskville and on the management of fire water generated in such training; to the extent that it can be determined, report on how effectively each comment or recommendation was acted upon; and, where no action was taken, comment on the reasons for and implications of such lack of action;

   c. identify the origins of the flammable substances (paying particular attention to the likelihood of the substances being contaminated with material such as heavy metals and persistent organic pollutants, e.g. polychlorinated biphenyls); report on how they were stored, used and disposed of; and assess the likelihood of the use and management of flammable substances and extinguishing agents having led to the contamination of air, land or groundwater at, under or beyond the Fiskville facility;

   d. identify the nature and extent of exposure to the flammable substances (and their combustion products),extinguishing agents and fire water of persons on-site and in surrounding areas that could have potentially been impacted by contaminated runoff or wind drift; and, to the extent practicable, list persons who may have been exposed;

   e. on the basis of available information, assess the risk that there are buried flammable substances drums and/or other related contaminants on the site; where possible identify the location of such materials and make recommendations about any clean up and remediation required; identify where information is considered to be inadequate to enable a risk assessment and recommend action to improve the information base (which may include carrying out exploratory sampling of soils).

2. **The Chair will have open access to all documents, systems and studies held or accessible to CFA; access to all people employed or associated with CFA or the site, past and present (subject to their willingness to participate in the investigation); and access to all CFA resources necessary to thoroughly investigate and provide the report to fulfil these Terms of Reference (including the procurement of specialist and any other external resources as required).**

3. **The report is to be completed and submitted to the Board and CEO of CFA by 30 June 2012 *[amended reporting date]* and following consideration by the Board and the CEO of CFA, the report will be made public.**

4. **These Terms of Reference may be expanded to include other training sites if deemed necessary.**

On 6 December 2011, the Chief Executive of CFA responded, noting in his blog the intention to support CFA members and investigate the allegations made in the Herald Sun reports. On 7 December, the Premier Ted Baillieu noted that the Government "takes this issue very, very seriously, and I know the CFA will do likewise". He assured that the matter would be fully investigated.[2] There were calls, including by the United Firefighters Union, for a full and independent investigation. CFA initiated an urgent search for information on historical training practices at Fiskville and the matters raised by the Herald Sun. CFA sought to keep past and current members informed, and by 14 December 2011 had set up a 1800 hotline for people to register their interest in these issues. WorkSafe Victoria conducted inspections of the Fiskville site to review compliance under health and safety legislation and CFA commissioned two separate independent hygienists' reports on the site.

On 8 December 2011, CFA publicly announced that the former Deputy Chairman of the Victorian Environment Protection Authority and Adjunct Professor at RMIT, Robert Joy, had agreed to chair an independent investigation into chemical use at Fiskville.[3] On 14 December, the Terms of Reference for the Independent Fiskville Investigation were publicly released.[4] Early in 2012, the Investigation was established independently of CFA. This report sets out the Investigation's response to the Terms of Reference and includes sections outlining the historical and legislative context in which Fiskville operated, a review of regional training centres, conclusions and recommendations.

On 16 January 2012, Professor Joy stated publicly on the new Independent Fiskville Investigation (IFI or 'Investigation') website that, in agreeing to chair the Investigation, he had obtained a guarantee from CFA that he would be able to operate with complete independence, would have unimpeded access to all CFA personnel and records, would be provided with all necessary resources by CFA and that his report would be made public. He also stated that he had satisfied himself that the Terms of Reference were broad enough to address the matters raised publicly about past practices at Fiskville as well as at a number of regional training sites.[5] It is the Chair's assessment that these conditions have been consistently met by CFA throughout the investigation process.

The Independent Fiskville Investigation was established by CFA as an administrative investigation. It was not convened under any statutory or regulatory framework, and could not, for example, compel the production of documents or order that witnesses appear before it to give evidence. Accordingly, the Investigation was reliant upon the cooperation of CFA and third parties. However, while established and resourced by and reporting ultimately to the Board of CFA, all facets of the Investigation were conducted at 'arms length' from CFA under the sole direction of the Chair, Rob Joy.

The IFI investigated a range of firefighter training practices which occurred over some three decades. Over this period, tens of thousands of volunteer and paid CFA firefighters (collectively referred to in this report as CFA members) and third parties were trained at Fiskville. Nor was Fiskville the only CFA training facility. Six Regional Training Grounds were established around the state in the late 1980s and 1990s to make training more accessible to CFA members, particularly country volunteers. These centres were broadly modelled on Fiskville, on a smaller scale and with a limited range of facilities. While Fiskville has remained the focus of attention in this report, the Chair has judged it appropriate to act under point 4 of the Terms of Reference to include these training grounds within the scope of the Investigation.

In addition, as the Herald Sun articles made clear, it was not only firefighters' concern about the possible long term effects of past training practices. Over the years, families of CFA staff working at Fiskville lived on the property and were potentially exposed to smoke from training exercises, as were administration, catering and other support staff. The size of this Fiskville 'population' is large. Ensuring that the Investigation heard from all those who wanted to recount their experiences and to talk about their concerns was a key challenge for the Investigation.

While there was extensive effort to identify documentary material relevant to the Terms of Reference, the Investigation was reliant first and foremost on the recollections of the people who responded to its widely publicised calls for information, and on the knowledge shared by those individuals whom the Investigation sought out (collectively referred to as participants). The generosity and courage of participants in the Investigation deserves recognition. Some 324 people, the majority of whom initiated contact, participated in the Investigation.

Quite early in the course of the Investigation, it became clear that the magnitude of the task had been underestimated. Dealing with hundreds of participants, capturing and analysing the accounts of their experiences and searching an estimated four million documents over 20 sites was not possible within the Investigation's original three month timeframe.

On 8 March 2012, CFA agreed to extend the Investigation to 30 June 2012. This extension sought to balance the commitment to hear all interested parties and undertake background research, with the need to report in a timely fashion on a matter of considerable public interest and of direct concern to participants, including some who are seriously ill.

This report seeks to synthesise and summarise accurately, in a balanced fashion, the wide variety of information collected and to place it in the context of the regulations and common practice of the day. While key practices, incidents, reports and actions have been subject to detailed scrutiny, it needs to be acknowledged that accurately reconstructing and understanding in forensic detail events and practices thirty to forty years in the past is fraught with difficulty. The fact that much of the report's analysis and many of its conclusions are framed in general terms reflects this as well as the time constraints within which the report was prepared.

All of the information collected by the Investigation, together with the associated analyses and supporting documents, will be retained by CFA for future reference, with appropriate privacy protections.

The report is structured to provide:

- An Executive Summary
- An Introduction
- An outline of the methodology for the Investigation
- A broad picture of CFA training activities and the context in which they occurred from 1971 to 1999
- A response to each of the Terms of Reference , providing more detail on key issues
- A report on how these issues are reflected in other regional training centres
- Final conclusions and recommendations
- Appendices providing further detail, including technical reports. The appendices are lengthy, and are provided as electronic documents (with this Report) on the CFA website.

Finally, this Investigation is not a health study. As a consequence, some people will be disappointed by its findings, in particular, by the fact that it does not draw conclusions about possible linkages between past training practices and long-term ill-health experienced by some of those who trained, worked or lived at Fiskville. The Investigation was never intended to address such issues. Rather, as its Terms of Reference demonstrate, the Investigation sought to identify what is known about the nature and use of chemicals in training at Fiskville and regional grounds, the exposure risks of different groups of people on and off-site, the potential for on-going risks due to possible site contamination and CFA's knowledge of and response to such risks within the period 1971-1999.

By addressing these essential matters, the Investigation has established a basis on which informed judgements can be made on how best to frame a meaningful health study. On 9 March 2012, the Chief Executive of CFA committed publically to undertake a study of possible links between the types of materials, practices and exposure risks identified by the IFI and long-term health outcomes.[6] Framing and executing such a study will be a challenging task given the length of time which has passed, the lack of precise information about many of the chemicals involved and the difficulty in separating out the effects of confounding variables, notably occupational exposures outside training.

METHODOLOGY

2

Establishing the Investigation

By early January 2012, a secure office dedicated to the Independent Fiskville Investigation (IFI) and separate from CFA had been established in Gisborne, Victoria. Later that month, an Executive Officer and Investigation Leader were recruited with extensive experience in establishing and conducting investigations, leading complex projects and the governance and regulatory environment in which CFA operates. A call centre was established to receive calls from participants. Key consultants, operating solely under the direction of the IFI were put in place - KordaMentha to undertake the document search, and Golder Associates Pty Ltd to provide site assessment and toxicological expertise. King & Wood Mallesons were retained to act as solicitors for the Chair and the Investigation more generally.

Over its course, some 23 staff, 22 paralegals and various contractors contributed to the Investigation, operating under the direction of the Chair. Staff were contracted for various terms, and paralegals worked both part and full-time. The Investigation also benefited greatly from the contribution of two current, experienced CFA employees seconded to work full-time with the Investigation. These employees provided invaluable understanding and insight into CFA language, operations, culture and history. For the period of the Investigation, they operated under the direction of the Chair, Rob Joy. Retired CFA employees also provided vital chronologies of Fiskville training drawn from their personal recollections and document collections. The number and skills profile of staff varied through time to meet the changing needs of the Investigation, with teams formed to establish a call centre, undertake complex interviews, manage document search, carry out technical research, analysis and report writing and provide administrative support.

Liaison with CFA was managed through the IFI Executive Officer and the CFA Chief Executive's Office. CFA was not engaged in the planning and conduct of the operation of the Investigation except to facilitate where requested, for example access to records and support for office and technology infrastructure. CFA maintained a strong interest in ensuring the confidentiality and privacy of the records it held were fully respected and protected as required under law. All IFI staff and contractors acknowledged and were trained in privacy requirements.

The Investigation Chair met with the National Secretary of the United Firefighters Union, Peter Marshall, at an early stage in the Investigation. Mr Marshall confirmed the Union's view that it believed that the IFI was not independent of CFA and that a full coronial inquiry should be held into past training practices at Fiskville and their possible long-term effects on health.

Early on, the IFI established a website www.fiskvilleinvestigation.com.au, and sought to keep interested parties informed of progress while not pre-empting the outcomes of the Investigation.

The Interview Process

In January 2012, the Chair called publicly for input from people who believed they, or a colleague, friend or family member may have been affected by training activities at Fiskville. The call extended to those who did not believe they had been affected but had information about past practices at CFA training sites. Advertisements were placed in metropolitan and regional newspapers on 25 January, 1 February and 8 February seeking input by 17 February (see Figure 2.1).[1]

The advertisements were complemented by a media release issued on 25 January alerting the broader media to the press advertisements. This led to numerous press articles and coverage by local radio stations.

While the majority of participants expressed interest over the January/February period, the IFI continued to register interested parties until 30 May 2012. IFI requested CFA to provide the Investigation with details of those parties who had registered their interest in this issue with CFA, including through its 1-800 number. CFA did not provide these directly to the IFI due to concern this would breach privacy requirements. However, CFA wrote to those people informing them about the Investigation and providing contact details for the IFI and offering on-going CFA support. In addition, a number of parties assisted the IFI to reach and inform former and current CFA members and others with a potential interest in the Investigation. CFA and the Volunteer Fire Brigades Victoria provided regular updates in their websites and publications, as did the publisher of *The Fireman*, a monthly paper that has wide circulation among Victoria's firefighting community.

It is notable that a substantial majority of the 324 people who generously shared their experiences with the Investigation initiated the contact, and that in only in a few cases where the IFI sought people out, did any individuals decline to participate in the Investigation.

Throughout the Investigation, interviews were conducted in accordance with a consistently applied, detailed protocol, which recognised the sensitive nature of the matters being discussed, the age and infirmity of some participants and the need to ensure privacy. IFI assembled a professional interview team with extensive experience in sensitive investigation and research interviews, with a mix of genders and ages. The interview team travelled thousands of kilometres across Victoria and interstate, speaking with participants. Planning for and conducting such a complex interview program was a major logistical exercise.

The goal of the interview process was to ensure participants were fully respected and heard – that they could tell their story – and to elicit knowledge relevant to the Investigation. As a result, more than 95% of face-to-face interviews were conducted in peoples' homes, where they felt comfortable and could be supported by family members. While the interview team used standard approaches, these were framed to allow the interviewer to develop a line of questioning that was relevant to the individual's background and concerns. The emphasis was on ensuring people were able to share the information as they wished to, rather than being constrained by a rigid set of parameters. The team took great care to keep the interview process secure and confidential, even between interviewees. Phone interviews ranged between 14-90 minutes and face-to-face interviews between 90 minutes and 5 hours. 324 individual interviews were conducted. Interviews were at times emotional with people sharing personal issues and long-standing concerns.

Figure 2.1
Press advertisement

CALL FOR INPUT TO INDEPENDENT FISKVILLE INVESTIGATION

An independent investigation has commenced into allegations that CFA members and other persons may have been exposed to harmful chemicals at the CFA Training Facility, Fiskville in the 1970s, 80s and 90s. The investigation is being chaired by Robert Joy, Adjunct Professor at RMIT. Broad Terms of Reference have been established for the investigation and these can be accessed at **www.fiskvilleinvestigation.com.au.**
Professor Joy is being assisted in the investigation by a multi disciplinary team that includes people with expertise in site contamination, toxicology and risk assessment.
Investigators have unrestricted access to records held by CFA and other relevant Government agencies.

We would like to hear from you if -

you believe that you (a family member, friend or colleague) may have been exposed to harmful chemicals as a result of activities at Fiskville or at any of CFA's regional training centres

OR

you have direct knowledge/experience relating to past chemicals handling and training practices at Fiskville or at regional training centres.

Written submissions relevant to the Terms of Reference should be sent to Professor R Joy PO box 915 Gisborne Vic 3347 or via email to info@fiskvilleinvestigation.com.au to be received by close of business Friday 17 February 2012. Please indicate if you wish the contents of your submission to be treated as confidential.

You may prefer to meet with an investigator. To arrange a meeting, please contact the Investigation Team on (03) 5420 9260 or send an e-mail to info@fiskvilleinvestigation.com.au

For further information on the Independent Fiskville Investigation, please visit our website **www.fiskvilleinvestigation.com.au**

Interviews were recorded, with participants' permission, and transcripts or audio recordings provided back to them. To protect confidentiality, even within the Investigation, interviewees were given personal identity numbers and files and documents use these numbers instead of names. CFA has agreed that all interview records will be kept securely and confidentially by CFA as part of the Investigation records. Through an agreement negotiated with CFA, participants had the option to have the records of their interviews kept separately and securely by CFA's lawyers Ashurst on the understanding all such records may be discoverable under future legal processes. Most participants chose to have their contribution kept as part of the general records of the Investigation. 134 interviews were transcribed into text documents to facilitate analysis. The openness of participants, together with well-targeted research (pre and post-interview), enabled the IFI to extract extensive, quality information that proved to be central to addressing its broad Terms of Reference.

Over the course of the Investigation, as the credibility and understanding of the interview approach grew across CFA networks, the number of participants steadily increased. The Investigation mapped participants against factors such as period and length of service, location, roles and relative risk profiles to ensure there was relevant knowledge to support all facets of the Investigation. The IFI actively sought out people who were identified as potentially having key information or filling a gap in understanding.

For example, interviewers actively door knocked neighbours within a radius of some 4 kilometres of Fiskville, though it was noted most of these had moved to the area after 1999. Participation remained voluntary. About 25 per cent of interviews were initiated by the IFI. At the end of April 2012, the Investigation team wound up all but a small number of critical interviews to enable analysis and report writing. The remaining interviews with a number of senior ex-CFA staff and Board members were concluded in May. Careful records have been kept of all those who expressed an interest to the IFI, including those who registered an interest but who did not seek and interview and/or were not a priority for IFI to interview.

Other Contributors

As well as contacting former and current paid and volunteer CFA members, the Investigation sought input from a range of other parties. On 8 February 2012 the Investigation wrote to 188 parties (e.g. businesses, government agencies) who were listed in records obtained from Fiskville as having used Fiskville for training in the period of interest. These organisations were encouraged to inform staff who had trained at Fiskville and who might be interested in participating in the Investigation, and to provide any relevant information. In general neither IFI nor these third parties had specific information on the nature of staff attendance. Most of the responses from these third parties sought information on names of employees or dates of attendance which the Investigation was unable to provide. Seeking to put together exact attendance lists from the extensive uncatalogued documentation at Fiskville would have taken more time than was available to the Investigation, required significant resources and was likely to remain incomplete. Some organisations indicated they would seek to alert staff to the Investigation. Ultimately, no information relevant to the Investigation was obtained from these sources.

Throughout the course of the Investigation, interviewers and those analysing documents sought to identify and confirm any suppliers of flammable materials to Fiskville. A summary of findings, together with details of IFIs contact with companies identified as likely suppliers is provided in Chapter 5 which deals with Term of Reference 1(a).

The IFI also sought information, including inspection reports, records of notices served or of other forms of enforcement action and any other documents relating to Fiskville or to regional training grounds from WorkSafe Victoria (and its predecessors) and Environment Protection Authority (EPA). Both regulators provided full records of past interaction with the Fiskville site, and these underpin key Investigation conclusions. The broader regulatory context in which CFA operated is outlined in Chapter 3.

Similarly, the Investigation contacted the Department of Education and Early Childhood Development to alert them to the Investigation and to seek their support in reviewing relevant records and contacting teachers and students who attended the Fiskville Primary School. The Department cooperated fully, encouraging former staff to contact the Investigation (see Chapter 7 for a discussion on potential exposure risks).

The Document Search

In January 2012, the IFI retained KordaMentha to undertake an independent search of CFA documents on its behalf. KordaMentha is an established firm with a large forensic practice. KordaMentha regularly conducts major complex litigation, investigation, fraud and e-discovery assignments for lawyers, corporations and government. KordaMentha brought a wealth of expertise, methodology and rigour to the extensive document search.

The first stage in the document search process involved physically locating and assessing documents - in itself a major exercise. KordaMentha searched:

- CFA head offices in Burwood
- seven training grounds including Fiskville
- seven regional headquarters
- three district offices
- third party document stores - primarily 12,000 boxes of documents at Recall facilities in Port Melbourne
- relevant files at the Public Record Office
- electronic CFA information.

Documents held at these sites varied from single pages, to files and folders, bound books, maps, photographs and films. Record keeping practices varied across these sites and through time, but were generally poor, with very limited, inaccurate cataloguing. Ultimately, in the order of four million documents were subjected to rapid review against criteria supplied by the Investigation.

The IFI was able to identify and review a number of key, known documents from the outset of its work obtained directly from CFA or key participants. However, the IFI received most of the documentation from the KordaMentha search from mid-April 2012. By the beginning of May, approximately 30,000 potentially relevant documents were provided to IFI. These were further reviewed and some 8,000 deemed most relevant were examined through a qualitative analysis system (outlined below). A process was established to escalate documents most likely to be relevant to the Investigation. By the end of May a further 50,000 documents were provided by KordaMentha. This largely reflects the size and complexity of the search process. Through May the Investigation scaled back review of documents to focus on analysis and report writing. No further review of documents occurred after 31 May. All documents within the KordaMentha database will be passed to CFA following the Investigation.

KordaMentha also undertook an extensive search of electronic documents but, this was not completed in time for the Investigation to consider. However, the Investigation believes the majority of the key documents from the period of interest, 1971-1999, were hard copies and would have been discovered through the search and interview process.

Where potentially relevant documents were identified, these were electronically scanned and labelled by specialist contractors, and stored in a Relativity database by KordaMentha and accessed solely by the IFI. This scanning process presented challenges - such as scanning fragile, bound books or microfiches - and extended the timeframe until the documents were available to the Investigation. KordaMentha has also captured and stored documents produced in the course of the Investigation, including documents provided by EPA, WorkSafe, participants and researchers.

A single, secure, electronic repository of documents potentially relevant to the Terms of Reference is a major legacy of the Investigation. As well as providing a key resource for the Investigation, KordaMentha's work will provide CFA with an accurate catalogue of many of its most critical records, which can be readily searched, and electronic copies of important degrading historical documents. This database will be provided to CFA following the Investigation.

Searching Fiskville

Searching the Fiskville site itself for relevant documentation was a challenge. The Investigation ultimately benefited from the fact that much material was retained on site, including past and current CFA records and the contents of a former library and photographic studio. However, most of this material was uncatalogued and poorly stored. CFA had initiated efforts to catalogue and rationalise this material prior to the Investigation, and much of it has now been put into long term secure storage.

The search for Fiskville documentation was challenging

KordaMentha's search of Fiskville included:

- 442 files held in compactors
- the contents of the former library, mostly held in boxes in a shed
- extensive maps, plans, slides and film reels stored under the amphitheatre
- the contents of five shipping containers
- offices of current Fiskville staff
- 22 pallets of documents stored in sheds.

Large quantities of uncatalogued films and photographs, were not reviewed or digitised given time and cost constraints. The Investigation believes these are unlikely to add substantially to its findings.

KordaMentha worked closely and iteratively with the IFI to share knowledge about documents as they were discovered and to discuss information emerging from the Investigation. The IFI requested specific documents where their existence was known, but also relied on the experience and rigour of KordaMentha to conduct a generalised search focused on the Terms of Reference. KordaMentha staff assisted IFI to locate 30,000 potentially relevant documents and to further review these to identify a subset of some 8,000 documents for more detailed analysis. It is this subset that forms the basis of the documentary evidence in this report.

Given the large number of CFA documents involved and the relatively short period of time IFI had to consider the results of this extensive search, the Investigation will not have identified or considered every relevant document. Despite CFA's support in facilitating access to the organisation's records, it remains possible some relevant information has not been identified.

During the course of the investigation, the IFI received information from one participant that he had received instructions from another CFA employee to destroy certain documents that were relevant to the Investigation. The allegation relates to one of the regional training centres and appears to be an isolated incident. The Investigation has been provided with copies of documents which were allegedly directed to be destroyed. Those documents, while relevant to the Terms of Reference, are not material to the Investigation's findings. On the information provided to the Investigation, it was not possible to determine whether the allegation was true or false and it was beyond the Investigation's terms of reference to investigate allegations of this nature. The allegation has been referred to the Ombudsman.

With further time, more documents could have been reviewed and greater cross-referencing and synthesis of information, interviews and other sources could have occurred. However, the Investigation is confident that its targeted, rigorous and risk-based approach to locating and reviewing documents has identified a sizable majority of material relevant to the Terms of Reference. This documentary information ultimately supports the Investigation's strong foundation of first-hand information from participants. Consequently, the IFI is confident its general conclusions are supported by first hand evidence.

Both KordaMentha and the IFI observed relevant Commonwealth and State privacy and health records requirements during the course of the Investigation. All staff and contractors signed confidentiality agreements and were subject to privacy training. By agreement with CFA, personal health records within its documents were quarantined in the KordaMentha document management system and only released to the IFI where permission was sought and granted through CFA. Where participants elected to keep their contribution to the IFI confidential, these records have been securely quarantined and are available only to relevant IFI investigators. These records will be held by CFA's lawyers, Ashurst.

Research Commissioned

Golder Associates were retained in December 2011 to assist the Investigation by undertaking a preliminary assessment of potential site contamination at Fiskville. Golder Associates are a global environmental and engineering firm with extensive experience in contaminated site assessment. Golder Associates' assessment of Fiskville involved a detailed review of historical documents and reports, targeted sampling and analysis of soil, water, sediments and vegetation in areas most likely to have been contaminated and use of ground penetrating radar surveys in suspected drum burial locations.

In the absence of detailed information on specific materials brought to Fiskville, samples were analysed for a broad range of analytes. Golder Associates site investigation report includes an analysis of background information, a chronology of events, a preliminary qualitative assessment of risks to human and environmental health from potential soil, surface water and sediment contamination and recommendations for further investigation or remediation. The results of Golder Associates' work are drawn on in Chapters 6 to 8 dealing with Terms of Reference 1c, 1d and 1e and their reports are provided as appendices to this report.

Early in January 2012, CFA, following consultation with Professor Joy, initiated an assessment of its six Regional Training Grounds to inform and assist the IFI in determining whether to exercise the option provided in Term of Reference 4 to include other training sites in the Investigation. The assessment was carried out by Brian Lawrence, CFA's Manager of Training and Development – Hume Region, and is included as an appendix to this report. The sites involved were at Bangholme (near Carrum in Melbourne), Huntly (north of Bendigo), Longerenong (east of Horsham), Penshurst (south-east of Hamilton), Wangaratta, and West Sale (later called Gippsland) (see Chapter 10). Mr Lawrence was formally seconded to the Investigation to undertake this work and operated as a member of the IFI staff and under the direction of the Investigation Chair.

While the regional training sites' assessment covered the same areas of concern as the IFI, unlike the Investigation, it also focused on the sites' current health and safety. To address this area, CFA commissioned hygienist reports on the safety of each of the six Regional Training Grounds.

The hygienist reports met a significant part of the original brief given to Mr Lawrence and allowed him to concentrate on past training practices at the Regional Trainning Grounds and on the potential for site contamination. Following consultation with Mr Lawrence, in April 2012, the Investigation commissioned Golder Associates to undertake a preliminary site assessment of the six regional training sites. Mr Lawrence provided background and assisted with site visits for this assessment. This assessment included a review of available information, a site walk-over, identification of potential contaminant sources, pathways and receptors and a summary on common themes observed across all sites.

A summary of the findings of the assessment of the regional training sites is provided in Chapter 10 and Golder Associates' preliminary assessment of the regional sites is provided in Appendix F.

Golder Associates were also retained to provide a literature review on fuel combustion products arising from materials or classes of materials which may have been used at Fiskville. The review also included consideration of health hazards that may be associated with exposure to flammable materials and combustion products (including leaded and unleaded petrol), and potential exposure routes associated with typical fire training activities. As knowledge of the exact materials brought to and used at Fiskville is limited, much of this literature review was general in nature. While providing useful background to a consideration of risks associated with firefighter training, the information does not enable an assessment of individual exposures or of associated levels of risk. Nor does it identify causal links to individual health outcomes from training at Fiskville. This report is provided in Appendix B.

Analysis and Drafting

A key challenge for the Investigation was to rapidly but effectively synthesise, integrate and analyse the rich body of information collected through interviews, document searches and research. Teams of paralegals assisted the Investigation in reviewing and analysing documents and interviews.

KordaMentha used the established Relativity e-document search product to provide a single integrated document catalogue that could be readily searched and refined by the IFI. KordaMentha's processes and this software provided a rigorous audit trail and useful tools with which to review the 30,000 documents identified as potentially relevant to the Investigation.

About 8,000 of the documents assessed as most relevant were imported into the state-of-the-art Nvivo qualitative analysis program. Nvivo enabled the analytical team to import, classify, query and work with information in a wide range of forms. Nvivo extends traditional search tools to drill into detail and to link and search across complex, large sets of material. However, ultimately these are only support tools not substitutes for the intellectual effort needed to analyse and evaluate information and to develop rigorous lines of argument and conclusions. The experience and skills of the Investigation team were therefore critical to the framing of this report.

The Report was drafted in May 2011. To assist his analysis, on 10 April, the Chair announced he had appointed an expert panel to focus on assessing key risks to human and environmental health from the materials and potential contaminants brought onto and burnt at Fiskville prior to 2000. Panel members include:

- Honorary Professorial Fellow at Melbourne University, Ian Rae
  - Professor Rae is an expert on chemicals in the environment and an advisor to the United Nations' Environment Programme
- Associate Professor Susanne Tepe
  - Dr Tepe is an occupational health specialist at RMIT University with many years' experience in industry
- Dr Heather Wellington
  - Dr Wellington is a medical practitioner and lawyer who has worked in the health care sector for more than 30 years and is currently a consultant with DLA Piper.

The panel's role was purely advisory in nature, operating at arms' length from the Investigation, providing a fresh, expert perspective on the information available and on emerging conclusions. The panel held a workshop with key Investigation staff and consultants and reviewed draft material. However, the framing of the report was the responsibility solely of Investigation staff and the Chair. The panel has not been asked to endorse the Report or its conclusions, nor is it in any way responsible for its content.

In preparing this Report, a particular concern was to ensure that privacy requirements are met. The Chair had publicly stated that an individual's name would only be mentioned in the Report with their permission. However, some names and events central to the Investigation are already in the public domain and some parties may be identifiable to CFA members from contextual information. To the extent possible, the Investigation sought to balance individual protections and public interest.

Key Limitations of the Investigation

While the Chair considers a thorough investigation has been conducted in response to the Terms of Reference, there were a number of significant limitations which have been canvassed in this chapter.

Key limitations include:

- The administrative nature of the Investigation, and therefore the lack of ability to compel witnesses or documents
- The short time frame for the Investigation relative to its complexity
- The extensive, complex document search required
- The large, sensitive interview program undertaken
- Seeking to reconstruct events and practices which occurred over the past forty years
- The lack of documentation of informal and historical practices
- The challenge for witnesses to recall matters that happened so far in the past.

BACKGROUND

3

Safe and effective firefighting is dependent on the knowledge and skills of those who actually deliver the service. Staff training is therefore seen as a fundamental responsibility of front line firefighting organisations around the world. To be effective, training must provide exposure to the range of emergency situations likely to be confronted by firefighters in the field under realistic but controlled conditions.

Figure 3.1: Fiskville Location Map

The decision to purchase the Fiskville site in 1971 to establish a State Training College represented a watershed in CFA's approach to training, with the commitment of significant funds to purchase and equip the college as a residential firefighter training centre servicing the whole of Victoria.[6]

From its early days, Fiskville's aim was to provide training that would equip CFA staff and volunteer firefighters to respond efficiently and effectively to a variety of fire and emergency situations and to anticipate and manage associated risks. Fiskville provided a venue for both theoretical and practical firefighting and emergency response training. For the period addressed by the Terms of Reference (1971–1999), CFA Annual Reports indicate approximately 87,000 CFA training attendances for both theoretical and practical training or other functions such as conferences. It was not possible for the Investigation to obtain more precise figures of attendees undertaking practical fire training relating to the Terms of Reference. It should be noted that many CFA and Fiskville trainees would have attended multiple courses over the scope period and are likely double-counted in the aggregate figure. Also, many students did not undertake practical firefighting training on the flammable liquid practical area for drills (PAD) or in the original structural fire attack building (as outlined in Chapter 5). Thus, the total numbers of students undertaking hot fire training at Fiskville cannot be accurately quantified.

In addition to CFA trainees, emergency services personnel from other government agencies from Australia and overseas trained at Fiskville. On a commercial basis industrial fire officers and industry fire wardens from private companies nationally and internationally also used the facilities. Fiskville increasingly used the fees from these commercial clients to fund capital works, training activities and general operational costs. (See Chapter 9.) From the mid–1970s, for a period, Fiskville promoted itself as the leading facility of its type in Australia. By the 1990s, however, new state-of-the-art-training facilities were established in New South Wales and South Australia which were purpose-built to provide realistic training while minimising risks to human health and the environment.[36-37]

The initial development of physical facilities at Fiskville took place in the 1970s, with the practical area for drills (PAD) completed in 1974 including the flammable liquid and gas training props and structural fire attack building. The development during this early period set the general pattern for practical training for the next 25 years.

Geographic Context

Fiskville is located in a rural area characterised by sheep and beef cattle grazing. It was and is relatively isolated, situated some 80km from Melbourne on the western side of the Geelong to Ballan road, approximately 55km north of Geelong and 10km south of Ballan. Its isolation from any densely settled areas reduced the likelihood of fire training exercises creating a significant off–site nuisance and was likely a factor in CFA choosing the site as its major training facility. The nearest residence (other than those on the property itself) is located on the Geelong–Ballan road at the south–east corner of the Fiskville site. This property has recently been purchased by CFA. There are several other residences located within a 1.5km radius of the fire training area at Fiskville. The small Fiskville primary school, established in 1933 and closed in 1993, was located on the property adjacent to the Geelong–Ballan road. Children of Fiskville staff and local farming families attended the school.

The site is approximately 146 hectares in area and previously housed an international radio telecommunications facility operated initially by Amalgamated Wireless Australasia and, until its closure in 1969, by the Overseas Telecommunications Corporation (OTC).[12]

The Fiskville site lies on a flat to slightly undulating plateau formed on Tertiary olivine basalt and drains generally to the south. A low north–south rise divides the site drainage between the eastern–side Yaloak Creek (the Werribee water supply catchment) and the western–side Beremboke Creek.[13]

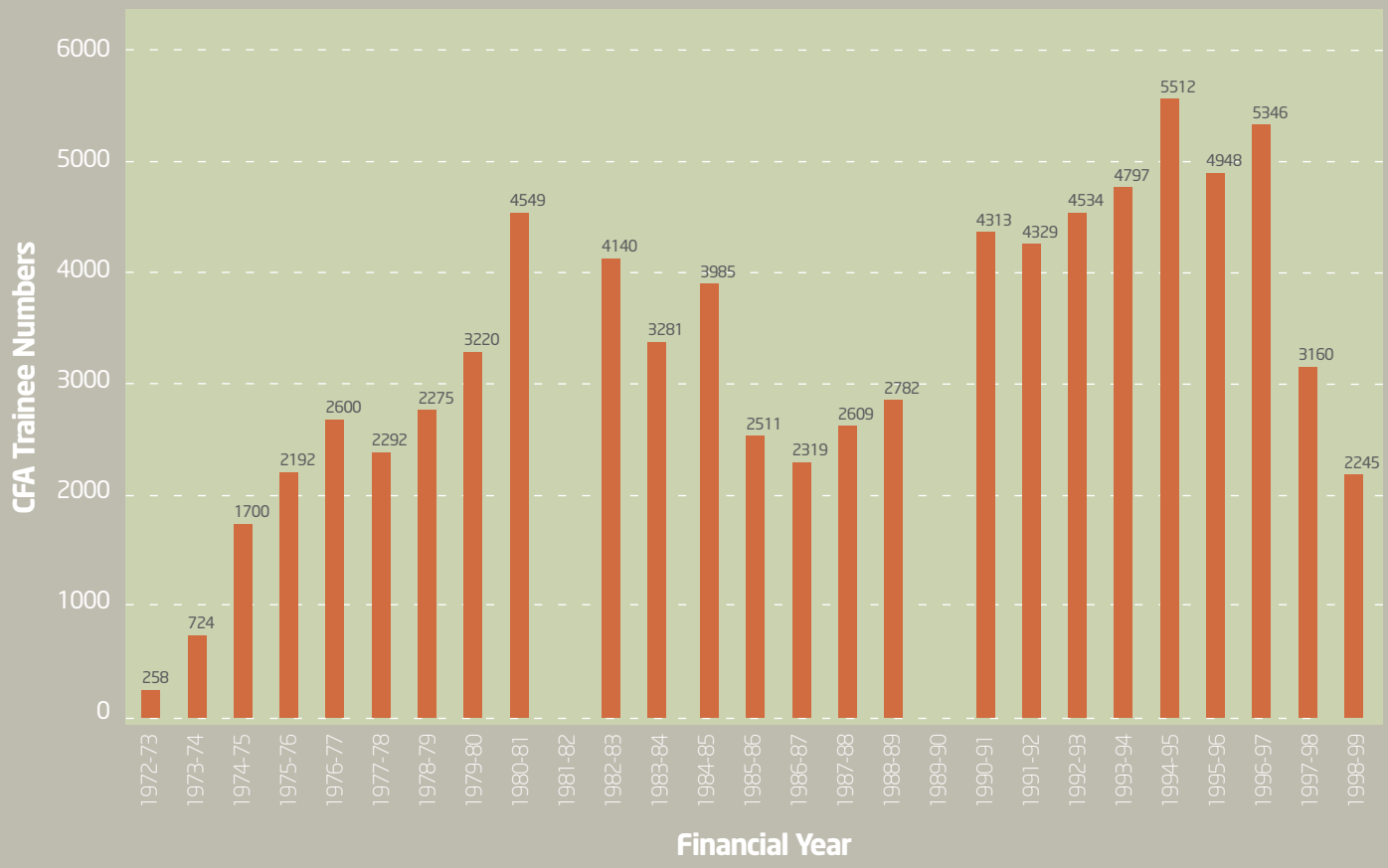
Figure 3.2: Fiskville Topographical Map

Soils are generally less than two to three metres in depth, of silty clay texture, overlying heavier high plasticity clays formed from variably weathered basalt. No comprehensive study of groundwater is available for the area so little is known about the aquifer, its continuity or direction of flow. A consultant's report prepared for CFA in 1996 noted that: "groundwater is likely to comprise of an unconfined aquifer within the variably weathered basalt at depths ranging between approximately 8 and 15 metres below existing ground surface level".[14] Only one of a series of groundwater bores constructed on the property in the mid-1990s reached this aquifer at a depth of 20 metres. The groundwater was found to be slightly saline.

Based on data from 1994 and 2012 from the Bureau of Meteorology site at Sheoakes, approximately 25km south of Fiskville, the area has a recorded average rainfall of 497.7mm with maximum falls between July and November. The daily average maximum summer temperatures are approximately 24°C, with winter average maximums 12°C. Fiskville is well known for the frequency and strength of its winds, which come principally from the north through to the west. The average afternoon wind speed over the period of 1991 to 2010 was 20kph.[15]

A detailed fold-out map of key infrastructure at Fiskville is available on the back page of this Report.

Figure 3.3: Attendance Numbers Across All CFA Training Sites, 1972-73 to 1998-99[23]



Notes to Figure 3.3:

1. Commercial training started from 1976-77.

2. Data between 1972-73 to 1984-85 is exclusively Fiskville Training College.

3. Data from 1985-86 onwards may include Regional Training Centres.

4. Aggregate numbers may not include all trainee groupings (see discussion on page 36).

Evolution of CFA Training - A Brief Review

Prior to the appointment of Brigadier Richard Eason as CFA Chairman in 1965, training was carried out at local brigade and group level with limited organisational support. Eason recognised the need for the organisation to take responsibility for training rather than leaving it to the efforts of members at grass roots level. In May 1968, on Eason's initiative, the manual *Tactics and Administration in the Field* was produced, establishing a uniform framework and set of principles for all CFA operations.

Eason also moved quickly to establish a new department, the Training Wing, to coordinate training across the state and to prepare training notes on a variety of topics to support consistent volunteer training. The Training Wing was originally located at CFA headquarters in Malvern and charged with developing a system to support the existing Regional Training Committees (RTCs) to improve training effectiveness.[16] Following the establishment of Fiskville, RTCs played an importantc role in supporting the state-wide training facility. They supplied additional instructors, crew leaders and supervisors and provided underpinning training in theory at the local level to support training at Fiskville.

From the 1970s to the mid-1990s, theory courses at Fiskville focused on content which included topics such as the science of fire, properties of materials (i.e. fuels, solids) and methods of extinguishment. On the flammable liquid PAD, each prop was designed to simulate potential emergencies that a firefighter may encounter. It is evident that instructors' experience and attitude to risk and safety varied, and influenced the approaches to practical fire training. Up to the mid-1990s, many of the approaches to safety on the PAD would not be considered acceptable by today's standards. Over time, instructors became more knowledgeable and skilled in managing risk in emergency responses.

In the early days of Fiskville, personal protective equipment (PPE) and personal protective clothing (PPC) were rudimentary compared to current day issue, and supply of such equipment on–site at Fiskville was limited. Where personal protective clothing was provided, it was often shared between trainees. Often volunteers as part of their brigade membership were required to purchase their own personal protective clothing and would bring this to Fiskville when training. As discussed in the report, the lack of provision of protective gear, and inconsistent use of PPE and PPC on the PAD (particularly face masks and gloves), was a common theme of trainee experience throughout Fiskville's history until the late-1990s.[17] However, it should be noted that use of PPE and PPC in the field was also variable and grew over time.

In 1983 and 1986 respectively, two regional training centres were established at Wangaratta and West Sale to provide more accessible practical training facilities in the north-east and south-east of the state.[18 19] These facilities grew largely out of local initiatives with limited centralised funding. In the early 1990s, a further four regional training facilities were developed in line with a corporate *Field Training Grounds Policy* which, among other things, aimed to provide training grounds within a two hour drive of all brigades.[20] Fiskville effectively became the field training ground for its surrounding regions, but maintained its status as a state-wide facility. Although the establishment of regional training grounds state-wide reflected a greater degree of central planning and direction, the development of these Regional Training Grounds was still to a considerable extent driven and controlled at the regional level. Each training ground was managed by its own Field Training Ground Management Committee. These regional facilities largely replicated the types of physical training experience provided by Fiskville, although on a smaller scale. From the 1990s, the regional training grounds were required to be designed to meet with regulatory requirements,[20] although as Chapter 10 outlines, this varied in practice.

By the early 1990s, there was a growing recognition within CFA of the need to reflect modern best practice in curriculum development and teaching methods in training at Fiskville and across the regions.[21] Around the same time, the development and introduction of national standards (the Australian Fire Competencies (AFCs) occurred under the auspices of the Australian Fire Authorities Council. CFA played a role in this development, which was the first nationally recognised accredited training system for firefighting in Australia.

"[W]e only had woollen turnout coats and woollen trousers then. We didn't have over trousers or anything like that. And the leather boots were just hopeless. They were for show I think. They didn't seem to do too much."

- CFA Trainee, 1970s[1]

A review of the www.training.gov.au database confirms that CFA was first listed as a Registered Training Organisation on 1 February 1994 for the purposes of delivering and assessing Nationally Recognised Training, registration number 3739.[22] Training delivery included training packages, qualifications, accredited courses, skill sets and units of competency. In the initial registration, CFA primarily delivered AFCs. In 2011 the AFCs were discontinued and the Public Safety Training Package is now the nationally recognised standard for which CFA is registered to deliver specific modules and units of competency. CFA instructors qualified as assessors can assess against these competencies at any of CFA's regional training sites. However training and assessment can also occur at brigade level based on the competency outcomes.

Consistent historical data on trainee numbers at Fiskville are not available for all years of the period of the Investigation. The data that is available - mostly through Annual Reports - contains inconsistent 'units' of attendance measurement, meaning that available data may not include all trainees. Data from 1982 and 1989 was not accessible. From 1985-86 onwards, trainee numbers data typically included Fiskville and other Regional Training Centres. Within these caveats, Figure 3.3 summarises available data on trainee numbers across all CFA training sites. Based on available information, it is estimated that the average annual number of students to attend CFA training grounds was approximately 3245 with the maximum in any one year being 5512 in 1994 and the lowest 258 at the time of the site establishment in 1972. As already reported, for the period addressed by the Terms of Reference (1971-1999) approximately 87,000 training attendances (as distinct from trainees) were reported across Fiskville and other CFA training grounds, for both theoretical and practical training. Many individual trainees would have accrued multiple attendances at different courses across the scope period.

