



# **Inquiry into the Explosion and Fire at Icepak Coolstores, Tamahere, on 5 April 2008**

**Incident Number F128045**



**New Zealand Fire Service**

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## EXECUTIVE SUMMARY

On Saturday, 5 April 2008 a serious explosion and subsequent fire occurred at the Icepak Coolstores facility in Tamahere near Hamilton. The incident followed a routine response by Hamilton fire crews to a smoke detector, and resulted in the death of one firefighter and serious injury to seven others. The National Commander of the New Zealand Fire Service appointed a four-person inquiry team to look into the circumstances surrounding the incident and to provide a draft report to him for comment within 90 days. This period was later extended by a further 30 days. The final report was required to be presented to the New Zealand Fire Service Commission.

This report describes what the inquiry team found out about the facility, the incident, and Fire Service preparedness for such an event. The team was given the freedom to use whatever processes it chose to conduct the inquiry, but had no powers to require documents or other information from external parties. Though many individuals and bodies were extremely helpful, the contents and findings of this report have to be considered within that constraint.

The coolstore facility was large, covering an area of around 4,000 m<sup>2</sup>. It provided storage for a variety of perishable goods but at the time of the fire was principally storing dairy products, including cheese and butter. It was located some 12 km from Hamilton, outside the urban fire district from which the fire crews attended. The facility was using a commercially available refrigerant known as Hychill Minus 50, which consists principally of propane.

The legislative framework surrounding the management and use of flammable refrigerants is complex, and it is not clear to what extent the Icepak facility complied with all requirements. There are a number of different mechanisms whereby the Fire Service could be informed that hazardous substances are in use at such a facility. The Fire Service could also have identified the facility through its own processes, even though the facility lay outside the Hamilton Fire District. Ideally fire crews of the Hamilton district should have visited the facility as part of their own risk planning process, but for a number of reasons, including possibly the site's location outside the district, this did not happen. The facility itself was always at risk from fire, with very large quantities of combustible material contained in the expanded polystyrene construction panels and also in the foodstuffs stored. There were no compliant fire detection or protection systems or hydrants, and very limited firefighting water.

At about 16:00 on the day of the incident, the Fire Service turned out two fire appliances (eight firefighters) to the reported operation of a smoke detector at the premises. With the agreement of the building owner, they made entry to a plant room at the facility, where they could see what appeared to them to be smoke, vapour, or leaking refrigerant. There appeared to be no smell associated with this smoke or vapour, and no warning signage about the presence of flammable gas appears to have been evident either on the buildings or inside the plant room. Three firefighters entered the building to investigate at around 16:28.

At 16:30 a massive explosion occurred. Flames and debris shot tens of metres in the air. The firefighters were seriously injured, and several of them were trapped under steel wreckage of the plant room. However, the drivers of the two appliances continued to manage the situation, call for help, and provide assistance to the others.

There were about 300 people attending a gala at the nearby school and about 80 were attending a wedding close by; some of these people started to run to the scene. Many of the people at the school gala were medically qualified. Over the next hour or so some 40 to 50 people who responded provided a considerable level of care to the firefighters, bandaging their injuries, cooling burns with water from one of the fire appliances, and resuscitating one of the officers who required CPR. These people cared for the injured firefighters until ambulances arrived, and in some cases they accompanied the injured to hospital.

The fire in the coolstore buildings grew with extreme rapidity.

The next three fire appliances and a water tanker started to arrive about 10 minutes after the explosion. The attending crews assisted with the care of the injured, and attempted to fight the fire, which was huge by this time, fuelled by burning butter and cheese. As more water tankers arrived, attempts were made to cut the fire off at a central driveway through the facility, but the radiation from flames tens of metres high was so intense that eventually this had to be abandoned. To protect the only coolstore buildings not involved in fire a second water curtain was set up and maintained. This could be achieved only after a steady shuttle of water tankers to and from the site was established over the next hour or so. Police closed one of the lanes on the adjacent State highway to facilitate this shuttle overnight.