Development of Practical Training Facilities at Fiskville

Over the years, Fiskville's training facilities have evolved through a series of incremental changes and major restructures. Following the 1971 purchase of the Fiskville property, CFA refurbished the small number of existing buildings and progressively constructed additional residences for staff, accommodation for trainees, classrooms, a kitchen and dining room and various workshops, garages and storage buildings.

In August 1972, staff of CFA's Training Wing moved into newly renovated buildings at Fiskville, with the first training course being conducted in the following month. Early courses were limited to classroom sessions and focused on improving instructional techniques and rural fire tactics, command and control. By 1974, construction of the practical training facilities had been completed enabling the first practical courses to begin.[24] The area containing these facilities was known as the PAD and included areas for fires involving LPG, flammable liquids, and a three storey building suitable for structural fire attack and breathing apparatus training.[24] The PAD courses were based on a series of training guides- PAD Briefs -documenting principles and practices to be taught, safety factors to be stressed and strategies and tactics relevant to different operational situations.[25]

The original Flammable Liquid PAD was an area approximately 90 by 90 metres, surfaced with compacted rock. On it were located a series of props designed to simulate common fire situations of the time, such as tank fires, fires in pools of liquid and fires running in drains. Training with these props focused on teaching fire attack techniques with a range of extinguishing agents. The props were fuelled either by LPG from a bulk tank, or by flammable liquids including petrol and diesel fuels stored in purpose built tanks. The PAD was developed with separate systems of pipes and valves for the LPG and the stored petrol and diesel. Sump oils and other waste flammable liquids, often of unknown composition, were also collected from a range of premises and stored either in 44 gallon drums or the fixed fuel tanks that were plumbed directly to the props. The nature of these fuels is outlined further in Chapter 5. These flammable fuels were either stored in overhead tanks and went through the plumbing system to the props or in other cases 44 gallon drums were rolled out to the prop and manually emptied into the bunded props or foam pits by Fiskville staff.[25]

Until 1996 the props and foam pits were often primed with fuels of a low flashpoint by PAD operators, who were sometimes assisted by instructors or trainees. This would involve pouring flammable liquids directly from drums, or materials decanted from drums or overhead tanks, into smaller containers or open buckets which were carried on to the PAD to props and the foam pits. The foam pits immediately to the east of the PAD were earthen pits that could be flooded with flammable liquids and were exclusively fuelled manually by 44 gallon drums. These were then set alight and used for training in the application of foam, and by industry in the testing of various types of foams. Unless successfully extinguished, flammable liquid fires would burn until their fuel supply was exhausted. On 29 May 1989, Fiskville management determined "*Large pits on P.A.D. are to be filled in. Maybe problems with E.P.A. No foam training until new PAD area is completed*"[26] The foam pits were subsequently filled in. Flammable liquids training ceased at Fiskville over 1996 and 1998, and resumed again in 1999 when the fuel lines to the PAD props had been upgraded and reconstructed to comply with environmental, safety and dangerous goods standards.[11]

The original fire attack building constructed in 1973 comprised three floors that could be used to simulate fires likely to occur in industrial, commercial and residential settings. The building included a simulated ship's engine room and container hold to simulate ship fires. Portable containers were used to fuel flammable liquid tray fires in the enclosed space fire attack building along with solid materials such as wooden pallets. In addition, industrial smoke generators were used in exercises in the enclosed space smoke tunnel training.

Hazardous materials incident training exercises could involve simulated incidents involving dangerous goods and other forms of hazardous materials using limited amounts of various hazardous materials (i.e. sodium, chlorine, magnesium and so on (see Chapter 5). In the 1970s and 1980s, demonstrations occurred on the PAD, and later in a science room equipped with a vented hood. Some exercises used harmless liquids such as water with food colouring and coloured smoke to simulate the results of transport accidents, gas leaks and industrial chemical spills.

Figure 3.4: Flammable Liquid PAD

The PAD Circa 1985

1. High Flashpoint Prop
2. Cloverleaf Prop
3. Circular Prop with drum
4. Running Drain
5. Water Tank
6. Shed (not a Prop)
7. Drum Rack
8. Simulated Rail Car
9. Flanges
10. LPG Bullet
11. Impingement Shield
12. Domestic Household Cylinders
13. "T" Extinguisher Prop
14. Round Flammable Liquids Tray (Extinguisher Prop)
15. Flammable Liquids Slide (Extinguisher Prop)
16. Square Flammable Liquids Tray (Extinguisher Prop)
17. Cross (Extinguisher Prop)
18. Tank
19. Foam Pits (AKA Old Fire Training Pits)
20. Fire Attack Building
21. Dam 1
22. Triple Interceptor
23. Flammable Liquid Fuel Supply for PAD Props
24 LPG Supply for PAD Props

1. High Flashpoint Prop

3. Circular Prop with drum

4. Running Drain

7. Drum Rack

8. Simulated Rail Car

11. Impingement Shield

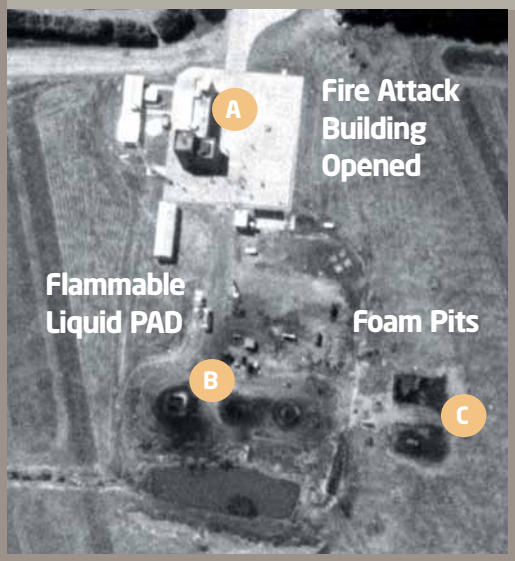
13. "T" Extinguisher Prop 17. Cross (Extinguisher Prop)

15. Slide (background) 16. Square Flammable Liquids Tray

18. Tank

Figure 3.5: Comparison of PAD Over Time

Aerial photo of Fiskville 1977



The original Flammable Liquid Practical Area for Drills (PAD) was constructed over 1973 - 1974.

The original training area included:

A. Fire Attack Building

Enclosed space for training including search and rescue, structural fire attack, breathing apparatus and foam exercise.

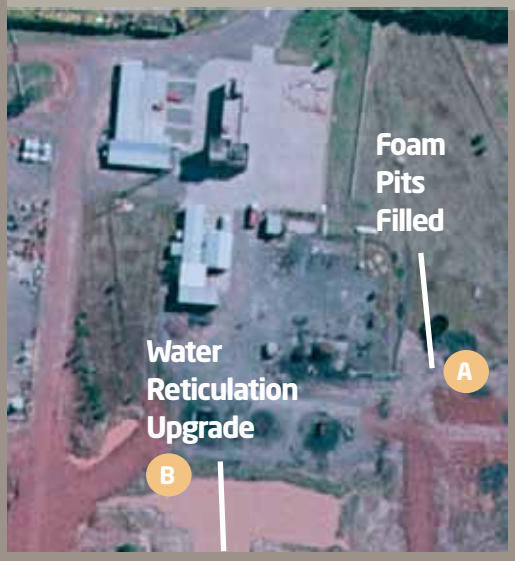
B. Flammable Liquid Prop

Bunded prop to utilise two line or five man fog attack. Fuelled by flammable liquids and LPG.

C. Foam Pits

Two pits both approximately 20 X 40 metres in non-bunded areas off-side of PAD. Drills involved extinguishing flammable liquid fires with foam.

Aerial photo of Fiskville 1990



A series of incremental site upgrades occurred between 1973 to 1989. Over 1989-91, a significant PAD extension was completed. The main changes included:

A. Foam Pits Filled

On May 29 1989, Fiskville management determined "Large pits on P.A.D are to be filled in. Maybe problems with E.P.A. No foam training until new PAD area is completed." Both foam pits were filled in. [26]

B. Upgrade PAD runoff water reticulation

Dam 1 extended to south and construction of dam 2 (not shown).

C. Development of new LP Gas PAD and PAD amenities building

D. Construction of single storey and two storey structual fire attack building

Aerial photo of Fiskville 2002

In 1995, training ceased in the original fire attack building due to structural concerns. In 1996, the flammable liquid PAD was deemed unsafe and closed. Between 1996 and 1999, major works were undertaken including:

A. Removal of Contaminated Soil and Land Farming

B. Construction of Concrete Flammable Liquid PAD

C. Construction of New Prop Fuel Delivery System

D. Development of New Dual Fuel Props (LP Gas and flammable liquid)

Training continued on the LP Gas PADs through 1996 to 1999. In September 1999, the redeveloped flammable liquid PAD was opened for training.

Photograph courtesy of Photomapping Services

Table 3.1: Examples of drills conducted at Fiskville

Enclosed space training
Enclosed space training occurred in the three-storey fire attack building. Drills conducted in the fire attack building included:
• Multi-storey building: Enclosed space training included search and rescue drills, structural fire attack, and breathing apparatus exercises. Accelerants used to create smoke included a wood fire on the ground floor, and solid materials such as pallets and hay bales.
• Smoke tunnel: materials used to create smoke included hay, metre square flammable liquid trays.
• Fire tower: Filled with high expansion foam, burnt magnesium shavings.
Open space training
Open space training occurred on the flammable liquid PAD and up until 1990, on the foam pits. Drills were designed to simulate fires likely to occur in industrial and commercial settings.
• Flammable liquid pit: Bunded pit to utilise two line or five man fog attack. Using a fog spray to push through thick smoke and any flame, trainees would advance towards a dummy valve set to turn a dummy lever to simulate shutting off the flow of the flammable liquid prop, and then back out. Flammable liquid used.
• LPG bullet: a gas fuelled bullet that was remotely controlled by the PAD operators. The PAD operators would remotely fire up the gas, ignite the bullet, the bullet would catch fire, trainees would combat the fire with water, when the instructor was happy the correct techniques had been deployed the PAD operator would turn off the gas supply and the fire would extinguish.
• Foam pits: two pits both approximately 20 metres by 40 metres in non-bunded areas off-side of PAD. Drills involved extinguishing flammable liquid fires with foam. Clover leaf prop: Materials used included LPG, diesel and petrol. (see Chapter 5)

In the 1970s, there was a rudimentary system for collection and treatment of run off of firewater generated in exercises on the PAD. This firewater would be contaminated by products of combustion, unburnt flammable liquids and fire suppression materials such as foam. In the absence of hard surfacing and effective bunding, much of the PAD runoff failed to enter the treatment system, instead flowing overland onto adjoining paddocks (chiefly to the east and south east). Collected runoff was directed via a small, undersized triple interceptor trap to a primary treatment dam in the early years (Dam 1). After PAD re-development in the early 1990s, which established a secondary dam (Dam 2), water would exit the first dam to a secondary dam and from there flow to a man-made lake ('Lake Fiskville') located to the west, adjacent to the staff residences.[27] A third dam was added to the system in the mid 1990s and a fourth around 2010. The flammable liquid PAD was not sealed until the upgrade in 1999.

Within a backdrop of expanding regulatory requirements and increasing industry focus on environmental practice and health and safety, there is evidence of concern amongst some CFA staff in the mid-1990s about dangerous goods storage and handling practices at Fiskville. As detailed in Chapter 9, CFA staff trained in dangerous goods requirements for industry realised that Fiskville itself was a dangerous goods site and needed to comply with regulatory requirements. This led to a number of internal assessments, audits, reports and non-compliance notices.[28] CFA staff engaged regulators to help drive change. Up to that point, the Fiskville site had rarely gained the attention of regulators. Regulators confirmed practices failed to meet regulatory requirements that had been in place for a number of years notably the Dangerous Goods *(Storage and Handling) Regulations* 1989[29], *Occupational Health and Safety Act* 1985[30] and requirements under the *Environment Protection Act* 1970[31] and associated regulations for licencing of landfills and waste water treatment systems[7].

> "...[T]hat water which came from the dam and the water in the dam, even at that time, was highly contaminated. The intersectors were never designed to take the flow - the capacity off the [PAD]."
>
> - CFA Instructor (Paid)[4]

Following a comprehensive review by an instructor, which was considered at Chief Officer level, a number of consultants were commissioned to characterise potential contamination of the soil, surface and ground water on the site[32, 33] (see Chapter 4). CFA actively worked with regulators to bring the site into compliance. While there were concerns about the cost of remediation and upgrade and loss of commercial revenue, an effort to remediate and upgrade facilities was made.[34] Over the period from 1996 to 1999, bioremediation of contaminated soil from the flammable liquid PAD and foam (called 'old fire training pits') pits took place. The waste water treatment system was upgraded, and the PAD extensively redeveloped including to improve fuel systems. Despite these changes, it is evident not all recommendations were followed through. For example, there is no evidence a recommendation to remediate Dam 1 and a known drum burial site was acted upon.[35]

The flammable liquid PAD facilities at Fiskville were closed during this redevelopment. Fiskville practical training over these years was contained to fires fuelled by gas or non–hazardous solid materials.

The redevelopment of the PAD involved a shift away from flammable liquids to LPG for the bulk of training. This reduced the degree of contamination of runoff waters making adequate treatment more achievable. While unleaded petrol and diesel are still used to fire individual training props, the quantities involved are reduced and their bulk storage and handling meet dangerous goods regulatory requirements. In addition, control and treatment of contaminated runoff from the PAD and other training areas was upgraded at the time of the PAD redevelopment, with further refinements made since, reducing the risk of contamination of surface and groundwater.

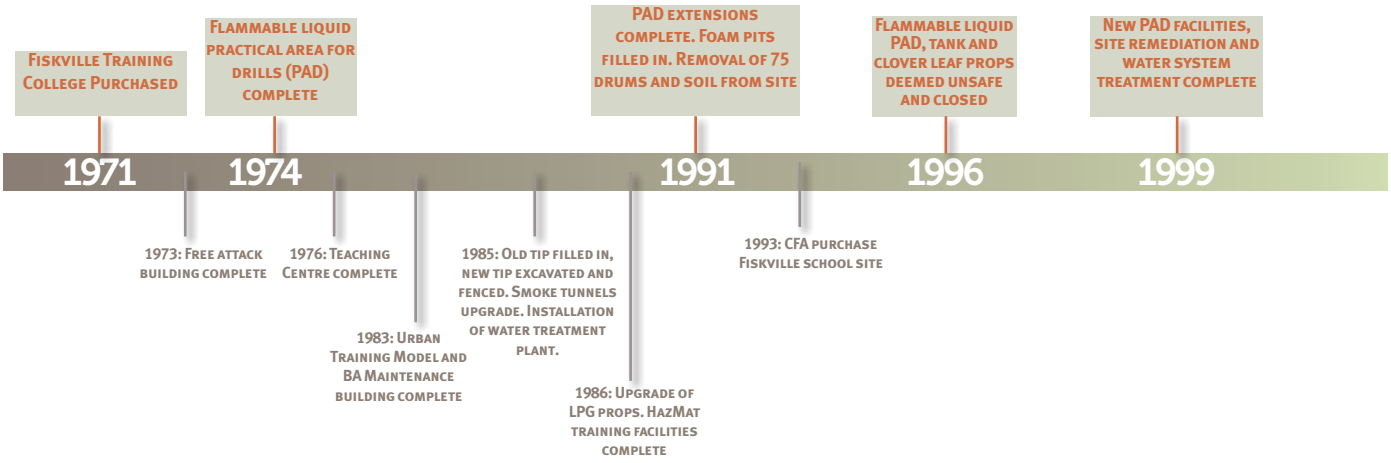
By 1996 when CFA began to fully consider the environmental and health impacts of its practical training facilities, (see Chapter 9) other states had adopted new approaches. Firefighting services in New South Wales and South Australia in developing their training facilities in the early 1990s had considered and adopted training practices and infrastructure that clearly considered and minimised risks to human and environmental health. These included using gas as a replacement for flammable liquids, using only simple, biodegradable training foams, conducting drills in bunded areas and collecting waste waters.[11, 36, 37] The health, safety and environmental impacts of firefighter training were being debated by other states and internationally. At this point, CFA was lagging in considering safe training practices.

"Linton was a bit of a watershed for CFA. It's where five volunteer fire fighters died, the grass fire over in Ballarat western district. And it was after Linton that the organisation became very safety first and they took on this whole 'Safety First' culture."

- CFA Trainee [2]

From the late 1990s, as well as remediating and upgrading the infrastructure at Fiskville, training techniques placed greater emphasis on risk reduction through minimising exposure via inhalation or skin contact to smoke, foam and recycled firewater. The Linton fire tragedy of 1998 - and the subsequent Linton Coronial Inquiry which completed in 2002[38] - was mentioned by several participants as the instigator of CFA–wide promotion of a 'Safety First' culture'. For example, Linton was the event that triggered the establishment of a policy for volunteer firefighters to meet national standards of operational competency.[39]

Figure 3.6: Key Milestones in the Physical Development of the Fiskville site



Overview of Use of Flammable Liquids in Training

Up to 1996, a range of flammable materials were used at the site in firefighter training exercises. These included leaded and unleaded petrol, diesel, waste oils, expired fuels, paints and paint thinners. These practices were largely informal and undocumented: the precise range, volume and constituents of material brought onto, used and disposed of at Fiskville will never be known. What is known is outlined in more detail in Chapter 5.

The practice of acquiring donated materials for training was established at region and brigade level before the establishment of Fiskville Training College. Regions and brigades received free fuels and solids from local garages, businesses and farmers.[5, 8] The early years of the development of Fiskville corresponded with the increase in oil prices following the Fourth Arab–Israeli War in 1973 and the subsequent OPEC embargo. This created budget pressures on Fiskville and impetus to expand the practice of receiving waste fuels free of charge. From very early on in its operation, Fiskville staff sought to augment purchased supplies of petrol and diesel with donations of flammable materials, including expired Avgas and aviation fuel usually supplied in drums.[40-42] Used mineral and vegetable oil was also collected and stored in 200 litre drums and overhead fuel tanks, as was a wide range of miscellaneous flammable materials such as solvents and oil–based paints that were supplied in drums. Flammable material came from various suppliers, including some of Fiskville's commercial clients (i.e. firms whose staff trained at Fiskville) as well as small–scale suppliers such as fleet owners and local garages.[41, 43-45] Aviation fuel stored on site during the fire season used for fuelling helicopters was often left to be burnt on the flammable liquid PAD at the conclusion of the fire season or after the fuels expiry date was.

> "The Flammable Liquids (flam. liquids) Area or PAD is used for firefighting exercises using props and flammable liquids. Some of the area is sealed, however this surface is extensively cracked and broken. The fuel and burnt residue has been allowed to escape to the soil surrounding, and beneath the flam[mable] liquids area, as clearly evident by the gross black oily contamination of these areas. The flam liquids PAD is serviced by a relatively small interceptor sump which discharges to a small artificial lake (pond) adjacent to the pad. This installation is clearly overwhelmed by the hydrocarbon loading and does not prevent discharge of contaminants to the pond. The liquid within the interceptor was thick and black, being heavily contaminated with fuel and oil."
>
> - 1996 EPA review[7]

"[T]he practice of acquiring donated fuels for training was well established before the advent of Fiskville. Regional and brigade training exercises had been doing it for years so it was really a continuation of an existing practice – but on a larger scale because of greater need and the cost aspect."

– CFA Instructor (Paid) [5]

"Local garages - in those days petrol wasn't as dear as it is these days and - they used to use it to wash parts and one thing or another. [It became] contaminated so they used to put it in a tin and we would use it. ...If a local panel beater gave an old car we'd burn it."

- CFA Trainee, 1970s [8]

During the 1970s and 1980s, the origin and nature of the drummed material was the focus of periodic concern by staff at Fiskville. On several occasions decisions were taken by Fiskville management to discontinue use of these materials and to dispose of stockpiled drums, including through burial on-site (as outlined in Chapter 8). However, despite this, the practice of receiving flammable materials of unknown composition in drums continued into the 1990s. Over this period, significant numbers of drums built up from time to time. Interviews with former Fiskville staff record estimates of up to 150 to 200 drums being stored and disposed of at Fiskville (see Chapters 5 and 8 for details).

As previously discussed, the redevelopment of the PAD completed in 1999 involved a shift away from flammable liquids to LPG for approximately 70% of drills on the PAD.[46] While unleaded petrol and diesel are still used to fire training pits and props, bulk storage and handling meet current dangerous goods requirements.[46]

A similar dependence on donated flammable materials characterised the earliest regional training facilities established at Wangaratta and West Sale prior to the establishment of flammable gases as the primary flammable material used for training. Bangholme uses natural gas, while all the other regional training centres use LPG. However, unlike Fiskville, supply of flammable materials in drums at these regional facilities tended to occur as required for particular training exercises and there was minimal storage of drums at these sites.

Table 3.2: Variables Influencing Training Practice at Fiskville, Pre-1996 and Post-1999

Variable	Pre -1996	Post -1999
Materials	Waste, expired and other unknown flammable liquids were commonly used	PAD reconstruction, only known flammable liquids purchased from suppliers used in drills
	Flammable liquids main material source used on the flammable liquid PAD	LPG used in 70% of drills on flammable liquid PAD
	Solids used included common A–class combustibles such as disused timber pallets (potentially treated or contaminated from chemical leakage), vehicles (therefore, components of vehicles including tyres, seats).	Solids used included vehicles (therefore, components of vehicles including tyres, seats), straw and timbers. However, timber was bought in as firewood (i.e. not chemically contaminated).
Personal protective equipment and Personal protective clothing	Rudimentary design of PPE and personal protective clothing, impacting on effectiveness.	Standard issue of structural firefighting PPE and personal clothing. Innovations significantly improved effectiveness.
	For example, the negative pressure compressed air breathing apparatus provided a lesser level of protection against atmospheric pressure.	Positive pressure compressed air breathing apparatus provided an additional level of protection against leaks from the external atmosphere.
	Further, personal protective clothing including items such as gum boots, rigger's gloves, woolen turnout coats, and Topguard helmets without visors.	From 2002, standard issue of structural firefighting gloves from 2002, level 1 boots (wildfire), level 2 boots (structural), level 3 (structural and hazmat), helmets. From 2010, new structural firefighting ensemble was introduced. This included structural firefighting over–trousers and jacket with moisture barrier, and flash–hoods.
Attitude to risk and safety	Inconsistent use of PPE and PPC during drills based on interview feedback	More consistent use of PPE and PPC during drills
	'Bigger the fire, the better' attitude by many instructors based on interview feedback	PAD training is subject to increased procedural documentation and teaching process
	Avoidable risks taken during drills based on interview feedback	Greater focus on putting safety theory into practice on PAD
	Poor incident reporting culture based on incident report books and interview feedback	Heightened focus on incident reporting regardless of outcome

Management and Reporting Arrangements

The Country Fire Authority's legislative foundation hails from the Fire Brigades Act 1890. The modern CFA is constituted under the *Country Fire Authority Act 1958*. CFA is overseen by a Board of governance reporting to the portfolio Minister. The twelve–member CFA Board is accountable for CFA's overall performance and compliance with relevant legislation, government requirements and corporate objectives.[47] The Board comprises the CFA Chairman and members appointed by the Governor in Council. The Chief Executive Officer (CEO) is appointed by the Board and is responsible for organisational policy and general business.

Throughout its history, Fiskville has operated relatively independently with limited oversight by corporate senior management. Fiskville did not operate as part of an operational firefighting region. While its budget was fixed centrally and periodic standard reports were required, the expectation and practice was that Fiskville generally managed its own affairs (see Chapter 9). In the training sphere, Fiskville had a high degree of autonomy, setting curricula and training practice. Fiskville management largely determined standards and practices in relation to safety, including matters relating to storage and handling of dangerous goods, conduct of drills and reporting of incidents.

The management structure at Fiskville throughout the 1970s and most of the 1980s was a hierarchical model with an Officer in Charge (OIC) who held the rank of Assistant Chief Officer (ACO): that is, at the same level as CFA Zone Officers. Until the early 1980s, Fiskville reported directly to the Chief Officer, and after the restructure of the Chief Officer's role that followed Ash Wednesday in 1983, to the position of Deputy Chief Officer (Technical).

Reporting to the ACO Fiskville was a senior instructor who was responsible for the management of a varying population of paid resident and visiting CFA staff. Instructors numbers increased over time to a maximum of 17 in 1990 with a minimum of five in 1995 (excluding during the PAD closure of 1996–1999).[48] Instructors were a mix of staff and volunteers from regions who came in to run training. Mid-week courses were generally conducted by resident or appointed staff. On weekends a staff instructor would be designated Duty Officer to be responsible for the site. Practical training in small groups required the use of several instructors, so weekend courses required regions to provide their own instructors to supplement the Fiskville instructor. This also applied to any night training done by the surrounding regions that used Fiskville as their field training ground.[5]

A generalist Business Manager from a non firefighting background, reporting to the ACO/OIC, looked after matters such as maintenance, catering and cleaning staff. Rostering of PAD operators was the responsibility of the Business Manager. However, during training PAD operators reported to the instructor conducting the training.

In the early 1990s, CFA went through a period of significant organisational restructures. In late 1991, the new Chairman of the Board effectively became the Chief Executive Officer responsible for the day to day running of the organisation. The Chief Officer remained responsible for operational fire response and assumed responsibility for Communications and Mechanical Services. In August 1992, a Director of Management Development and Vocational Training was appointed. The Chief Officer remained responsible for Operational Training at Fiskville.

During 1993–94, there were further changes to the executive management arrangements with the creation of a Directorate of Risk Management with responsibility for Community and Environmental Management and Structural Fire Safety. It must be noted that this role did not take on an enterprise risk management function.

In 1995, the CEO appointed a Training Manager with responsibility for all aspects of training. Departing from former practice, the Training Manager was based in head office, rather than at Fiskville. Responsibility for Fiskville on-site was divided between a senior officer with responsibility for all aspects of training and a business manager responsible for non-operational staff, budget, facilities and administration.

1995 also saw the creation of CFA 'areas' and the appointment of a Training Manager to each area to plan and manage the implementation of the Competency Based Training program and to oversee compliance

with CFA's responsibilities as a Registered Training Organisation. In subsequent years there were appointments of Wildfire and Structural Instructors to regions to deliver training to CFA members.

Corporate reorganisations have continued. Today there is an Executive Director of Training and Volunteer Development reporting to the Chief Executive. Operational Managers report to the Chief Officer. The division of training and business responsibilities at Fiskville continued until early in 2012 when decision was taken to revert to the earlier model with a single officer with overall responsibility for Fiskville.

Viewing Past Practices in Context

As the Investigation progressed, it became increasingly clear that practices employed at Fiskville in the 1970s, 1980s and early 1990s to acquire, store, use and dispose of a wide range of flammable materials would be unacceptable judged against today's occupational health and safety and environment protection standards, community expectations and industry norms. However, it is important to consider these practices in the context of the day, including the regulatory context and common practice across sectors and the community.

During the 1970s, the regulatory environment for storage, handling and disposal of hazardous material was limited to facilities which stored large bulk quantities of material such as petrol, gas and diesel and was of limited relevance to Fiskville's operations. The passing of the Dangerous Goods Act 1985[49] established explicit and rigorous controls to protect health and safety, particularly in relation to the storage, handling and transport of dangerous goods including many of the materials collected and used at Fiskville. In parallel, occupational health and safety and industrial waste regulation was also strengthening, with the introduction of Victoria's first *Occupational Health and Safety Act 1985*.[30]

"The first time I became aware of it was probably – and I'm not sure what date in '91 – was when there was advice – and I don't know who gave it to us, but it was just verbal advice that there would be, er, a company coming up, and I don't know who the company was – a company coming up to – to dig up and handle, er – which either meant take – I don't know whether they took them all away or they re-buried them, or what they did, but they were to come up and handle that. My sort of vague recollection is that they took them away, but reading between the lines, some of the people are saying they were re-buried, but I couldn't tell you that. But certainly I – I didn't stand by and see them dug up and then another hole dug and put in. So I would suspect more likely that they were probably taken away .

...But there was no big deal made of it. It was just, "Look, FN170, we've got – there'll be a company coming up. There was some drums buried there some time back, and we've – they've got to locate where they are. We think we know where they are. They're going to just dig them up and get rid of them." You know, that was, um – you know, that was all it was. No, you know, "Be careful about this," whatever, you know. No alarm. It was just a day-by-day thing, you know, and so – until this sort of hit the fan, then it didn't give me concerns. There wasn't any, "Look, we've got some highly toxic drums up there; be careful; we don't want a leak; they can cause this" – I can tell you there was none of that."

– OIC[9]

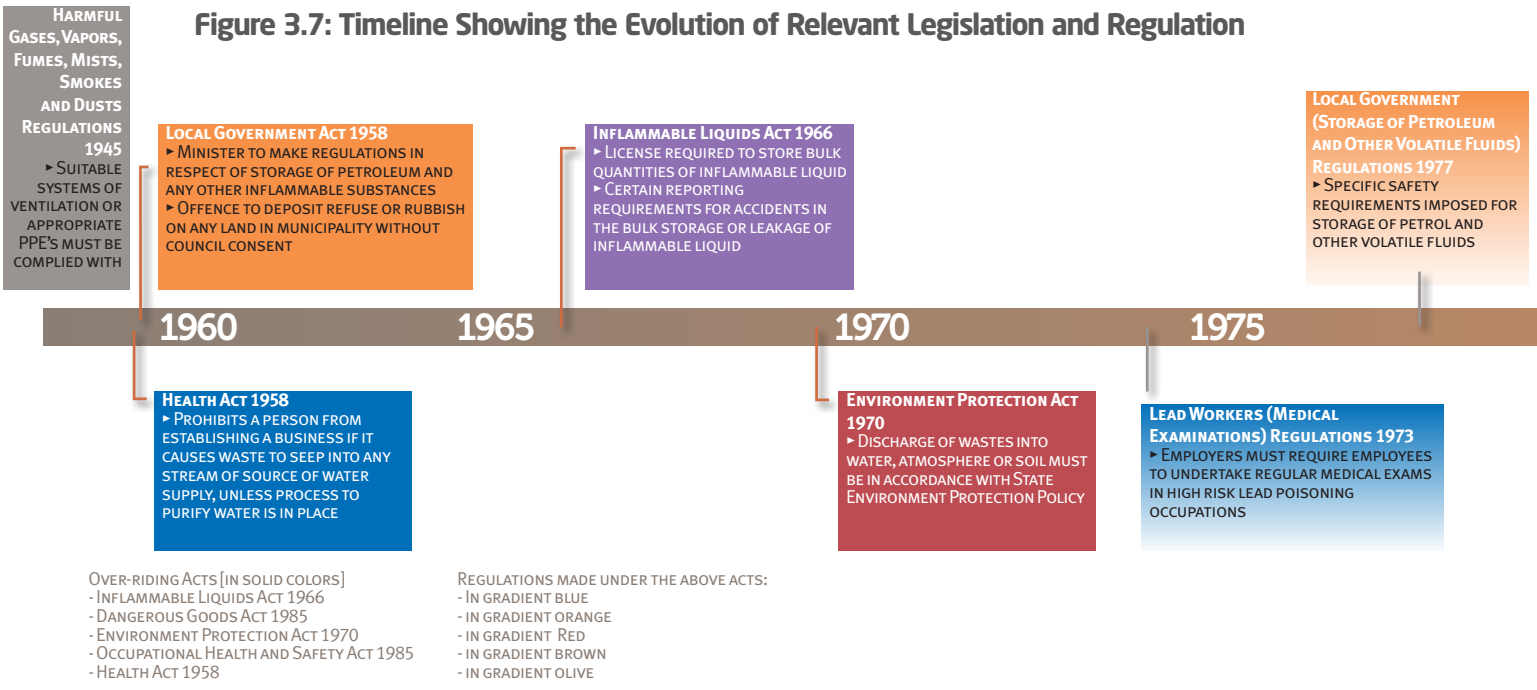
The mid to late 1980s were characterised by growing community concern about the number and volume of hazardous wastes from industry. There were neither effective regulatory controls nor safe commercial treatment and disposal options for such wastes. In 1986, Victoria adopted its first Industrial Waste Strategy which drove adoption of new 'prescribed' industrial waste legislation that regulated the full lifecycle of hazardous waste from production, reuse, transport, treatment and disposal including landfilling and incineration.[50] A professional waste management industry sector supported by these regulations began to develop, including proposals for a national high temperature incinerator. However, in the 1970s and 1980s there were limited treatment and disposal options. Waste chemicals were commonly dumped in crude landfills across Victoria or incinerated in a largely unregulated manner. As controls tightened, there is some evidence that Fiskville, eager to accept donated fuels, was effectively being used as a waste disposal route for some suppliers.[51]

While new safety and environmental regulatory controls were established in the mid–1980s, the recognition and implementation of these tighter requirements tended to lag in a number of sectors, including the agricultural sector. Additionally, there tended to be a lag in uptake by government agencies. Government agencies were less likely to see those regulations as applying to them in the way as they did to the private sector. This was mirrored by a historical reticence of regulatory agencies to directly enforce these requirements on other government bodies. There is little evidence of regulatory bodies' interest in Fiskville until the mid-1990s. Indeed, the documentary evidence studied shows that an initial notice handed to CFA by the Health and Safety Organisation (HSO) of Victoria in 1993 does not appear to have been actioned by CFA or followed up by the HSO.[28] Further, regulatory review post-1995 was prompted by CFA staff seeking guidance rather than by the regulatory agencies.

From the late-1980s, the implementation of occupational health and safety, environmental and risk management approaches in many sectors had become more transparent and systematised. This was influenced by the growth of worker health, environmental and sustainability movements driven by dramatic pollution and safety disasters. Flowing from international quality systems approaches which arose in Japanese manufacturing, the world-first environmental system standard, BS7750, was issued in Britain in 1979, followed by the international environmental system standard ISO1400 in 1996. At the same time, industry bodies were adopting self-regulation initiatives such as the international Responsible Care Program for the chemical industry from 1987.

With these influences, practices were implemented more systematically across the private and public sector in Australia. There was a growing recognition amongst some CFA staff that CFA practices were now lagging behind regulatory requirements and developing norms. CFA staff were involved in

Figure 3.7: Timeline Showing the Evolution of Relevant Legislation and Regulation

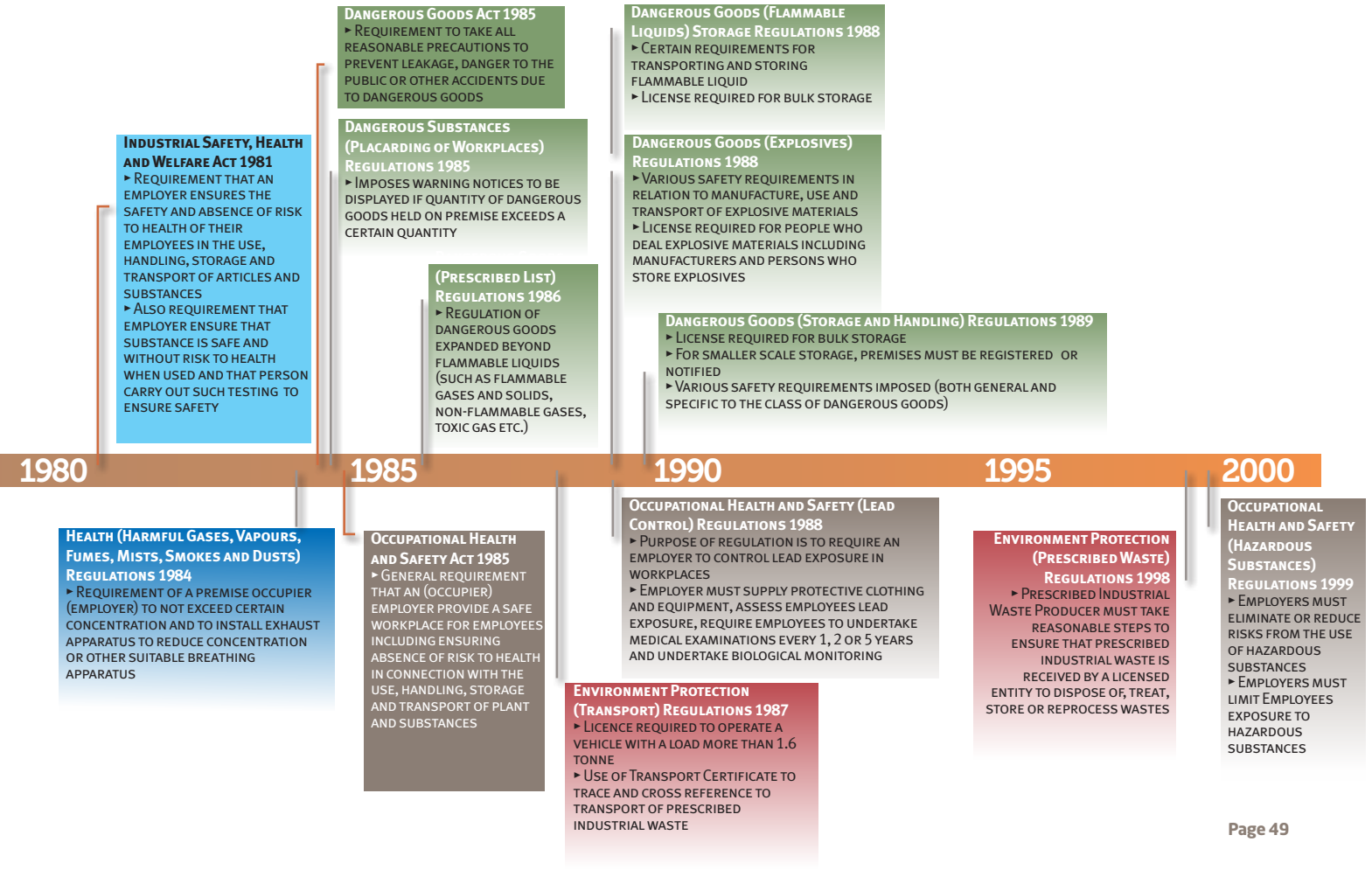


determining safety requirements for businesses under various pieces of legislation such as the *Dangerous Goods Act 1985*[49] as well as promoting and enforcing safety and risk standards in the community. However, until the mid-1990s there is no documentary evidence that CFA was making systematic efforts to apply regulatory and community standards to their training environment.

As discussed in Chapter 1, it is outside of the Terms of Reference to draw conclusions about the potential health impacts of any exposure at Fiskville on individuals. However, consideration of the exposures forms an important part of the Investigation's brief. Various factors influencing exposure need to be considered including availability, effectiveness and wearability of PPE and PPC over the scope period - including during training and operational emergency responses. Some participants reported occupational exposures to chemicals, for instance Agent Orange during the Vietnam War, arsenic during farming, petrochemicals for related industry workers. Nevertheless, some participants expressed concern that they had not received warnings about the possible health effects of the chemicals they were exposed to during CFA training.[52, 9]

Another critical dimension to understanding the practices of the day is the prevailing culture of CFA which was organised along hierarchical and paramilitary lines, where clearly defined command structures and acceptance of tight discipline assisted operational fire response. These cultural traits have both strengths and weaknesses. For example, the courage and stoicism of firefighters is laudable, but arguably fostered the adoption and acceptance of unnecessarily risky practices in training and in the field. This was the so called "Can Do" culture which, post Linton Coronial Inquiry[38] moved towards a "Safety First" culture. There was a prevailing view that to complain was to show weakness and to undermine authority and teamwork. For example, participants outlined circumstances where even as personal protective equipment and clothing became available, there were norms against using it within CFA.[53, 2]

> "We'd come out black and people ... had that as a bit of a badge they used to wear, of how black and how dirty and how hot we all got. So it was never a factor of do I go in there or is there a safety issue with that. We just did it."
>
> – CFA Staff, FN101[3]



CFA was focused on the risks of firefighting. This underpinned efforts to train firefighters, and was the focus of reviews and reform after tragic incidents such as the Linton fires. The risks inherent in fighting fires ('operational risks') dominated views about risks and may have obscured a focus on the risks of training itself. The effort to make the simulations realistic involved consideration of how to ensure the safety of the participants from the actual fire situation, but not always the exposure to the associated hazards of combustion products or the fuels used. Many participants stated that the focus of safety precautionary measures for most of the 1970s, 1980s and early 1990s was primarily on avoiding burns and falls during live drills. Indeed, incidents described in interviews and verified in CFA records relate primarily to minor burns, broken limbs due to falls and to muscle strains associated with manual handling. Despite the risks of many aspects of practical fire training exercises at Fiskville, and the tens of thousands of trainees, the Investigation identified only three verifiable acute incidents at Fiskville involving hazardous materials and none at the regional training grounds across the 30 year period of the Investigation (see Chapter 7).

Firefighter training with hot fires is a process that aims to reduce the risks of fighting real fires in the field. The training undertaken at Fiskville has undoubtedly contributed to the skill base and emergency preparedness of trainee firefighters and industry fire officers. However, the manner in which such training is designed and takes place can significantly reduce risks to trainee health and the environment while still achieving its primary aim. For example, as the design of modern facilities illustrates, direct exposure to materials can be minimised and various fire situations simulated so chronic risks such as exposure to potentially harmful smoke and fire extinguishing agents are minimised.[10]

PART TWO

ADDRESSING THE TERMS OF REFERENCE

4 INTRODUCTION TO THE TERMS OF REFERENCE

At various points during the Investigation, the Chair took a number of decisions with respect to the way in which the report would address the Terms of Reference.