A coordinated incident management system was set up very early, with the Hamilton hazmat-command unit as the incident control point. This worked well coordinating the efforts and interests of the many different agencies that became involved as the incident developed. Command and control processes were clearly in place from the early stages of the fire.

Process was put in place from the outset to manage the welfare of the injured firefighters and their families. Senior Fire Service personnel responded to Waikato Hospital and set up welfare support at Hamilton Fire Station. Later in the evening the Fire Service announced the death of one of the firefighters from injuries sustained in the explosion. A welfare support team responded from Auckland.

Recognising that the operational officers now had their own grief and that of their colleagues to contend with, regional management from Auckland and Western Fire Regions offered to come in and take control of the fire incident.

Environmental control was a serious challenge from the outset and an inter-agency team worked throughout the first evening and the next day to reduce the risk of fire water runoff into the local waterways, which would have had the potential to contaminate Hamilton's drinking water.

Communication with the local community in general was reported to have worked well, with the Fire Service becoming involved in several local events after the incident. Managing the intense media interest proved to be a major challenge for those at the scene, for the Fire Service media team in Wellington, and for those at Hamilton station. An experienced media coordinator was appointed at the incident, which was very valuable in the early stages. Not only the media but also large numbers of the public were very interested in the fire and put themselves at risk at times by getting too close. Management of scene security was further complicated by the arrival of large numbers of private investigators at the scene on the Sunday.

In terms of the training of staff, the inquiry team found that the Fire Service was adequately prepared for this incident. Operational instructions (National Commander's instructions) were in place for an incident of this type and were followed. The only possible exception was that firefighters who enter a building where the atmosphere is potentially irrespirable should wear and

use breathing apparatus; in this instance, it is not certain whether the firefighters had turned on their breathing apparatus. However, whether or not they had done so did not affect the outcome of the incident in this case.

Had the firefighters suspected a flammable atmosphere to be present, their training and National Commander's instructions would have required them to withdraw at once and evacuate to a safe place.

Personal protective equipment performed according to expectation. Full structural firefighting clothing, where it was worn, provided protection against burns. Such clothing is not designed to protect against blast injury. The appliances and other equipment at the scene also performed as expected, with the exception of the prototype hazmat-command unit where some aspects of its pilot communication and information technology systems need to be re-examined.

Scene examination, as well as examination of other evidence, suggests that the explosion was almost certainly caused by a leak of flammable refrigerant that was ignited when the firefighters were in the plant room. The igniting event was probably electrical.

Specific matters in the inquiry team's recommendations include the following:

- The Hazardous Substances and New Organisms ("HSNO") regulations and standards should be amended so that stationary refrigeration systems, and the refrigerant they contain, are subject to appropriate controls.
- All large-scale flammable gas installations should by law require inclusion of stenching agents in the gas.
- The regulatory regime as a whole should be reviewed to promote the sharing of information about hazardous substances between regulatory and other interested agencies.
- The current rural/urban fire legislation should be analysed in relation to risk planning and control of fires in buildings throughout New Zealand.
- Agencies need to share information about buildings using nationally consistent formats.
- Fire Service pre-incident planning processes need to identify high-risk buildings, including those that are outside the urban fire district.
- The current Fire Service instruction on significant incident and post-incident support should be reviewed to capture lessons learnt in this event.
- Fire Service operational instructions on the use of gas detectors should be reviewed to provide more detailed information.
- Formal security and scene handover procedures for major fires should be improved.

The inquiry identified nine different factors, any one of which could have avoided the risks and injuries to the responding firefighters:

- HSNO regulations applied fully to this installation
- prior notification to the Fire Service of hazardous substances at the premises
- receipt of an application for approval of an evacuation scheme
- pre-incident planning and familiarisation visit by local Fire Service staff
- Fire Service awareness of the large-scale use of flammable refrigerants in New Zealand
- warning signage at the premises
- stenching agent present in refrigerant gas
- flammable gas detection on the premises alerting crews
- crews using a portable gas detector.

This indicates that the fundamental cause of the incident may lie in part in systemic defects in the regulatory environment and the communication between the various regulatory agencies. This is an issue that may deserve wider investigation by the Government.

## **PART 1: INTRODUCTION**

This is the report of an inquiry team commissioned by the National Commander of the New Zealand Fire Service to investigate the circumstances of Incident Number F128045, an explosion and fire on 5 April 2008.

### **1 Description of incident**

On Saturday, 5 April 2008 at approximately four o'clock in the afternoon Hamilton Fire Station sent two fire appliances, each with a four-person crew, to a reported smoke detector activation at Icepak Coolstores, Tamahere, some 12 km from Hamilton. Approximately half an hour later whilst the crews were investigating at the scene, an explosion occurred and all eight responding firefighters sustained serious injuries. One officer subsequently died, and at the time of writing this report one other remains in hospital. After the explosion, a major fire engulfed the facility. The coolstore buildings were extensively damaged, and a new fire appliance was also lost in the incident.

### **2 Structure of the report**

The report is divided into eight parts. This introductory part sets the context of the report, discusses the terms of reference, and explains how the inquiry team went about its business. The second part provides the background to the incident; it includes a detailed description of the Icepak facility and an explanation of how the New Zealand Fire Service (“the Fire Service”) prepares for operational response. The third part describes the incident, not only in the form of a detailed chronology but also by exploring how various aspects of the incident were managed. The fourth describes the investigation of the fire scene after the event, and what might be deduced from it. The analysis is in Part 5, which leads to findings in Part 6 and recommendations in Part 7. Appendices form Part 8.

Internal investigations prepared by experienced professionals for use by experienced professionals do not usually describe normal Fire Service procedures for carrying out operational activities. Given the likelihood that the present report may attract interest from overseas agencies and the public, this report goes somewhat further than usual in explaining the nature of Fire Service business, as well as the meaning of commonly used terms, abbreviations, and acronyms.

### **3 Inquiry team membership**

In the days immediately after the explosion and fire, the New Zealand Fire Service National Commander appointed a four-person inquiry team to look into the circumstances surrounding the

incident. Investigation of the scene commenced within three days. The inquiry team membership was as follows.

Paula Beever, PhD CEng, BSc (Hons), FIPENZ, FIEAust, MSFPE, MIFireE (inquiry leader):

- Director Fire Risk Management, New Zealand Fire Service.
- International standing in fire engineering discipline.
- Particular qualifications in combustion science.

Paul McGill, MA, MCGI, MIFireE:

- Director of Operations and Training, New Zealand Fire Service.

Paul Henderson, MBA, BA (Hons), MIFireE:

- Assistant Fire Region Commander, South Canterbury.
- Joined the New Zealand Fire Service in August 2007. Previously Brigade Commander of the Durham and Darlington Fire and Rescue Service, UK.
- International experience in inquiries.

Steve Warner:

- Station Officer, Christchurch.
- President, New Zealand Professional Firefighters Union.

Given the nature of the incident and the high level of public interest the National Commander invited an experienced and respected independent fire investigator, Inspector Bob Alexander from the New South Wales Fire Brigades in Australia, to assist and advise the site investigation team. That team was set up by, and reported to, the inquiry team.

The inquiry team also had access to such other independent specialist advice and assistance it required.

## 4 Terms of reference

The terms of reference for the inquiry are attached as Appendix A.

In commissioning this inquiry the National Commander exercised his powers under the Fire Service Act 1975. The inquiry team is required to deliver its report to the New Zealand Fire Service Commission.

Within the Fire Service the requirement for certain types of internal investigation can arise as a result of three separate triggers.

First, under the Fire Service Act the National Commander of the New Zealand Fire Service issues operational instructions, one of which requires that the origin and cause have to be investigated and recorded for every fire that the Fire Service attends. For all fires this requires the relevant details to be filled in by the officer in charge on a web-based form. For most larger or otherwise significant fires there is, in addition, a detailed **scene investigation** and subsequent report prepared by an experienced fire investigator.