Time Period

The Terms of Reference specified the period to be covered in the Investigation from 1971, when CFA purchased the Fiskville site, to 1999, when the redeveloped PAD was reopened. While the Investigation and the Report have focused on this period, the Chair concluded there was a strong case for extending consideration of some matters considered by the Investigation beyond 1999 into the 2000s. The first of these related to the burial of drums at Fiskville (relevant Term of Reference 1e). Chapter 8 outlines a number of potential drum burials at Fiskville through the 1970s and 1980s. In 2002, a contractor was exposed to chemical fumes from drums that he had accidentally dug up at a site south of the airfield at Fiskville (relevant to Term of Reference 1d relating to exposure). As a result, the Investigation has considered how drum burials, within the period of the Investigation, and later exhumations are likely to relate to each other.

The second matter relates to the use at Fiskville and at Regional Training Grounds of particular types of firefighting foams that, since the early-1990s, have been known to include persistent, bioaccumulating components which are potentially harmful to human health and the environment (relevant to Terms of Reference 1a, 1c and 1d). Despite a clear recommendation in 2003 from the responsible Australian Government agency against continued use of these foams in training, a number of those interviewed have stated that use continued at training facilities into the 2000s (relevant to Term of Reference 1b). CFA undertook a major audit and destruction of B Class foams in 2007. In dealing with both these matters the Investigation extended its view beyond 1999.

Inclusion of Regional Training Grounds

Term of Reference 4 left open the possibility of including other training sites if deemed necessary. While CFA was not aware of any allegations being made in relation to use of chemicals in training at any of the six regional grounds, in January 2012, it initiated an assessment of these six regional training sites. The IFI Chair endorsed a document setting out the scope of the assessment, which was carried out under the Chair's direction.

In May 2012, based on an evaluation of a draft of that site assessment, together with input from consultants Golder Associates, the Chair decided to apply Term of Reference 4 and formally include the six Regional Training Sites in the Investigation. This decision was not taken on the basis of specific concerns raised about any of the sites. Rather it recognised the broadly similar histories of the sites to Fiskville in relation to use of flammable chemicals in training exercises and the relevance of the Terms of Reference to each of the sites.

Ordering of the Parts of Term of Reference 1

Term of Reference 1b relates to the effectiveness of CFA management's response to any comments or recommendations about use of chemicals in training at Fiskville. Early in the Investigation it was decided that it would aid the logical flow of the Report to deal with this Terms of Reference after addressing 1a (nature, acquisition and use), 1c (contaminants), 1d (exposure) and 1e (burial of drums).

Overlap Between the Parts of Term of Reference 1

There is a degree of overlap between the parts of Term of Reference 1. In order to avoid undue repetition in the Report, where such overlap was identified, the Chair made a decision as to the primary focus of each part. The nature of these decisions is set out below.

Term of Reference 1a and 1c both address: *acquisition* (1a) and *origins* (1c) of flammable liquids/substances; and use (1a) and *how they were stored, used and disposed of* (1c). To resolve this overlap, the Report deals with the acquisition and origins and the storage, use and disposal of flammable materials under 1a and focuses 1c on assessing *the likelihood of the substances being contaminated* ...[and of] ... *the contamination of air, land or groundwater.*

Term of Reference 1c and 1d both address: *the contamination of air, land or groundwater at, under or beyond the Fiskville facility* (1c) and *... exposure ... of persons on-site and in surrounding areas that could have potentially been impacted by contaminated runoff or wind drift* (1d). To minimise repetition, in addressing 1c, the Report focuses on the nature and likelihood of contamination, while with 1d, it focuses on potential exposure.

5 ACQUISITION, NATURE AND USE OF MATERIALS

Term of Reference 1A

"Examine and consider the historical facts relating to the nature, acquisition and use of liquids, gases or solids (with particular emphasis on flammable substances and extinguishing agents, including but not limited to water, foam and dry powders) for live firefighting training at Fiskville. In doing so, the report is to set out a chronology of events, reports and documents about the management of the site at Fiskville, along with a listing of the identified flammable substances and extinguishing agents"

Acquisition of Materials

Flammable Materials

As outlined in Chapter 3, throughout its history Fiskville purchased supplies of petrol and diesel fuels for hot firefighting training. These were delivered in bulk and stored in above ground tanks. Although LPG was used from the early 1970s to fuel a few of the props on the Practical Area for Drills (PAD), it was not the primary source of fuel for hot fires until the late 1990s after the PADs redevelopment.

From very early on in its operation, Fiskville staff sought to augment these fuels with "donations" of used flammable liquids such as sump oil, solvent and paints. These practices were outlined in a number of interviews including those with PAD operators directly involved in the practices. While used oil was mainly collected in bulk by Fiskville staff in a tanker truck (colloquially called the "muck truck,") other flammables were supplied in drums, the exact contents of which were generally not known, certified or tested.

The Fiskville 'Muck Truck'

According to over a dozen Investigation participants, including five PAD operators, Fiskville used an Austin tanker to collect waste and sump oils to supplement their fuel supply. Confirmation of this was found in an undated typed vehicle inventory, likely from the 1970s or 1980s. Specifically, the vehicle was identified as "1956 Austin S.T.U. (oil truck)."[4] This practice began during the 1970s and lasted throughout the 1980s, and potentially even into the 1990s. [5]

The truck was driven mainly by PAD operators who developed their own routes, contacts and sources of fuel, largely from local businesses such as garages, service stations and bus transport companies in the Ballarat and Geelong areas. It held 400 gallons [UK] of fuel, [6] which is about 1800 litres. According to one former 1970s instructor, ***"[W]e used to call it the muck truck. They would collect sump oil and such from service stations. We'd bring it back to use in the oil pits. And that - I think that's pretty well documented- the use of that truck. It had a sludge pump on the back that was able to pump out of the tanks."***[7] In addition to collecting sump oil from underground tanks with a 15-foot hose, the tanker was equipped with a shorter 7-foot hose[4] to syphon out fuel from drums. [8] ***"There'd probably be petrol and diesel in it and a bit of everything, I don't know. They might have put anything in it, but they wanted to get rid of it and we wanted some for the fire."***[9]

Once back on site at Fiskville, the sump oil was usually pumped out of the tanker and stored in overhead tanks on the PAD. Some waste oils were stored in drums. Although reference was made to a vehicle log book, the Investigation did not find any documentation of these informal waste collection practices.

Table 5.1 Suppliers of Flammable Materials to Fiskville

	Material	Time Frame	Level of Confidence and JustificationPermanent
Firm A	Fuel and Pallets	Late 1970s	Medium - Two PAD operators corroborating story
Firm B	Drums of flammable liquid, potentially including solvents	Late 1970s, Early 1980s	High - Multiple witnesses and documentary evidence stating there were no PCBs in fuels delivered to Fiskville in drums
Firm C	Drums of flammable liquid	Late 1970s	Medium – Identified by long term PAD supervisor; reliable witness
Firm D	Drums of flammable liquid	Late 1970s, Early 1980s	Medium – Identified by long term PAD supervisor and an instructor remembered company markings on the drums
Firm E	Fuel included waste fuel "seconds stuff"	Long term, from 1970s through 1980s	High - Multiple witnesses. Documents show training dates for Firm E employees.

The Investigation found one document, dating from around 1987, that was an offer from a Western suburbs food company to donate twenty-eight 200 litre drums of waste refrigeration oil for PAD fuel, noting it contained ammonia (Figure 5.1).[1] Although free, the offer appears to have been denied.[2] A second document regarding the nature of a donated fuel was a 1980 letter from the paint company Dulux declaring that "[t]he material supplied does not contain any Poly Chlorinated Bi–Phenyls, it is basically Aromatic and Aliphatic Hydocarbon solvent, hence the dense black smoke that is generated."[3] (See Chapters 6 and 9 for further discussion of this letter and activity around it).

Supply of donated materials benefited both Fiskville by reducing costs, and suppliers by providing a means of disposing of unwanted and waste material at no cost other than that of transport. Not surprisingly, given that the supply of these materials was essentially ad hoc in nature and lacked any financial component, the Investigation has found virtually no documentary records of the practice aside from the Dulux letter and the food company offer of waste refrigeration oil referred to above. Consequently, knowledge of the origin and nature of materials used at Fiskville from its inception until the mid–1990s is derived almost exclusively from information supplied during interviews conducted with former Fiskville staff and trainees.

Some interviewees provided the names of firms they recalled as having supplied flammable materials to Fiskville. Some 40 businesses were mentioned by participants as potentially supplying fuels to Fiskville. A small number of these were identified by a large number of participants. These were large companies, many sited to the west of Melbourne, which would be expected to have significant volumes of flammable waste, including Alcoa, Dulux, ICI, Monsanto and Shell. However, documentary evidence of such supply is limited to the Dulux letter noted above.[3] Furthermore, many of the firms have undergone structural changes over this period and supplies may have come from former subsidiaries.

In March 2012 and again in April, the Chair wrote to the CEOs of six companies (five major and one small) each of which had been identified by a number of participants as a source of flammable materials used in training drills. The initial letters informed the CEOs about the Investigation, advised that their companies had been identified as having supplied flammable material to Fiskville and sought any information they could provide relevant to the Terms of Reference. One firm replied advising that it was only able to confirm historical supply of Phos–Check, a Class A foam. Two of the companies requested additional information to assist them to locate any relevant documents. The Chair responded that the Investigation lacked any specific information about the types of material other than broad generic descriptions or the period during which the supply was thought to have occurred. The Investigation has been informed Dulux subsequently conducted a document search of their organisation for relevant material and to date no documentation has been identified. This search continues with previous subsidiaries. Dulux also identified and arranged for a former employee to be available for interview and the information obtained was of value to the Investigation. Ultimately, other firms did not provide any information to the Investigation.

In addition to direct supply arrangements between businesses and Fiskville staff, interviewees reported that some private sector and government bodies using Fiskville on a commercial basis for hot fire training supplied their own flammable materials.[10] This may have been in order to reduce costs or in some cases because of the need to train with fires involving specialised materials of direct relevance to the individual firms. Comment was also made that where third parties supplied fuel, unburned material was often left at Fiskville.

One such third party is The Australian Fire Protection Association (AFPA).[11] The AFPA began using Fiskville to conduct industrial firefighting courses in the mid–1970s. AFPA courses were up to five days in length,[3,12-14] and were largely run by Fiskville instructors.[15] Although the courses were tailored to meet the needs of the particular group,[16] they usually involved flammable liquids training.[15] The courses were arranged on a commercial basis and were an important source of funds for Fiskville.[17]

Although the AFPA paid for the use of the Fiskville facility and its instructors, there is evidence to suggest that the standard rate could be discounted if the AFPA industry members provided their own fuel.[5,16,18] A 1980s instructor explained that the AFPA would:

> *"...run courses up there and they'd say 'righto we'll bring some fuel up if you want or we'll supply some fuel' which made it cheaper for them and we wouldn't have to worry about going to find fuel."* [18]

Often, the precise nature of the fuel provided was unknown.[18] It is unclear whether the AFPA industry members only brought materials that were expected to be used during the courses or provided additional fuel on request for CFA training. A 1980s PAD operator noted the following about some individuals who were members of AFPA:

> *"[A] lot of their blokes that run their courses they come from chemical factories and things like that... And, um, they'd say, 'Oh, you're getting a bit low on that. Do you want some more of it?' Yeah, send up a thing next time you come up."* [5]

Although the AFPA continues to train at Fiskville, how long industry members supplied materials is not known. Two participants reported that the Officer in Charge at Fiskville from 1978–80 stopped accepting unknown substances brought by commercial clients.[10,19] However, there is evidence that supply and disposal practices, particularly around drums, waxed and waned over time (see Chapter 8).

Investigation participants also discussed burning tyres and wooden pallets. Mobil was named as a source of large truck tyres for an Australian Institute of Petroleum course[20] (1980) and Alcoa was named as a source of pallets.[21,22] One PAD operator noted that another supplier would,

> *"send the timber up from Melbourne. They were only pallets. They'd send them up on the train and we'd go in and cart them out. Now, those pallets, some of them was just blacksed [sic] up all over them, it was stuff they couldn't get rid of. So you don't know what they were, what was on that "* [9]

Other fuels, including those provided by commercial clients were supplied in 44 gallon (200 litre) drums. Some drums arrived to Fiskville on the back of a flatbed truck. Estimates of load size range from about 20 drums[23] up to about 60–80 drums.[19] A number of former Fiskville staff volunteered terms such as solvents, paint thinners and paints to describe the contents of some drums brought to Fiskville. Such descriptions appear to be based on clues such as odour (in the case of acetone), appearance or drum labels that may have had little relationship to the actual contents. Drums supplied to Fiskville may have included fuels, including off–spec and expired material, such as Avgas, kerosene and other aircraft fuels.[5,18,23-30] Others are likely to have contained solvents including paint thinners (a broad term encompassing products such

FN110: "[T]he Australian Fire Protection Association used to run a one week course for them, er, several times a year, and in the latter years, it was only, I think, one course a year. But there were companies like ICI, Dulux and that, would offer their products, and you know, when, um, the course would start, invariably, they would rock up with maybe a – or several days before, they would rock up with, um, a trailer load of drums or something like that, um, which you know, you might be told, oh, it's acetone, or it's benzene or something, um, in the drums. Now, whether it was fully that, we wouldn't have a clue."

Interviewer: "No. And they were used for their – – – "

FN110: "They just took them at face value."

Interviewer: "Would they be used for their – sorry, I – – – "

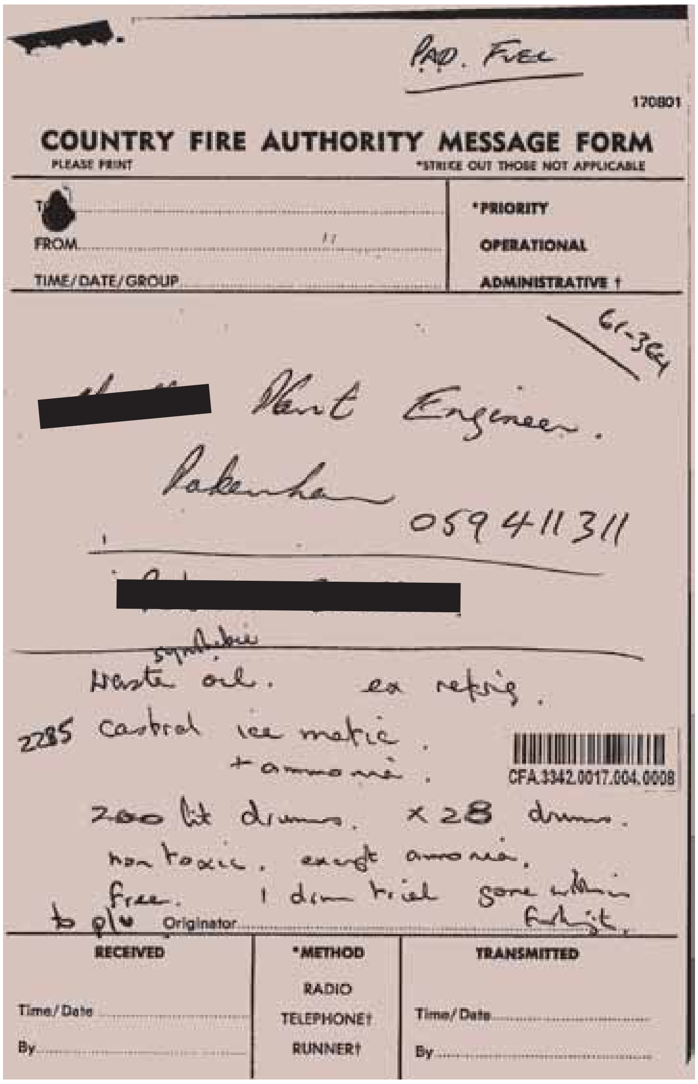
FN110: "For their courses, and, um, what wasn't used, um, they would generally bring up more than what was required for the course, and we would use it for general training. It was for – it was a good partnership in those days."

as mineral spirits, acetone, turpentine, methyl ethyl ketone); benzene; toluene; and xylene. As noted above, one undated handwritten message records the offer of 28 free 200L drums containing "synthetic waste oil" from a food processing plant (Figure 5.1).

In many cases, drums with a proprietary label will have passed from the original supplier through other firms before being supplied to Fiskville. Along the way they may have been emptied and used to store material, including mixed wastes, unrelated to the original product label. Interviewees commented that the quality of the drums seen at Fiskville varied. While many of these drums were delivered in good conditions, once they had been on site for a while, handled roughly and exposed to the elements, their condition may have changed. "Majority [of drums] I would say were in reasonably good condition but it was noticeable every so often that there were some that were dented, damaged, twisted, rusted."[24]

The drums that were eventually buried (see Chapter 8) were more likely to have been delivered to Fiskville in poor condition. One interviewee noted,

"[T]here were some dodgy [drums] and they had to be thrown out or disposed of. Wherever that happened, I'm not too sure. .... Apparently, early on, some of the drums were pretty ratty and I don't know whether they had any problems but you talk to the PAD operators and they'd say, 'Oh, we chucked a few out last week' and 'this was a bit crook." [31]



PAD. FUEL

170801

COUNTRY FIRE AUTHORITY MESSAGE FORM

PLEASE PRINT *STRIKE OUT THOSE NOT APPLICABLE

TO ......

FROM ......

TIME/DATE/GROUP ......

*PRIORITY

OPERATIONAL

ADMINISTRATIVE †

61-3GY

[redacted] Plant Engineer.

Pakenham 059411311

[redacted]

synthetic waste oil. ex refrig.

2285 Castrol ice matic.

+ ammonia.

200 lit drums. x 28 drums.

non toxic, except ammonia.

Free. 1 drum trial some within fortnight.

to p/u Originator ......

CFA.3342.0017.004.0008

RECEIVED	*METHOD	TRANSMITTED
Time/Date	RADIO	Time/Date ......
By	TELEPHONE†	By ......
	RUNNER†	

Figure 5.1 A handwritten message documenting the offer of synthetic waste oil for PAD fuel [1]

"Like a Grenade" - The Disposal of Sodium

Concern about the quantity of hazardous materials was raised and documented by a senior instructor in 1983 in a memorandum to a colleague. A representative from the Department of Minerals and Energy was reportedly "shattered" with regard to the stock of sodium in particular when consulted about how to reduce Fiskville's stock of materials. [33]

At a later date, when trying to dispose of the same stock of sodium, a PAD operator recalled,

"I got back and said look we've got six drums of this we don't really need six drums, a house brick would last a month so we had enough there for 50 years. So I said to the boss there we need to get rid of some of this, we'll just keep one drum and get rid of the other five and he said righto get rid of it. So I'm not sure who the company was I rang, it was one that I obviously used to work with, and I said, 'Look we've got six drums of sodium here that we need to get rid of, have you got any idea where to get rid of it?' And he said 'hang on I'll get you a phone number.' So next minute he comes back and says 'Yeah, you got a pen?' and I said, 'Yeah.' And he said 'It's 03 53681000' and I said, 'hang on that's my phone number.' And he said, 'are you at the CFA Fiskville?' And I said 'yeah' and he said, 'that's where we get rid of all our rubbish.' And so we were the dumping ground for anything they wanted to get rid of." [18]

Eventually, staff took matters into their own hands.
FN078:"I was in the Great Southern Stand [fire attack building], and I hear this almighty bloody "waang," you know, like a grenade."

Interviewer: "Right."

FN078:"Um, and so, continued to go on, and - and when I got rid of the guys, I went out to see what was going on, and so the PAD guys were there, ah, with a two and a half inch line, ah, and - and throwing these blocks into the - into the dam, and then chasing them around until they got it all and - and, you know, of course, once it hit the water, it exploded and it went all over the place, and so they'd just sweep it around, and there'd be - and then they - another one would go in."

Interviewer: "Yeah."
FN078:"Yeah. It was - that was a great afternoon's fun."[35]

Demonstration Materials

Chemicals such as aluminium, chlorine, phosphorous, magnesium shavings, sodium (in blocks) and sulfur were stored at Fiskville to facilitate exposure of trainees to emergency situations involving these materials. These chemicals ('demonstration materials') were not used on a regular basis, but when they were, their use was dramatic and memorable. *"[W]e used to do a lot of hazardous materials displays so we'd just show what happened if you mixed chlorine and brake fluid, you'd put them together and it would explode. We used to do a magnesium fire so you'd have all these magnesium shavings you'd put water on it and it would basically explode. Then we used to do some sodium, we had blocks of sodium about the size of a house brick and we used to put water on that and it would explode."*[18] The origins and method of acquisition for these materials were unclear. *"[W]e didn't actually go and buy sulfur or anything like that. It was just word of mouth, basically that stuff."*[5]

From the 1970s to the mid–1990s these chemicals were stored along with explosives and detonators in unsafe conditions together in a shed.[32] They were stored in inappropriate, poorly labelled or unlabelled containers and in unsafe proximity to one another.

"There would have been well over 100 or so of them [little glass bottles of ether] in the original cardboard crates all just stacked on top of each other. The sodium was in a number of very large chemical storage jars and sodium you would well be aware of is meant to be kept in a liquid state. The blocks were quite substantial and the kerosene ... [was]largely evaporated because the boys used to take the tops off and cut a slice out and go and throw it around on the...it was quite spectacular. The phosphorus was just stored in a drum on the floor and the lid was half ajar from memory. And the chlorine was sitting in a container but on the wrong way around so it was facing downwards on the floor. It was very poorly stored and had been for a long time."[19]

Demonstrations were conducted on the PAD in the early days and later in a science classroom equipped with a vented hood.

Extinguishing Agents

Like flammable substances, historically the sources of supply of foam concentrates to Fiskville are unclear and largely undocumented. Although a couple of documents were found from the 1990s noting product names for some foams, the Investigation did not locate documentary evidence confirming how foam was supplied to Fiskville. Some was likely to have come from commercial suppliers. However, some investigation participants noted that some foams were acquired through "donations".[36-38] Some of these were reportedly materials left over from industrial petrochemical courses or were from organisations looking to dispose of expired goods.

"Foam for firefighting] was often in, brought to site in 44s and then decanted. ... At some stages, I recall we had quite a deal of it given to CFA from some other fire services, because it had use by dates, and so rather than them use it in their appliances and so on, they may have donated it to Fiskville because it didn't matter if we didn't put the fire out sort of thing. There was a lot of that." [39]

One ex–CFA employee with extensive industry experience noted that companies had two options when foam expired: pay to have their products incinerated at $1.30 per litre, or take it to Fiskville.[38]

"Fiskville was used very much as a dumping ground by the petrochemical industry or oil refineries where they had off spec firefighting foam [foam that did not meet specified quality standards]. In other words, their foam would be submitted to a testing laboratory to [test] for fitness for purpose and if it was found to be ...unfit for purpose in those high risk areas then perhaps a phone call to Fiskville would be made and a number of litres, whether it be hundreds or even, in some cases, thousands of litres, of firefighting foams perhaps of many different types would be accepted by Fiskville." [38]

Table 5.2 Levels of Certainty - Flammable Materials Used at Fiskville, 1970s to mid-1990s

Fuels	
High/Certain	Aviation fuel (expired, stored in drums), crude oil, diesel, kerosene, LPG, petrol (leaded and unleaded), oil (including sump and waste oil collected by muck truck (stored in bulk and drums)
Medium/Plausible	AvGas (expired, stored in drums), liquid petroleum gas
Low/Unconfirmed	Fish and chip oil, paraffin, propane
Solvents and Thinners	
High/Certain	Methanol, paint thinners, solvents
Medium/Plausible	Acetone, benzene, ether, phenol, toluene, xylene
Low/Unconfirmed	MEK, dry cleaning fluid
Solid materials	
High/Certain	Cars, crates, hay/straw, mattresses, pallets, plastics (including polyurethane), tyres, wood
Medium/Plausible	Treated timber
Low/Unconfirmed	Masonite
Demonstration Materials in Hazmat Shed	
High/Certain	Aluminium brilliant, ammonium nitrate (nitropril), barium nitrate, calcium hypochlorite, chlorine, hydrochloric acid, magnesium shavings and powder, phosphorous (red), potassium chlorate, potassium permanganate, potassium perchlorate, sodium, sulphur, sulphurous acid, strontium nitrate, titanium bright, thermite
Medium/Plausible	Brake fluid
Low/Unconfirmed	Ammonia, mercury, temporite

High/Certain- Confirmed in multiple interviews and/or documents

Medium/Plausible- Discussed in more than one interview, but not enough corroborating evidence to be certain

Low/Unconfirmed- Mentioned in one interview or, if mentioned in more than one interview, no corroborating evidence

Nature of Materials

Flammable Materials

As described in the preceding section, despite the small number of records viewed, by careful examination of information provided by participants and by cross checking their reports, the Investigation has developed a reasonable understanding of the general categories of flammable materials used in training at Fiskville. Having said this, it needs to be acknowledged that the level of certainty we can attach to the identification of different types of materials varies considerably. Table 5–2 lists these materials and indicates the level of certainty associated with their listing.

The following discussion focuses on the nature of these flammable materials. It attempts a qualitative risk assessment of the intrinsic hazards associated with the materials and of the likelihood of those hazards being realised. For the purposes of this discussion, the materials have been divided into a series of primary and secondary categories.

- Liquid materials supplied primarily in bulk:
  - fuels supplied at commercial rates (leaded and un–leaded petrol and diesel);
  - used oils collected in bulk by Fiskville staff from "local" sources, mainly in and around Ballarat and Geelong – mineral (mainly sump) oil from garages and fleet operators and possibly vegetable oils from fast food outlets.
- Liquid materials supplied in 44 gallon (200 litre) drums:
  - fuels (including off–spec and stale material) – Avgas, kerosene and other aircraft fuels;
  - solvents which may have included dry–cleaning fluid (tetrachloroethylene); paint thinners (a broad term encompassing products such as mineral spirits, acetone, turpentine, methyl ethyl ketone (MEK)); benzene; toluene; ethylbenzene; and xylene;
  - paint.
- LPG
- Solid materials – including wood in various forms (including used pallets) and tyres

Risk in Toxicology [12]

RISK = HAZARD x LIKELIHOOD OF EXPOSURE

Risk and hazard are usually distinguished as follows. Hazard is an intrinsic property. It becomes a risk only when there is a finite probability that the hazard will become manifest. Applying this framework leads to a definition of risk as the product of a hazard and likelihood of exposure – a definition widely accepted within toxicology.

The risks associated with the use in training of the groups of materials described above varied considerably between and within the groups, reflecting:

- the intrinsic hazards associated with the materials themselves, which relate to their physical form (liquid, gas or solid), flammability or combustibility, reactivity, corrosivity and toxicity and
- the manner in which the materials were stored and handled, since this significantly affected the likelihood of both acute and chronic exposure to potentially harmful substances.[12]

Table 5–3 attempts to summarise key aspects of intrinsic hazards and of materials management and to generalize from these to make qualitative assessments of the relative hazard and the likelihood of exposure for each of the broad groups of materials set out above. The qualitative descriptors applied to intrinsic hazard are based on a subjective assessment by the Investigation of potential acute and chronic health effects (including carcinogenicity). The table does not deal with hazards associated with exposure to their combustion products. These are considered in Chapters 6 and 7 and in Appendix B.

Table 5.3 Flammable and Combustible Materials Used at Fiskville A Qualitative Assessment of the Components of Risk

Material	Physical Form	Hazardous Properties	Constituents	Management		Intrinsic Hazard	Likelihood of Exposure Due to Management
				Storage	Handling		
Petrol	Liquid	Flammable - low flash point >43°C vapour/air mixtures explosive toxic via inhalation and ingestion (but "not particularly toxic"[2]) possible carcinogen - International Agency for Research on Cancer (IARC) Group 2B.[41]	Complex mix of aliphatic and aromatic C_4-C_{12} hydrocarbons, including benzene which is a carcinogen and possible mutagen. Composition varies with crude oil source and manufacturing process. Tetraethyl lead –an organo lead compound used as an octane enhancer in petrol banned in Australia in 2002.	Principally in bulk (AST & UST); some limited drum storage	Reticulated supply; limited manual handling	Low	Low
Diesel	Liquid	Flammable - flash point >62°C Vapours may be violently reactive with air. Under normal conditions of storage, handling or use as fuel, diesel should not present a hazard to health providing excessive skin contact is avoided".[32] IARC has evaluated diesel fuels as being not classifiable as to their carcinogenicity to humans (Group3).[32]	Complex mix of hydrocarbons – composition varies with source of crude oil but generally aliphatic C_8-C_{21} with up to 21% aromatics. Numerous additives	Principally in bulk (AST & UST); some limited drum storage	Reticulated supply; limited manual handling	Low	Low
Used lubricating oil	Liquid	Combustible - flash point >215°C but this will be reduced if contaminated with fuel or solvent. Mineral oils (including lubricating oils) are known to be human carcinogens based on sufficient evidence of carcinogenicity from studies in humans. [4]	Complex mixture of paraffinic, naphthenic and aromatic petroleum hydrocarbons. Composition varies depending on composition of the original oil and the degree of degradation. Will have contained a range of additives such as antioxidants (phenols) and viscosity improvers.	Principally in bulk – some drums	Principally reticulated; limited manual handling	Low-Moderate	Low
Various hydrocarbon fuels- incl avgas, kerosene and other aviation fuels	Liquid	e.g. kerosene flammable - flash point 38°C - 62°C Vapours may be violently reactive with air.[42] Toxic by inhalation and ingestion but "is not particularly poisonous [and] the acute health risks involved in handling and using kerosene are minimal, provided that the product(s) are used in accordance with current safety practices".[42] IARC concluded that there was inadequate evidence to classify kerosene as s human Carcinogen.[43]	e.g. kerosene mixture of C_9 – C_{16} hydrocarbons produced by the distillation of crude oil.	Drums	Manual	Low	High

Material	Physical Form	Hazardous Properties	Constituents	Management		Intrinsic Hazard	Likelihood of Exposure Due to Management
				Storage	Handling		
Solvents	Liquid	Flammability varies but it is reasonable to assume that most solvents supplied to Fiskville would have been flammable or at least readily combustible Toxicity variable – some e.g. benzene highly toxic and are therefore no longer used as solvents. Many organic solvents are known carcinogens, including various chlorinated solvents used in industries such as dry cleaning.	Vary widely but relevant classes include: aliphatic hydrocarbons e.g. hexane cyclic hydrocarbons e.g. benzene aromatic hydrocarbons e.g. toluene and xylene aldehydes e.g. furfural ketones e.g. acetone (not all of the above have been reported as having been received at Fiskville)	Drums	Manual	Moderate - High	High
Paint thinners	Liquid	See organic solvents	Includes individual solvents such as toluene acetone and proprietary mixtures of various solvents	Drums	Manual	Moderate	High
Paint (oil based)	Liquid	Combustible - high flash point (60°C – 90°C) See organic solvents	Solvents such as naptha, toluene and xylene are used to keep the solids in oil based paint in suspension. While lead was phased out or banned in paint in the late 1970s, the pigments in oil-based paints may still contain some heavy metals	Drums	Manual	Low	High
Wood	Solid	Hazards associated with combustion products rather than with raw material	Copper, chromium and arsenic in treated timber Formaldehyde in various types of composite timber products, particle board, etc	NA	Manual	Low	Very Low
Tyres	Solid	Hazards associated with combustion products rather than with raw material	Natural and synthetic rubber, carbon black, silica, sulfur, zinc oxide, anti-oxidants	NA	Manual	Low	Very Low
LPG	Liquefied gas	Fire and explosion hazard - forms a flammable mixture in air in concentrations between 2% and 10%. Can cause severe cold burns in liquid form. Vapour acts as an asphyxiant at very high concentrations	Mixture of hydrocarbon gases propane and butane	Bulk	Reticulated	Low – Moderate	Very Low

Foams

A variety of firefighting foams have been used in training at Fiskville. These include:

- high expansion foam – designed principally for flooding enclosed spaces (can be used on A Class and on small scale B Class hydrocarbon fires)
- Class B foams (used on liquid fires)
  - synthetic aqueous film forming foams (AFFF) and alcohol resistant aqueous film forming foams (AR–AFFF) both of which contain the fluorosurfactants perfluorooctanoic acid (PFOA) or perfluorooctanesulfonic acid (PFOS) which, since the late 1990s, have been a focus of concern over their potentially harmful effects on health and the environment; and
  - fluoroprotein foams (FP) a type of biodegradable foam based on animal or other protein sources with the addition of a fluorinated surfactant.

In the mid–1990s, CFA reviewed and subsequently introduced A Class foam.[44] For further information on the different types and uses of foams and on their potential effects on health and the environment see the section headed Storage and Use of Materials – Extinguishing Agents – Foams later in this chapter.

Storage and Use of Materials

Flammable Materials

As discussed above, flammable substances used at Fiskville over time have included a variety of liquid, gaseous and solid materials. This section outlines storage and use patterns of each of the main types of material used at Fiskville for firefighter training over time. Known flammable materials used at Fiskville have been listed in Table 5–2 earlier in this chapter.

Flammable Liquids

As noted in Chapter 3, use of unknown flammable liquids on the PAD (e.g. oil collected offsite and unknown fuels delivered in drums) effectively ended with the redevelopment of the PAD in the late–1990s. Since then, use of flammable liquids has been limited to unleaded petrol and diesel.

In addition to use on the PAD, flammable liquids were also the fuel source for exercises in the 1970s and 1980s using the foam pits adjacent to the PAD and were used frequently in open trays in enclosed space training in the Structural Fire Attack Building as well (see Figure 3.4 in Chapter 3 for orientation).

Exercises conducted on the flammable liquid PAD used a variety of props that were fuelled primarily by flammable liquids. In the early days of Fiskville, the props were loaded with fuel that had been stored in above ground tanks near the PAD and in lesser quantities in drums. These included primary fuels supplied in bulk by commercial suppliers (petrol and diesel) as well as waste oil collected by the muck truck. Although there were underground storage tanks near the ablutions block, their primary purpose was to fuel vehicles. A series of pipes delivered fuel from these tanks to props and a series of tank props on the PAD.[6] However the piped system was not the sole means of fuel delivery.

To prepare the tank props for drills on the flammable liquid PAD, high flashpoint fuel was poured on top of water in the props, and a low flashpoint fuel was added to prime the high flashpoint fuel. Diesel is an example of a high flashpoint fuel that could be used in these props, and oil that had been collected offsite was also used. Although fuel was delivered to the tank props through pipes, an investigation participant noted:

"[The fuel was] brought back [by the oil tanker] and sometimes, if we needed the truck, er, to go off the next day to do another job or something, it could be put into 44 gallon drums. Or if the pit was – one of the pits was getting low we'd just pump it straight into the pits." [5]

There were two methods of manually adding fuel to the props on the PAD. The fuel stored in the overhead tanks could be accessed through a spigot tapped into the prop. Smaller quantities of fuel were transported across the flammable liquid PAD and added to the props with buckets. *"[The buckets] were 20–litre drums with the top cut out and a [wire] handle put on them."*[5] In the process of transporting the fuel, the contents of the bucket often splashed the PAD operators and the PAD itself. Once at the desired prop, the fuel would then be tipped into the pit and set alight.

Larger quantities of fuel were added from 44 gallon drums. When adding fuel in larger quantities, PAD operators (and sometimes instructors willing to lend a helping hand) rolled 44–gallon drums across the PAD to the props and foam pits and poured in their contents.[16] *"[I]f the need arose for us to lend – give a hand to the PAD operator, yeah, okay. That's what we're here for. We'll do it."*[28] Figure 5.2 shows three CFA staff helping a PAD operator, in standard green overalls, load two drums into the foam pits adjacent to the flammable liquid PAD prior to a drill.

Figure 5.2 PAD operator receiving assistance from others to load foam pits, circa1990. Photo courtesy of CFA

While describing the process of preparing the flammable liquid props, one Investigation participant reminisced,

"[W]e came up with the new beaut bright idea, and we were still loading with drums, but we had petrol or light end injections so that we had overhead tanks with petrol in them reticulated underneath coming up in the middle of the pits so that you turned the valve on and petrol would come out and then we'd ignite it with wand sticks and all sorts of stuff." [45]

Although this quote exemplifies a step forward in safety by preventing the need for manual addition of petrol to the flammable liquid props, at the time, fuel was still transported manually to individual props on the PAD and continues to be done so today, though in lesser quantities than it would have been done prior to 1996.[46]

In addition to props on the flammable liquid PAD, there were two large foam pits next to the flammable liquid PAD. They were designed sometime before 1977 for the Harbour Trust to test the comparative effectiveness of AFFF and protein foam. They were later used for industrial courses and were in operation for about 15 years before being filled in with earth, likely in 1989.[47] These pits (also known as 'old fire training pits') were part of the testing, bioremediation and restoration that occurred in 1998 prior to the PAD area being redeveloped in 1999.

The process of loading any fuel, known or unknown, from a drum into any of the props or pits would have been the same. *"[Y]ou'd roll the 44-gallon drum along the ground and pour it up over the pit and take the bung out and let the stuff flow out into the pit, um, and all the splashing and things that went on with it."*[30] Known flammable liquids used for firefighter training at Fiskville are identified in Table 5–2.

In 1996, the flammable liquid PAD was closed down. It was dug up and the soil was bioremediated and may have been used as 'clean fill' in the redevelopment of the PAD. Some of the props were saved for the new flammable liquid PAD. Although flammable liquid is still used on six of these props today, the fuel is either diesel or unleaded petrol. While the reticulation system delivers fuel (liquid fuel and LPG) to the majority of props on the flammable liquid PAD, it should be noted that the props used for hand–held extinguisher training are still loaded with flammable liquid manually.

During the 1970s and 1980s, the drum storage area lacked hard standing, protective bunds and overhead cover (Figure 5.3). Access to this area was not restricted by fencing in the early days, as is evidenced by reports of children of Fiskville residents playing in the drum storage area, but a fence had been erected by 1985 (Figure 5.3).

Figure 5.3 Main training area circa 1985. Enlarged area below shows drum pallet and tyre storage areas. Photo courtesy of CFA

Flammable Gas

Beginning in the 1970s, liquified petroleum gas (LPG) was used on the flammable liquid PAD on the gantry, flanges and LPG props.[40] Separate LPG PADs were developed by the early 1990s (maybe as early as 1989) which involved props that were plumbed to LPG bullets. Exercises conducted with LPG were cleaner and safer than exercises conducted with flammable liquids[25] because they produced less smoke and particulate material and therefore lessened risks of inhalation and fall-out on and off-site (see Chapter 6). PAD operators were able to control the amount of fuel used for drills from a control room reducing risks to students and instructors.

Flammable Solids

Solid flammable substances were burned outside in the open air as well as indoors, mainly in the fire attack building. Outdoor drills involved cars, tyres and piles of wood including stacks of pallets.

Enclosed space training occurred in the three story T-shaped Structural Fire Attack Building. Drills were designed to simulate fires likely to occur in industrial, commercial and residential settings. The building included a simulated ship's engine room and container hold, smoke tunnel and fire tower.

"We lit fires in there to produce heavy smoke so you couldn't see in closed areas, so to get in there was difficult. Now those fires were lit in receptacles both metal, mainly metal, half drums, specially made containers and they were moved about. They were in different locations so that they would be variable. The fuels used in them were often ... they were sometimes solid fuel like wood but most of the time it was ignited by flammable liquids by the PAD operator." [36]

PAD operators were responsible for setting up the drills in the fire attack building. In the early days, smoke was created for the smoke tunnel exercise (breathing apparatus tunnel) using hay and oil.[8] While the quality of the timber being burned was sometimes questioned, the Investigation has no evidence on whether these concerns were addressed.[48]

Figure 5.4 Comparative photograph of drills on the flammable liquid PAD. The bullet prop on the left uses LPG; rail car prop in the centre burning flammable liquid, 1984. Photo courtesy of Peter Baker.

Components of the fire attack building (Figure 5.5) included:

A. 3-Storey Fire Tower

Enclosed space training included structural fire attack (A Class and B Class fires) and thermal layering exercises. Materials used included: trays with flammable liquid (diesel and petrol); dry chemical extinguishers, timber (including pallets) and high expansion foam.

B. Ship's Hold

Contained adjustable cage walls and doors. Used for training in "hot, smoky, dark conditions."[43] High expansion foam drills conducted here.

C. Search and Rescue Tunnels (Breathing Apparatus Tunnels)

Training included search and rescue drills and breathing apparatus exercises. Filled with theatrical smoke.

D. Stairwell

Used to access different levels of the Fire Attack Building. No live fire used in this area.

Figure 5.5 The Fire Attack Building

1. High expansion foam generator, 1980.
2. Firefighters after exiting high expansion foam drill, 1980.
3 - 5. Sequential photos of hot fire training, mid-1980s.

Photos 3-5 Mid 1980s, courtesy of Peter Baker

Extinguishing Agents

From its inception to present day, firefighters training at Fiskville have practiced extinguishing fires with a variety of agents. These include foams, dry chemical extinguishers and water. All of these agents were used for different drills on the flammable liquid PAD and in the Fire Attack Building. Table 5.3 outlines confirmed extinguishing agents used at Fiskville.

Foams

Firefighting foams are used to extinguish and to prevent fires in flammable or combustible solids (Class A foam) and liquids (Class B foams). They act in the following ways:

- separating by creating a barrier between the flames and the fuel surface;
- cooling by lowering the temperature of the fuel surface and the adjacent surfaces;
- smothering by suppressing the release of flammable vapours from the fuel surface, thus reducing the likelihood of ignition or reignition; and
- penetrating – by lowering the surface tension of water aids penetration of deep–seated fires.

In summary, firefighting foams act by cooling the fire and coating the fuel, excluding access to oxygen.[49, 50]

Surfactants, which are present in these foams at a very low concentration (less than 1%), reduce the surface tension of the foam, enabling it be supported on the surface of the fuel. Other components of firefighting foams are organic solvents, foam stabilisers and corrosion inhibitors. Foams are supplied from the manufacturer in concentrated form and must be mixed with the correct proportion of water and air before use.

Different types of foam concentrates are effective on different types of fires. Class A foams are essentially wetting agents – a special combination of hydrocarbon surfactants for use on a broad range of flammable solids such as wood, paper, plastic and rubber (Class A fires) either in enclosed spaces or in the open air. They lower the surface tension of water, aiding the wetting and saturation of the fuel with water. Class A foams can also be used as a fire barrier to pretreat Class A combustible materials. In concentrated form, Class A foams have solvent characteristics and are mildly corrosive. This class of foam is not suitable for use on flammable liquids, not being designed to contain explosive vapours generated by flammable liquids.