Secondly, where there is serious injury to Fire Service personnel, the organisation's health and safety manual requires as a matter of Fire Service policy that "all incidents that cause harm or

may cause harm to our employees ... are promptly reported and investigated". Where the harm is serious, a team is appointed to conduct a **serious harm investigation**.

Thirdly, where there is a major fire, Fire Service operational instructions require an **operations review** for all major incidents involving one or more of the following characteristics:

- fourth alarm<sup>1</sup> or greater
- substantial community disruption or loss
- substantial business impact
- long-term loss to communities and/or businesses
- any time when it is considered that the outcome will benefit the whole Fire Service, including when there will be significant benefit from the sharing of information obtained from incidents that have been handled successfully
- when recommended by the regional or national health and safety adviser in preference to an accident investigation after a serious harm accident or near miss
- when equipment or procedures have not operated in the manner intended
- when Fire Service operational assets, including equipment and appliances, suffer significant damage (significant damage is where any potential insurance claim exceeds \$2,000).

In each case it is normal practice to appoint an independent team with no operational involvement in the incident to undertake a formal review of how the operation was conducted.

It would be unusual for all three types of investigation (scene investigation, serious harm investigation, operational review) to be required for a single incident, but the Icepak incident triggers all three for a number of reasons. The terms of reference make it clear that all three investigations are to be conducted simultaneously by the inquiry team.

Reports from investigations referred to above are usually designed for internal consumption in a spirit of organisational learning and are conducted on a no-blame basis. The terms of reference require that this inquiry be conducted in the same way.

## 5 Inquiry team process

The inquiry team recognised that, in order to complete the work required by the terms of reference on time, a number of streams of activity would have to be carried out in parallel. Because of the nature of its work, the site investigation team was deployed to the scene as soon as practicable. Other subgroups were set up with the appropriate expertise to look at operational readiness for an event of this type, the regulatory compliance issues surrounding the Icepak facility, and data and information availability.

The inquiry team had no powers under legislation to require any external party to cooperate or to hand over information. A great many members of the public and representatives of other agencies freely gave of their time and effort to speak to the inquiry team over the weeks after it commenced its work. The National Commander directed all members of Fire Service staff to cooperate with the work of the team.

The inquiry team interviewed a large number of witnesses in relation to the incident. These included members of the public who arrived early on the scene, firefighters, police officers and

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<sup>1</sup> Discussion of alarm levels may be found in section 10.11.

ambulance personnel who arrived shortly after the explosion, communications centre staff responsible for receiving and transmitting messages throughout the event, and members of other agencies who were intimately involved with the incident over the days that followed.

In most cases the full four-person team conducted the interviews, though in some cases one, two, or three members of the team conducted certain interviews where circumstances dictated. A few interviews were conducted by telephone or videoconference. In each case, the process for conducting interviews was the same. Individuals were invited to speak frankly about their experience of the events under scrutiny. This was on the clear understanding that nothing would be released that could be attributed to the individual unless the inquiry team were required to do so by law, in which case this would first be communicated with the person concerned. The inquiry team members took handwritten notes as their own aides-mémoire and used these to compile this report. In order to avoid repeated interviews by multiple parties, police officers (acting on behalf of the Hamilton coroner) undertook the initial interviews of the injured firefighters, most of whom were still in hospital at the start of the inquiry. The transcripts of these interviews were made available to the inquiry team.

In addition to information obtained by investigators at the scene, the inquiry team also examined Fire Service records, photographs taken at the scene and building files, and studied radio message logs (described in section 10.11). The team also inspected the personal protective equipment retrieved from the injured firefighters.

The facility's owner, Icepak Coolstores Ltd, was unable to provide assistance to the inquiry team during the inquiry itself because of restrictions placed on it by its insurers. However, Icepak was able to provide comments on selected passages of the report in draft form, and those have been incorporated in the report.

## **6 Relationship to other inquiries**

As the terms of reference note, the Fire Service inquiry has been one of several concurrent inquiries and investigations into the cause and management of the incident. The Hamilton coroner has been undertaking an inquiry under the Coroners Act 2006, assisted by New Zealand Police. The Department of Labour has been undertaking an investigation under the Health and Safety in Employment Act 1992. And the Fire Service inquiry team has been aware of a number of private investigations being undertaken at the behest of insurers.

Each of the investigations has a different focus. The extent of investigative powers – and, accordingly, the information available to the investigators – also varies. For example, the Department of Labour has a power to require production of information for its investigation, and there is also a statutory duty on employers to provide assistance to it. The coroner also has powers to require information and summon witnesses. In the case of the Fire Service inquiry, it had no powers to compel anyone to produce information, although the National Commander did direct Fire Service staff to provide assistance if called upon.

The inquiry team has had extensive cooperation from many parties, but the inquiry team was also aware that the Department of Labour may have obtained some evidence that, for reasons connected with the objects of its own investigation, it has declined to make available to others at this stage.



The inquiry team has completed this report and prepared its findings on the basis of such evidence that has been available within the time for reporting set by the National Commander.<sup>2</sup> This time frame was set with a view to providing timely advice to the Fire Service Commission on matters that might need to be addressed with some urgency. The range of evidence collected is extensive.

Within the given time constraints and restrictions on availability of certain evidence, the team is confident that its findings are robust and reflect a comprehensive understanding of what happened before, during, and after the incident. However, the inquiry team would be happy to resume its investigations and review any findings, should the National Commander so direct, in the event that material evidence emerges at a later date of which the inquiry team had not been aware.

## **7 Specialised terms, abbreviations, and acronyms**

Appendix B provides a glossary covering the terms and abbreviations used in this report that relate mainly to Fire Service business and with which readers may be unfamiliar.

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<sup>2</sup> The 90-day period specified in the terms of reference for providing the National Commander with a draft report was subsequently extended by a further 30 days.



## **PART 2: BACKGROUND**

This part of the report covers the legislation governing aspects of the inquiry. It describes relevant details of the site of the incident and provides a background to the Fire Service.

### **8 Legislative framework**

The inquiry touched on many areas of legislative compliance, involving a number of different statutes and regulations. The focus was not to judge in a fault-finding way whether specific legislation was complied with, but to examine the adequacy of the legislative framework and its application, and identify points where the framework or its implementation could be improved in future.