High expansion foams are a sub–group of Class A foams. They are synthetic detergent–based with a low water content designed principally for flooding enclosed spaces. Although classified as a Class A foam, high expansion foams can also be used on small scale Class B hydrocarbon fires. At Fiskville, they were used in enclosed space exercises in the fire building. Following the use of high expansion foam, dry chemical extinguishers were used to reduce the volume of foam.

"[T]hey'd fill a building up with the white fluffy [high expansion] foam and send us in there, no breathing apparatus, just in our normal turnout coats, etcetera, just to [get] the sensation of walking into the foam. It's a funny sensation to go in because as soon as you're inside it, you lose all perspective of where you are, and the foam doesn't carry sound so you can't hear anything, and you're just in this white space. And basically you stood in there until someone walked in … and fired a dry chemical extinguisher off which instantly killed the foam, and the foam just disappeared and you turned around and walked out again." [51]

Class B foams are used to extinguish or prevent ignition of fires in flammable and combustible liquids. (Flammable liquids will ignite and burn easily at normal ambient temperatures – flashpoint less than 37.8°C – while combustible liquids ignite at higher temperatures – flash points above 38.7°C and below 93.3°C). Some Class B foams are designed only for use on liquid hydrocarbon fires and will not extinguish fires in polar solvents (flammable liquids such as alcohols, ketones and lacquers that are attracted to water). Class B foams are made from either a synthetic base (generally a mixture of hydrocarbon surfactants including fluorosurfactants) or from a natural protein base or from a mixture of these two. At Fiskville, Class B foams were used in exercises involving liquid fuelled props on the PAD and liquid fuelled fires in the foam pits adjacent to the PAD.

Synthetic foams flow better and provide better knockdown of flames than protein foams. A major sub-group of synthetic Class B foam is the aqueous film forming foams (AFFF). These are water based which contain fluorosurfactants such as perfluorooctanoic acid (PFOA) or perfluorooctanesulfonic acid (PFOS). This sub-group is designed to spread over the surface of hydrocarbon liquids. Another sub-group of synthetic Class B foams is the alcohol resistant aqueous film-forming foams (AR-AFFF). As the name indicates, these are resistant to the effects of polar solvent fuels such as alcohol that destroy the protective aqueous film. Unlike protein based foams, synthetic foams do not biodegrade.

Protein-based foams are biodegradable and provide a more heat resistant and durable foam blanket than synthetic foams. Like the synthetic sub-group, protein foams include alcohol resistant foams (alcohol-resistant fluoroprotein foam – AR-FP and alcohol-resistant film-forming fluoroprotein – AR-FFFP). Other members include: regular protein foam (P), fluoroprotein foam (FP) and film-forming fluoroprotein (FFFP). While protein based foams are subject to breakdown in the environment by micro-organisms, this process consumes oxygen and can lead to reductions in dissolved oxygen levels in freshwater systems which can harm fish and other aquatic organisms. [49,50]

Internationally, concern over the health and environmental impacts of foams developed in the late 1990s, focusing on Class B synthetic foams containing the fluorosurfactants PFOS and PFOA. Both are readily absorbed by the body after ingestion and are very slowly eliminated. Limited data make it difficult to reach conclusions as to the potential effects of acute exposure, but animal studies suggest both are moderately toxic affecting the liver and gastrointestinal tract. An association between PFOS and PFOA exposure and several forms of cancer has been shown in a small number of occupational studies. Animal studies involving relatively high dose levels suggest both may be carcinogenic.[52]

In December 2000, the world's largest manufacturer of PFOS (3M) stopped production. In the same year, the USEPA imposed a ban on PFOS, with exemptions for special uses in the aviation, photography and microelectronics industries. In 2003 Australia's National Industrial Chemicals Notification and Assessment Scheme (NICNAS) reported that production of PFOS containing products (including firefighting foams) would be phased out in Australia by December 2003.[53]

In Alert No. 2 (April 2003) NICNAS recommended that:

- PFOS and related perfluoroalkyl sulfonate (PFAS) based chemicals be restricted to only essential uses, for which no suitable and less hazardous alternatives are available such as certain Class B firefighting foams.
- PFOS-based firefighting foam not be used for fire training purposes to limit environmental release.
- PFOS users exercise caution in selecting PFOA as an alternative, as PFOA may have the same environmental and health concerns as PFOS.[54]

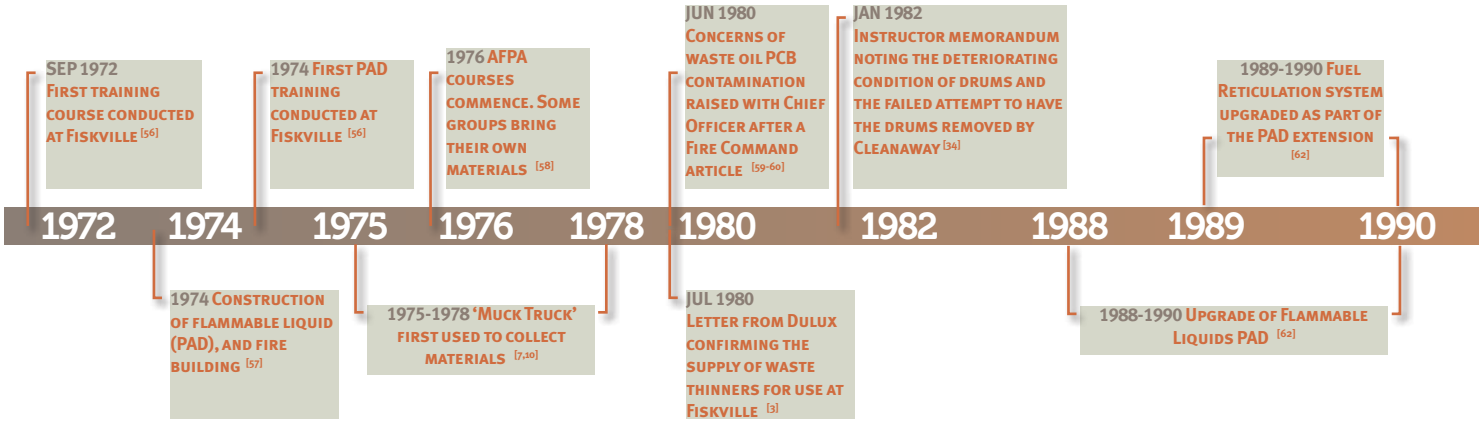
Two foams containing PFOS and PFOA (AFFF and AR-AFFF) were used at Fiskville from the 1970s until 2007. In 2007 CFA implemented a program to identify and dispose of stocks of Class B foams. [55] That is, its use in training continued for four years after NICNAS's explicit recommendation that PFOS and PFOA based foams be restricted to essential uses and not employed in training. [38]

Figure 5.6 Rail Car Drill involving B class foam, 1984. Photo courtesy of Peter Baker.

Table 5.4 Extinguishing Agents Used at Fiskville

Extinguishing Agent	Use over time	Confidence and Justification
Protein Foam (B class)	1970s, 1980s	High- Confirmed in multiple interviews
Fluoro-protein Foam (B class)	1990s	High- CFA Report FV Upgrade Flammable Liquids Training PAD (1990s)
Aqueous Film Forming Foam Concentrates (AFFF) (B class)	1970s – 2007	High- Confirmed in multiple interviews and documents
BCF/Halon	1970s - mid-1990s Phased out in mid-1990s	High- Confirmed by multiple participants
High Expansion Foam	1970s - 1990s	High- Multiple witnesses trained with this foam and documented evidence in CFA Report FV Upgrade Flammable Liquids Training PAD (1990s)
Dry Chemical Extinguisher	1970s-Present	High- Use confirmed by multiple participants
A Class Foam	1990s	High- Multiple documents indicate use in the 1990s.

Figure 5.7 Chronology of Events Pertaining to Materials at Fiskville



As noted earlier, two large foam pits were constructed in the 1970s. Participants indicated that industrial companies used Fiskville to test the effectiveness of various foams. A test was conducted at Fiskville in the 1970s comparing the effectiveness of two B Class foams: AFFF vs. protein foam. A 1989 Monday Morning Meeting Minute notes that no foam training will occur until the new PAD area is completed and that the foam pits "are to be filled in." A 1990 aerial photograph confirms that the foam pits were filled in (Figure 3.1 in Chapter 3).

In addition to using Class B foams in various training drills on the flammable liquid PAD (Figure 5.6) and in the foam pits, portable extinguishers were used on the PAD extinguishing props and are still used on these today. As noted previously, the extinguishing props on the flammable liquid PAD are still filled manually with diesel and petrol.

Recycled Firewater

A safety hose drawing water pumped from Dam 1 was used to direct a spray or fog of water over groups attacking a fire in case a hose or pump supplying mains water failed. In addition to this direct exposure to the recycled firewater (Figure 5.8), the physical arrangement of the PAD and pumping system was such that some of the runoff from the PAD flowed overland into the nearby concrete holding tank from which mains water was supplied to the PAD, leading to an unknown degree of contamination of the primary water supply. As a result, instructors and trainees would have been exposed to water and aerosols with a range of contaminants – dissolved hydrocarbons, foam breakdown products and suspended fine particles (soot) with various chemicals adsorbed to their surfaces.

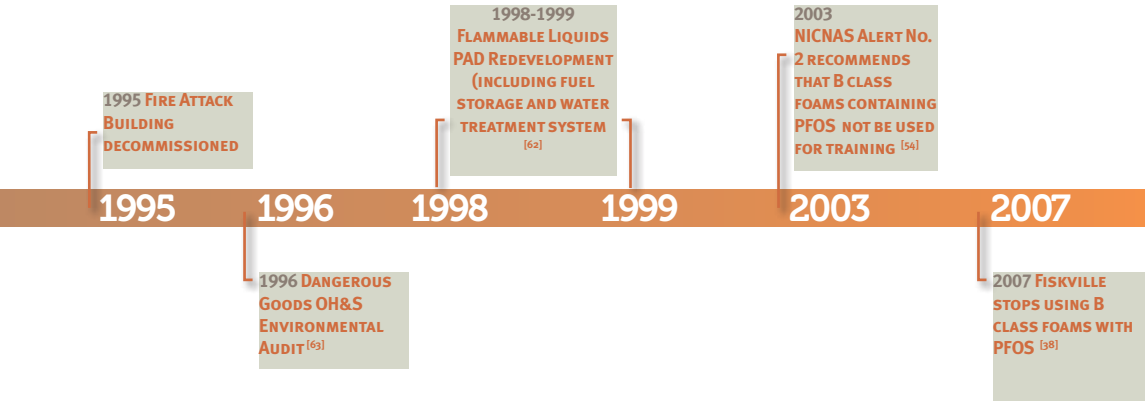


Figure 5.8 Trainees performing a two-line fog attack, 1990. Photograph courtesy of CFA

CONTAMINANTS AND CONTAMINATION

6

Term of Reference 1C

"Identify the origins of the flammable substances (paying particular attention to the likelihood of the substances being contaminated with material such as heavy metals and persistent organic pollutants, e.g. polychlorinated biphenyls); report on how they were stored, used and disposed of; and assess the likelihood of the use and management of flammable substances and extinguishing agents having led to the contamination of air, land or groundwater at, under or beyond the Fiskville facility"

Chapter 3 outlines the development and use of the Fiskville Training College, including the nature of training activities and infrastructure. What is known about the acquisition and use of potentially hazardous materials at Fiskville is discussed under Terms of Reference 1 (a) in Chapter 5 and likely exposure patterns detailed under Term of Reference 1(d) in Chapter 7. This chapter addresses Term of Reference 1(c) focusing on potential contaminants of concern in the materials that may have been used in firefighter training; and on the potential contamination of the environment at and surrounding Fiskville. Chapter 8 provides further exploration of drum burial practices and the potential for residual contamination from drums.

Potential Contaminants

For the purposes of this chapter, "contaminant" has been interpreted broadly to include not only chemicals present in a substance as a result of adulteration, such as polychlorinated biphenyls (PCBs) in automotive oil, but also chemicals that are an integral part of an unadulterated product, such as tetra-ethyl lead in leaded petrol. Such lead may become a contaminant when released into the environment, for example as a product of combustion. In both these situations, the focus of concern is contaminants that persist for long periods in the environment and which, in some cases, accumulate in living organisms.

Furthermore, apart from potential hazards arising from the presence of specific contaminants of concern, a product such as unleaded petrol is itself a contaminant if released into the environment due to poor storage, handling and disposal practices.

Flammable Liquids

The exact nature of many of the flammable liquids brought onto Fiskville will never be known. Many supply practices were informal and undocumented, particularly where materials were brought in drums and, in the case of used oils, in mixed tanker loads. This report has sought to characterise, to the extent possible, the materials known and likely to have been brought onto the site. Some reasonable suppositions can be made about the nature of some of these materials. For example, because materials were being brought onto Fiskville to serve as fuel for hot fire fighting training, this tends to discount use of materials that didn't burn well such as persistent organic chemicals (e.g. pesticides such as dichlorodiphenyltrichloroethane (DDT) and dieldrin, as well as polychlorinated biphenyls (PCBs)) and dry-cleaning fluids such as carbon tetrachloride and tetrachloroethylene. However, that does not rule out the possibility of such materials being added to waste oils or other flammable liquids.

Drum storage area, 1996. Photo courtesy of CFA

Much of the material burned at Fiskville and Regional Training Grounds prior to conversion of PAD operations to liquified petroleum gas was readily available fuels - leaded and unleaded petrol and diesel - sourced in bulk from commercial outlets. These fuels were stored in above ground tanks from which they were reticulated to the PAD (see Chapters 3 and 5). Leakage from underground tanks and associated pipework is a common source of soil and groundwater contamination at service stations and similar facilities. At Fiskville, the underground fuel tanks, used for fueling vehicles, were removed by contractors Coffey Associates in 1996 at the same time as the cleanup and redevelopment of the PAD which was completed in 1999.[1-3] Contaminants associated with fuels that might be of concern at Fiskville include tetra-ethyl lead (the octane enhancer in leaded petrol sold throughout this period), total petroleum hydrocarbon (TPH), polycyclic aromatic hydrocarbons (PAH) and simple aromatic compounds such as benzene, toluene, ethylbenzene and xylene (collectively known as BTEX).[4,5]

However, following excavation by Coffey in 1998, Rio Tinto was contracted to conduct bioremediation of the flammable liquid PAD and 'fire training pits' (i.e. foam pits).[6] Soil contaminated with fuel from these sites was tested by Rio Tinto, who found that lead contamination levels were far lower than the Australian guidelines.[6] Testing by Golder Associates in 2012 of soil in drum burial area 1 (south of the airstrip), drum fire area, prop storage area and soil composting area for a range of analytes including TPH, BTEX and PAHs found that TPH and BTEX concentrations were below the laboratory limit of reporting and therefore below both the available ecological and human health assessment criteria.[7]

Used oils collected in bulk or in drums will have contained a range of additives such as antioxidants (phenols) and viscosity improvers. Through use, these oils will have become contaminated with suspended metals such as zinc and phosphate. In addition, given the nature of the reported sources of waste oil (e.g. garages and vehicle fleet operators in Ballarat and Geelong) adulteration of used oil by liquid products such as degreasing solvents, brake fluid and kerosene is likely.[8-19] However, these automotive waste oil sources are relatively unlikely to have been a source of contamination with persistent organic compounds, notably polychlorinated biphenyls (PCBs), although this cannot be completely discounted.

PCBs are a group of non-flammable, highly stable chemicals ideally suited to use as cooling and insulating fluids in electrical transformers and capacitors. Because they persist in the environment and are soluble in fat, they can build up in food chains, and produce a range of adverse environmental and human health impacts.[20,21] Concern about the adverse effects of PCBs and other persistent organic pollutants developed worldwide throughout the 1970s. In Australia, PCBs were used in large quantities until the late 1970s, and their importation was banned in 1975.[22] Over the next twenty years use of equipment containing PCBs was phased out in line with a 1995 national plan.[23]

It is unlikely that concentrated liquid PCBs would have been accepted at Fiskville, firstly because they are fire resistant, are unlikely to have been contained in oils coming from sources like garages and because in concentrated form they were a valuable commodity. By 1980, the potential for used oil to be contaminated with PCBs had been noted by staff at Fiskville, and recommendations made to ensure waste oils used at Fiskville were certified as PCB free.[22] While the Investigation has evidence that efforts were made to ensure that waste oils were PCB free, this does not extend to seeking formal certification (see Chapter 9). Such certification would have been difficult for small businesses like garages.

At the outset of the Investigation, there were two disused electrical transformers, drained of insulating oil, in the props compound at Fiskville with no accompanying certification that they were PCB-free. These have now been removed in line with requirements for prescribed industrial waste under the *Environment Protection Act 1970*. Similar props are still used at regional training centres.[24] This raises the possibility of a small amount of diluted liquid PCBs having come onto training sites in undrained and unflushed disused transformers. While possible, this is judged to be unlikely because by the time such transformers were being withdrawn from service (mostly in the late 1980s and 1990s) the risks of PCBs in transformers were widely known and managed. Analysis of soil samples taken by Golder Associates in the current props' compound did not detect PCBs. Nor were PCBs detected in any of the other samples of soil, sediment and water collected in the drum burial area 1, drum fire area, soil composting area, dams 1-4 and Lake Fiskville.[7]

Eight years later, there is evidence of further concern about contaminants in fuels used at Fiskville. Documentation suggests that CFA was advised by the CSIRO in 1989 that copper chromium arsenic (CCA) treated timber "should not be burnt". In a memo from the Regional Officer in Charge (Research & Development), the Assistant Chief Officer (Training Wing) was advised that the CSIRO ***"will test residues from the [fire] building to determine if copper residues exist".***[25] According to EPA ***"the burning of CCA treated timber carries a high risk of causing environmental harm due to toxicity associated with the release of airborne chromium and arsenic compounds... [Burning] results in condensation of heavy metals, upon cooling, which may settle on a receiving environment".***[26] As with PCBs, the Investigation has no evidence that these tests were conducted or further management response to these concerns.

There were also reports of pallets used as solid fuels that were likely to have pesticide residues from use in quarantine procedures. The Investigation does not have evidence of the extent and length of such use. This would again pose a potential risk in terms of exposure to smoke particularly in the structural fire building exercises.[41]

As noted in Chapter 5, in addition to bulk supplies of petrol, diesel and waste oil, substantial quantities of flammable material were received at Fiskville in drums. While the drums contained materials loosely described by former Fiskville staff as solvents, paint thinners, paints and tank bottom waste, the precise nature of the contents and origins of most of the drums were unknown and the drums were not sampled for metals or persistent organics. Consequently, the possibility of such contaminants being present in drummed material burned in training exercises can't be ruled out and is not likely to ever be known.

One of the few pieces of documentary evidence on the contents of drums is the 1988 A. S. James Geotechnical report. This concluded from the results of analysing material recovered directly from buried drums that ***"... the principle [sic] contaminant at the site consisted of aromatic compounds, i.e. resins or solvents, and may include benzene, toluene, xylene and phenol".***[4] Since some drums were in poor condition and drums were not stored on hard-surfaced, bunded areas, it is likely that there was contamination of soil with solvents, paint and other industrial wastes in drum storage areas.

On available evidence, the Investigation considers the likelihood of contamination of liquid flammable material supplied to Fiskville was low for petrol and diesel delivered in bulk. Apart from petrol or diesel stored in underground storage tanks, the risk of such material contaminating the surrounding environment was also low. While used oils (i.e. those collected by the 'muck truck' - see Chapter 5) burnt on the PAD would probably have included a range of contaminants such as phenol and suspended metals, the likelihood of containing persistent organic compounds (particularly PCBs) is low, as is the likelihood of the storage and use of this oil leading to significant contamination of the environment.

In contrast, given the uncertain origin, condition and contents of many, if not most, of the drums, it is possible that the contents of some were contaminated with persistent chemicals such as heavy metals, PCBs and pesticides. While this can never be known, what can be stated with a high degree of confidence is that the various solvents, paints and other flammable waste materials contained in the drums were potential environmental contaminants. Given that some drums were known to be in poor condition, that they were stored on permeable surfaces and at times buried, they pose risks of potential contamination of soil, surface and groundwaters.

Foams

Chapter 5 discussed the acquisition, use and nature of various types of firefighting foams used in training at Fiskville. The key contaminants of concern associated with the use of foam at Fiskville are the fluorosurfactants PFOS (perfluorooctane sulfonates) and PFOA (perfluorooctanoic acid). PFOS and PFOA are known to be persistent, accumulative and toxic.[27] The pathways and relative risks of exposure to these chemicals are discussed in Chapter 7.

On-Site contamination at Fiskville

Contamination on-site at Fiskville is likely to have arisen from several distinct activities: use of materials for fire training activities on the PAD; storage of fuels and materials used in training; overflow, capture and disposal of wastewater from training; burial of drums, sludge and other material including in on-site landfills; and potential leakage from underground fuel storage tanks.

See map page 78-79

The IFI commissioned Golder Associates to undertake a preliminary site assessment of potential contamination at Fiskville. The full report of this assessment is provided in Appendix C. Golder Associates designed their sampling on the basis of knowledge at the outset of the Investigation, including a review of relevant historical documents such as previous environmental assessment reports completed for the site. The Investigation discussed its findings with Golder Associates at key stages which led to Golder Associates seeking to identify further potential drum burial sites through the use of ground penetrating radar (see Chapter 8). The preliminary site assessment and the work of the Investigation provide essential background on which to base considerations about the need for any additional site assessment.

Historical Site Assessment and Clean-Up

An important part of Golder Associates work was to review relevant historical documents, particularly the body of work carried out to characterise contamination and remediate parts of the site during its redevelopment post 1996. This review helped to identify areas on which the preliminary site assessment would focus, including areas selected by the consultants for the collection of soil, sediment and water samples.

Golder Associates concentrated on those issues most directly relevant to the Investigation's Terms of Reference, including areas associated with buried drums and related contaminants. Central to this effort was the assessment of residual site contamination and risks remaining from historical practices and site cleanup, as well as of any current risks. A useful summary of Golder Associates' historical review is provided in Chapter 7 of their report. Chapter 8 provides a comprehensive discussion of the Investigation's understanding of the timing, circumstances and locations of drum burials and exhumations at Fiskville.

While a series of works was undertaken in 1990 to upgrade the PAD and the fire water treatment system (see Chapter 3) the major redevelopment that converted the PAD to LPG occurred in 1999. Prior to this, a major review of environmental and safety considerations took place and resulted in a program to characterise contamination and undertake some clean up between 1996 and 1998. This was driven by increasing concern among Fiskville staff and CFA dangerous goods staff over the failure of the facility to meet occupational health and safety, dangerous goods and environmental regulatory requirements (see Chapter 9). A key barrier was seeing Fiskville as a site holding dangerous goods that need to be managed rather than 'a CFA site'. As one regional staff member said in April 1996 in relation to planning for the PAD redevelopment ***"... it seems that environmental and dangerous goods issues, and indeed plain common sense was not considered .... There also seems to have been a sense here that the rules that apply to the general community do not apply at Fiskville"***.[28] In 1996 CFA staff at Fiskville actively engaged regulators and consultants to seek to understand and address health, safety and environmental issues.[2]

Figure 6.1 Historical Site Sampling

In 1996 CFA Fiskville staff commissioned a series of site assessments by Diomedes, Coffey and CRA/Minenco (later to become Rio Tinto). From these consultants' reports it is clear that by the mid-1990s the following areas were likely to have been contaminated to a greater or lesser degree by petroleum hydrocarbons and a variety of other organic pollutants:

- the PAD, which was not hard surfaced;
- two previously buried foam pits immediately to the east of the PAD;
- adjoining grassed areas to the east and south that had received overland flow of firewater from the PAD and overflows from the foam pits;
- areas in the immediate vicinity of underground storage tanks;
- the sediments in the primary treatment pond;
- the more recent of the two landfills to the west of the residences;
- surface soil in areas where drums had been stored immediately to the west of the training centre; and
- a known drum burial site south of the airstrip.

Testing by Coffey in 1996 confirmed there was localised contamination of soil, sediment and surface water as a result of storage and use of materials in firefighter training. In particular, measurements of TPH in soil samples were above 'soil investigation guidelines' for a number of sites including the flammable liquid PAD, fire training pits (i.e. foam pits) and a known drum burial area. TPH levels were also detected in sediments of Dam 1 and the inlet area of Dam 2. This pattern of contamination reflects historical practices such as storing and using fuels directly on the ground and not on hard surfaces or in bunded areas, and discharging of wastewater to Dam 1 with minimal treatment. Despite the limitations of the fire water treatment system, sampling showed that, by the time waste water reached the final pond in the system (located on a tributary of the Moorabool River immediately to the east of the staff residences), hydrocarbon levels were less than detection limits (presumably due to volatilisation and dilution). Heavy metals (lead, copper and to a lesser extent nickel and zinc) in surface waters were also elevated, but their distribution did not indicate any specific source. Levels were similar to those in groundwater, and Coffey concluded were likely to have been typical of naturally occurring background levels.

Coffey established eight ground water bores. However, given the depth at which groundwater occurs in the area, samples were obtained from only two bores. One of the four deep (20 metre) bore holes, intersected ground water. This groundwater was slightly saline; heavy metals were at natural background levels and no hydrocarbons were detected. One shallow bore hole intersected groundwater immediately adjacent to a trench in which drums had been buried - probably a result of locally enhanced recharge. Detection of TPH in the groundwater at this site matches the consultant's local recharge scenario. Coffey's view was that the nature of clays made significant migration of contaminants from such isolated sources unlikely unless localised permeability was increased by clay fissuring or human action. Coffey's overall conclusion was that their investigation indicated ***"... a low potential for contaminant migration either on or off-site via subsurface groundwater systems".***[29] In addition to testing for contamination of groundwater, a portable photoionization detector (PID) was used to check for volatile hydrocarbons in vapour from six of the bores (including the bore at the CFA landfill closed in 1996). Negligible soil vapour concentrations were detected.

Burning Off Fuel Residue From Dam 1, adjacent to the flammable liquid PAD in 1996. Photos courtesy of CFA

PAD operator pouring approximately 5 litres of petrol on to the surface of the dam to 'prime' it.

Approximately five minutes after ignition.

Approximately ten minutes after ignition.

Approximately 20 minutes after ignition. The dam was observed to burn for approximately 4 hours.

In 1996, CRA-ATD (formerly Minenco Pty Limited) reviewed the work of Diomedes and Coffey and developed a two-stage remediation plan for the site which was implemented in 1998. The planned remediation was discussed with the Environment Protection Authority who were reported as being supportive and not requiring formal approval given there were no offsite effects.[30] The first stage, carried out by Coffey, involved excavation, validation and reinstatement of soil from the flammable liquids PAD and fire training pits (i.e. foam pits). In the second stage, Rio Tinto Research and Technology Development was commissioned to manage on-site treatment of this excavated soil which was bio-remediated through 'landfarming' (on-site soil composting) which was completed over six months in 1998. The area used for this lies immediately to the east and south east of the present PAD. This landfarmed area was sampled by Rio Tinto six months after the completion of bioremediation. TPH concentration was '730mg/kg, below Victorian EPA clean fill criteria',[31] and no other contaminants of significance were detected. Based on these results, in June 1999 Rio Tinto requested, on behalf of CFA, that the EPA approve use of the material as clean fill in further construction.[32] As the Investigation and EPA have no record of a response to this request or how the material was used, it is unclear whether this material was used in the subsequent redevelopment of the PAD.

The Investigation viewed evidence from EPA, and could find no evidence that cleanup of Dam 1 or the known drum burial area south of the airstrip recommended by CRA-ATD in 1996,[33] occurred. Indeed, as Chapter 7 outlines, it appears the existence of the drum burial area was forgotten and in 2002 a bulldozer driver was overcome by fumes while ripping that area for plantation establishment.

Further work to design and redevelop the PAD was then carried out and the site was substantially redeveloped over the following years finishing in 1999. Fiskville recommenced hot fire training in 2000. The PAD redevelopment significantly reduced the risk of future contamination by substituting LPG for flammable liquids as the primary fuel used for training and by establishing hard surfacing and bunding in areas where liquid fuels still needed in training were stored. Further development of the firewater treatment system through the construction of an additional pond between Dam 2 and Lake Fiskville reduced the likelihood of water-borne contaminants moving off-site.

Golder Associates Preliminary Site Assessment – 2012

Based on analysis of these historical reports and information provided by the Investigation, Golder Associates designed a targeted preliminary site assessment aimed at identifying any areas of residual historical or recent contamination. Because the chemical constituents of the contents of the great majority drums could only be inferred from generic descriptions such as solvent, paint thinner, Golder Associates had to consider a broad range of potential contaminants. The analytical suite included TPH, BTEX (benzene, toluene, ethylbenzene, and xylenes volatile organic compounds typically found in petroleum), PAHs (polycyclic aromatic hydrocarbons), PCDDs and PCDFs (polychlorinated dibenzodioxins and polychlorinated dibenzodioxins furans), VOC (volatile organic compounds), metals, Phenols, Perchlorates, PFOA/PFOS (Perfluorooctanoic acid and Perfluorooctane sulfonate), PCB (polychlorinated biphenyl), pesticides and TOC (total organic carbon).

In addition, Golder Associates analysed for "tentatively identified volatile and semi-volatile compounds" to determine whether they warranted further assessment on the basis of their being a known or suspected human carcinogen or mutagen. The process did not identify any such compounds. Eucalypts at drum burial area 1 south of the airstrip were sampled to screen for potential VOC in the subsurface soil vapour. Analytical results were below the laboratory limit of reporting for VOC. However, as Golder Associates' report notes this does not rule out VOC vapour being present in the sub-surface soil.

The results of Golder Associate's targeted sampling of soil, sediment, surface water, groundwater and vegetation were "assessed against available, generic risk-based criteria protective of humans and the environment in a screening level risk assessment". In making their assessment, Golder Associates considered likely uses of the environment, particularly those designated as 'beneficial uses' which should be protected under relevant State environment protection policy. Their report (Appendix C) details the methodologies, assumptions, limitations and results of this site assessment.

They conclude that, when the soil analytical results are compared with ecological and human health assessment criteria, most compounds were below the adopted soil criteria. PFOS and 3- & 4-methylphenol (an organic compound found in household cleaners and disinfectants) were detected at

levels above the criteria. However, Golder Associates conclude that the exceedance of the PFOS criteria was marginal and the location where the exceedance was found is a soil stockpile in an area of the site infrequently accessed by site users (the remediated soil composting area). Therefore PFOS concentrations in soils do not indicate the potential for an adverse impact on human health. Similarly, 3- and 4-methylphenol concentrations in soils do not indicate the potential for an adverse impact on ecology at the site due to the conservative nature of the adopted criteria.

Golder Associates concluded that overall the soil analytical results from the drum burial area 1, drum fire area, prop storage area and soil composing area do not indicate the potential for an adverse impact on the maintenance of modified ecosystems and human health.

Golder Associates was not able to obtain any groundwater samples from available bores as all the bores were found to be dry.

The nature of groundwater, its movement and potential contamination at the site remain largely unknown. The IFI believes gaining an understanding of the local groundwater system, including the direction and rate of its lateral movement, is likely to be challenging. Given the cleanup carried out in 1998 and the assessment of drum burials and excavations outlined in Chapter 8, the Investigation believes it reasonable to conclude that ongoing risks to groundwater from contaminant sources near the surface are likely to be limited. However, the long period over which a number of areas at Fiskville are known to have been contaminated with hydrocarbon fuels and aromatic solvents leaves open the possibility that groundwater has been contaminated in the past.

Golder Associates recommend characterising and assessing groundwater flow and quality. The Investigation believes this should focus on solvents which can potentially persist at depth and migrate away from the original source of contamination. Liquids such as petrol that are lighter than water tend to pool within groundwater at the top of aquifers while dense liquids, such as dry cleaning fluids and industrial degreasers can penetrate the water column and accumulate below the groundwater. Given that groundwater could not be sampled and that soil sampling was limited and did not include additional potential drum burial sites that were identified during the Investigation, the Investigation supports further groundwater investigation.

Golder Associates consultants recommend further assessment of groundwater and soil quality particularly in the following areas not included in the site assessment phase:

- drum burial area - south of the airstrip and Deep Creek Road
- drum burial area east of the administrative building
- drum burial area north of the administrative building
- historical and current above and below ground fuel storage tanks
- the two closed landfills.[7]

Above ground fuel storage tanks, 1996. Photograph courtesy of CFA

Golder Associates also recommends further groundwater investigations in the vicinity of the historical flammable liquid pad, fuel mixing area, historical fire training pits, sludge burial pits, drum burial area south of the airstrip, drum fire area, soil composting area and prop storage area to assess water quality and flow conditions. The IFI supports these recommendations, noting the Investigation does not believe sludge burial pits existed.

In terms of surface water, Dams 1-4 are part of a wastewater treatment system and would be expected to be contaminated to some degree. The assessment of surface water and sediment samples shows most analytical results are below drinking water criteria. While results for PFOA and PFOS (persistent potentially toxic chemicals), and for TPH were above the drinking water criteria, application of these criteria to these waters is inherently conservative since they would never be used as a source of potable water.

The likely exposure to treated firewater would be during training when this water is used to supply backup safety hoses. In 2010, consultants Wynsafe tested for PFOS and PFOA residues in the primary pump and in Dam 2.[34] While also detecting levels above drinking water criteria, their report concluded *"...it can be shown that the estimated exposures will produce daily intakes several hundred times lower than the recommended Tolerable Daily Intake (TDI) for both PFOS and PFOA even based on the highest result."*[34] Limited contact with sediments might occur through occasional maintenance activities. Golder Associates recommends procedures should be established to manage the risks to individuals who have the potential to come into contact with surface water and sediments in Dams 1-4 during training and routine maintenance activities, consistent with the previous advice to CFA from Wynsafe.[7]

After passing through a triple interceptor trap and Dams 1 to 4, the treated firewater flows to 'Lake Fiskville' on Beremboke Creek which flows southwards and forms part of the headwaters of the Moorabool River. The man-made storage Lake Fiskville acts as the final link in the chain of treatment ponds before water leaves the property.

In summary, the majority of analytical results for surface water at Lake Fiskville were below drinking water guidelines against which potential risks to human health were assessed. Concentrations of PFOS and PFOA, while an order of magnitude below those in Dam 1 and 2, were still significantly above drinking water criteria at both the inlet to and outlet from the Lake. People are more likely to be exposed to contact with the waters of Lake Fiskville than the dams during primary contact recreation activities. However, based on Wysafe's estimates of likely daily intake relative to total daily intake (TDI) for the waters of Dams 1 and 2, intake of PFOS and PFOA from the waters of Lake Fiskville are likely to be between two and three orders of magnitude below the TDI.

Golder Associates concluded that as Lake Fiskville is hydraulically connected to the Moorabool River Catchment, the beneficial uses set out in State environment protection policy "human consumption" and "contact recreation" have the potential to be realised with pathways potentially linking PFOA and PFOS in waters of Lake Fiskville to human receptors downstream. The criteria used are conservative in that they are based on a daily consumption of around two litres of water, which for downstream users will not come from Lake Fiskville alone. Furthermore, dilution of the PFOA and PFOS concentrations in the Moorabool River Catchment following discharge from Lake Fiskville is likely to result in reduced exposure concentrations compared to that reported in Lake Fiskville. In addition, the exposure concentrations may be further reduced via mechanisms of environmental fate and transport.

Golder Associates assessed TPH levels for hydrocarbons in Lake Fiskville in the range C16-C34 as unlikely to have an adverse impact on human health *"as the criteria adopted were developed in regard to aromatic hydrocarbons and PAH were not detected above the laboratory LOR (Limit of Reporting) in this sample"*. It should also be noted that Lake Fiskville is in the upper reaches of the catchment and discharges would be greatly diluted as they pass through increasingly larger streams.

In terms of assessing risks to the environment, the analytical results for surface water were below ecological criteria with the exception of copper and zinc. The Investigation believes these are likely to reflect natural background levels in catchments on basalt.[35] Commenting on these levels, Golder Associates concluded that *"the surface water results from Lake Fiskville are unlikely to have an adverse impact on aquatic ecosystems in Lake Fiskville".*

Sediments tested in Lake Fiskville were below ecological criteria except for PCDD and PCDF - related dioxin-like compounds for which International Toxic Equivalents were assigned. Golder Associates conclude that, while reported PCDD and PCDF TEQ values exceed ecological criteria by a factor of three, ***"these criteria are considered to be conservative and an exceedence [sic] of this type does not necessarily demonstrate evidence of adverse impact to aquatic life."***

Golder Associates recommend further investigation to better quantify the potential for risk to downstream human health receptors taking into account downstream dilution and environmental fate and transport mechanisms. They also recommend assessing background water quality for the presence of naturally occurring metals like copper and zinc, and an assessment of the ecological condition of Lake Fiskville.[7]

Combustion Products

Combustion of petrol, diesel and used oil may also produce environmental contaminants. The potential for such contaminants, particularly soot and particles, to be deposited on-site or off-site needs to be considered. In the open, as is the case on the flammable liquids PAD, fires involving petrol, diesel and oil have a ready supply of oxygen and while they reached high temperature combustion was incomplete producing significant smoke and particles. The surfaces of these particles may carry metal contaminants such lead, arsenic, cadmium and nickel and a range of complex organic compounds. The latter include some types of PAH - polycyclic aromatic hydrocarbons – some of which are known or suspected carcinogens and tend to persist in the environment.[36, 37]

Variables that would affect the risks of contamination through fallout of combustion products onsite include: how hot the fires were and therefore how complete the combustion; the size and duration of fires; local wind speed and direction and local barriers to smoke such as windbreaks.[36] In some cases, wind conditions may have favoured the rapid fallout of particles and associated pollutants onto paddocks and buildings at Fiskville. Under different conditions, the plume may have retained its integrity until well away from the property, in which case fallout could have occurred over a wide area downwind.

It was difficult to get a clear picture from residents about whether fallout of soot from fires at Fiskville affected tank water collected from roofs. Staff houses were to the west of the PAD and therefore up-wind of the prevailing north westerlies, but at times winds would have directed smoke from PAD operations over these houses. A small number of past residents recalled ash in gutters. Many noted regularly having to bring in their washing (and sometimes their neighbours) when winds brought smoke and ash over the staff residences.[38, 39]

Many residents complained about water quality issues, but these appear to have been primarily due to the poor quality of reticulated water from the Ballan reservoir, reportedly arising from old pipework on-site at Fiskville. Two principals of the Fiskville primary school some 600 meters east of the PAD, which closed in 1993, had no recollection of problems associated with smoke from the PAD (see Chapter 7 for further details).

Contamination Off-site

During the first two decades of the operation of the flammable liquids PAD, a key risk of off-site contamination from Fiskville related to the discharge of partially treated firewater via Lake Fiskville to Beremboke Creek. By the late 1990s, this risk had been significantly reduced due to the conversion of the PAD to LPG as the primary fuel and the progressive upgrade of the firewater treatment system. The first of these changes was significant because burning LPG produces markedly less soot (i.e. particles) to contaminate runoff from the PAD than did burning petrol, diesel and used oil. The second involved the addition of a triple interceptor trap, aerator and second treatment dam, increasing the system's capacity to deal with petroleum hydrocarbons and particles.

It is important to note that the only contaminants of concern identified by Golder Associates in the surface waters of Lake Fiskville were the organic pollutants PFOS and PFOA - components of some types of firefighting foam that have been progressively phased out of use due to concerns over potential health effects. The presence of these contaminants at low levels at Fiskville is not unexpected given their persistent nature and the extensive use of foams in which they were constituents. Use of such foams in training at Fiskville ceased in 2007, four years after the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) recommendation (see Chapter 5).

It is to be expected that PFOS and PFOA residues will have moved off-site via Lake Fiskville, particularly in the years prior to the upgrade of the treatment system. However, these residues would be subject to significant dilution as they moved downstream. Given this and the conclusions summarised above in relation to the relatively low level of risk to human health posed by PFOS and PFOA, offsite risks associated with these waterborne contaminants is assessed as being low to very low. Nevertheless, the Investigation supports Golder Associates recommendations to:

- better quantify the potential risks to human health downstream taking into account dilution, environmental fate and transport mechanisms
- investigate and potentially reduce sources of PFOA and PFOS discharges into Lake Fiskville.[7]

Contaminants that may exist in sediment or soils at Fiskville do not present an off-site risk. However, as outlined above, the characteristics, flow and quality of groundwater beneath Fiskville are not known. Contamination by chemicals such as solvents is possible and could be further investigated. However, groundwater exists at significant depth, with limited inflows and is subject to only limited use locally. Neighboring bores, some of which are licensed for use for stock and domestic purposes are more than two kilometers distant.[7] Coffey noted their bore drilling program "suggests that the basalts are generally dense and unjointed without any significant ... porosity to enable groundwater flow ... the nature of the basalt in the region appears to preclude any significant groundwater occurrence".[40] These factors limit the potential risk of groundwater contamination migrating off-site.

As noted above, wind conditions are likely to have carried smoke offsite where fallout of particles and associated combustion products would have occurred, potentially over a wide area. As was the case on-site, some of this fallout may have affected tank water quality at local residences. Interviews with long-term neighbours have not indicated that this was a concern, and it is therefore not possible for the Investigation to draw any definitive conclusions as to offsite risks from smoke from Fiskville. However, such risks are likely to have been intermittent and limited.

EXPOSURE OF PEOPLE TO MATERIALS

7

Term of Reference 1D

"Identify the nature and extent of exposure to the flammable substances (and their combustion products),extinguishing agents and fire water of persons on-site and in surrounding areas that could have potentially been impacted by contaminated runoff or wind drift; and, to the extent practicable, list persons who may have been exposed".

Introduction

Firefighting is an inherently risky undertaking. Training firefighters to recognise and manage risks is essential if they are to deal successfully with the many challenges they will face at emergencies. While exposing firefighters to such risks in controlled situations forms a necessary part of training, it needs to be recognised that such exposures are not risk free.