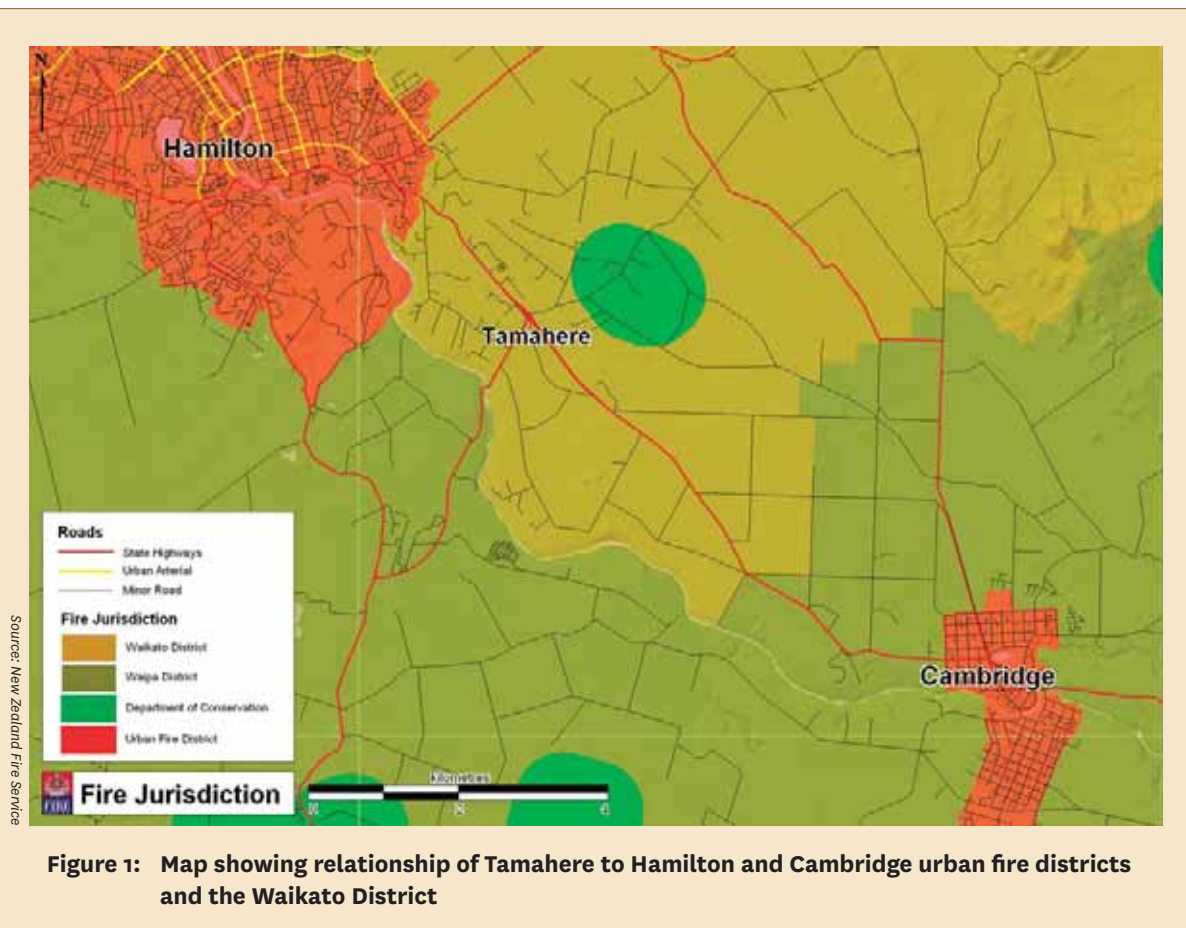
It is useful, at the outset, to summarise the key elements of the applicable framework.

#### **8.1 Fire Service legislation**

There are two statutes governing the prevention and response to fires in New Zealand. The Fire Service Act 1975 is the governing legislation of the New Zealand Fire Service Commission (“the Commission”) and the Fire Service, whose jurisdiction applies in respect of urban areas. The Forest and Rural Fires Act 1977 is the governing legislation for rural fire authorities, which operate in rural areas under the oversight of the Commission in its capacity as National Rural Fire Authority. About 99 percent of New Zealand’s land area is under the jurisdiction of rural fire authorities; however, 84 percent of New Zealand’s population resides within urban fire districts. The two statutes have a number of points of intersection, and together provide for a system of cooperation between urban and rural firefighters.

Tamahere is located in the New Zealand Fire Service Bay-Waikato Fire Region, but outside the Hamilton urban fire district. It lies within a territorial area for which Waikato District Council is the rural fire authority (see Figure 1). Despite that, it was the Fire Service that responded to the alarm. The issues around preparedness, safety, the Fire Service’s response, its management of the incident, and the involvement of other fire authorities (for example, in the provision of water) therefore brought into play a number of the points of intersection between the 1975 and 1977 Acts. These matters are discussed in sections 10.3 and 26.

Fire safety is dealt with comprehensively in the Fire Service Act, and is a function of the Fire Service Commission across New Zealand. Building owners must provide evacuation schemes for certain types and uses of buildings, and must notify and seek the approval of the Fire Service about such schemes. These issues are discussed further in section 9.5 of the report.



**Figure 1: Map showing relationship of Tamahere to Hamilton and Cambridge urban fire districts and the Waikato District**

## 8.2 Hazardous substances management

Hazardous substances are controlled and managed under the Hazardous Substances and New Organisms (“HSNO”) Act 1996, under the oversight of the Environmental Risk Management Authority (“ERMA”). The HSNO regime is extremely complex, and contains a large number of regulations, rules, and standards relevant to the Icepak facility, its refrigeration plant, and the refrigerants used in it.