Throughout its existence, Fiskville has placed a premium on creating realistic live fire training situations. These practices are outlined in previous chapters. From the many interviews conducted by the investigation with ex-Fiskville staff and trainees, it is clear that some of the materials and practices used in training during its first twenty or so years posed levels of acute and chronic risk that would not be acceptable today.

In addressing this Term of Reference, the approach developed by the investigation was to assess the nature and potential significance of exposures of different groups at Fiskville. Consideration of the risks of these exposures includes acute and chronic exposures and cumulative risk. Acute exposures are brief exposures which occur over a short period of time the effects of which appear promptly after exposure. Chronic exposures refer to on-going exposures which occur over a long period of time either continuously or intermittently and effects of which develop over a long period. Cumulative risk is the related total risk that increases with each added risk.[1]

In applying this approach, the term *risk* has been used in a less precise manner than in Chapter 5, where it was defined as the product of intrinsic hazard and likelihood of the hazard being realised. In this chapter, as an aid to communication, risk is being used in a more colloquial sense to describe both the likelihood of the hazard being realised and the outcome that follows.

This assessment was based primarily on a group's role (e.g. PAD operator, instructor and trainee). Such roles largely determined the nature of the hazardous materials and by-products to which each group was exposed, as well as the routes and relative frequency of exposure. Ultimately, the risks to each group are a function of the cumulative impact of acute and chronic exposures over time.

Foam pit training drill,1979. Photograph courtesy of CFA

An additional consideration in the case of full-time Fiskville staff was how much time they spent at Fiskville in a given role. The following discussion of exposure needs to be considered in conjunction with the review of the nature of the flammable materials, extinguishing agents and recycled firewater used at Fiskville outlined in Chapter 5.

This Term of Reference called for the development, if practicable, of a list of persons who may have been exposed. However, early in the Investigation it became clear that this was not practicable. CFA does not have consolidated records of attendees and staff at Fiskville over four decades. Some of this information exists within historical records. However, as outlined in Chapter 2, capturing and searching these records, even at Fiskville was a major task, and the Investigation necessarily had to focus its efforts. The Investigation was able to develop lists of key staff at Fiskville over periods critical to the Investigation.

The Investigation understands the importance of identifying individuals who may have been subject to acute exposure to hazardous materials through training activities. Through review of CFA occupational health and safety (OHS) records and extensive interviews, the Investigation was able identify and seek to confirm a small number of incidents involving acute exposure to individuals.

However, many tens of thousands of people underwent practical training on the liquid flammables PAD at Fiskville since its establishment in the early 1970s. All were likely to be exposed to some degree to products of combustion and to recycled firewater and many would also have been exposed to extinguishing agents notably foam. This chapter seeks to explore the likely nature and relative risks of such exposures.

Background - Routes of Exposure

Of the four routes of exposure by which a substance can enter the human body, three (absorption, ingestion and inhalation) have been considered in the following discussion. The fourth (injection, i.e. through wounds to the skin) is judged not to be relevant to the types of exposure situations characteristic of fire training at Fiskville. Of the three relevant means by which chemicals can enter the body, absorption is generally recognised as the least effective, with ingestion next and inhalation as the most effective.[2]

Absorption

Absorption of toxic substances through the skin (i.e. dermal absorption) is affected by a range of factors, notably by the condition of the skin. Where the skin is intact (free of cuts or abrasions) it provides an effective barrier against the absorption of some chemicals. The nature of the product will determine whether it is likely to be absorbed by the skin. For example, absorption of organic solvents and petrol occurs more easily than inorganic products such as lead. Absorption also occurs through the eyes which afford a far less effective barrier than the skin and are particularly sensitive to chemicals.[2] Across all the groups considered in the following discussion, absorption is considered to be the least significant exposure route.

Ingestion

Ingestion occurs when chemicals are swallowed and enter the stomach. Unless they are irritating or corrosive, chemicals that inadvertently enter the mouth and are swallowed do not generally harm the gastrointestinal tract (stomach, small and large intestines). Those that are insoluble in the fluids of the gastrointestinal tract are usually excreted, while those that are soluble are absorbed through the lining of the stomach or intestines from where they are carried in the bloodstream and can impact on internal organs.[2]

At Fiskville, ingestion of toxic substances (hydrocarbons, foam breakdown products – PFOS and PFOA - and particles) is most likely to have occurred through the unintentional swallowing of liquid aerosols associated with the occasional use of recycled fire water from the back-up safety system.[3-5] Clean, portable water was the primary source of firefighting water. Ingestion is considered to be a significantly less important exposure route than inhalation.

Series of two line fog attack drill, downwind of smoke circa 1980s. Photographs courtesy of Paul Blythman

Inhalation

Inhalation is breathing in substances into the airways and lungs. Inhalation is the major path of entry to the body for most chemicals as vapours, gases, mists and particles.[2] At Fiskville, chemical vapours from flammable liquids, gaseous products of combustion, liquid aerosols and soot all may have been inhaled. Following inhalation, chemicals that are not exhaled are deposited in the respiratory tract. There tissue damage may occur due to the physical effects of direct contact or the chemicals may pass through the lung-blood interface and diffuse into the blood. Health effects of chemical contact with tissue in the upper respiratory tract or lungs can range from simple irritation to severe tissue destruction. Once in the blood stream, chemicals can impact on internal organs.[2]

Applying foam to flammable liquid fires, circa early 1980s. Photo courtesy of CFA

Relative Risks of Exposure at Fiskville

Employing the approach outlined at the start of this chapter, the Investigation assessed the relative risks of exposure of different groups of people at and near Fiskville to flammable liquids, extinguishing foams, products of combustion and recycled firewater. The following discussion seeks to assess the likely risk of exposure of each group, and is ordered broadly from highest to lowest risk of exposure.

PAD Supervisor and PAD Operator

The role of PAD supervisors and operators included handling concentrated chemical materials.[6, 7] These workers were responsible for setting up the props and for filling fire and foam pits for training drills and for periodically cleaning out the accumulated sediment and solids from the bottom of the flammable liquid pits and the drainage system. Consequently, they were far more exposed far more regularly to direct chemical contact than any other group.[8, 9]

While fuels such as petrol, diesel and most used oil were principally handled in bulk, liquid flammables supplied in 44 gallon drums (200 litres) were usually manually handled. They were rolled onto the PAD and their contents sometimes decanted into smaller open containers which were carried onto the PAD (see also Chapter 5).[3, 10] PAD operators also handled foam concentrates of various types when refilling tanks on vehicles and small 20 litre containers from 205 litre drums. In addition, they would also have been exposed to low concentrations of product when cleaning up equipment and hoses that had been in contact with finished foams.

The most important exposure route is likely to have been inhalation, particularly when hot weather promoted the generation of fumes from poorly sealed drums and open containers. Given the very limited use of personal protective equipment (such as goggles) exposure through, dermal contact is likely to have been common, potentially leading to burns or skin irritations and irritation of the eyes.[8, 9] In his interview, a PAD operator at Fiskville from 1979 to 1982 described the type of protective clothing worn during actual handling of drums as ***"all we had then was the green overalls and a pair of - oh, like, riggers' gloves".***[3] Another PAD operator at Fiskville during the 1970s to the 1980s also described the regular practice of tipping fuels from open containers into the pits as "it goes through your clothing".[11]

In addition to the risk of acute exposure to known and unknown flammable chemicals, a number of staff worked as PAD operators for many years (the longest was 24 years),[8] and therefore were chronically exposed to these substances. PAD operators were also exposed to products of combustion and extinguishing agents through their work in the structural fire attack building where they would stoke the fires between groups of students. As noted in Chapter 5, the materials burnt in the building included diesel, petrol and timber. There was a general awareness between the participants that the timber was not suitable for other uses.[12, 13] In particular, one participant reports that the timber had been exposed to pesticides as part of quarantine processes and CCA treated pine.[9]

From the late 1990s, the risk of exposure of PAD operators to flammable chemicals reduced substantially. This resulted from the redevelopment of the PAD and associated changes to fuels, principally increased use of LPG, and to infrastructure. The combined effect of these changes was to reduce, but not eliminate, the need for manual handling of fuels in drums. From the late 1990s PAD personnel were still required to manually transfer small volumes of fuel into portable props from approved flammable liquid containers.

Furthermore, the 1999 redevelopment addressed compliance issues surrounding the transfer of flammable liquid and gas through the reticulated fuel supply system.

It is also worth noting that while other products were used on specialist courses, for example explosives, these were only handled by competent and licenced staff under regulated conditions designed to minimise risks.

Preparing to fight flammable liquid fire,1979. Photo courtesy of CFA

Instructors Appointed to Fiskville

Instructors appointed to Fiskville worked at the location on a full time basis. Unlike PAD operators, instructors' formal duties did not include transporting drums to the PAD or transferring the flammable contents to fuel the props or the foam pits. As a result, their direct or acute exposure to concentrated chemical products was significantly lower than that of the PAD workers. Although it was reported in some interviews that instructors would occasionally help set-up the props, this was the exception rather than the norm. For example an instructor in the 1980s stated that *"...you would help the PAD operators do the work and you're decanting because it allowed you to do your stuff quicker [allowing] you to do more fires..."*.[14]

Due to the full-time nature of their appointment, the cumulative exposure of Fiskville instructors to products of combustion, foams and recycled firewater would have been greater than that of part-time instructors who were drawn from regional staff and volunteers, and substantially greater than trainees. On a typical practical training weekend an instructor would have spent a period of six to eight hours supervising four or five drills per hour.[9] The primary exposure pathway was inhalation of smoke and liquid aerosols. Limited ingestion of firewater and particles would have been common, but this would arguably have been a far less significant exposure route than inhalation. While exposed skin quickly became coated with combustion products, dermal absorption is minor and unlikely to have been a significant exposure pathway.[2]

When talking about getting in and doing work, an instructor at Fiskville from late 1970s to mid-1990s stated that *"I guess they had the philosophy, well, you know, it's a dirty job, but...it's got to be done; that's what you're paid to do"*.[5] Participants consistently discussed being dirty from smoke, other products of combustion and firewater. Another instructor at Fiskville from the late 1980s to early 1990s also commented on some of the most obvious short term effects of fighting fires on the PAD: *"... blow your nose, and it would be quite some time before the black would stop coming ...clearly you had been in smoke, and so there was that side of it"*.[15] In discussing the measures taken to keep clean another instructor at Fiskville commented that *"...as an instructor... in the early nineties... before I went out on the PAD, I would smear my head and face and neck and any exposed skin in Vaseline so I could get clean afterwards."*[13]

Exposures to foams needs to be thought of in three ways: firstly, as exposures to the foam concentrate, the packaged product before the introduction of any water; secondly, as exposure to foam solution, the mixture of water and foam before any aeration by a foam making branch; and thirdly, as exposure to finished foam; the white fluffy aerated product that is most often thought of as 'foam'.

Direct exposures to finished foams were common both in the open on the PAD and in exercises involving the foam pits and in enclosed spaces. For example, instructors and trainees would walk through high expansion foam in the three-storey fire attack building.

In summary, this group of instructors, due to the frequency and cumulative duration of their chronic exposure, was more exposed to potentially hazardous products of combustion, foams and firewater than any other group.

Regional and Volunteer Instructors

The types of exposure risk faced by regional instructors, including both paid staff and volunteers, are considered to be essentially the same as those described above for instructors appointed to Fiskville. However these instructors were only occasionally called on to teach at Fiskville, so the frequency of their exposure to combustion products, foam and firewater were substantially less than their full-time colleagues, as would have been their long term cumulative exposure. However, many of these personnel would also have experienced some exposure to fuels and combustion products when conducting training back in their own regions and at Regional Training Grounds.

Practical Firefighting Trainees

The frequency and duration of practical training that a CFA firefighter was likely to experience varied through time. For example, a recruit firefighter in the mid-1980s would undertake a 12-week course, which entailed a high frequency of live fire training. In other periods, the duration and intensity of recruit training courses was often less than this. For example, one trainee stated that his recruit training course in 1978 ran for 'six weeks' while another trainee said his training went for 'eight weeks' in 1986.[16]

Frequency of training also tended to differ between paid staff and volunteers. Over their careers, paid staff could be expected (in addition to their recruit training) to attend several courses in order to prepare for or participate in assessments.

Frequency of volunteers' training would vary mostly as a function of their proximity to Fiskville and to Regional Training Grounds. For example, regions in close proximity to Fiskville could be expected to train at Fiskville several times a year, whereas a region in far-east Gippsland may have sent volunteers to Fiskville only once or twice a year. Frequency of attendance by commercial clients also varied, but in most cases was likely to be a one-off event.[17] For example, a trainee describes going up to Fiskville for a one-off fire fighting training in the mid-1980s with the Australia Institute of Petroleum when he worked with ESSO.[17]

Training practices also changed through time, leading to variations in the likely exposure of trainees to combustible products, foams and firewater. For example, from the 1970s through to 1996, training using flammable liquids involved small teams of students accompanied by an instructor going in to attack a fire from downwind.[18,19] As protection from the radiant heat and flames, they would use fog branches (hoses equipped with nozzles that produced a spray of fine droplets).[20-22] This practice did not involve the use of respiratory protection, for example compressed air breathing apparatus (CABA), or face masks, such as the P2, both of which would now be common practice in similar fire situations. Such direct downwind attacks on a fire would now be considered to pose an unacceptable level of risk.[13]

As one trainee who eventually became an instructor the 1990s confirms, *'we would never do that in this day and age and we should never had done it that – in that day and age'*.[13]

In summary, like their full and part-time instructors, trainees were exposed to combustible products, foam and firewater. However, while the frequency of exposure varied through time and between different groups of trainees, the cumulative frequency and hence the chronic risk of such exposures would have been far less than those experienced by a full-time instructor and probably less than those of most regional instructors.

The inadequate PPC standard in Fiskville was especially problematic during foam training. One Instructor says: **"... they generally had a fire on the second floor and then we would fill up with high expansion foam and then we ... were told to walk from the top floor, which is three storeys, down to the bottom ... we were linked together ... you know, in a ... line to the bloke in front".[13] He goes on to say that this was done without respiratory protection, merely "with a helmet across our face."[13]**

The poor PPC practices were confirmed by FN049, a foam expert who was also a consultant to CFA: **"....in those days, and I wouldn't want to put a specific, ah, year or date on them but probably about the mid-70s to at least the mid-80s, when those void spaces were filled with high expansion foam, the participants or the students would enter this high expansion foam without the use of breathing apparatus and they were encouraged to enter it by just putting their fire helmet over their face and walking through this... the danger of this is that because that's going to reduce the surface tension of mucus if that gets into the lungs, well, could I say that, ah, metaphorically you could say, 'One could drown in one's own saliva', because of the reduced surface tension of that mucus...So, you know, it was not a really smart practice". [45]**

Regional Officer Trainee

As noted above, PAD workers operated the PAD on their own apart from occasional assistance volunteered by an instructor. However for at least part of the 1970s, newly appointed Regional Officers spent a short period at Fiskville where they would act as PAD staff as part of their training. This is the only group of trainees that, at least for a short period, would have experienced similar exposures to flammable chemicals as those described by PAD operators. One of the regional trainees offers a useful insight into this group's experience, describing his rookie officer role as *"...general [labouring] duties... [working] predominantly on the practical training PAD, which involved setting fires, lighting fires, pouring flammable liquids...and getting splashed on ..."*.[5]

This group would have experienced similar levels of acute risk of exposure to raw chemicals as the PAD operators for the short period involved. However, their overall cumulative risk would have been significantly lower.

Other Fiskville Employees and Residents

Other Fiskville employees and residents have been treated as a single group as their exposure risks were similar. The key risk to this group was occasional short duration exposure to smoke. Given that members of this group would have been unlikely to be near the flammable liquids PAD or fire pits during exercises, it is unlikely they would have come into contact with foam or contaminated liquid aerosols. In any case, any such exposures would have been very infrequent and of low duration.

As noted in the previous chapter, it is also possible that household rainwater tanks used for drinking water may have contained soot and associated products of combustion. However, it was difficult to determine from interviews or documentation how tank water was used at Fiskville and whether it was affected by smoke and particles from fires. As discussed in Chapter 3, the wind at Fiskville predominantly came from the north to the west. While there were reports of east wind,[23] this was not a common occurrence. Accordingly, it is likely that the residences, the school, the administration area and the student accommodation were not often in the path of smoke plumes.

Many residents complained about water quality issues, but these were primarily due to the poor quality of reticulated water from the Ballan reservoir, reportedly arising from old pipework on-site at Fiskville.[19] This water was over time tested, treated and ultimately upgraded in 1987.[24] Similarly, while there was some reported corrosion of guttering, as the site manager at Fiskville explained, this was due to cleaning tiled roofs leading to run off of cleaning chemicals.[24] Houses and buildings at Fiskville had small water tanks collecting water from the roofs installed in 1984,[24] and these were reportedly used for drinking water in some cases,[19, 25, 26] but not in others.[26] However, there were some reports of ash in gutters.[25] Ultimately, use of tank water collected on roofs for drinking is a potential route of exposure by ingestion at Fiskville and its near neighbours.

It is possible that residents' children playing on-site may have occasionally been exposed to low levels of contamination through contact with water and sediments in Fiskville Lake, despite site rules prohibiting children from this area (see Chapter 6 for a discussion of the types and levels of contaminants). Any such exposure would most likely have been via dermal contact with water and sediments and possibly ingestion of water.

Students and Teachers at Fiskville Primary School

The previous chapter examined the potential for deposition of soot and associated contaminants to have affected children and teachers at Fiskville Primary School. The key exposure route would have been inhalation of smoke. This small school, which was closed in 1993,[27] serviced the children of families' resident at Fiskville and of neighbouring families. It was located some 660 meters east of the PAD behind a tall windbreak and adjacent to the Ballan to Geelong Road.

Interviews with families who sent children to the school, ex-pupils and two past principals have provided no evidence that the school experienced problems with smoke from training activities on the PAD or elsewhere at Fiskville. For example, participants could not recall the need to close windows or to call children indoors because of smoke.[25] The school did not use rain water tanks, and relied on mains water.[28] Consequently, it is reasonable to conclude that any exposure to staff and children to smoke would have been infrequent and of short duration.

Non - Practical Firefighting Trainees

Not all Fiskville trainees were involved in practical firefighting training utilising flammable liquids.[29] According to one instructor who was at Fiskville between 1984 to 1990, many attended theory courses (such as train the trainer),[29] courses in confined space rescue (which may have been on the PAD but did not involve fire training),[30] or off-site forest firefighting training. While trainees would have been exposed to smoke or spray draft during their attendance at Fiskville, it is likely such exposures would have been very infrequent and of short duration.

Neighbours

One of the reasons CFA chose the Fiskville site in 1971 was its rural setting and the presence of only a handful of residences within a several kilometres radius. That situation has changed little. Until late 2011, when CFA purchased the property, there was one close neighbour to the site. That property is located on the Ballan to Geelong Road, approximately 650 to 700 meters from the PAD, along part of Fiskville's southern boundary. The next closest residence is approximately 1.5 km from the PAD.

The nature of potential off-site exposures to wind borne and water borne contaminants has been considered in Chapter 6. In summary, the most likely form of exposure off-site relates to inhalation of smoke from fires on the PAD. A lower risk is ingestion or dermal contact with low levels of contaminants in water and sediment moving downstream and offsite via Lake Fiskville. The likelihood of either of these routes leading to significant exposure of people off-site is extremely low.

Furthermore, as noted in Chapter 6, Coffey Associates' investigations revealed low potential for contaminant movement offsite in groundwater. Even if it were assumed that this was occurring, the likelihood of exposure to groundwater contaminants is seen as being very low, whether via ingestion or dermal contact, since the groundwater in the area is slightly saline and is not generally used for domestic or agricultural purposes.

Table 7.1 provides a qualitative assessment of the relative risks of chronic (i.e. long-term) exposure of these groups prior to the redevelopment of the PAD and the greatly increased use of LPG.

Table 7.1 Qualitative Assessment of Relative Risks of Chronic Exposure of Various Groups - Fiskville [1971-1999]

Groups	Materials				Overall Risk of Exposure
	Flammable Chemicals	Combustion Products	Foams	Recycled Firewater	
PAD Workers	High	Medium	Low	Low	High[1]
Instructors (full-time)	Low	High	Medium	High	High
Instructors (volunteer and regional staff)	Very Low	Medium	Low	Medium	Medium
Trainees (practical firefighting)	Very Low	Low	Low	Low	Low
Trainees (regional officers - 1970s)	Low	Low	Low	Low	Low
Other employees and residents	Negligible	Very Low	Negligible	Negligible	Very Low
Students and teachers	Negligible	Negligible	Negligible	Negligible	Negligible
Trainees (non-practical firefighting)	Negligible	Negligible	Negligible	Negligible	Negligible
Persons off-site	Negligible	Negligible	Negligible	Negligible	Negligible

Note

1. **Based on giving particular weight to the groups' frequent and long-term exposure chemicals via inhalation and absorption.**
2. **Students who were residents at Fiskville are seen as belonging in the "Other employee and resident group"**

Identification of Acute Exposure Incidents

The Investigation gave a high priority to identifying and examining any acute incidents involving exposure to chemicals, extinguishing agents or firewater during training, either at Fiskville or any of the regional training grounds. This aspect of the Investigation was informed by a review of all documented CFA OHS incident reports for the period 1970-2000 as well as by the recollections of participants during interview. CFA facilitated this process, subject to strict conditions on access to protect the privacy of personal records.

Two search processes were undertaken. The first was a manual search of hard copy records predating the establishment of a computer-based OHS record system in 1994. The second was a search on post 1994 electronic records. Under the conditions established by CFA for accessing the hard copy records, the IFI Chair and a staff member reviewed more than 8,000 handwritten OHS incident summaries contained in bound journals (referred to as "parchment") covering the period 1970 -1999. These summaries included

the person's name, their location (i.e. CFA brigade or post where they were stationed), the date of the incident and a very brief description of the nature of the incident. It is important to note that these records related only to incidents which resulted in compensable claims.

These handwritten records were searched to identify any incidents that involved 'chemicals' or 'hazardous materials' or 'fumes'. Where these criteria were met, authorised CFA staff would then check the details of an incident on the relevant files. If these details confirmed that the incident occurred at Fiskville or at a regional training ground and involved material of interest, consent for access by the IFI could be sought via CFA.

The second search process applied the criteria described above to the review of the computerised summaries of incident reports post 1994. These included all incident reports, not just compensable claims. As with the hard copy records, where an incident matched the 'chemicals, hazardous materials or fumes' criteria, CFA checked the relevant detailed files to identify any that occurred at Fiskville or a regional training ground and provided additional information about these incidents to the IFI. The Investigation then decided which of these cases warranted seeking the person's consent to access the files. During both the manual and electronic searches, care was taken to follow up on any incidents mentioned during interviews to see whether they were recorded in the OHS records.

At the IFI's request, 357 incidents identified in the manual and electronic records were more closely examined by CFA. The incident files were subsequently located and reviewed against the following criteria - 'associated with training activities' and 'chemicals, hazardous materials or fumes'. CFA provided the results of this search to IFI. It should be noted that in five cases that matched the criteria, the detailed records could not be located.

The net result of this effort was to identify only four incidents that met the IFI's criteria. Examination of further detail of these incidents by the IFI confirmed that they were not significant OHS incidents relevant to the Terms of Reference. In summary, no acute incidents involving chemicals, extinguishing agents or recycled firewater at training grounds were identified in formal OHS records. Three acute incidents were identified during interviews and from other documentary sources but none was reflected in formal OHS reports. Each of these incidents is discussed in detail below.

The lack of any formally documented OHS incidents of acute or direct exposures to hazardous materials during training may arguably reflect a generally poor or variable historical level of reporting of OHS incidents at CFA. Without reaching a conclusion one way or the other on this, it is notable that the search of the post-1994 records did reveal some 153 cases involving individuals being assessed for potential exposure and harm arising from responding to hazardous chemicals emergency incidents. This demonstrates the relatively high risks firefighters face in responding to emergencies as distinct from exposure in training simulations. It is also notable that the overall number of OHS incidents reported at Fiskville from 1971 to 1999 was generally low and of a physical nature e.g. sprains, strains, broken limbs, burns and on, one occasion, a heart attack.

As noted above, a small number of acute incidents involving use of chemicals at Fiskville were reported through the interview process. The following summary of incidents includes cases that were reported by more than one person. In only one case have supporting documentary records been identified.

Review of Identified Incidents

Acute Chlorine Exposure (estimated to have occurred between 1976 & 1977)

During the 1970s and possible the early 1980s, training exercises used a range of chemicals such as sodium, phosphorus, ammonia and chlorine that were likely to be encountered in hazardous materials incidents.

It has been reported in three interviews that an acute exposure to chlorine occurred (probably in 1976) during a training session intended to familiarise people with the smell of chlorine by direct exposure to a small quantity of chlorine gas. The circumstances were described as follows:
"...they had a yellow tank full of chlorine... somebody would go over to it [and] an instructor would go over with breathing apparatus on and open it so you could see what it looked like and you could actually get a very small whiff of it in your nose ...if you got too much of it, you were in trouble."[23]

In this particular incident, the valve on the tank was apparently opened too far resulting in one person inhaling enough gas to suffer immediate acute effects. These effects were serious enough

for him to be given oxygen and taken to Ballarat Hospital for a period reported as less than a week.[31] The affected person returned to duties at Fiskville where he continued to work as an Instructor until 1977.[31]

It is unclear whether this incident resulted in any change to this training practice. One interviewee commented that the approach was changed to ensure that the instructor always wore a breathing apparatus during the exercise. However as described above, the Instructor was wearing breathing apparatus at the time.

There is no documented evidence that has been identified by the Investigation that confirms this reported exposure. The search of the CFA OHS 'parchment' outlined above, which contain compensable claims, did not have any reference to the person concerned making a claim relating to this exposure and no documented incident report was identified.

Chemical Exposure 23rd December 1982

On 23rd December 1982, following a fire in an area in which a large number of 200 litre (44 gallon) drums containing flammable liquids were stored, an incident occurred at Fiskville in which an instructor was temporarily overcome by fumes leaking from a damaged drum.[32]

The drum store was located immediately west of the current teaching centre and the drums (probably over a hundred in number) were reported to have been on site for approximately 18 months. However it was not possible to establish an exact length of time they were on-site. The condition of some of the drums was reportedly poor, with failing integrity, rust and in some cases with holes and lids that had fallen off. In a memo to the Acting Officer in Charge of Fiskville in January 1982, the drums had been described as *"showing signs of deterioration and leakage..."*.[33]

The incident occurred while the instructor and two other officers were in the process of removing the fire-affected drums (estimated to be around 20 to 30) for burial in trenches that had been dug for the purpose not far to the north of the drum store.[32] A utility was used to transport the least damaged drums to the burial site and a Chamberlain backhoe/front end loader was used to carry the damaged drums. The weather was hot and humid, with a breeze from the north. The driver of the front-end loader, who was operating downwind of the drums, was wearing a chemical splash suit and compressed air breathing apparatus (CABA). However, the other two who were working upwind were wearing splash suits and gloves, but not CABA.[32]

In a written report to the Assistant Chief Officer, an instructor of Fiskville from the 1970s to 1980s stated that *"at approximately 1654 hours whilst...driving the tractor, transferring drums to the Fiskville Utility I observed officer ... rolling a drum into position to be picked up. I noticed that a black substance had begun to leak from the end and was spilling onto the ground. [The officer] at this stage appeared to be in a daze and collapse [sic] appearing imminent."*[34] The affected officer was immediately moved to a safe area and given oxygen. His condition improved with the oxygen therapy and upon removal of the chemical splash suit and provision of a blanket to provide warmth. The instructor further stated that *"after a short period of treatment [the officer] appeared to have fully recovered."*[34] The officer did not seek medical attention as a result of the incident. Other staff were not affected.

The details of this incident are well documented in a number of reports from people present that confirm information supplied in interviews.

Chemical Exposure February or March 2002

A number of interviewees spoke about an incident that occurred around 2002. This involved an independent contractor using heavy machinery to rip lines for the establishment of a tree plantation planting. During the operation, a number of drums were caught on the ripper and brought to the surface. The driver reportedly came into contact with liquid from the drums and was affected by fumes. A further review of the documentation and interviews indicates that the incident occurred in early 2002, most likely between end February but before 5 March.[35-37]

This incident is best described by an Instructor at Fiskville who states, *"...while carrying out this work the ripper on his bulldozer had dug up 200 litre drums of the foul liquid. This liquid was on his skin, his clothing and all over the bulldozer ... [he was wearing] a khaki shirt and I don't think he had any sleeves in it, and a pair of khaki short and - and boots"*.[38] A PAD operator who was also present at the incident further states that *"...he hooked up two drums" and that "...it smelt like a solvent"*.[39]

The bulldozer operator left the machine and walked across to the gas PAD where he made contact with the course co-ordinator.[38] The bulldozer operator was described as *"... dry retching..."* by the time he reached the gas PAD.[38] As a result, the PAD operator and the course co-ordinator rendered first aid.[38, 39] The machine operator insisted on completing the job and wanted to take his machine with him that night as he had work the following day (Monday) at another location.[39] The drums were unhooked and the machine moved to an area clear of the drums for cleaning. The PAD operator and the course co-ordinator reported using five or six tanker loads of water to clean the machine.[38, 39]

The Officer In Charge (OIC) of Fiskville was notified of the incident and following an inspection of the site by the OIC and the PAD operator, a decision was made to have the drum burial area cleaned up.[14, 39] The OIC stated that an incident report was not completed nor was an investigation into the incident conducted.[14]

There is sufficient evidence based on statements from those present to confirm that an acute exposure occurred to an unknown machine operator when ripping furrows for a blue gum plantation at Fiskville in late February or early March 2002. Removal of the drums and associated contaminated soil from the area is documented in a tax invoice dated 5 March 2002 from Chemsal (Laverton North) specifying the removal of 56 drums, 136 tonnes of contaminated soil and approximately 2940 litres of product over four days. This also supports the estimate of the date of the incident. Environment Protection Authority transport certificates issued 5 March (no 817000 and 849683), 6th March (no 849684 and 844217), 7 March (no 844218) and 15 March (no 844226, 844228 and 844230) provide further support for this date.[35, 36, 40-44] Based on a search of incident reports and witness statements no incident report appear to have been completed for this incident. This was inconsistent with CFA policy effective then and now. There was also no evidence a report was made to the relevant statutory authority as required under the *Victorian Occupational Health and Safety (Incident Notification) Regulations 1997*.

Conclusions

Since the flammable liquids PAD reopened in 1999 following its redevelopment in 1997-1998, there has been a significant reduction in the risk of direct exposure to potentially hazardous chemical products for PAD workers, instructors and trainees at Fiskville. This is due primarily to the redevelopment of the PAD and adoption of LPG as the principal fuel for training exercises, significantly reducing but not eliminating the use of drummed materials and the need for manual handling of flammable liquids.

8 BURIED DRUMS

Term of Reference 1E

"On the basis of available information, assess the risk that there are buried flammable substances drums and/or other related contaminants on the site; where possible identify the location of such materials and make recommendations about any clean up and remediation required; identify where information is considered to be inadequate to enable a risk assessment and recommend action to improve the information base (which may include carrying out exploratory sampling of soils)."

Historical Context

Through the 1970s and until the late 1980s, when dangerous goods and industrial wastes began to be directly and more tightly regulated, drums containing both solid and liquid chemical wastes were commonly landfilled in Victoria. With the exception of the Tullamarine landfill (the sides of which were clay lined) these landfills lacked even the most basic engineered safeguards necessary to safely contain hazardous wastes. The State's industrial waste management industry was in its infancy and safe treatment and disposal routes were not readily available. As a result many companies stockpiled waste, some of which may have ended up in Fiskville.

However, by the early 1980s, there was growing community awareness and debate on the need to safely dispose of hazardous wastes. By 1986 Victoria had its first Industrial Waste Strategy,[1] which was supported by the *Environment Protection (Industrial Waste) Amendment Act 1985*[2] and new regulations establishing a 'cradle to grave' system of controls over hazardous wastes. This system drove the development of an expanded and more sophisticated waste management industry able to treat a broad range of liquid chemical wastes and led to a ban on landfilling of liquid hazardous waste in 1987.[3]

As discussed in previous chapters, for many years drums of flammable materials were obtained from a variety of sources and their contents used for fire-fighter training at Fiskville. These practices were largely undocumented and the exact nature of their contents was often unknown. Even where drums had labels, these may not have matched their contents, which in many cases were likely to have been mixtures of materials rather than unadulterated products. As is the case with their contents, the number of drums brought on site and exactly how long this practice continued is unclear. The practice of accepting, disposing of and burying drums appears to have waxed and waned over time. For example, former managers at Fiskville reported giving directions to cease taking drums from unknown sources in 1980;[4] following the 22 December 1982 drum fire[5] and post 1996 site reviews.[6] However, drums continued to periodically be accepted at Fiskville through most of the period of the Investigation as outlined in Chapter 5.

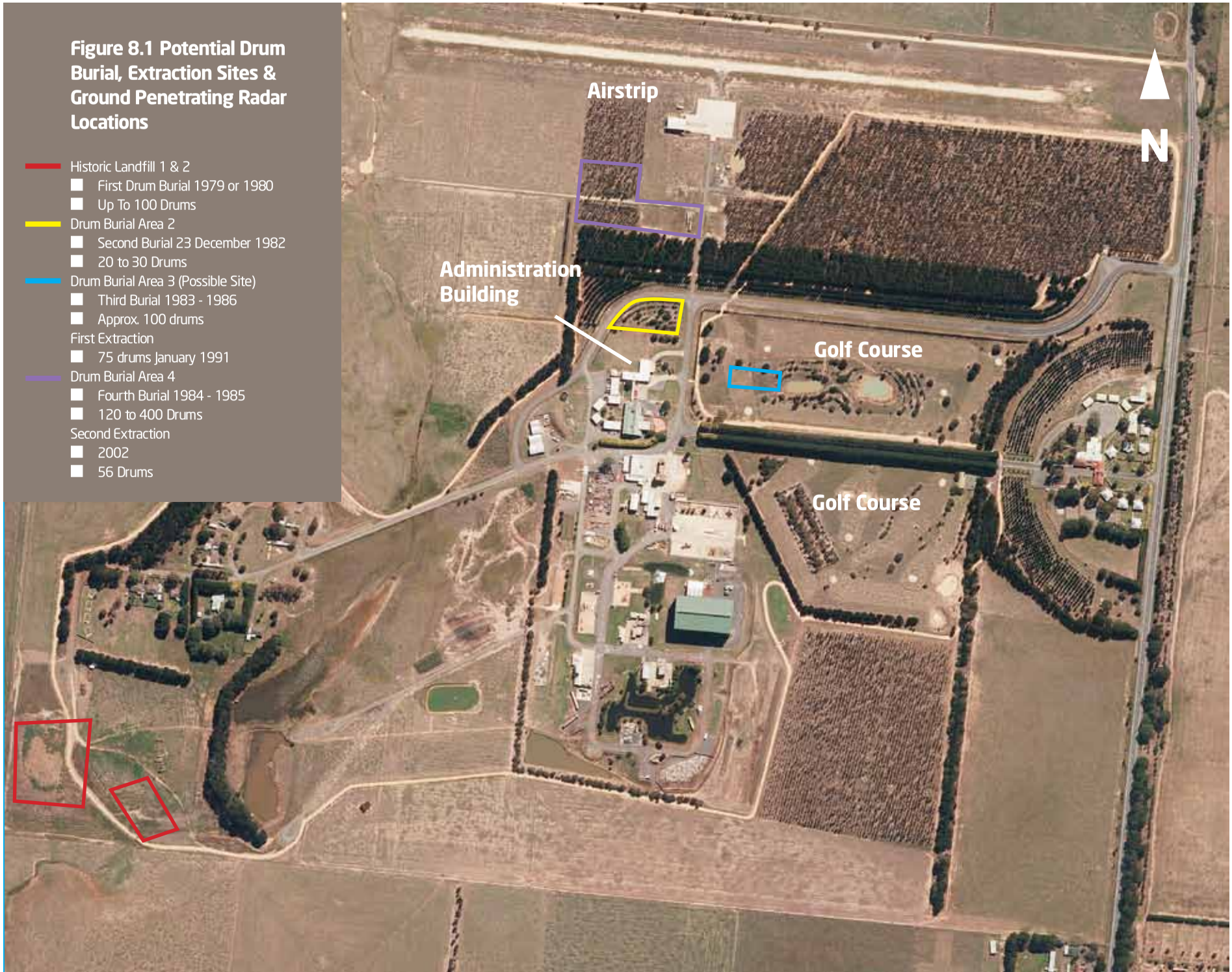
Information from a significant number of ex-Fiskville PAD operators and instructors makes it clear that, while the practice of accepting and burying drums varied over this period, it originated and was conducted primarily at the local level. Until 1987, when the Investigation has evidence of corporate awareness of the response to the burial of drums following a fire on 22 December 1982,[7] knowledge of the practice appears to have been limited to staff and management at Fiskville. This lack of corporate awareness reflects the operational independence of Fiskville management and a lack of corporate environmental or safety systems through this period.

Figure 8.1 Potential Drum Burial, Extraction Sites & Ground Penetrating Radar Locations

- Historic Landfill 1 & 2
  - First Drum Burial 1979 or 1980
  - Up To 100 Drums
- Drum Burial Area 2
  - Second Burial 23 December 1982
  - 20 to 30 Drums
- Drum Burial Area 3 (Possible Site)
  - Third Burial 1983 - 1986
  - Approx. 100 drums

  First Extraction
  - 75 drums January 1991
- Drum Burial Area 4
  - Fourth Burial 1984 - 1985
  - 120 to 400 Drums

  Second Extraction
  - 2002
  - 56 Drums



Drum Burial at Fiskville – an Overview

The practice of burying drums was almost completely undocumented, which makes getting exact information on locations or numbers of drums buried very difficult. Most of what the Investigation understands of drum burials has come from interviews. A small number of documents, including EPA waste transport certificate records for hazardous wastes (a legal requirement from 1 January 1986),[2] relate to the two known exhumations of drums since 1990.

As a broad generalisation, two different situations characterise the on-site burial of drums at Fiskville. Firstly, it was reported that drums were regularly returned to their suppliers for reuse, particularly where they were in good condition. However, throughout the 1970s, and probably from time to time during the 1980s, drums of industrial waste which had been used on the flammable liquids PAD which were not returned to their supplier were routinely buried in small batches in either or both of two landfills near the south-western corner of the property. While the drums were reported to be empty,[6] in practice many would have still contained viscous or solidified residues. By contrast, on at least two occasions during the 1980s, burials of larger quantities of drums, most of which would have been likely to be full, took place into pits or trenches at different locations on the property. It is also considered possible that a burial took place during the late 1970s. In the case of two of these burials, there is documentary evidence that all or most of the drums were exhumed and transported off-site for disposal on two separate occasions after 1990.

The primary purpose of this chapter is to provide a chronology of what is known about the disposal and extraction of chemicals drums at Fiskville. The Investigation has assessed the risk that buried drums remain on site and made recommendations in relation to drums that are likely to remain buried at Fiskville. However, the full facts about drum burial and exhumation at Fiskville are likely never to be known. The Investigation has concluded the risks posed by any remaining drums are likely to be limited and to relate primarily to groundwater or to personnel involved in excavations on the site who might accidentally expose buried drums.

Small Batch Burials in Landfill

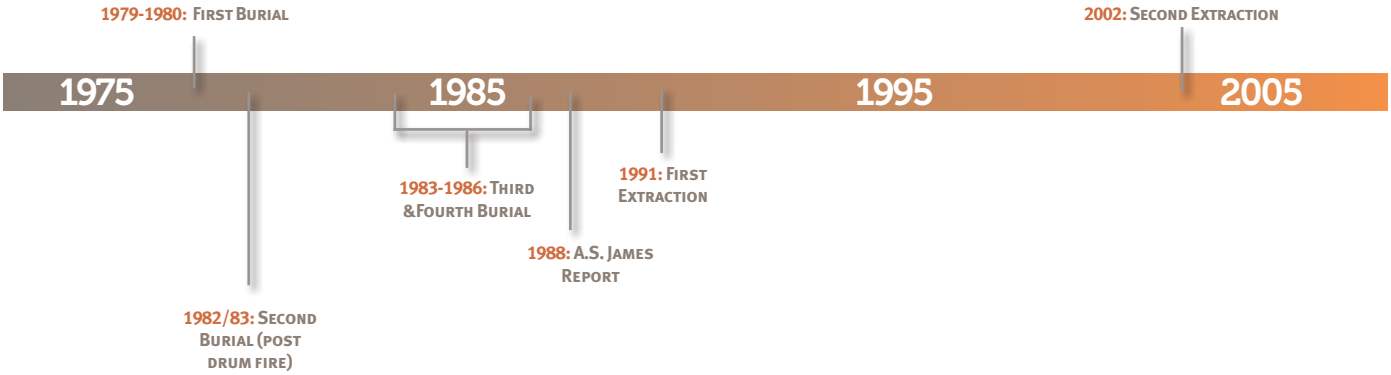
According to PAD operators at the time, when drums were empty it was regular practice to send them back to the company they had come from to be refilled and re-used.[6, 8] After repeated use, some drums ended up with a dry, hard 'sludge' that partially filled the drum, making it no longer suitable for use. At this point drums were taken to an on-site landfill, crushed with a front end loader, and buried amongst the other debris.[6, 9] Thirteen separate participants based at Fiskville in the late 70s and early 80s stated that this was regular practice during their time there. The overall number of drums that may have ended up buried in the landfill due to this practice is unclear, as the only information comes from the recollections of these participants and only one hazarded a guess at the number, suggesting could have been 'up to 100' over a 20 year period.[6] As the practice continued for many years, it is reasonable to assume that it resulted in a substantial number of drums being landfilled on-site some of which would have contained dried residues. The landfill also occasionally received scrapings from the flammable liquids PAD and the foam pits.[10]

Major Burials and Extractions

Concerns about the number and condition of drums on-site fluctuated through the 1970s and 80s, generally peaking when a specific batch of containers started to deteriorate noticeably. As far back as 1978, such concerns led to periodic attempts to dispose of accumulated drums and to restrict or ban further intake. For example, by the early 1980s, there is documentary evidence of concern being expressed by Fiskville staff over the condition of some of the stockpiled drums and the unacceptable risks associated with continuing to use their contents in training exercises on the PAD.[11, 12]

The following sections provide a brief account of the four major burials and two extractions of drums that the Investigation identified.

Figure 8.2 Timeline of Fiskville drum burial and extraction



First Drum Burial: 1979 or 1980

The first major drum burial reported to the Investigation occurred in 1979 or early 1980. It was reportedly ordered by the then Officer in Charge (OIC) of Fiskville and was prompted by concern that the contents had corroded the drums which would often release unpleasant vapours that 'anybody walking past would get a lungful'[4] of if the wind was blowing in the wrong direction. The drums were located near the main access road from the staff living quarters to the administration building. The drums were reportedly buried in a large pit dug in the vicinity of either an old landfill dating from AWA's ownership of the site or at the newer landfill established by CFA in the 1980s. Both of these were located near the south-west corner of the property not far from the staff residences.[4] The pit was dug by a contractor who regularly worked at Fiskville[8, 11] and could have contained up to 100 drums. No records have been discovered indicating that drums have been removed from this area. Due to the strong likelihood of other metal debris in these landfill locations, it is difficult to ascertain exactly where these drums may have been buried, making potential extraction very difficult. The only evidence of this burial comes from a single interview with a senior officer with first-hand knowledge. However, in the absence of any confirmatory evidence, the Investigation's confidence in relation to the location and extent of this burial is limited.

Second Burial: 23 December 1982

The next burial concerned an uncertain number, most likely 20 to 30, of a stockpile reported as up to 160 drums that were delivered to Fiskville by an unknown contractor using a semi-trailer in mid-1981.[11] Soon afterwards, two instructors attempted to light the contents of one of the drums and concluded they were too volatile to use safely in practical drills.[11] After this, unsuccessful efforts were made to dispose of the drums through commercial means. In January 1982 an instructor[11] took samples from a variety of different drums and sent them to a commercial waste management firm Cleanaway for assessment. The then OIC informed the Investigation[5] that he directed the site manager[13] to try to get Cleanaway to remove the drums.[14] The report on the samples from Cleanaway was reported by an instructor as noting that some of the chemicals in the drums were toxic, corrosive and had a low flashpoint. Cleanaway reportedly refused to remove the drums due to the danger of moving such hazardous chemicals in containers that were in a poor condition. In a memorandum dated 12 January 1982, the instructor[11] alerted the Acting OIC to the refusal by Cleanaway and suggested talking to two other groups, Chemorganics or EPA for advice on removing the chemicals.[12] There is no record of this suggestion being taken further.

On the 22nd December 1982 about six of these drums, located behind the training centre, caught fire and were subsequently extinguished. The day after this incident the OIC[5] reported that he ordered that the drums be buried to avoid any similar incidents. Around 20 to 30 fire-affected drums were then marked for burial. The same contractor, who assisted in the first burial outlined above, dug trenches using a front-end loader. The OIC informed the Investigation that he directed

that the drums be rolled into the trenches, split open and set alight to burn off most of the product reportedly in order to protect ground water supplies.[5, 13] He recalls that the drums were buried in three trenches directly to the north of the administration building and describes standing over the three trenches and looking at the burnt remnants of the drums and realising that there was a significant amount of product that had not burnt.[5]

Before all of the drums had been transported to the burial site and placed in the pits, one of the officers[11] was temporarily affected by fumes and work on burying the drums ceased for the day. The exact date when the burial of the remainder of the fire affected drums was completed is not known. However, it is reasonable to conclude that burying of the remaining drums would have been completed very soon after the incident on 23rd December and that the trenches prepared and partially filled with drums on that day would have been used for this purpose. This is supported by an instructor[15] who indicated that the other fire-affected drums were buried around this time.

The officer who drove the front-end loader transporting the drums from the site of the fire to the burial trenches on the day following the fire[15] has revisited Fiskville with Professor Joy. Without hesitation, he identified a treed area to the north of the current administration building as the burial site.[15] This is supported by the OIC[5] who stated that the location of the drum burial, north of the administration building, was chosen to avoid run off into the water supply to the west, as this area was flat. He also stated that the drums would not have been buried in the area that is now part of the golf course, to the east of the administration building.[5] The location north of the administration building is also supported by both a PAD operator[8] and site manager.[13] Two of those present on 23rd December, recall the burial being at a different site - an instructor placing it to the east[16] and a PAD operator placing it much further to the west.[17]

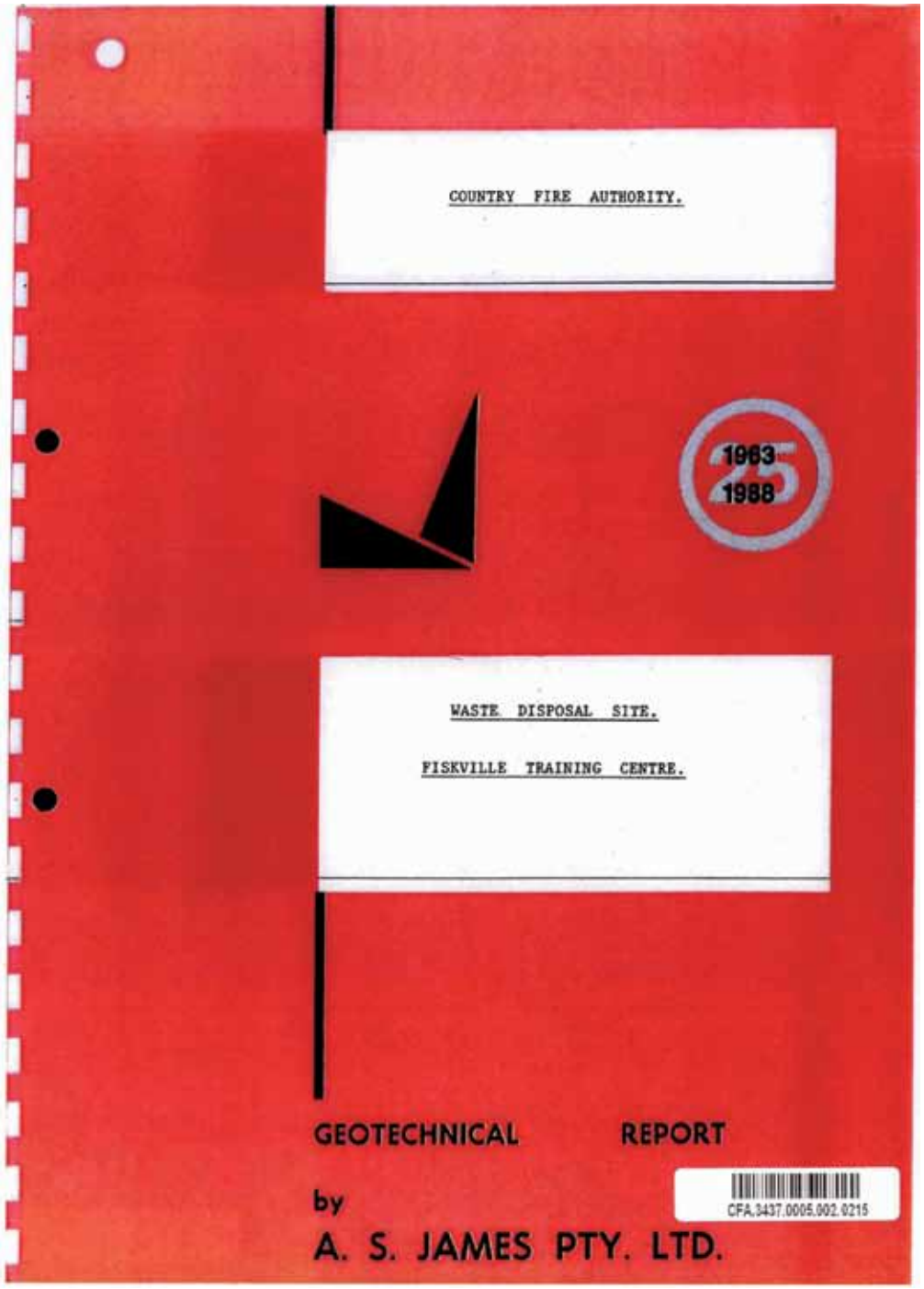
Due to the fire and the exposure incident on the following day, this burial has significantly more documentary evidence around it than other mass burials. This documentation includes an instructor's written report[18] on the incident, another instructor's memo[12] on the incident and an OIC's statement.[14] However, none of these documents specified the site of the burial, nor did they provide any information on who completed the burial and when this was done.

Third Burial: Probably 1983-86

At some point, possibly as early as 1983, but more likely a year or two later, the remaining drums from the stockpile (probably numbering more than 100) that had not been affected by the December 1982 fire were buried on-site. The Investigation has not been able to find either first-hand information or documentation in relation to this burial, so our conclusions regarding it are based on inference considering factors such as timing, number of drums and condition of drums.

In 1988, following concerns raised by an instructor over the possible health hazards associated with the contents of the drums involved in the 1982 fire,[19-25] CFA's corporate human resources branch contracted A.S. James, a firm of geotechnical consultants, to conduct testing on industrial waste buried at Fiskville and to recommend an appropriate long term approach to management of the area. It was reported to the Investigation that A.S. James was working at Fiskville in 1988 on building works. At some point, likely to be early May, CFA staff asked A.S. James workers and another contractor to assist with uncovering and sampling the contents of buried drums. A.S. James was then commissioned to produce a report on the content of those drums. While a participant[26] involved recalled being led exactly to where the drums were buried and assisting with this sampling around 1986, it appears likely to have been 1988. The Investigation has the invoice[27] for a contractor for works 'digging up' drums in May 1988, and records of the East Melbourne Laboratory receiving samples to test for A.S. James on 6 May 1988. A.S. James provided their report to CFA on 1 July 1988.

A participant[26] identified a location on what is now a golf course west of a dam as the burial site based largely on his memory of roads at the time. Infrastructure, including roads, has changed since 1988, and this participant was the only person to identify a potential drum burial site in the golf course. Moreover, this is a highly visible site and major works would have been evident to passing trainees and Fiskville staff. It may have been that one of the other existing drum burial sites (such as the site north of the administration buildings where the fire affected drums are likely to have been buried) was also the site of this third burial and of A. S. James' works. The participant recalls that the drums were forty-four gallon capacity. The drums were in three trenches, some 30 to 50 metres in length which were filled in again once sampling took place.



A.S. James Geotechnical Report, 1988

Based on this description, it is unlikely that these were the fire-affected drum discussed above, since those drums had been split open and set alight.[5] Further, the trenches described by the consultant, totalled between 90 and 150 meters in length, much longer than would have been required to bury the relatively small number of fire-affected drums, but long enough to dispose of the 100 or so unaffected drums.

Testing was conducted by East Melbourne Laboratories for A.S. James on nine samples from the drums and on a tenth sample taken from the surrounding clay to test for potential seepage of chemicals from the drums. The laboratory report concluded that *"the principal contaminant at the site consisted of aromatic compounds i.e. resins or solvents, and may include benzene, toluene, xylene and phenol. Materials of this type are slowly biodegraded and their presence would normally constitute an environmental problem".*[28] In light of these results, the consultants' report concluded that the only way to ensure that, over the long-term, breakdown of the drums did not result in contaminants reaching groundwater was to remove the material and dispose of it in a suitable manner.

Fourth Burial: probably 1984 or 1985

Sometime, most likely in 1984 or 1985 another large drum burial occurred on site at Fiskville. The identity of the person responsible for ordering the burial is unclear. According to the PAD supervisor,[6] PAD operators were ordered to help bring up drums to an area south of the east-west airstrip. Three trenches were dug; drums were rolled into them, crushed with the bucket of a front end loader and buried. The number of drums that were buried in this location remains unclear, with only one participant[6] giving a range of possible numbers from 120 to 400. The drums in this burial were described as, for the most part, being empty or semi-empty, which makes it unlikely these were the drums that remained from the stockpile which caught on fire in 1982. Though there were several participants who discussed a burial up near the air-strip, only one[6] gave any detailed information on the method of disposal, making this burial likely, but not confirmed. The physical landscape, such as roads and plantings, has changed substantially at Fiskville over the last four decades. This makes it more difficult for participants to locate previous landmarks and therefore previous drum burial and extraction sites.

The likely area where these drums were buried could reportedly be identified in aerial photographs which were taken in 1996 (but were not located by the Investigation). This was the basis for Coffey Associates identifying and sampling that drum burial area and CRA-ATD subsequently recommending its clean up in 1997.

First Extraction: January 1991

On 16 and 17 January 1991, some two and a half years after receipt of the A S James report, 75 drums of what was described as 'solid paint waste' in accompanying EPA transport certificates[29] and 243 tonnes of contaminated soil were removed from Fiskville by the waste disposal firm Australian Waste Processors.[30] It is reasonable to assume the extraction of this number of drums at this time relates to the third burial, i.e. large volume of drums, largely intact, buried sometime after the 1982 drum fire. It is not clear where these drums were buried or extracted. This extraction may therefore have occurred at one of the two northern drum burial sites, i.e. north of the administration buildings or south of the airfield, or at the golf course site identified by one participant.

This extraction was at the direction of the then Chairman. Once alerted to the issue, the Chairman took action. He drove to Fiskville to see the drum site; sought expert technical and legal advice, and directed the removal of the drums in line with current regulatory requirements.[31]

Second Extraction: 2002

Sometime in early 2002, while using a bulldozer (or possibly a back hoe or tractor) to rip furrows for the establishment of the blue gum plantation south of the airfield, a contractor breached drums. The Investigation has been unable to identify or interview this contractor. Reportedly, the bulldozer pulled up several drums of material which splashed over some parts of the bulldozer and the contractor was adversely affected by the material (for full details see Appendix E). While no documentary record of this incident has been found, interviews with some of those involved indicate that the response by local management was immediate.[32-34] The then OIC[34] authorised the removal of the drums by Altona based company Chemsal. Over four days in March 2002 according to its records, which are supported by EPA transport certificates, Chemsal removed 56 drums, 136 tonnes of contaminated soil and 2940 litres of product from this site.[35] On the receipt for this piece of work, the drums retrieved are described as 'mainly damaged or crushed'.[35]

This drum area appears to coincide with the fourth drum burial site outlined above, and was clearly documented by Coffey in their 1996 site assessment. Furthermore, clean-up of this site was recommended in the CRA-ATD report.[36] The Investigation has no evidence such a clean-up occurred, and is supported by the bulldozer incident. The fact that the areas was ripped for a blue gum plantation appears to point to a loss of knowledge and a lack of a systematic approach to managing environmental and safety issues at Fiskville.

Findings from Golder Associates' Investigation

Golder Associates' preliminary site assessment [37] included sampling and analysis of soil from a number of areas that had been identified at an early stage in the Investigation as potential sources of contamination. One of these, the drum fire area, was immediately to the west of the training centre where a number of interviewees had indicated drums had been stored in bulk and which was the site of the drum fire in 1982. Another was the drum burial area in the blue gum plantation south of the airstrip and north of Deep Creek Road (burial site 4 see Figure 8.1). Samples were analysed for a wide variety of compounds. Subsequent, to Golder Associates' work additional sites of likely drum burial (burials sites 2 north of the administration building, and burial site 3 in the golf course and at the disused landfills) were identified by the Investigation. However, their identification occurred too late in the Investigation to permit their being added to the sampling program.

The results of Golder Associates analysis of soils from the drum fire site and from the blue gum plantation showed that levels of BTEX (benzene, toluene, ethylbenzene and xylene), PAHs (polycyclic aromatic hydrocarbons), PCBs (polychlorinated biphenyls), pesticides, perchlorates, VOCs (volatile organic carbons) and SVOCs (semi-volatile organic carbons) were below the adopted ecological and human health based assessment criteria, and indeed below levels of detection. Results showed detectable levels of TPH (total petroleum hydrocarbon), metals and PFOS (perfluorooctane sulfonate) and PFOA (perfluorooctanoic acid), and phenols at concentrations which do not indicate the potential for an adverse impact on human health and modified ecosystems.[37] These chemicals reflect the past use of petroleum fuels, firefighting foams and potentially background levels of metals in the basalt derived soils.

While evidence of compounds such as BTEX were not detected in the soil samples from either the drum storage site or the plantation burial site, it should be noted that many solvents can readily volatilise (evaporate) in surface soils, and can migrate, moving deeper into the underlying basalt parent material, possibly reaching and contaminating groundwater. In relation to possible residual contamination of areas where drums have been buried, it needs to be emphasised that the results summarised above relate only to sampling of one burial site – a site from which drums were probably removed some eight years ago.

Given the lack of certainty around a number of potential drum burial sites, Golder Associates was asked to commission a search for potential drum burial sites using ground-penetrating radar (GPR) at three locations nominated on the basis of information gleaned from interviews and documentation. The areas nominated for testing included four potential drum burial sites: drum burial site four the area south of the airfield; drum burial site three in the golf course to the east of the administration building; and drum burial site two north of the administration building. Locations tested are shown on Figure 8.1.

The GPR search was carried out by Cardno Aus Pty Ltd. Their report concluded "No anomalies were detected that resembled the suspect buried drums that were the focus of the Investigation. Subsurface conditions limited the effective penetration of the radar signal to a depth of no greater than 2.0m. Also no indications of trenches were identified through the GPR survey process."[38] These results are therefore not conclusive and further assessment of these sites may be possible. However, they add weight to the conclusion that only limited numbers of drums are likely to remain buried at Fiskville.

Summary of Findings

General disposal in to landfill on-site:

The Investigation found no documentary or anecdotal evidence of action to retrieve the drums that were periodically crushed and dumped in the old AWA landfill and later in the landfill established by CFA, both located at the rear of the property. As noted, verbal accounts indicate that the drums were generally empty or if partially full probably contained solidified product rather than liquid. While it is uncertain when this practice was discontinued, use of the AWA landfill probably stopped with the establishment of the separate landfill by CFA in 1984. This landfill ceased taking all forms of waste (including scrapings from the flammable liquids PAD) in1996, when EPA advised a licence would be required for it to continue operating. This prompted CFA to close and subsequently cap the landfill.[10]

In light of the above and in particular given the length of time over which CFA landfill has been closed and capped, it is unlikely to pose a significant on-going risk to human health or to the surface environment due to escape of gas or leachate. However, the landfill may pose a residual risk to the environment through groundwater contamination. Consideration of the need for further remediation, if any, of the landfill should follow further assessment of the potential for soil and groundwater contamination at the site as recommended by Golder Associates and supported in the Investigation's findings.

First 1979-80 burial:

The drums reported as being buried in bulk in the AWA landfill seem to have remained undisturbed. This is most likely due to the lack of any perception of a need to recover such material in the decade or so after the burial and, thereafter, due to the lack of awareness that the burial had ever occurred. As there is no documentary or anecdotal evidence suggesting that these drums have been removed, if the burial did take place, it is likely any migration of contaminants away from the site will have already taken place, possibly impacting on surface and groundwater. The recent construction of a walking path through this old landfill, which appears to have only minimal cover, has brought material such as old ceramic insulators to the surface. Apart from any further work to assess the likelihood of residual contamination associated with burial of drums, the AWA landfill site needs to be properly drained and capped.

Second burial of fire affected drums 1982-83:

As noted above, it appears most likely that these 20-30 drums were buried directly north of the administration building, as this is where most people directly involved in the incident have indicated the drums were buried. The Investigation has no evidence these drums were removed.

Third 1983-86 burial:

It appears likely that some 100 drums were buried but the location of the burial is uncertain. Some of these drums appear likely to have been the ones uncovered, sampled and recovered by consultants A.S. James in 1987 and eventually removed for disposal off-site in January 1991.

Fourth 1984-85 drum burial:

It is reasonable to conclude an unknown number of drums were buried in trenches to the south of the airfield in an area that is now a plantation and that some or all of these were exhumed and removed for disposal off-site in 2002 after an incident in which some drums were brought to the surface during tree planting operations.

Overall, the Investigation was unable to find conclusive evidence that would give a clear indication of the likelihood of buried drums remaining on site at Fiskville. This is due: to burials, and, to a lesser extent, subsequent exhumations, being poorly documented; to the failure of the ground penetrating radar to detect anomalies that might betray the presence of buried drums; and finally, to the understandable difficulty experienced by those involved in recalling in detail events that occurred thirty or more years ago.

MANAGEMENT RESPONSE

9

Term of Reference 1B

"Identify and list any documents or reports that contain comments on or recommendations about the use and disposal of flammable substances and extinguishing agents used for live firefighting training at Fiskville and on the management of fire water generated in such training; to the extent that it can be determined, report on how effectively each comment or recommendation was acted upon; and, where no action was taken, comment on the reasons for and implications of such lack of action"

This chapter addresses the key questions around what CFA management, at various levels, knew about materials and training practices at Fiskville from 1971 – 1999. More specifically, it focuses on reports and recommendations received by management about these matters and examines the nature and consequences of their response or, where there was no response, the consequences of inaction. The chapter provides a detailed chronology of key reports, memos and audits relating to health, safety and environment issues at Fiskville, exploring in detail a significant series of events triggered by a fire and acute exposure incident in December 1982 (details of the fire and the incident have been provided in Chapter 7). This is followed by an overview of the evidence presented and a series of conclusions.

Avgas storage at Fiskville, non-compliance with Bureau of Air Safety, 1995/96. Photo courtesy of CFA

Chronology of Documents and Reports

1970s

The IFI's search has not revealed any documents relevant to this Term of Reference, during the first eight years of Fiskville's operation.

1980s

1980: Contaminant Concerns

March 1980

The *Fire Command* (a journal published by the Australian Fire Protection Association) included an article 'Warning on Use of Waste Oils'. This reprinted article from the December 1979 *Maryland Fire and Rescue Institute Bulletin*[1] warning firefighter agencies that:

> *"Certain oils, normally used by utility firms (electricity and telephone) and disposed of as waste to fire training agencies, have been found to [contain] high [levels of] PCB [polychlorinated biphenyls]... Until more information is available, all fire departments should continue to be very careful in the acceptance of contaminated fuels for burning exercises and should make every attempt to have the supplier provide an exact description of the product. [Those] who use waste oils [are advised] to be more careful when using these materials during training."*

The ACO (that is, the OIC) at Fiskville brought this article to the attention of the Chief Officer (CO) noting that "the Training Wing uses considerable quantities of sump oil and I am concerned that similar problems might exist".[2] The CO sought information on PCBs from the CFA's Research Unit. On 24 June 1980, an officer in CFA's Research Unit provided a report to the CO indicating serious health and environmental risk of PCBs.[3]

> *"The possibility that waste oils used for training purposes might be contaminated with PCBs deserves careful analysis because of the toxicity and environmental hazard of these materials.... They are carcenogenic [sic] and give off highly toxic fumes when burned. The combination of toxicity and resistance to chemical breakdown makes them a serious environmental hazard.... Disposal of PCBs is strictly regulated by the Environment Protection Authority. They are therefore considered a difficult industrial waste disposal problem. Hence a motive exits for the passing on of undeclared hazards for disposal by others. In the case of doubt, the presence of PCBs can be readily detected by chemical analysis. The use of 'sump' oil for training purposes would be free from the dangers of PCB contamination provided the supplier can certify that the oil originated only from waste engine or vehicle lubricating oils. It is recommended that only oils that can be certified in this manner be used for training purposes at Fiskville."*

30 June 1980

The CO provided a copy of this report to the ACO Fiskville noting "the obvious solution is to be more selective in choosing waste oil for this purpose. Please take appropriate action".[4] The Investigation has limited evidence of what action was taken at Fiskville following this.

July 1980

Dulux's manager of manufacturing in Victoria wrote to the ACO in response to a query to their Safety Officer on the use of waste thinners Dulux supplied for use in fire pits at Fiskville. The Investigation has not found a copy of the query. The letter assures that the thinners do not contain PCBs but *"... is*

basically Aromatic and Aliphatic Hydrocarbon solvent, hence the dense black smoke that is generated. This smoke would contain irritants, but as far as we are aware nothing of any highly injurious nature would be involved."[5] Interviews with Fiskville managers confirm concerns about possible contamination of fuels with PCBs. For example, one Fiskville manager says:

> *"We knew all about the dangers of oils from transformers and all that, with PCBs and whatever".* [6, See also 7, 8].

Following these initial expressions of concern and inquiries, there is no evidence of any action to address the issue. In particular, other than the approach to Dulux, there is no evidence to indicate that attempts were made to obtain assurances from suppliers of waste oil, solvents and other fuels that the materials were free of PCBs. Given the practical difficulties in obtaining reliable assurances from the many small scale suppliers that the used fuels they were donating to Fiskville were free of PCBs, it seems likely Fiskville management simply decided to continue the practice rather than lose a useful supply of flammable liquids.

While outside this Terms of Reference, the Investigation noted evidence from 1984 that CFA was concerned about firefighters responding to emergencies involving PCB contaminated SECV fuels.[9]

1981 - 83 Problems with Drums

Sometime, probably in mid-1981, a large consignment of flammable materials in drums was delivered to Fiskville.[11] This consignment was of concern to some staff at Fiskville, particularly one Instructor,[11] because of the poor quality of some drums and the noticeable presence of odorous vapours. As a result of his concerns, the Instructor, in consultation with the OIC, took samples from a number of drums with a view to finding an appropriate commercial waste management firm able to dispose of these materials. The samples were sent to Cleanaway, a waste disposal firm.

12 January 1982

Memo from FN118 to Acting OIC.[15] This memo advised the Acting OIC that Cleanaway could not accept the material in the drums for disposal because the flashpoints were too low. The memo also noted that another alternative for disposal may be Chemorganics or that EPA may be able to advise on this matter.

22 and 23 December 1982 and January 1983

Fire in drum storage area and subsequent acute exposure of an officer to fumes (for a detailed description see Chapter 7).

29 December 1982

(a) Memo from Instructor FN118 to acting OIC Fiskville.[12] This was the first of two memos of this date from this officer to the OIC. The memo describes the circumstances of the fire, attributing it to spontaneous combustion, and actions taken to bring it under control.

29 December 1982

(b) Memo from Instructor FN118 to acting OIC Fiskville.[13] The memo describes the circumstances on the day following the fire, when FN118 and two other officers were tasked by the OIC to bury the fire affected drums. It details the approach adopted to transport the drums and the fact that only the officer operating downwind of the drums was equipped with breathing apparatus. The memo describes how FN118 was exposed to fumes from material leaking from one of the drums. FN118 detailed how he and one of the other officers were overcome by the fumes and had to receive oxygen. He goes on to state that *"no ill effects persisted"*. It should be noted, however, that the other contemporary written report on the accident and information obtained at interview indicate that FN118 was the only officer affected by the fumes.

30 December 1982

Memo from Station Officer FN283 to Assistant Chief Officer FN283 [that is, OIC Fiskville] reporting on the incident involving FN118.[14] The memo set out the sequence of events leading to the incident on 23 December and broadly matches FN118's account apart from indicating that only the one officer (FN118) was affected.

As noted in Chapter 7, no record of this incident has been found in the search of CFA OHS records, nor is there any evidence from the document search or interviews that the incident was brought to the attention of human resources staff or to the DCO responsible for Fiskville. It was not until 1987 that head office personnel and eventually the Chairman became aware of the fire, FN118's exposure and the eventual burial of the fire affected drums (see discussion below.)

1987 - 1991 Revisiting the 1982 Drum Fire and Chemicals Exposure Incident

16 September 1987

FN118, the Officer who had been temporarily affected by chemical fumes while moving fire-damaged drums at Fiskville in December 1982, wrote to the CFA Chairman.[16] The Officer advised that he was absent from work following an illness that had resulted in damage to his hearing. He outlined the circumstances in which he had been exposed to chemicals at Fiskville and said that his medical specialist wanted to obtain details of the chemicals to assist with diagnosis and treatment of the Officer's condition.

Over the next six to eight weeks, inquiries were carried out to identify and obtain statements from people involved in the events of 22 and 23 December,[18] and to find any contemporary records of the event.[19, 20] The documents summarised earlier in this chapter were located, however no one was able to provide definitive information about the contents of the drums.

20 October 1987

The Officer again wrote to the Chairman. His letter focused on matters relating to superannuation, but also sought a reply to his earlier letter regarding chemicals.[17]

9 November 1987

The Chairman replied to the Officer addressing processes related to medical disability and superannuation. The letter also noted that the Chairman had requested a full investigation and report of the chemical exposure incident. The letter was signed by the Chairman as well as by the Supervisor of Personnel Services.[21]

12 November 1987

The CFA Manager Personnel Resources replied to the Officer's letter summarising what CFA knew about the fire and the subsequent incident.[22] The letter was headed "Exposure to Chemical Fumes" and quoted at length from the report (noted earlier in this chapter) prepared on the incident by FN283 which described the drums as containing ***"solvents, thinners and other unknown substances (... believed to be acetone)."*** The letter concluded by stating that in view of the length of time since the drums were buried ***"... short of digging up the drums to have them chemically analysed which may prove to be fruitless I do not believe that any further information will be obtained."***

22 January 1988

The State Secretary of the United Firefighters Union wrote to the CFA Chairman stating that the Officer had written to the union indicating it was essential that the materials to which he had been exposed be identified.[23] The State Secretary advised CFA that their action in burying the drums 'poses further environmental problems'.

10 February 1988

The CFA Chairman responded to the union.[24] He notes that the matters raised are under active consideration and that the Authority had moved to:

- Ascertain extent and nature of all data in the Authority on the drums and their contents
- Ascertain whether the drums pose an immediate danger to health through soil contamination
- Ascertain the contents of the drums
- Receive expert advice on whether or not they can be safely stored at Fiskville.[24]

Around that time, CFA commissioned geotechnical consultants A.S. James to ***"determine the nature of the [buried] waste and to recommend an appropriate long term approach to future utilisation of the site."*** The consultant's report to CFA was dated July 1988.[25] As noted in Chapter 8, the analytical report on samples taken from the buried drums by A.S. James concluded that ***"the principle [sic] contaminant at the site consisted of aromatic compounds i.e. resins or solvents, and may include benzene, toluene, xylene and phenol. Materials of this type are only slowly biodegraded and their presence would normally constitute an environmental problem".***

8 September 1988

The Deputy Chief Officer (Operations Services) sent a memo to the Acting Chief Officer noting that EPA had been contacted about the disposal of the hazardous material.[26] EPA had advised due to the doubtful integrity of the drums, the solidification of the material in drums, the low flash point of the materials and their possible toxicity, they could not be disposed of to landfill. As a consequence, the Deputy Chief Officer recommended that the burial site remain undisturbed.

3 August 1989

The Chief Officer wrote to the Deputy Chief Officer (Operations Services) referring to the A.S. James report.[27] The Chief Officer requests that discussion take place with the Hazardous Materials Division, Department of Labour and Industries to seek their advice on necessary action.

7 August 1989

The Chief Officer made a handwritten annotation to Acting DCO (Operations Services) in the memo of 8 September 1988 indicating that this matter has ***"again been referred to me".***[28] The CO wrote that he would like to discuss the options with ACO Fiskville and Deputy Chief Officer (Operations Services).

19 December 1989

The CFA was advised by the CSIRO in 1989 that copper chromium arsenic (CCA) treated timber 'should not be burnt'. In a memo from the Regional Officer in Charge (Research & Development), the Assistant Chief Officer (Training Wing) was advised that the CSIRO "***will test residues from the (fire) building to determine if copper residues exist."***[10] The Investigation has not found any information to suggest that these tests were carried out.

16 May 1990

The next record identified by the Investigation is from 16 May 1990, when the United Firefighters Union again wrote to the Chairman of CFA.[29] Since the Union's earlier letter, the previous Chairman had retired and a new Chairman had been appointed. The Union's letter stated that they had been unable to find a final report or advice from the Chairman regarding the drums and noted that there was a "very strong possibility" of media intervention, and that the situation could "blow-up" in the very near future.

21June 1990

The Officer wrote to the new Chairman seeking a copy of the previously requested chemical analysis report and expressing disappointment at the delay in supplying data of samples taken in 1988.[30] On 23 July 1990 he again wrote to the Chairman requesting a reply to his letter of 21 June.[31] On 24th August, CFA's Human Resources Manager wrote to the Officer, noting that CFA took samples of the soil and water at Fiskville in May 1988 and advising that levels of benzene, toluene, xylene (BTEX) and phenol had been found.[32]

4 October 1990

The Chairman wrote to the Deputy Chief Officer, regarding the ongoing discussions concerning waste disposal.[33] He indicated that following an independent expert review of CFA's file on the drums, it was "prudent" to take advice on the removal of the material. Specifically, he asked the DCO to consult with the Assistant Chief Officer, EPA, Chemsal and Harpers (commercial waste disposal firms), and come back to him to formulate a plan.

29 October 1990

The Human Resources Manager wrote to the Officer providing a copy of a report of analysis of compounds buried at Fiskville as requested.[34]

13 November 1990

The Officer replied to the Human Resources Manager acknowledging the information received and expressing the opinion, based on previous discussions with CFA Human Resources Management, that *"should there be the likelihood of a health risk of the buried deposits. There were others involved who I felt should warrant advice along with myself. I was told that should samples be taken advice would be distributed I do feel that this should be done."*[35]

21 January 1991

The Officer wrote to the Chief Officer, advising that his medical tests had revealed reactions to petrochemicals and phenol and seeking a meeting to discuss these results.

21 May 1991

The Officer wrote again to the Chief Officer, noting that he had tried unsuccessfully on several occasions to meet with the CO and seeking advice on a non-operational role that might be available for him at Fiskville.[36]

29 May 1991

The Chief Officer replied.[37] His letter focused on matters relating to the officer's possible return to employment. The subject of chemicals and the buried drums was not raised.

28 October 1991

The Officer again wrote to the Human Resources Manager advising that he had been told that the chemicals buried at Fiskville had not been removed.[38] He was also seeking advice as to whether this was the case.

12 November 1991

The Human Resources Manager replied confirming that works were undertaken in mid-January 1991 by a recognised firm of waste processors to remove and safely dispose of the buried drums.[39]

11 December 1991

The Officer replied requesting results of analysis of chemicals removed from the location.[40]

8 January 1992

The Human Resources Manager replied, noting that when the chemicals were removed from Fiskville ***"the soil and drums were in such a state that it was difficult to make any further analysis".***[41] He concluded that he was unable to provide him with further chemical analysis.

Summary

This long series of documents was initiated by the health concerns of a single individual, but it goes to the heart of this Term of Reference. Management at Fiskville appear to have considered the initial fire and chemicals exposure incident in December 1982 to be a local matter. The Officer exposed to the fumes had recovered rapidly and the drums had been buried soon after the incident.

The matter was not seen as something that necessitated taking it up the line to head office. That it eventually came to the notice of the CFA Chairman and senior management nearly five years later was solely due to the subsequent medical concerns of the individual and the fact that his medical specialist perceived a possible connection between his illness and the earlier chemical exposure.

From the record set out above, it can be seen that, while the Officer raised the matter directly with the Chairman, it was seen and dealt with as a human resource matter. The Chairman initiated a search for background documentation and reports from those who had knowledge of the incident. The letter to the Officer of 12 November 1987 from the Manager Personnel Resources demonstrated a strong disinclination to dig up and sample the materials in the drums.

In 1988 the United Firefighters Union wrote to the Chairman stressing the need to identify the chemicals and raising concern about the environmental consequences of burying the drums. Following the Union's letter, the organisation's focus shifted to the drums and their contents. The CFA commissioned consultants whose report described the drums as containing a range of aromatic compounds which may have included BTEX. At that stage CFA attention focused on how to manage the buried drums. The records from September 1988 indicate that they could not identify an appropriate commercial firm able to take the materials and as a result the decision was made to leave them in the ground.

In 1989 a new Chairman was appointed to CFA. Unlike previous Chairmen, the person appointed had no past involvement with CFA and believes he was viewed as an outsider. At interview, he has indicated that the concerns raised by the Officer were brought to his attention and that he quickly decided that the drums must be removed.[42] For reasons that are not clear from the documentation, that decision was not implemented until January 1991, when the Investigation has documentary evidence that some 75 drums and 253 tonnes of contaminated soil were removed from Fiskville by Australian Waste Processors Pty Ltd.[43] According to the Chairman, some members of the Board did not support his decision to have the drums removed.[42]

In August 1990, some two years after the consultant's report identifying the drum contents, CFA advised the Officer of the types of chemicals that had been identified. Two months later, CFA provided him with a copy of the consultant's report on the basis that he would treat it as confidential. The Officer replied two weeks later expressing concern that if these materials were likely to pose a health risk, others who might be affected should be informed. There is nothing in the records examined by the Investigation to indicate that CFA did this and interviews with those involved in the incident on 23 December 1982 confirm that the Officer was the only person advised about the materials by CFA.[44, 45]

1987 - 1991: the Fiskville Master Plan

April 1987

The Chief Officer FN279 prepared a report on the Fiskville Master Plan for consideration by the CFA Board on 6 April 1987.[46]

The origins of the Fiskville Master Plan date back to a limited concept plan prepared in 1978 when the CO was OIC Fiskville. That plan proposed an upgrade to the administrative block. It was never implemented due to budget limitations. Increased staff and a higher volume of trainees in Fiskville during the mid-1980s caused the CO to revisit the 1978 concept plan and use it as the basis for development of the Master Plan.

The Master Plan involved centralising management facilities within Fiskville and improving the infrastructure including the practical training areas, accommodation and recreation facilities and the potable water supply system.[46] A key argument put by the CO in support of the plan was that the practical training facilities were limiting the function of Fiskville, and that the proposed upgrade of infrastructure would draw in more commercial clients.

The Board approved the Plan, which was expected to cost $2.15 million. Some $250,000 of this was for:

> *The large-scale expansion southward of the practical training area, together with training props, water and fuel reticulation....[and] ...improvement of liquefied and gaseous fuel supplies to meet projected training and student and instructor accommodation needs.*[46]

The Board also approved the hiring of a consultant over two years to further develop and implement the plan.

By March 1988 the budget for the Fiskville upgrade had increased to $2.4 million. Later that year, the Chairman saw an opportunity to secure external funds for the plan by putting a submission to the Australian Assembly of Fire authorities (AAFA) for Fiskville to become a National Training Centre. While this bid was unsuccessful, its development and pursuit were given priority over the Master Plan despite the view of some managers that it should go ahead in parallel with the bid.[47] In June 1989, the consultant submitted their final report on the Master Plan.[48] This fully developed version of the plan was approved by the Board on the 16 November 1989, by which time the redevelopment of the PAD was already underway.[49] Some two and a half years later, in August 1991, the newly appointed CEO decided against approving further capital funding for Fiskville that financial year.[50]

One CFA manager who was responsible for local management decisions argued in his interview that this decision led to development of Bangholme being prioritised as the 'jewel in the CFA crown', which meant that funds were diverted away from Fiskville.[51] This was considered to have resulted in the need for Fiskville to become self-sustaining and drove the need for training more commercial clients. The view that Bangholme was made a priority at the expense of Fiskville was strongly rejected by the CEO when interviewed by the IFI.[52]

Ultimately, the redevelopment of Fiskville in this period driven by the Master Planning process led to significant upgrades in infrastructure. The documents reviewed by the Investigation show that the primary motivation behind the Master Plan was the need to expand facilities at Fiskville to cope with increases in the number of trainees through the 1980s and a desire to attract more commercial clients to the facilities. The key elements of the plan reflected these drivers: expansion of accommodation and recreation facilities and upgrade of the physical infrastructure associated with the liquid flammables PAD.

While there is no evidence that health, safety and environment considerations were central to the development or implementation to the Master Plan, a number of these upgrades improved safety and environment outcomes. For example through improvements to the reticulated supply of liquid flammable fuels and LPG to the PAD, the filling in of the foam pits, the installation of a triple interceptor trap and aerator in Dam 1 and the construction of Dam 2.

1990s

May 1990 - July 1993: Focus on Training

May 1990

Acting Deputy Chief Officer (Operations) publishes the *Field Training Grounds (FTG) Policy Document* establishing a uniform training policy.[53]

First drafted in April 1988, the draft *Field Training Grounds - Policy Document* was distributed to senior officers with intention to send the final report to the Board for approval.[54] It was eventually published two years later. The reason for the lengthy delay is unclear.

At the time that the FTG Policy was drafted, the three main CFA training grounds were Fiskville, Wangaratta and West Sale. The policy recognised the need to address issues including the lack of uniformity of training programs and operating standards, the lack of training resources at Fiskville, the need to establish cost effective regional training grounds and the need to integrate CFA training into the National Training Reform Agenda. The policy provided the impetus and the framework within which the remaining four regional training grounds were established in the 1990s as further detailed in Chapter 10 and Appendix D. The policy advocates a similar funding model to the Fiskville Master Plan relying on income from third party organisations.

The FTG Policy, unlike the Fiskville Master Planning process, explicitly notes the need for all the regional sites to comply with the Occupational Health and Safety Act 1985 and for this to be included in all standing orders or operating procedures. The policy also directs that all fuel storages must be installed in accordance with the relevant codes of practice or Australian Standards.

August 1992

The CFA appointed a Director of Management Development and Vocational Training to develop a strategic, long-term policy framework. Features of the strategy include decentralising training and integrating CFA training into the National Training Reform Agenda. This review became an input to the 1993 report on Field Training Grounds.[55]

November 1992

A Business Manager was appointed to Fiskville charged with identifying commercial opportunities and improving utilisation and performance of the site. To support this manager, the CFA commissioned KPMG to develop a 'Status Paper' on the Fiskville Training Wing.[56] This report focuses primarily on the business model for Fiskville, particularly on demand for use of Fiskville, staffing models, infrastructure, financial practices and revenue. There is some very brief discussion of recycling of water, however this appears to relate to recycling of treated water from residences and related sources, rather than to water from the practical training facilities. The report comments that "pollution" is an issue for the site, with one paragraph noting that runoff of firefighting water containing dirt and oil may cause "pollution"' which would require clean up "should the facility ever have to move". A second paragraph notes the large amounts of smoke produced, but concludes that this should not be an issue in a remote location. Health, safety and environment issues are not considered systematically or at any length in the report.

1993

A report on Field Training Grounds Policy prepared by the Management Development and Vocational Training Department identified that the hazardous materials shed at Fiskville posed a health problem. This recommendation was not actioned until 1996, when the *Dangerous Goods, Occupational Health and Safety, Environmental Audit Report (the 1996 DG & OHS Report)* drew attention to the fact that these requests had gone unanswered.[58]

February 1993

Report on Field Training Grounds (FTGS), prepared by the Management Development & Vocational Training Department.[57] This report was commissioned by the State Training Committee following the August 1992 appointment of the Director Management Development and Vocational Training to provide a greater senior focus on training. One of the key features of this Director's role was to integrate CFA training into the National Training Reform Agenda. That is, to align the CFA training with the Australian Fire Competencies.

This competency based approach to training allowed the CFA to systematically integrate training for volunteer and career personnel. As part of the Director of Management Development's portfolio, the 1993 report reviewed the CFA's existing training policies, principally the 1990 *FTG Policy Document*. The report drew on interviews with senior staff and volunteers and included a physical review of Penshurst, Gippsland, Wangaratta and Fiskville. The 1993 report reinforced the need for an integrated approach to training policies and procedures for all the field training grounds. The report was framed within the broad policy context set by the FTG Policy, but unlike that document did not discuss occupational health and safety issues.

28 July 1993

The Western Region Inspector of the Health and Safety Organisation (HSO) of Victoria served Fiskville with a violation notice relating to dangerous goods requirements, in particular signage. The 1996 *DG & OHS Report* commented that the notice was not actioned.[58] This report stated that the notice was delivered to the PAD Supervisor who did not action the recommendations for two years, until 1996, when Fiskville was served with several further notices. The Investigation has no evidence of follow-up by the HSO in this period.

May 1995-April 1996: Sedgwick Report & Management Responses

May 1995

Sedgwick Ltd was commissioned by CFA to prepare *Liability Risk Audit* of the Fiskville Training Ground.[59-61] Sedgwick had been appointed CFA's insurance brokers in 1993.[59] In March 1994, Sedgwick presented a Strategic Risk Management Review at the CFA Finance Committee meeting.[61] The Sedgwick Fiskville audit report presented a range of preliminary findings which are akin to a standard occupational health and safety hygienist audit.[62] It did not evaluate the issues considered by this Investigation, though it does make recommendations to make fuel reticulation and storage infrastructure safer, e.g. with bunding, signage and extinguishers. The safety of recycled water was canvassed in terms of potential bacterial contamination.

May 1995

Sedgwick Ltd was also commissioned to prepare a 'Property and Liability Underwriting Report' for the CFA Penshurst Training Ground at Penshurst.[63] This report was prepared for insurance underwriting purposes, and while it identified potential hazards, it was focused on potential financial loss liabilities for insurers. It was not an exploration of health, safety or environment risks and their mitigation.

15 June 1995

The final Sedgwick Fiskville report was delivered to the Director of Risk Management at CFA.[64] No feedback to Sedgwick is evident.

24 August 1995

Sedgwick wrote to the CFA Risk Management section following up their recommendations for Fiskville and Penshurst.[65] Upon this prompt, the Risk Management section apologised for the delays, saying they hoped that the Sedgwick review might help their reporting structure in the future.[66] CFA assured Sedgwick that their report had been forwarded to the Manager Operations Training Delivery.

January 1996

The Operations Manager forwarded the Sedgwick Report to the Area Manager for further review and comment.[67] Further internal communications follow sporadically over the next four months, with different managers seemingly unclear as to whose responsibility it was to review and action the recommendations.

24 April 1996

In response to the Sedgwick report, the District Officcer wrote a memo to the Manager Operations Training Delivery and copied the Fiskville Manager stating that many of the various recommendations could not be met as they were deemed to be too costly, unnecessary, or outside of the scope of his managerial portfolio.[68]

1995-1996: Lead up to the 1996 Dangerous Goods, Occupational Health and Safety and Environmental Audit

9 March 1995

The Structural Fire Safety Department instituted a program to ensure all CFA sites, such as fire stations, were compliant with dangerous goods regulations. As a part of his role the Structural Fire Safety Department, one CFA Dangerous Goods Inspector conducted a site inspection of Fiskville and delivered a report to the Fiskville Business Manager.[69] FN010 described how his inspection involved looking "at specific items required under the regulations which were signage, manifest, fire protection of the product...and the emergency management arrangements on-site...their emergency management plan."[70]

One of the Officer's recommendations related to the need to instigate self-assessment under the Dangerous Goods Act 1985. The Dangerous Goods Inspector commented that full compliance would require an ongoing audit process and offered his support to assist. The author of the 1996 *Dangerous Goods, Occupational Health and Safety and Environmental Audit Report* informed the IFI that the Dangerous Goods Officer's report was not fully actioned by management.[51]

The primary role of CFA officers who were delegated authority under the Dangerous Goods Act 1985 was to inspect commercial premises for compliance. These Structural Fire Safety Department officers were able to recognise that Fiskville, while being part of their own organisation, was a dangerous goods site under the Act and should comply with legislation. It appears staff from this department used their training and delegated powers and their own initiative to drive consideration of dangerous goods matters within CFA.

24 October 1995

CFA Dangerous Goods Inspector who had conducted the Fiskville Dangerous Goods inspection on 9 March 1995 submitted a memo to District Officer Fiskville advising of the requirements for the flammable liquid drum store under AS1940:1993 *The Storage and Handling of Flammable and Combustible Liquids*.[71]

27 October 1995

CFA Dangerous Goods Inspector who had conducted the Fiskville Dangerous Goods inspection on 9 March 1995 submitted a memo to District Officer Fiskville.[72] He advised the requirements for the transport of aviation fuel under the Road Traffic Regulations (Victoria).

December 1995

Regional Officer working in Community Risk Management (and who would later become the Manager of CFA Community Infrastructure and Environment), observed on-going clear non-compliance with dangerous goods storage during a site visit. This was despite the March 1995 inspection. He subsequently contacted a Fire Protection Officer attached to the CFA Risk Management Department, who then conducted an inspection at the Fiskville site on the 18 January 1996.[58]

18 January 1996

Following the inspection, the Fire Protection Officer directed that a follow-up inspection occur in one month's time. CFA's Occupational Health and Safety Officer and local management were advised.[73]

12 February 1996

The Bureau of Air Safety contacted the PAD Supervisor giving CFA one month to comply with safety standards on the storage of aviation fuel.[73] The Bureau warned the PAD Supervisor that failure to comply would lead to the serving of a direction notice. The PAD Supervisor did not make this warning known to subsequent inspectors, as noted in an inspection report from 1996.[73]

13 February 1996

Fiskville was inspected by the CFA's Occupational Health and Safety Officer.[58, see Appendices] During this inspection it became evident that there were many issues that required attention within the PAD area and maintenance shed. He arranged a follow up inspection that occurred two days later.

15 February 1996

The Fire Protection Officer instigated an inspection with a Health and Safety Organisation Inspector (Western Zone).[58] A number of deficiencies were identified relating to the storage of dangerous goods at Fiskville as well as a number of items on the previous HSO direction notice of 28 July 1993 and the March 1995 report by the CFA Dangerous Goods Inspector that had not been addressed. As a result of this inspection, the HSO served CFA with a prohibition notice (number 3224045) dated 15 February 1996.[58, see Appendices] This prohibited the use of the LPG props on the flammable liquid PAD.

The 1996 *Dangerous Goods, Occupational Health and Safety, and Environment Audit Report* & Management's Response

In early 1996 a Fiskville Instructor was tasked to undertake a review of dangerous goods, occupational health and safety and environmental issues at Fiskville (i.e. the 1996 DG & OHS report referred to above). The Instructor reviewed previous audits, reports and notices, commissioned significant further investigations and actively engaged regulators, particularly EPA and HSO to ensure the site was in compliance with regulatory requirements.[51, 58] These included assessments of soil, surface water and ground water contamination.

21 February 1996

Memo from the Instructor who conducted 1996 DG & OHS Report of Fiskville to the PAD Supervisor.[58, see Appendices] The memo issued a standing order to all staff that transport of flammable liquids in open containers was a prohibited practice.

31 May 1996

The *Dangerous Goods, Occupational Health and Safety and Environmental Audit Report* was submitted to the Chief Officer of the Country Fire Authority.[58] The Instructor reportedly focused on environmental compliance because the penalties were then much higher under the *Environmental Protection Act* 1970 than under the *Occupational Health and Safety Act* 1985. This provided greater incentive for local staff to comply and corporate staff to support greater compliance.[51] The report made recommendations on 44 items. Some of the issues identified in the audit report and actions taken included:

- licenses were required for staff operating specialist equipment;
- permits were required for construction and maintenance procedures and for hot work;
- a decision was taken to no longer accept fuel in unidentified drums;
- a decision was taken to provide Material Safety Data Sheets (MSDSs) and to label all dangerous goods; and
- a series of directives was issued requiring compliance with safety procedures for the storage and transportation of dangerous goods.

The Instructor also raised concerns about firewater and Dam 1 and recommended closing the flammable liquids PAD and implementing a long term environmental strategy. The Instructor requested environmental contamination tests from Minenco,[74] CRA,[75-77], Diomides,[78] Coffey Associates,[79, 80], Rio Tinto,[81] and Central Highlands Water Laboratory Services.[58, Appendices] (see Chapter 8 and Appendix C).

As a consequence of these various assessments, a direction was given to staff that hydrocarbon waste from the flammable liquid PAD was not to be dumped into the surrounding environment. As a result of the 1996 *Dangerous Goods, Occupational Health and Safety and Environmental Audit Report*, the flammable liquid PAD was closed in late May 1996.

Late July 1996

The Fiskville OH&S Committee was established.[82] The Committee contacted EPA seeking advice on further groundwater testing and the landfill.[83-85]

August 1996

As further environmental testing continued, the Instructor issued new occupational health and safety directives, and wrote to Fiskville management to seek support on compliance. For example, in August, he wrote a memo, concerned that potentially hazardous props were still being used.[86] He also wrote to the PAD Supervisor FN155 reminding him that, under legislation, the maximum quantities of fuel on the PAD needed to comply with his previous directives.[87,88]

November 1996

CFA corporate management and Fiskville management engaged in communication about the various environmental reports that had been prepared throughout the latter part of the year.[88]

November 1996

CRA ATD was commissioned by CFA to review the environmental status of the site and evaluate remediation options. The Investigation does not have evidence this plan was comprehensively considered or responded to. A number of key recommendations, for example to clean up Dam 1 and a known drum burial site, were not actioned.

December 1997

CFA commissioned Rio Tinto to prepare a remediation action plan for the flammable liquids PAD and old fire training pits (that is, foam pits) through bioremediation or land farming (see Chapter 6).

Mid-1997

As the fuel reticulation system had not been in use for around 12 months, Fiskville management informed EPA that they wished to reopen part of the flammable liquid PAD.[89,90] This does not appear to have occurred. Other site upgrades and reports were pursued throughout the year, including a Dangerous Goods Inspection Report and waste water and Class A foam investigations.[90,91] By the end of November 1997, the CFA Joint Training Committee Meeting discussed the approval of Fiskville's flammable liquid PAD upgrade.[92]

Early 1998

Coffey Partners undertook soil excavation, validation and reinstatement from the flammable liquids PAD and fire training pits.[93] Rio Tinto delivered remediation in accordance with their Remediation Action Plan.[81,94,95] (See Chapter 6).

May 1998

GHD was commissioned to produce a Report on Upgrade of Flammable Liquids Training PAD that included consideration of the need to improve treatment of waste firewater.[96]

November 1998

AMCOSH delivered the report to Fiskville Area Manager, *Health and Safety Risk Audit of Country Fire Authority Training Grounds*.[97] It identified the need to improve documentation of systems and procedures at all CFA training grounds. It supported the upgrade of the flammable liquids pads and directed that hazardous chemicals needed to be stored according to regulations. The report further recommended:

- that all training sites should adopt an occupational health & safety management system such as Safety Map;
- that Standard Operating Procedures should be developed based upon the FTG Manual of Operations;
- that PAD operating briefs should be developed and incorporated into standard operating procedures; and
- that all training grounds should develop emergency procedures.

In addition, the report included various recommendations about making safety documentation requirements uniform, making material safety data sheets (MSDSs) readily available, regularly auditing systems and procedures, and training volunteers about safety requirements and best practice. The report recommended that the CFA work with the Victorian Workcover Authority and the Environment Protection Authority during the removal, transport and disposal of asbestos. It further recommended that: "All hazardous substances should be labelled in compliance with the Draft Occupational Health and Safety (Hazardous Substances) Regulations 1998".[97:p.4]

June 1999

Remediation of Hydrocarbon Contaminated Soil. Rio Tinto was commissioned by CFA to prepare a report validating the soil bioremediation.

September 1999

Construction of the upgrade of the Flammable Liquids Training PAD was completed.[103]

An Evaluation of Management Response

A key element of Term of Reference 1B asks the Investigation to consider "the reasons for and implications of" any lack of action on comments and recommendations about health, safety and environmental impacts of live fire training at Fiskville. There are different ways of considering and drawing inferences from the chronology outlined above. This section comments on management, regulatory, cultural and strategic factors which might reasonably be considered to underlie the response to health, safety and environment issues at CFA training sites.

Management

The Board

The Investigation could not find evidence, including through extensive searches of CFA Board minutes, that the Board considered issues around the management of Fiskville other than day-to-day and operational issues. As one CFA Chairman from the early 1990s notes, the Board would discuss "the colour of the fire trucks", and yet "There was no such thing as a strategic plan, no business plan or whatever."[52]

The Investigation has identified only three incidents involving acute exposure to chemicals at Fiskville, throughout the term of the Investigation. Given that none of these raised sufficient concern at the level of Fiskville management to warrant reporting to head office, it is not surprising that none came to the attention of the Board. While as detailed above, two Chairmen were briefed on matters relating to the 1982 drum fire and its consequences, there is no record in the minutes to indicate these matters were raised with the full Board. The Chairman from 1989 – 1991 has told the Investigation that some membrs of the Board did not support his decision to have a large number of buried drums and associated contaminated soil removed from Fiskville in January 1991.[42] It appears that the Board was ultimately made aware of the issue by this Chairman at some point.

Throughout the period of the Investigation, it is not evident that the Board considered health, safety and environment issues more generally or strategically, or that it raised or drove consideration of these issues. For example, there is no evidence that the Board reacted to new regulatory requirements such as the Occupational Health and Safety Act 1985. This is not to suggest that the members were not concerned about the health and welfare of CFA's people. Commenting on this, the CFA Chairman from 1991 -1999 said that:

"The Board is critical to your investigations, in my view ... it's a representative Board of which there were four - still are - four volunteer members, two rural two urban ...there would be nothing that happened in the CFA ... that would be unknown to those four volunteer members of the Board. Very, very important point... their sole purpose in life was to protect volunteerism. And if - if one of them saw that there was some health issue emerging, they would have been on it."[52]

This CFA Chairman stressed that the Board was a representative board including volunteer and community members through most of this period.[52] It is understandable that it did not adopt modern governance practice such as enterprise risk management. At the same time, systems approaches to safety and environment issues were being established through the 1980s and 1990s and it is notable CFA did not adopt these approaches at a corporate level. From the early 1990s, the new CEO and his Human Resource Managers instigated numerous corporate reforms that included strategic planning at the Board level for the first-time in the CFA's history.[52, 98] This included hiring its first occupational health and safety manager in 1994.

Executive Management

For much of this period, the Chief Officer was the senior executive position in the organisation as determined by the *Country Fire Authority Act* 1958. In 1991, a new Chairman was appointed with a brief from the government to modernise CFA.[52] This Chairman explicitly took on the role of an executive chairman (a CEO in all but name). Through the 1990s, the Executive Chairman focused on corporate functions, instituting a range of organisational reforms. At the same time, the role of the Chief Officer was focused more narrowly on operations.

As the above chronology demonstrates, Chief Officers were regularly made aware of issues at Fiskville and were directly involved in shaping its long term future, notably through the development of the Master Plan in the late 1980s. Through the 1970s and 1980s, Fiskville was ultimately the CO's responsibility as an operational function. From 1992, as a result of the organisational reforms noted above, Fiskville was managed under the corporate human resource executive.

Fiskville Management

There was a regular turnover of 'career firefighters who became instructors and managers at Fiskville as they progressed through their careers. Management response to health, safety and environment issues at Fiskville outlined in the chronology appears to have varied substantially and was dependent on the approach of key individuals and relationships at Fiskville at the time. In the absence of standard practices, procedures or reviews, staff and managers were left to exercise their own discretion on many key issues. The Investigation concludes individual staff raising safety issues were challenging the predominant culture and practice and notes they were at times seen as "trouble makers".[11,51]

The Regulatory Environment

Another factor to consider is the regulatory environment – both evolving regulations and the role of regulating agencies such as WorkCover (formally known as the Health and Safety Organisation) and Environment Protection Authority (EPA). Health, safety and environment regulations in Victoria evolved significantly between 1971 and 1999, reflecting increasing community concern about worker safety, human health and the environment. This evolution is outlined in Chapter 3.

In its early days, many of the activities commonly undertaken at Fiskville such as landfilling a variety of wastes and chemicals storage and handling were unregulated.[99] Awareness of the hazards of chemicals to humans and the environment was a developing issue. Training and safety in many industries was ad hoc. Over time, community concern and debate grew and were reflected in new regulations and significant pressures to improve health, safety and environment practices across Victoria.

A key development was the new occupational health and safety legislation of 1985. New dangerous goods regulations were also established in this period, focusing specifically on ensuring high levels of safety for bulk storage and use of potentially hazardous liquid chemicals. In parallel, in 1986 EPA released Victoria's first Industrial Waste Strategy[99] which shaped a new regulatory regime to control industrial wastes "from cradle to grave", as well as strengthening provisions designed to protect the environment and regulate operations like landfilling.[100]

For the period of the 1970s and 1980s, the above chronology does not demonstrate any systematic, planned approaches by CFA to considering and ensuring compliance with health, safety and environment

requirements for training grounds. From the evidence available to the Investigation, by the early 1990s, Fiskville was not compliant with a range of regulatory requirements.[58,69,72,73,101] It was increasingly out of step with wider community expectations and practice in other sectors or even other firefighting agencies.[96: pp.16-17, 102,104]

It should also be noted that the documentary evidence demonstrates regulators evinced little interest in Fiskville. Regulators too have scarce resources, and these were likely to have been focused on much higher risk sites than Fiskville, which was remote, small and run by a government agency. In addition, until the 1990s, regulators were generally reluctant to review and take enforcement action against other government bodies.

By the early 1990s, an increasing number of CFA staff, particularly those with roles relating to dangerous goods and occupational health and safety issues, could see Fiskville as a site with poor, non-complying practices. They could see that Fiskville was not practicing what CFA was preaching to commercial sites with significant stocks of dangerous goods.

It is apparent that these internal change agents used regulatory requirements and actively engaged regulators to gain corporate support for improved practice, including some site clean-up and upgrade to facilities. It is also notable that after 1996, there was no further engagement with the site by EPA (except around approval to burn tyres), and limited engagement by WorkCover.

Health Safety and Environment Culture

Health, safety and environment protection were not a focus of culture, practice or systems at Fiskville through the term the Investigation considered. The firefighting culture, particularly in the 1970s and 1980s, was 'can do' and paramilitary. Firefighters were encouraged to be uncomplaining, brave, and to follow orders. This has strengths in firefighting situations, but may have contributed to not recognising and accepting unnecessary risks during training. This was demonstrated by examples of putting trainees in purposefully risky situations, for example in smoke and foam, and a resistance to wearing personal protective equipment, when it was available, in some training situations.

Health, safety and environment issues were raised periodically by Fiskville staff from early days. However, they appear to have been responded to in a largely ad hoc manner. All levels of CFA seemed to view the issues in isolation and did not recognise them as signals of the need to consider health, safety and environment matters more broadly both at Fiskville and corporately. Lessons learned and the impetus for change was lost when staff changed or were moved on. For example, documented concerns, such as those raised about possible contamination of fuel with PCBs, do not appear to have led to thinking through the whole fuel supply approach and how it could be made safer.

While individual Fiskville leaders reportedly banned the practice of accepting drums of fuel, or at least poor quality drums, this appears not to have been documented or embedded. The drivers that led to acceptance of drums in the first place (such as costs) continued and the practices appear to have re-emerged repeatedly. Loss of corporate memory is also revealed in the case of drum burials. In 1997 a consultant's report clearly mapped a historical drum burial site south of the airstrip and recommended it be cleaned up. Not only does this clean up not appear to have occurred, the existence of the site appears to have been forgotten until a bulldozer driver ripping the area for plantation establishment was overcome by fumes in 2002.

Over the period the Investigation considered, improvements in firefighter safety did occur. For example, training was standardised and professionalised through the development of national curricula. Tragedies like the Linton fires drove rethinking about firefighter safety. But this does not appear to have extended to considering the need to minimise the risks of hot firefighter training while providing realistic training experiences. It seems to have been difficult for most parties at CFA to see their own training sites and training activities as themselves generating risks to people and the environment which should be considered and could be managed.

As the chronology demonstrates, health, safety and environment matters were generally not or only marginally considered in plans to develop Fiskville and RTGs, whereas, factors like increasing demand, growing costs and limited budgets dominated. By the early 1990s, this contrasted strongly with the situation interstate. There, other Australian fire agencies contemplating the development of their firefighter training facilities were concerned to minimise health, safety and environment impacts, while providing realistic hot firefighting training experiences.[96, pp.16-17,102,104]

By the mid 1990s, a number of staff at Fiskville and in corporate roles that focused on safety and dangerous goods recognised that Fiskville had significant health, safety and environment issues. Eventually, some Fiskville staff were asked to take a more holistic look at these issues. Redevelopment plans for Fiskville – largely responding to increased demand – did take some of the issues into account. As noted above, it is significant that staff pushing for change felt impelled to use regulatory requirements to ensure CFA management's attention to these matters.

The Investigation cannot comment fully on corporate approaches through this period as the Investigation focused on training grounds and relevant corporate documentation was not readily evident. Fiskville staff did not appear to get advice or support on health, safety and environment matters from head office until the dangerous goods staff focused on the site in 1995.

Even after the extensive studies and plans of 1996 and 1997, the response from Fiskville and corporate management appears limited, with no evidence of follow up, review or auditing of previous recommendations. Only some of a large number of recommended actions appear to have been implemented. Just as importantly, the Investigation saw no evidence of a fundamental, lasting cultural shift to considering health, safety and environment issues in planning and operational practice.

Strategy and Systems

Throughout the 30 year span considered by the Investigation, Fiskville and the regional training grounds lacked a systematic approach to health safety and environment issues. Rather the approach was largely reactive (a culture which often characterises emergency response organisations) and not strategic. A systematic approach would have sought to look at the issues and drivers holistically, and test whether individual issues and incidents were part of broader issues requiring systemic solutions. A systematic approach would have documented issues and embedded responses so that subsequent action would not have depended on individual staff members' memories and commitment, and would have been taken with clear corporate authority.

There is little evidence available to the Investigation that the key reports and recommendations that did focus on health, safety and environment issues at training grounds were fully considered and acted upon. Planned, documented responses to such reports and recommendations were not evident over the period, even as recently as the late 1990s, nor were responses regularly reviewed or independently audited. Without some type of "plan-do-review" cycle, systematically applied, achieving sustained, much less continuous improvement is difficult. While limited budgets can undoubtedly restrict the range of practicable responses to consultant and internal recommendations, a planned approach can ensure that available budget goes to the highest risks and that priorities for further budget bids and allocations are understood and pursued.

10 REGIONAL TRAINING GROUNDS

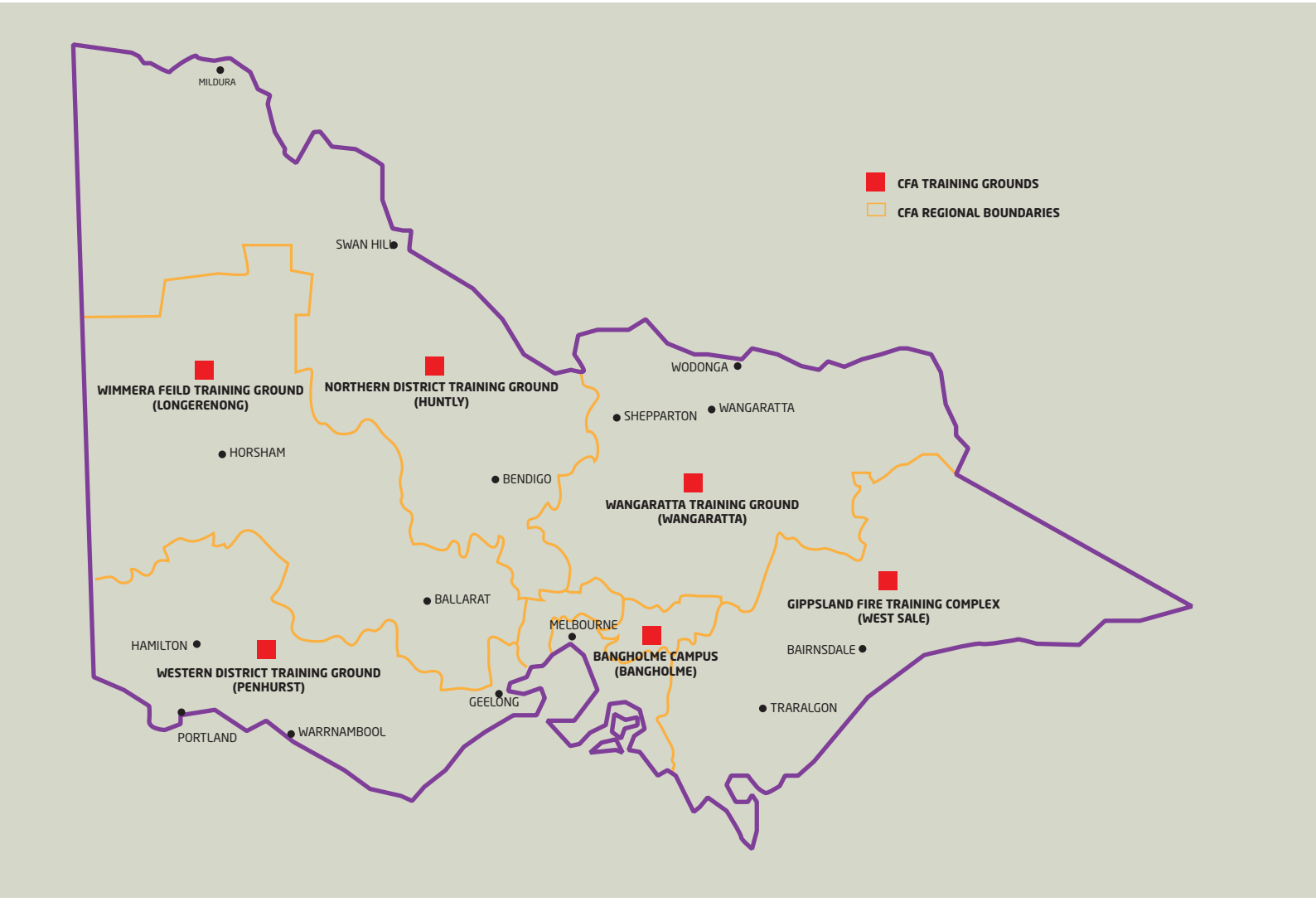


Figure 10.1 Regional Training Ground Locations

Introduction

Term of Reference 4 of the Independent Fiskville Investigation left open the possibility of including other training sites if deemed necessary. While CFA was not aware of any allegations being made in relation to use of chemicals in training at any of the six regional grounds, in January 2012, CFA initiated an assessment of its six regional training sites.

The primary aim of this assessment was to gather a body of information concerning the current state and historical use of these sites to inform and assist the Independent Investigation in determining whether to exercise the option provided by Term of Reference 4. An important secondary aim was to survey the state of health and safety at the regional sites and identify any current risks. This aspect of the assessment differed from the Investigation's focus at Fiskville, which was solely on historical activities and associated risks. The IFI Chair endorsed a document setting out the scope of the work (see Appendix D).

CFA tasked Mr Brian Lawrence, Manager of Training and Development Hume Region, to co-ordinate this assessment and to provide a report ('The Regional Training Ground Report') to the IFI Chair. As part of the assessment, in February 2012, independent hygienists' reports were prepared on each site by HAZCON Pty Ltd, Health, Safety and Environmental Consultants. In addition, in April 2012 the Chair commissioned Golder Associates to prepare a Preliminary Site Assessment for each site[1] focussing on potential contamination on-site. Mr Lawrence worked closely with the IFI throughout the Investigation, assisting the Golders consultancy and providing advice and updates on the progress of his work.

In May, based on discussions with Mr Lawrence and on consideration of an early draft of his report, the independent hygienist reports and discussions with Golder Associates, the Chair decided to apply Term of Reference 4 and formally include the six regional training sites in the Investigation. This decision was not taken on the basis of specific concerns raised about any of the sites. Rather it recognised the broadly similar histories of the sites to Fiskville in relation to use of flammable chemicals in training exercises and the relevance of the Investigation's other Terms of Reference to each of the regional sites. A copy of The Regional Training Ground Report to the Chair and of the Golder Associates' Preliminary Site Assessment of regional sites can be found in Appendices D and E.

This chapter draws on the The Regional Training Ground Report and on Golder Associates' Preliminary Site Assessment, to apply each of the Fiskville Terms of Reference (i.e. 1A-1E) to the regional training grounds. In doing so, it seeks to draw out similarities with and differences between these sites and Fiskville and to identify any significant differences among the regional sites themselves.

Regional Training Grounds

The six Regional Training Grounds (RTGs also called 'field training grounds') and their dates of establishment (being approximate date of first known use of the training grounds for Wangaratta and West Sale and official opening dates for remaining training grounds) are:

a. **Gippsland Fire Training Complex**, previously known as West Sale Field Training Ground ('West Sale') established 1986 (Grounds initially used in conjunction with the National Safety Council of Australia and exclusively used by CFA as of June1992);

b. **Wangaratta Training Ground**, previously known as Wangaratta Field Training Ground ('Wangaratta') established 1983 (Grounds known to have been previously used by some brigades);

c. **Bangholme Campus**, previously known as South East Training Ground ('Bangholme') established 1993;

d. **Wimmera Field Training Ground** at Longerenong ('Wimmera') established 1994;

e. **Northern District Training Ground**, previously known as Huntly Training Ground and Bendigo Field Training Ground ('Northern District') established 1996; and

f. **Western District Training Ground**, previously known as Penshurst Training Ground ('Western District') established 1993.[2]

Historical Outline

In 1969 comments were made in relation to the lack of training in CFA.

"A step by step understanding of procedures is needed so that we can get down to basic essentials of Brigade and Group organisation."[3]

In the same year the CFA Annual Report notes training of staff within their region.[3] Additionally the Chief Officer required Regional Officer's to form Regional Training Committees (RTC) to plan and conduct training within each region. These committees were the first real attempt by management to establish a training system. They consisted of experienced volunteers with an interest or particular expertise in training and performance improvement.[4]

Fiskville's establishment as CFA's state-wide training centre did not fundamentally change the need for individual CFA brigades around the State to conduct local training. Sending staff to Fiskville involved significant time and costs, including long travel distances. Local training was needed to complement and supplement training at Fiskville.

By the 1980s, local training was conducted at Wangaratta and West Sale on an 'ad hoc' basis,[5] and included live fires or 'hot' training drills burning flammable material. Such practices were not subject to centralised direction, control or scrutiny by CFA.

Training was generally run at the brigade level. Brigades located training grounds where hot fire training facilities would not become a nuisance to local communities. Brigades, supported by volunteers and local communities, had few funds for training activities. Development of training grounds, for the most part, relied on local initiative and the labour, particularly contributions of CFA volunteers. Local businesses and government bodies often tried to assist training activities by providing sites, props and fuels.[6] At times people on Community Based Orders provided labour.[7]

Over time, CFA began to recognise that a more consistent approach was required to ensure effective training and safety for staff, volunteers and outside organisations using CFA facilities. The Field Training Grounds – Policy Document May 1990 helped to centralise, professionalise and develop training at Fiskville as outlined in Chapter 3 and at regional training grounds.[8] The policy document was intended as a guide for regions and zones contemplating establishing practical training areas in the field.[9] By 1990, Wangaratta and West Sale (now Gippsland) had already established their own Training Ground Committees of Management consisting of enthusiastic volunteers and staff representatives.

The Field Training Grounds Policy drove the use and development of existing and proposed training grounds. It emphasised that there were regulatory requirements that needed to be complied with. However it did not detail what these actually were. It further outlined standard operating procedures and expected training outcomes and specified that any funding had to be sought through a submission to the CFA Capital Works Program.[6] Any proposed development had to be in accordance with the policy to attract funding from CFA.[8]

In August 1992, CFA appointed a Director of Management Development and Vocational Training who compiled a Report on Field Training Grounds in February 1993.[6] The report established the structure for managing training across the State including the setting up a Coordinating Team.[6]

The 1990 policy and the 1993 report both set out the practices to be followed at regional training grounds. Most documentation at RTGs demonstrates they were developed and operated over time as a result of strong local initiative and direction. These RTGs operated with a high degree of local autonomy, being effectively accountable through the Regional Training Committee/ Regional Training Ground Management Committee to the Zone Assistant Chief Officer rather than to CFA head office. This management structure changed in the mid 1990s in line with a re-structure of CFA management. Further key investigations, reports and audits of RTGs and the response to them are outlined in Chapter 9.

Terms of Reference

As noted in the Introduction, this chapter applies each of the Fiskville Terms of Reference (i.e. 1a-1e) to the regional training grounds. As with Fiskville, the order in which the Terms of Reference have been dealt with has been varied to consider 1b that addresses audits and reports and management's response to them last. Where appropriate in the following discussion, reference is made to relevant detailed material contained in earlier chapters rather than repeating it.

Term of Reference 1A

"Examine and consider the historical facts relating to the nature, acquisition and use of liquids, gases or solids (with particular emphasis on flammable substances and extinguishing agents, including but not limited to water, foam and dry powders) for live fire fighting training at Fiskville. In doing so, the report is to set out a chronology of events, reports and documents about the management of the site at Fiskville, along with a listing of the identified flammable substances and extinguishing agents."

Flammable Materials

As at Fiskville, prior to 1990, in the absence of a centrally allocated budget for purchasing fuels, local and regional training grounds were dependent on limited local budgets and so welcomed donations. Wangaratta and Gippsland sourced flammable materials such as kerosene, sump oil, jet and motor vehicle fuel and solvents from a range of local suppliers such as garages, trucking companies and aerodromes.

In the late 1970s, brigades based in and around Wangaratta conducted hot fire training on Crown Land in pits approximately three metres square. The pits were filled with water and a flammable liquid was poured on top and ignited to create fire and smoke. At Wangaratta the flammable liquid was predominantly white spirits (a common organic solvent derived from paraffin) obtained through donations from the two local dry cleaning firms. At Gippsland, JetA1 fuel and solvents from local companies was used. Diesel and/or petrol were also obtained from a local fuel merchant. Aviation fuel, usually out of date, was also donated to the training grounds. A similar practice continued into the 1980s at the Wangaratta and Gippsland sites prior to CFA establishing official RTGs. The flammable liquids were stored in 44 gallon (200 litre) drums and when required, rolled out to the pits used for hot fire training.[10]

As at Fiskville, many of these fuel supply practices appear to have been largely informal. Therefore, little documentary evidence has been found to suggest or confirm particular suppliers of the flammable liquids or what the flammable substances actually were. Fuels stored in drums may have been mixed and the nature of their contents, including potential contaminants, remains unknown. Like Fiskville, the practices of accepting undocumented, unknown fuels appears to have largely ceased by 1996 and RTGs moved to use primarily standardised motor vehicle fuel and liquified petroleum gas (LPG). In 1996 there was discussion amongst members of the Field Training Ground Coordinating Committee about the pros and cons of using just unleaded petrol rather than a mixture of petrol and diesel.[7] Gippsland commenced trialling the use of Jet A1 as an alternative to diesel. Currently, all RTGs except for Wangaratta use JetA1 or unleaded motor vehicle fuel with Wangaratta using kerosene.

Like Fiskville, in the 1980s commercial clients and external organisations attended the RTGs for hot fire training. External organisations may have supplied some of their own flammable materials, either to reduce costs of training their personnel or because the training involved specialised substances relevant to the individual industries. Unused flammable liquids or extinguishing agents were left in appreciation for the service and use of the RTG facilities.[2] In the absence of a documented list of the types of materials required for training by different industries, it is difficult to determine which fuels were used.

The recollections of staff involved with training at the early RTGs (Wangaratta and Gippsland) indicate that the liquid flammable materials they used were broadly similar to those used at Fiskville (see Chapter 5). The quantities of fuel were significantly smaller than at Fiskville, reflecting the smaller number of training activities and participants. For example, approximately 400 people were trained at Wangaratta in 1993/94 and 400 people were trained within six months at Gippsland in the same year.[11] In comparison, Fiskville trained thousands of volunteers, career fire fighters and external fire fighting personnel annually.

As a result, the problems associated with accumulation of large numbers of drums of flammable liquid that occurred periodically at Fiskville were not replicated at the RTGs.[2]

As indicated above, Wangaratta and Gippsland were established ten and seven years respectively, before the remaining RTGs. This was long before the move during the 1990s to a much greater reliance on LPG that reduced the use of flammable liquids in training. Nevertheless, even before this shift both these sites reportedly used minimal volumes of unknown or suspect flammable materials in training, and used predominantly petrol, JetA1 and diesel.[2] The later RTGs were constructed in accordance with CFA specifications, infrastructure and documented practices which also limited the use of suspect flammable materials.[12]

Other Flammable Materials

Solid fuels such as straw, untreated pine offcuts, hardwood and timber pallets, paper, and occasionally maps and books were reported as being sourced locally or purchased commercially by all RTGs for fire training. Currently rubber tyres are regularly burnt at Gippsland.[2]

Extinguishing Agents

Portable fire extinguishers

Historically training grounds accepted donations of out of date fire extinguishers or permitted external organisations to bring their own extinguishers to the training sessions in order to minimise costs. The extinguishing agents would have reflected the standards of the day. Because they were donated, there may have been some lag time before practices were adjusted to comply with changes to standards.

Presently extinguishers used in training at RTGs comply with current standards, but may not always meet requirements in relation to frequency of the hydrostatic testing. Bangholme does not use Class B foam extinguishers. Class B foam extinguishers are used occasionally by the other RTGs.

Bulk Foam

Class A Foam - Class A Foam is a relatively new extinguishing agent introduced to CFA in 1999.[13] Wangaratta, Bangholme and Penshurst do not use Class A foam. Some training grounds permit the use but in accordance with the handling and storage requirements set out in the Standard Operating Procedure SOP 9.07.

Class B Foam - In the early days at Gippsland, the RAAF and Esso brought stocks of foam to their training sessions, and in some cases, donated left over foam to CFA. Class B foams were also used in the flammable liquid pits at Wangaratta in early times. As a result of EPA concern in 1996, Class B Foam was prohibited at Wangaratta. When Class B foams are used at other RTGs, designated areas or trays are provided to minimise run off to dams or storm water drains.[2]

Use of Recirculated Firefighting Water

Firefighting water is recirculated and used for firefighting training exercises at each of the regional sites except Penshurst and Wangaratta. As at Fiskville, this water is likely to contain a range of contaminants. While an assessment of human health risks associated with the use of recirculated fire fighting water was carried out in 2005 and 2007 by consultants Wynsafe, those assessments did not consider contaminants associated with flammable liquids and foams (see Appendices D and E).

For information on the nature (including toxicological properties) of the flammable materials and extinguishing agents discussed above (see Chapter 5 and Appendix B).

Term of Reference 1C Contaminants

"Identify the origins of the flammable substances (paying particular attention to the likelihood of the substances being contaminated with material such as heavy metals and persistent organic pollutants, e.g. polychlorinated biphenyls); report on how they were stored, used and disposed of; and assess the likelihood of the use and management of flammable substances and extinguishing agents having led to the contamination of air, land or groundwater at, under or beyond the Fiskville facility"

As at Fiskville, flammable liquids from unknown sources supplied to RTGs may have contained contaminants that could potentially pose a risk to human health and the environment. Similarly, contaminants in some types of foam, combustion products and in recirculated fire fighting water may have posed a risk to health and may have resulted in contamination of the environment on and off-site. Old high voltage transformers of uncertain origins are currently in use as 'props' at a number of RTGs.[2] Even if they have been drained of their original insulating oil and flushed, they may still contain small trace quantities of polychlorinated biphenyls (PCBs), and there is no evidence they are certified 'PCB-free'.

A number of factors combine to support the case that the risk of on-site contamination by chemicals is likely to be lower at the RTGs than at Fiskville. Firstly, with the exception of Wangaratta and Gippsland, the RTGs were established in the 1990s when a shift towards less reliance on liquid flammables and increased use of LPG took place. Secondly, even in the early days at Wangaratta and Gippsland, training numbers were much lower than at Fiskville, so the demand for large volumes of material, particularly drummed material, to be stored on site did not arise. Thirdly, with the exception of Wangaratta and Huntly where underground fuel storage tanks (UST) were removed by 1999 and 2005 respectively, and Wimmera, which still has an underground fuel tank, there is no record of USTs being present at the other RTGs, thus removing an important potential source of contamination. Furthermore, with the exception of Penshurst, where part of the site is known to be contaminated with sodium fluoroacetate (1080), there is no knowledge of any significant incidents of fuel or other chemical spills.

Nevertheless as Golder Associates' Preliminary Site Assessment notes, with the exception of Bangholme and Gippsland, the majority of each site's fire training area is unsealed. Furthermore, there is visual evidence of hydrocarbon staining of small areas probably due to poor fuel storage and handling practices. These practices create the potential for contamination of soil and ground water.

As noted above, all sites other than Wangaratta and Penshurst recirculate fire fighting water, thus reducing the potential for contaminated runoff to leave the site. However recirculating water has the potential to increase the level of contaminants in the recycled water. At Penshurst, water collected from the fire training area flows through a triple interceptor trap (also known as oil/water interceptors) before discharging into the on-site dam. The Investigation understands that this dam does not discharge off-site. At Wangaratta, water from the fire training areas flows through a triple interceptor trap before being discharged into Three Mile Creek (also sometimes referred to as Fifteen Mile Creek).

Term of Reference 1D exposure

"Identify the nature and extent of exposure to the flammable substances (and their combustion products), extinguishing agents and fire water of persons on-site and in surrounding areas that could have potentially been impacted by contaminated runoff or wind drift; and, to the extent practicable, list persons who may have been exposed"

On-site

The types of exposure profiled for various groups of people at Fiskville (see Chapter 7) would generally be the same for equivalent groups at RTGs, but with significantly less cumulative exposure risks due to:

- the lower volumes of materials used;
- greater use of known fuels and LPG;
- lower frequency of hot fire training, and
- more frequent rotation and shorter periods of exposure working directly with flammable materials on PADs.

In addition, a number of groups relevant to Fiskville are not relevant to all of the RTGs for example, full-time instructors, non-operational staff, on-site residents, and teachers and students. Until the late 1990s, RTGs had either casual, part-time or volunteer PAD Operators and Instructors used in accordance with the level of activity of training. All RTGs now have permanent PAD Supervisors and the Northern District Training Ground and Bangholme have permanent PAD Operators.

Because RTGs did not operate as frequently as Fiskville, mainly casual staff and PAD Operators were employed.[7] The Committee of Management at Wangaratta used casual PAD Operators, known as 'Casual Grounds Managers/Training Ground Managers and Ground Assistants.[11] until a permanent appointment was made around 2000. Other Training Grounds had similar positions and employment practices. Casual PAD operators are still used at all sites, however the Northern District Training Ground has one full-time PAD Operator. Bangholme has a different management structure of PAD Supervisors and Operators due to the higher level of activity at the site.[2] There have been on-going industrial issues around balancing and recognising paid and volunteer work at RTGs.

It is difficult to determine the number of casual PAD personnel who have worked at the various training grounds over time and to draw other than general conclusions as to the exposures they faced. In comparison with Fiskville, the frequency of PAD personnel operating props at the RTGs and being directly exposed to chemicals or foam, e.g. through inhalation of fumes or via dermal contact, was low. The Investigation's review of CFA occupational health and safety incident reports as outlined in Chapter 7 did not reveal any acute, documented incidents involving chemicals at RTGs, and indeed showed a low level of occurrence of occupational health and safety incidents.

In July 1998, an explosion occurred in a hot fire training prop at the Bangholme Training Ground during a training session. Investigation into the explosion indicated that the mock fuel storage tank, which had a limited amount of fuel dripping over the outside, exploded due to a build-up of vapour inside the prop. The incident did not involve exposure of trainees to chemicals and no one in attendance was injured. A full investigation followed this incident.[2]

Off-site

The Wangaratta, Gippsland (West Sale), Huntly, Longerenong, and Bangholme RTGs are all located well away from normal residential areas. Potential effects from smoke or other offsite impacts were not seen as significant for these sites.

In the case of the Penshurst Training Ground, an environmental impact study was carried out prior to the final selection of the site. EPA also conducted a study of the site and made a number of recommendations. Conditions such as the timing and nature of burns were put in place to minimise impacts of smoke on residents. Similarly, for the Gippsland Fire Training Complex, attention was paid to the potential impacts of smoke plumes as part of the design criteria. It is notable that at the time these grounds were established, more developed planning processes and closer local relationships between government bodies led to regulators like EPA being more involved in the establishment of RTGs than at Fiskville. At times, CFA actively sought advice from EPA. This is discussed further in Appendix D.

Assessment of potential risks associated with contamination of groundwater and surface water from activities at RTGs is explored by Golder Associate's preliminary site assessment of regional training grounds in Appendix E. Wangaratta Training Ground, due to its proximity to the Three Mile Creek (or Fifteen Mile Creek), has modified training scenarios (e.g. no foam or minimal flammable liquids) to ensure that no contaminated water discharges off site.

Term of Reference 1E

"On the basis of available information, assess the risk that there are buried flammable substances drums and/or other related contaminants on the site; where possible identify the location of such materials and make recommendations about any clean up and remediation required; identify where information is considered to be inadequate to enable a risk assessment and recommend action to improve the information base (which may include carrying out exploratory sampling of soils)."

Manual handling of flammable material at some early RTGs was similar to practices at Fiskville. For example, at Gippsland drums were rolled to props. Smaller volumes of drums were used and were not retained on site. However, this practice ceased with the upgrade of RTGs in the mid 1990s. The Investigation has not identified any evidence to suggest that drums containing fuel or other chemicals, or empty drums, were ever buried at any of the RTGs. CFA members associated with the RTGs from their inception consistently stated that they had no knowledge of such practices during their tenure.[2]

Term of Reference 1B

"Identify and list any documents or reports that contain comments on or recommendations about the use and disposal of flammable substances and extinguishing agents used for live fire fighting training at Fiskville and on the management of fire water generated in such training; to the extent that it can be determined, report on how effectively each comment or recommendation was acted upon; and, where no action was taken, comment on the reasons for and implications of such lack of action"

Following the significant review and redevelopment of Fiskville post 1996, the regional training grounds' practices and infrastructure came under increasing scrutiny both within CFA and by external regulators. This resulted in a number of investigations and reports on all training grounds including the recently developed regional training grounds.

For example, in 1996 following an inspection, EPA indicated it would issue CFA with a Pollution Abatement Notice ("PAN") if it did not halt certain practices. In particular, EPA was concerned that the flammable liquid running drain prop at Wangaratta was discharging pollution into Three Mile Creek (also known as Fifteen Mile Creek). The triple interceptor trap from which the pollutant was being discharged was installed in the 1980s and was ineffective. Rather than being issued with a PAN, CFA ultimately received a letter directing that the site cease discharging waste into Three Mile Creek.[14] As a consequence of EPA actions, the flammable liquid prop at Wangaratta was decommissioned, and removed entirely in 1998.[1, 2] To enable hot fire training to continue, an LPG prop was used.

RTGs established in the 1990s had triple interceptor traps as part of their set up specifications. However, the efficiency and effectiveness of these devices has been questioned.[1] As at Fiskville, all RTGs, provide both LPG fuelled fire simulations and limited flammable liquid training in order to meet the demands within their location.[2]

In 1995 CFA engaged Sedgwick Risk Services Division to carry out liability risk audit reports for RTGs. The reports appear to have been commissioned by CFA Risk Management Department. These reports were not technical assessments of the risks of hot fire training infrastructure. They were high level risk assessments focused on "assisting the underwriters in their evaluation of risk" such as loss of infrastructure or major injury to personnel.

From the late 1990s, following developments at Fiskville, CFA became increasingly aware of and sought to comply with health, safety and environmental standards. CFA had at this stage undertaken a number of audits and investigations to understand and improve health and safety compliance at RTGs. The lessons learnt from poor practices at Fiskville were discussed. For example, an Instructor addressed a Field Training Ground Coordinating Committee meeting in 1996 on dangerous goods storage and handling, occupational health and safety, and environmental issues at Fiskville and how the lessons learned could be adopted by other Regional Training Grounds.[15]

In 1996, CFA engaged Emergency Management Planning Pty Ltd to identify compliance obligations ("The EMP Report") under the Victorian Dangerous Goods (Storage and Handling) Regulations 1989. The EMP Report found numerous instances of non-compliance, including hot fire training props, at the RTGs.[2]

Consequently over the next two year period, a number of organisations were commissioned to carry out technical audits on fire training props and review occupational health and safety at all RTGs. In this period, consultants were also engaged to prepare proposals for the upgrading and replacement hot fire training props.[16-18] The subsequent reports indicated that all RTGs had deficiencies, some serious. In the case of Penshurst, it was recommended that the system be completely replaced; however the other sites were deemed to be capable of being upgraded.

In January 1998, the Manager Community Risk Management wrote a letter to the Manager Training & Development strongly recommending that an audit of each site be undertaken to ensure that there were no corporate liabilities with respect to health and safety that had not been identified or had been identified but not acted upon.[19]

In October 1998, AMCOSH Occupational Health Services carried out a health and safety audit of the RTGs.[20] which once again produced a list of recommendations, some site specific, for improvement and compliance (see Appendix D for further details).

Four editions of the Field Training Ground Complexes Manual were produced between 1993 and 1999.[2] This manual specified roles and responsibilities, standard operating procedures, financial management and administrative systems and standards for facilities. Importantly, it specified that audit processes be carried out at the RTGs. The fourth edition of the manual was replaced by the Field Training Ground Manual of Operations in 2005.[22]

The Investigation understands upgrades were not completed fully as planned. The availability of capital funds appears to be the key factor in determining whether the various recommendations for improvements were completed. Prior to this time, infrastructure at training grounds had been constructed and modified with volunteer labour at low cost.

Furthermore, delays in developing workable specification and in construction made planning and funding more difficult. From the 1990s CFA sought the advice of various consultants to ensure appropriate specifications were developed in line with regulatory requirements. In most cases the infrastructure being developed was unique and required advice and assistance from a range of specialists. The situation was further complicated by rapidly developing health, safety and environment regulatory requirements. In particular, use of LPG to simulate fire scenarios for training is a difficult area in terms of interpretation and application of regulations which were typically designed to prevent all fires rather than permit them under controlled conditions. In some cases, because of the time required to obtain approval for capital and to let tenders, projects were overtaken by further audits and reports which produced new and different sets of complex recommendations necessitating redesign and delay. Ultimately CFA appears to have struggled to develop processes and systems to direct and work effectively with consultants in a timely way and to ensure key health, safety and environment requirements were met (see Appendix D).

In 1999, CFA's Manager of Training and Development requested the preparation of an audit of each training complex.[21] This audit was carried out by an officer from CFA Training & Development Branch in accordance with the requirements of the Training Ground Complexes Manual (see Appendix D).

PART THREE

CONCLUSIONS AND RECOMMENDATIONS

11 CONCLUSIONS

The historical risks to staff and the environment at Fiskville associated with the use of a range of flammable materials in training will never be fully known.

Viewed from the perspective of modern day health, safety and environment standards and regulations, Fiskville's acceptance and use of donated fuels posed substantial risks which would be unacceptable today. It can be argued that, during the 1970s and much of the 1980s, the general level of industry standards and of regulatory requirements in relation to the management of hazardous materials waste was low. However, by the early 1990s, that situation had changed and the CFA's own staff responsible for assisting industry to comply with dangerous goods regulations could readily identify that Fiskville was not compliant with regulatory requirements.

The Investigation believes for one group of staff (the PAD operators), the risks of exposure to flammable liquids were significant and considerably greater than to other groups. Instructors working full-time at Fiskville were the group most exposed to products of combustion, foam and fire water. Part-time instructors would have experienced the same types of acute exposures as the full-time instructors, but the frequency of such exposure would have been considerably less. Trainees' frequency of exposure would have been significantly less again. Exposure of other Fiskville staff and residents, including children, to chemicals, products of combustion, foam and firewater would have been negligible or very low and exposure of persons off-site would have been negligible. The key exposure of staff, residents, the primary school and neighbours would have been to occasional smoke and particulate fall out.

Exposure to chemicals during training needs to be seen in the context of the time and other risks firefighters would have been exposed to, particularly when responding to fires. The risks of exposure of firefighters to hazardous chemicals when responding to fires is likely to significantly outweigh any exposures as part of periodic training. Furthermore, exposures to chemicals as part of other occupational risks, particularly for volunteers, needs to be considered. For example, through the period considered by the Investigation, farmers often had significant exposures to agricultural and veterinary chemicals.

The risks associated with training need to be weighed against the benefits of hot firefighter training in saving the lives of firefighters and of community members. However, the risks inherent in training could have been recognised and managed earlier than 1996, without seriously compromising the realism of firefighter training exercises.

In view of the tens of thousands of people who trained on the flammable liquids PAD between its completion in 1974 and its closure in 1996, it is surprising that only three acute incidents involving exposure to chemicals have been identified. This is despite an exhaustive search of CFA's OHS records and over 300 interviews. No record of acute incidents involving exposure to chemicals has been found at the six RTGs.

Sampling and analysis of soil, surface water and sediments undertaken for the IFI by Golder Associates at Fiskville has shown that levels of a small number of residual contaminants, notably PFOA and PFOS, exceed human health or ecological guideline values. While the levels of contamination found are not judged to pose a significant risk either on or off-site, further work is needed: to characterise risks to groundwater; to better quantify the potential risks to human health downstream of Lake Fiskville (taking into account dilution, environmental fate and transport mechanisms); and to investigate and potentially reduce sources of PFOA and PFOS discharges into Lake Fiskville.

The full facts about drum burial at Fiskville remain unclear. However, the Investigation found documentary evidence that drums and contaminated soil from two mass burials in the 1980s were removed from Fiskville in 1991 and 2002. Drums are likely to remain buried at the former on-site landfills.

It is uncertain whether further drum burials remain or , where exhumations have taken place, whether all drums and contamination have been removed. Given the length of time for which any remaining drums will have been buried, it is likely that their integrity will have been breached and volatile components will have evaporated or migrated downwards. The Investigation believes that the risks associated with such drums are likely to be limited and to relate primarily to groundwater.

By 1996 the practice of Regional Training Grounds accepting undocumented, unknown fuels appears to have largely ceased with a shift to increased use of LPG. As a result, the four RTGs established in the 1990s were involved in accepting drums of donated fuel for only a relatively short period, so risks associated with exposure to chemicals, products of combustion and fire water were substantially less than at Fiskville. Unlike Fiskville, where PAD operators were mainly full-time employees, at the RTGs they were employed on a part-time basis. Even in the early days at Wangaratta and Gippsland, training numbers were much lower than at Fiskville, so the demand for large volumes of material, particularly drummed material, to be stored on site did not arise. Nevertheless the majority of each site's fire training area is unsealed and there is potential for contamination of soil and ground water.

In 1980 concerns over potential PCB contamination in donated fuels were transmitted from Fiskville to CFA senior management. However, the general approach of Fiskville management appears to have been that events that occurred at Fiskville (such as the 1982 drum fire and chemicals exposure incident) were dealt with at Fiskville without reference to head office.

In 1987, the Officer involved in the 1982 exposure incident sought information from the CFA Chairman about the nature of the chemicals in the buried drums. After some delay while head office staff inquired into the incident, CFA employed a consultant to temporarily exhume the drums and identify the chemicals. After a delay of more than two years, CFA provided the Officer with information about the chemicals identified in the consultant's report on the basis that the information would be treated as confidential.

The Investigation is aware of the problems in applying retrospectively current standards and community expectations in relation to corporate duty of care for health, safety and environment. Nevertheless, in the Investigation's view CFA managements' handling of concerns raised by the Officer is open to criticism on the following grounds. Firstly, the consultant's report clearly stated that the consultant was not qualified to comment on the possible health implications of exposure to the contents of the drums and advised that medical and/or legal advice should be sought. The Investigation saw no evidence that this was done and views this as a significant oversight. Secondly, the report included information on the acute and chronic toxicity of benzene, toluene and xylene that may have been present in the resins and solvents in the drums. In the case of benzene, the report noted that it was a recognised carcinogen of blood forming tissue.

Despite being made aware of the range of potentially serious impacts on health of exposure to these compounds, and despite the Officer expressing concern that there were others apart for himself that should be advised of the results, there is no documentary evidence that this was ever done. Nor do interviews with the other officers indicate they were ever informed of the results of the consultancy. In the Investigation's view CFA should, as requested, have contacted all those involved in that incident and have made them aware of the findings.

Further, the Investigation concludes that, on the basis of the information available to the CFA Chairman and senior management by the second half of 1988, a thorough audit of Fiskville focusing on the nature and management of fuels should have been undertaken. This should have comprehensively assessed hazards to health and the environment associated with the acquisition, storage, handling, use and disposal of flammable liquids in training. A plan should have been developed to mitigate such hazards. A similar audit and plan should have been undertaken at the two RTGs in use at the time, West Sale and Wangaratta.

In addition, inquiries should have been made with past and then present staff at Fiskville with a view to determining whether other incidents involving significant exposure to chemicals had occurred.

Where such incidents were identified, all potentially exposed staff should have been provided with timely and relevant information on potential risks.

Against a background tightening regulatory requirements and increasing industry focus on environmental practice and health and safety, by the mid–1990s, there is evidence of concern amongst some CFA personnel about dangerous goods storage and handling practices at Fiskville. Prior to this, Fiskville staff did not appear to get substantial advice or support on health, safety and environment matters from head office. It is significant that staff pushing for change felt impelled to use regulatory requirements to ensure CFA management's attention to these matters.

Following CFA dangerous goods auditing in 1996, a CFA Instructor was asked to take a more holistic look at these issues, and the redevelopment of Fiskville in the late 1990s did take into account some health, safety and environment issues. However, even after the extensive studies and plans of 1996 and 1997, the response from Fiskville and corporate management appears limited, with no evidence of systematic follow up, review or auditing of recommendations. Only some of a large number of recommended actions appear to have been implemented. The Investigation did not identify a fundamental shift in focus on health, safety and environment in the period of the Investigation.

The Board through most of the period considered by the Investigation was a representative board and it is understandable that it did not adopt modern governance practice. However, it is notable that CFA did not adopt a more systematic approach to health, safety and environmental issues as other sectors did through the 1980s and 1990s. The fact that CFA hired its first occupational health and safety manager in 1994 is indicative of a late awakening by senior management and the Board.

The Investigation's Terms of Reference do not include considering current materials used in training or training practices. Rather they focus on legacy issues such as possible site contamination that may pose an on-going risk to human health or the environment. Consequently, these are the areas which the Investigation's recommendations address.

RECOMMENDATIONS

12

The focus of the Independent Fiskville Investigation has been on materials and practices employed in practical or 'hot' firefighter training from the opening of CFA's Fiskville training centre in 1972, through the following three decades until the turn of the century. As such, it is an investigation of events that occurred up to forty years ago and of changes that occurred during the 1970s, 80s and 90s. The Investigation's Terms of Reference do not include considering current materials used in training or training practices. Rather they focus on legacy issues such as possible site contamination that may pose an on-going risk to human health or the environment.

Chapter 6 Contaminants and Contamination

Term of Reference 1c addressed the potential for contamination of fuels supplied to Fiskville with materials such as heavy metals and persistent organic pollutants. The Investigation considered whether such contamination and the management of fuels and extinguishing agents is likely to have led to contamination on or off-site at Fiskville. To assist the Investigation in addressing this and the closely related Term of Reference 1e, dealing with the burial of drums at Fiskville, Golder Associates was commissioned by the Chair to conduct a Preliminary Site Assessment of Fiskville.1 As described in detail in Chapter 6, the Preliminary Site Assessment involved: a desktop review of information relevant to the site; a review of historical documents and previous consultants' reports; and a targeted investigation of soil, sediment, surface water and tree material. Groundwater was not found in any of the existing bores at Fiskville, so no direct evaluation of its status could be included in the preliminary assessment.

This targeted investigation was directed at areas where contamination associated with storage and burial of drums containing flammable materials may have occurred and at the firewater treatment system, including Lake Fiskville. Decisions on sampling and analyses had to be made at an early stage in the Investigation to allow sufficient time for sampling and analysis. As a result, some potential drum burial locations that were identified as possible sites of contamination later in the Investigation were not included in the sampling and analysis program. Samples were analysed for a wide range of substances.

The Golder Associates' Preliminary Site Assessment makes a series of recommendations aimed at providing a more comprehensive understanding of site conditions. All of these have been adopted by the IFI. Those that relate to further investigation of potential site contamination, other than contamination linked to burial of drums, are set out below. Recommendations relating specifically to drum burials on site are dealt with later in this chapter in the section dealing with Term of Reference 1e.

Recommendation 1

That soil and groundwater quality be assessed in areas where fuel storage tanks are currently located or have been located in the past both above and below ground.

As Golder Associates note[1], while many solvents can readily volatilize from near surface soils over time, they can be more persistent when they migrate deeper into the subsurface or to groundwater where they can then migrate laterally.

Recommendation 2

That groundwater investigations be undertaken in the vicinity of: the historical flammable liquids PAD; the fuel mixing area; the historical foam training pits; the prop storage area; and the area used to rehabilitate contaminated soils in 1998.

The Golder Associates' Preliminary Site Assessment also included a recommendation that groundwater be investigated in the vicinity of the "sludge burial" pit. However, the best information available to the Investigation is that no such pit existed, rather that the sludge from the flammable liquids PAD and the foam pits was periodically collected in small quantities and buried in shallow scrapes located to the east of the pits. This area was most likely covered over during the bioremediation of contaminated soil in 1998.

Recommendation 3

That further investigation be undertaken into surface waters in and discharging from Lake Fiskville to:

- *better quantify the risk to downstream human health receptors, taking into account downstream dilution and environmental fate and transport mechanisms;*
- *investigate potential sources of PFOA and PFOS discharges to Lake Fiskville and discharging off site, if the potential risk of adverse impact on downstream human health receptors is found to be unacceptable;*
- *collect surface water samples at a representative location to assess whether the reported copper and zinc concentrations are consistent with background levels; and*
- *assess the ecological condition of Lake Fiskville.*

Chapter 6 of this report noted the presence in the fire prop storage area of two large electrical transformers, which have subsequently been removed, and discussed the potential for this equipment to be contaminated with oil containing PCB. Such transformers are also used for props at a number of regional training grounds.

Recommendation 4

That any electrical transformers located at any CFA training sites be inspected by an independent hygienist and, if not able to be certified as PCB-free under the National Polychlorinated Biphenyls Management Plan 2003, that it be treated as a scheduled waste and disposed of in accordance with the provisions of the Plan.

Chapter 7 Exposure of People On and Off Site

As noted in Chapter 1, the IFI's Terms of Reference did not require the Investigation to examine and assess the possible acute or chronic effects on health of cumulative exposure to materials during training at Fiskville. It is notable that the Investigation identified only three confirmed potential acute incidents over the three decades considered. Term of Reference 1d did, however, deal with the nature and extent of exposure of persons on and off-site to flammable substances, combustion products, extinguishing agents and fire water. In addressing this, the Investigation developed a hierarchy of groups of individuals based on a qualitative assessment of their relative risk of exposure. (See Table 7.1 for details.)

The Investigation believes that this hierarchy may provide a useful framework for any subsequent study of possible chronic health effects linked to exposure at Fiskville.

Recommendation 5

That any subsequent study of possible linkages between exposure of persons during training at Fiskville to materials such as flammable liquids and health effects evaluate the usefulness of the qualitative assessment of relative risk of exposure of different groups developed in Chapter 7.

Recommendation 6

That procedures be put in place to protect the health of personnel potentially exposed to waters and sediments in Dams 1 and 2 of the firewater treatment system and, in particular, to manage the risks to individuals who have the potential to come into contact with sediments in the dams during routine maintenance.

Chapter 8 Buried Drums

As noted above, priorities for Golder Associates' Preliminary Site Assessment had to be set at an early stage of the Investigation. As a result, a number of locations which were subsequently identified as possible drum burial sites were not subjected to sampling and analysis. In the light of additional information obtained, chiefly from interviews, the IFI has been able to identify additional locations at which drums may have been buried and may still remain. It should be noted, given significant documentary evidence of drum exhumations, that the number of drums that potentially remain on-site is likely to be limited. Drums and other wastes will probably remain buried at the two historical landfills. The following recommendations from the Preliminary Site Assessment relate to those areas and have been adopted by the IFI.

Recommendation 7

That soil and groundwater quality be assessed in the following areas that were not examined during the site investigation stage of the Preliminary Site Assessment of Fiskville (see Figure 8.1):

- *Part of Drum Burial Area 1 (south of the Airstrip and south of Deep Creek Road);*
- *Drum Burial Area 2 (north of the Administration Building);*
- *Drum Burial Area 3 (east of the Administration Building)*
- *Historical landfills 1 and 2.*

The following recommendations 8 and 9 are based on information and assessments by the Investigation.

Recommendation 8

That historical landfill 1 which has been disturbed by the construction of a walking track have its extent clearly identified, have an appropriate impermeable and properly drained cap constructed and be revegetated with shallow rooting species that will not compromise the integrity of the cap. This should ensure the safety of any people using the walking track.

Recommendation 9

That any decision on the future management of historical landfill 2, including possible exhumation of buried rums and further site rehabilitation, await the results of soil and groundwater quality assessment at the site (Recommendation 8).

Chapter 10 Regional Training Grounds

As noted in Chapter 10, the Chair's decision to include CFAs six Regional Training Grounds (RTGs) within the ambit of the Investigation was informed by a study of these Regional Grounds which was carried out in parallel with the IFI. The study was prepared by Mr Brian Lawrence, CFA's Manager of Training and Development – Hume Region, under the direction of the Chair. This study forms Appendix D, and is complemented by a Preliminary Site Assessment of the RTGs prepared for the IFI by Golder Associates. This Preliminary Site Assessment focuses on the current state of each of the RTGs (see Appendix E). In addition, it should be noted that CFA commissioned a series of hygienist's reports on each RTG, which were completed in February and the results of those reports are reflected in Appendix D.

The scope of work established by the CFA and endorsed by the IFI Chair for the parallel study of RTGs closely followed the Terms of Reference of the IFI. However, it differed in one important respect - it included an assessment of the current state of these sites as well as of their historical use.

In the concluding section of the RTG Preliminary Site Assessment, Golder Associates noted that, while each of the sites appeared to have " ... implemented procedures to manage potential risks of environmental contamination [arising] from site activities, these procedures were not consistent across the training grounds."[2]

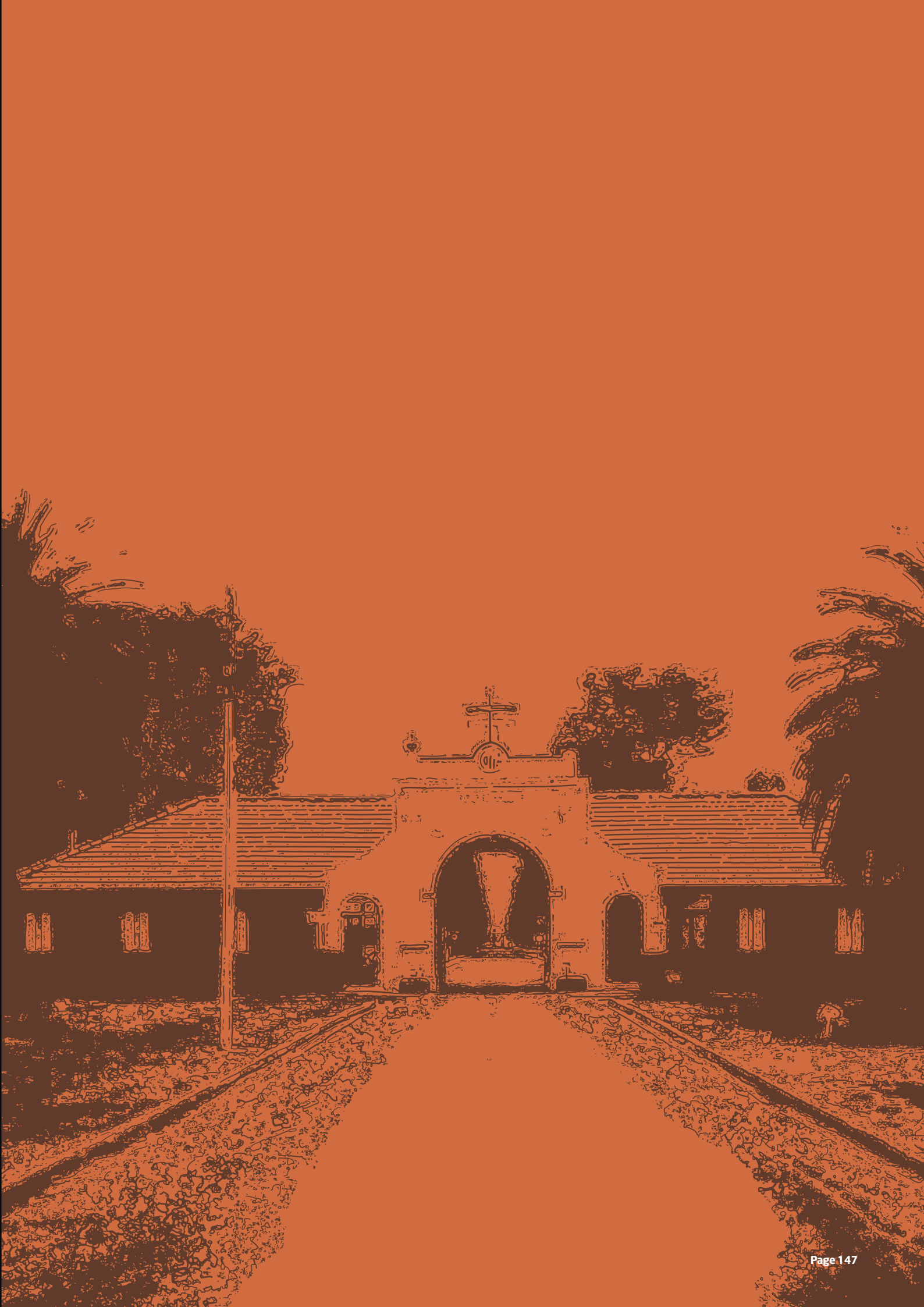
Recommendation 10

That the site specific recommendations of the Golder Associates' Preliminary Site Assessment – CFA Regional Training Grounds be adopted including recommendations to:

- *Undertake targeted soil and groundwater investigations at sites where possible sources of contamination have been identified;*
- *Assess firefighting water quality for contaminants associated with flammable liquids and extinguisher foams;*
- *Assess water quality where discharges occur to the environment.*

The Golder Associates' preliminary site assessment of RTGs makes a recommendation that consideration be given to the development of an overall environment management plan for RTGs which sets standard design and operational procedures. While this addresses current practice and is strictly beyond the Investigation's Terms of Reference, the Investigation supports the adoption of this recommendation.

The Regional Training Ground Report makes a range of detailed recommendations in relation to health, safety and environment at the regional training grounds. While these deal with current matters and are strictly beyond the Investigation's Terms of Reference, the recommendations are informed by the Investigation's review of past practices. The Investigation supports their adoption.



APPENDICES

The appendices to this final report of the Independent Fiskville Investigation can be found as PDFs on the CFA website www.cfa.vic.gov.au.

A. Summary of Key Acts and Regulations 1970 -2000
B. Health Hazards of Fuels & Possible Combustion Products – Golder Associates
C. CFA Training College, Fiskville, Vic Preliminary Site Assessment – Golder Associates
D. Regional Site Review - Brian Lawrence
E. Preliminary Site Assessment CFA Regional Training Grounds – Golder Associates

GLOSSARY

Alcohol Resistant Aqueous Film Forming Foam (AR-AFFF)	A specially formulated foam concentrate resistant to the action of alcohols for use on Class B and C fires.
Aqueous Film Forming Foam (AFFF)	A foam liquid containing fluorocarbon surfactants that control the physical properties of water so that it is able to float and spread across the surface of a hydrocarbon fuel.
Bioremediation	A process whereby micro-organisms are used to restore contaminated environments to their original condition.
Bund	An outer wall designed to retain the contents of its inner structure to prevent inundation of the surrounding environment.
CFA member	A term encompassing both CFA staff as well as volunteers.
CFA staff	Paid employees of CFA including both firefighters and non-firefighters.
Class A fire	A fire of combustible fuels such as wood, paper, textiles, cloth and other organic materials. Such fires are commonly extinguished by spraying the burning material with water.
Class A foam	An extinguishing agent that lowers the surface tension of water thereby enhancing the saturation of Class A fuels with water.
Class B fire	A fire of hydrocarbon fuels such as gasoline, diesel or oil. Such fires are commonly extinguished by blanketing or smothering the fuels.
Class B foam	An extinguishing agent of Class B fires. There are two categories of this foam: synthetic (such as AFFF and AR-AFFF) and protein (such as fluoroprotein foam).
Class C fire	A fire involving flammable gases, such as liquified petroleum gas and methane.
Combustible liquid	Any liquid having a flash point at or above 37.8°C (100°F).
Contaminant	A material that forms a residue in or on a substance that potentially poses a threat to health or the environment during an uncontrolled release.
Demonstration material	A material used to show firefighters the reaction process of chemical substances.
Expansion	The ratio of foam formed in relation to the volume of solution used to generate that foam when it is mixed with water and aspirated. For example, a ratio of 10:1 means there are 10 parts of finished foam to every 1 part of foam solution.
Fire prop	A prop or pit containing flammable liquids that were burnt for fire training drills.
Firewater	The water used to extinguish fires.
Flammable liquid	A liquid substance that has a flash point below 37.8°C (100°F)..
Flammable liquid PAD	A PAD at Fiskville approximately 90 by 90 metres containing a series of props designed to simulate common fire situations, such as fires in tanks, drums, dams and other industrial settings.
Flammable substance	An ignitable solid, liquid or gas.
Flash point	The lowest temperature at which a substance produces enough vapour to ignite and burn when an ignition source is applied but will stop when the source is removed.
Fluoroprotein foam	A foam based on natural protein and modified with a selected fluorinated surfactant which is loosely bonded to protein.
Foam	A mass of bubbles formed by mixing air with water and a foam concentrate in specific proportions. It is used as a firefighting agent to form a smothering, cooling and/or ignition preventing a layer over the surface of a flammable liquid or solid material fire.
Foam concentrate	A concentrated liquid foaming agent. When mixed with water it is the basis from which foam is generated.
Foam pit	Pits established for flammable liquid fires where foam could be applied.

Foam solution	The mixture of water and foam concentrate.
Landfarming	See bioremediation.
Liquified Petroleum Gas (LPG) bullet	A gas fuelled training prop used in drills that is remotely controlled by PAD operators.
Materials	Any solid, liquid or gas used for firefighter training, including flammable substances, chemicals and extinguishing agents.
Old fire training pits	See foam pit.
Paint thinners	A liquid substance that is likely to have contained solvents such as mineral spirits, acetone, turpentine, methyl ethyl ketone.
Paralegal	A para-professional who assists qualified lawyers in their legal work. In the context of the Investigation, paralegals, who were law graduates and students, were seconded from firms to assist investigators prepare the report.
Polar solvent	Generally water-miscible solvents, such as alcohol, which require special form concentrates.
Practical Area for Drills (PAD)	A generic term for an area where training drills are conducted. A larger PAD is usually divided into a series of smaller PADs for specific training exercises, such as extinguishers, industrial and transport settings.
Props	A generic term used to describe specific fixed or mobile training apparatus.
Protein foam	A concentrated form solution made from animal proteins.
Recycled firewater	Firewater that is reticulated through primary and secondary fire mains to be reused for future firefighting drills.
Structural fire attack building	A three-storey building located at Fiskville used to simulate fires likely to occur in industrial, commercial and residential settings. The building contained a ship's hold, smoke tunnel and fire attack rooms.
Surfactant	A chemical that lowers the surface tension of a liquid in which it is dissolved.
Thermite	A mixture of finely powdered aluminium and iron oxide that produces an extreme temperature on combustion.

ACRONYM	MEANING
AAFA	Australian Assembly of Fire Authorities
ACO	Assistant Chief Officer
AFC(s)	Australian Fire Competency(s)
AFFF	Aqueous Film Forming Foam
AFPA	Australian Fire Protection Association
AIP	Australian Institute of Petroleum
API	American Petroleum Institute
AR-AFFF	Alcohol Resistant Aqueous Film Forming Foams
AWA	Amalgamated Wireless Australasia
BA	Breathing Apparatus
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CABA	Compressed Air Breathing Apparatus
CCA	Copper Chromium Arsenic
CEO	Chief Executive Officer
CFA	Country Fire Authority
CO	Chief Officer
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCO	Deputy Chief Officer
DDT	Dichlorodiphenyltrichloroethane
DEECD	Department of Education and Early Childhood Development
EPA	Environment Protection Authority
FFFP	Film Forming Fluoroprotein
FP	Fluoroprotein Foams
FTG	Field Training Grounds
GPR	Ground Penetrating Radar
HAZCON	Hazardous Condition
HAZMAT	Hazardous Material
HR	Human Resources
HSO	Health and Safety Organisation
IARC	International Agency for Research on Cancer
IFI	Independent Fiskville Investigation
IRS	Internal Revenue Service
LOD	Level of Detection
LPG	Liquified Petroleum Gas
MSDS	Material Safety Data Sheets
MEK	Methyl Ethyl Ketone
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
OHS	Occupational Health and Safety
OIC	Officer In Charge
OPEC	Organization of the Petroleum Exporting Countries
OTC	Overseas Telecommunications Corporation
PAD	Practical Area for Drills
PAH(s)	Polycyclic Aromatic Hydrocarbon(s)
PAN	Pollution Abatement Notice
PCB(s)	Polychlorinated Biphenyl(s)
PCDD(s)	Polychlorinated Dibenzodioxin(s)
PCDF(s)	Polychlorinated Dibenzofuran(s)
PFAS	Perfluoroalkyl Sulfonate
PFC(s)	Perfluorinated Chemical(s)
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
PID	Photoionization Detector
PPC	Personal Protective Clothing
PPE	Personal Protective Equipment
RTC(s)	Regional Training Committee(s)
RTG(s)	Regional Training Ground(s)
RTO	Registered Training Organisation
SOP(s)	Standard Operating Procedure(s)
SVOC(s)	Semi Volatile Organic Carbons
TDI	Tolerable Daily Intake
TGA	Training.gov.au
TOC	Total Organic Carbon
TPH(s)	Total Petroleum Hydrocarbon(s)
UFU	United Firefighters Union
USEPA	United States Environmental Protection Agency
VOC(s)	Volatile Organic Compounds
VUT	Victoria University of Technology

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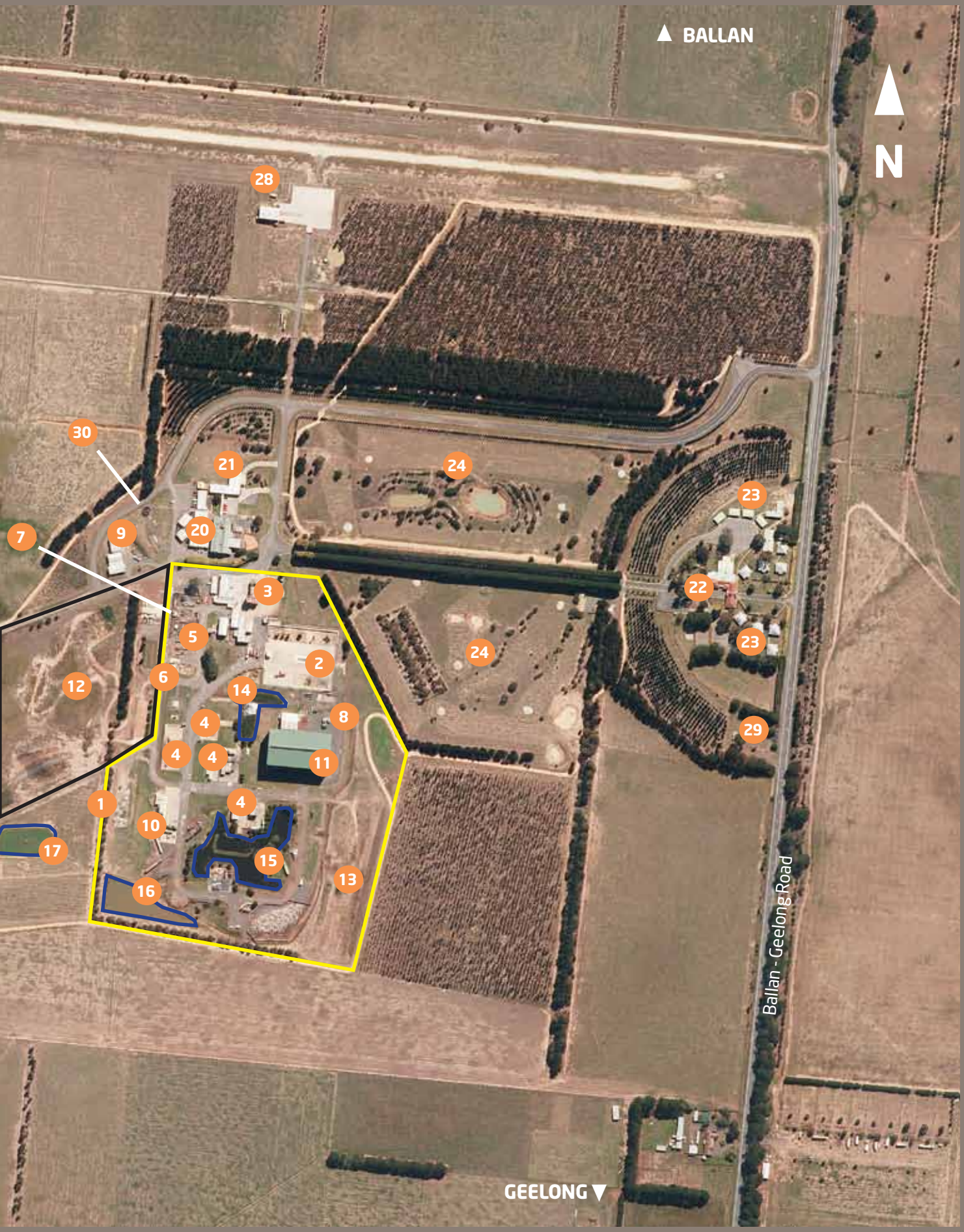
Fiskville Training College Key Reference Map

1 Outdoor fire training area
2 Flammable liquid PAD
3 Original fire attack building
4 Fire training PADs
5 Fire prop storage area
6 Above ground fuel storage tanks
7 Hazardous material store
8 Triple-phase interceptor trap
9 Workshop and storage buildings
10 Amenities buildings
11 VUT building
12 4WD training area
13 Soil composting area
14 Dam 1
15 Dam 2
16 Dam 3
17 Dam 4
18 Lake Fiskville
19 Offsite dam
20 Teaching centre
21 Administration buildings & reception
22 Dining room & recreation facilities
23 Course participant accommodation
24 Golf course
25 Residential buildings
26 Landfill 1 (AWA)
27 Landfill 2 (CFA)
28 Air strip and hangar
29 School site
30 Sewerage treatment tank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