The report examines the compliance issues under the HSNO regime in section 9.9.

## 8.3 Building and resource consents

Land use issues are governed by the Resource Management Act 1991 (“RMA”). Building requirements are governed by the Building Act 2004. Both statutes are implemented at regional and local government level. Regional and local authorities also have obligations under the Local Government Act 2002 and a range of other legislation.

The terms and conditions of the resource consents for the Icepak facility under the RMA, and compliance with building requirements under the Building Act, are addressed in sections 9.3 and 9.4 (with further detail in Appendix C).

## 8.4 Occupational health and workplace safety

Workplace safety is governed by the Health and Safety in Employment (“HSE”) Act 1992. This Act applied to Icepak as the owner of the facility and as an employer of the staff who worked there, and also to the Fire Service, whose staff attended the incident at the facility in the course of their



**Figure 2: Map showing the locality of the Icepak coolstore facility**

employment. Regulations made under the HSE Act apply to stationary refrigeration systems. These are discussed in section 9.9.

The Fire Service has duties under the HSE Act, and the National Commander issues operational instructions that draw on and give effect to those duties. These raised a number of issues relevant to the inquiry.

The Department of Labour administers the HSE Act, and its inspectors have powers to investigate workplace accidents and take enforcement action against employers. Those compliance matters are outside the scope of this inquiry.

## **9 Location, design, and use of the Icepak facility**

This section describes the nature of the industrial facility at Tamahere owned by Icepak Coolstores Ltd and the regulatory conditions under which the facility operates.

### **9.1 Tamahere**

The coolstore facility was located in Tamahere, a rural community of some 4,000 people. It is located about 12 km south-east of Hamilton and about the same distance from Cambridge on State Highway 1 (see Figure 2). The community consists mainly of rural dwellings and lifestyle blocks. Properties mainly use their own tank water.



Figure 3: Site plan of the Icepak facility

Prior to the fire, the most prominent building in Tamahere would have been the Icepak coolstore. The facility was situated alongside State Highway 1, though with no access from the highway itself. The site street address is 30 Devine Road; it also has access from Koppens Road on the south-west side of the site.

The coolstore was located 150 m north-west of Tamahere Model Country School. The school caters for about 400 primary students. The school is set in spacious grounds with playing fields, swimming pool, and tennis courts. Between the school and the Icepak site is a single-storey dwelling (34 Devine Road) with its garden fence on the Icepak boundary. Within the school grounds is a new community centre. On the far side of the coolstore to the school and about 250 m further away is Gails of Tamahere, a self-contained function centre with a small historical church and entertainment facilities. Between the coolstore site and Gails are paddocks also owned by Icepak but as yet undeveloped.

Tamahere is situated 3.5 km from the boundary of the urban fire district of Hamilton, and 12 km from Hamilton Fire Station.

## **9.2 Site history**

Icepak Coolstores at Tamahere was one of the major refrigerated and temperature-controlled storage facilities in the Waikato. Facilities at Icepak consisted of blast freezing, cool storage, and cold storage activities for a wide range of horticultural and agricultural products. (Figure 3 is a site plan of the Icepak facility.) The majority of the products stored at the Icepak site were locally grown and/or produced within a 15–30 km radius of the site. The site has been used for horticultural- and agricultural-related activities since the early 1970s.

The main industrial development of the site appears to have begun in the early 1980s with construction of a packing shed for fruit and vegetables. In 1997 a proposed plan process resulted in the cool storage activities being included as a permitted activity in Waikato District Council's district plan. Under the plan, the company's activities were limited to dealing with horticultural produce. An extension was then sought to expand the facilities to a wider range of produce to include horticultural and agricultural products and dairy products, as well as more diverse products such as biological samples for research.

As a result of this application for extension, the council included the site's proposed activities as a permitted activity in the district plan, allowing for three separate activities:

- horticultural services
- preliminary processing of horticultural produce
- cool storage.

Operations within the coolstore gradually moved away from servicing smaller, regular clients to clients with larger volume business. This resulted in the facility incorporating bulk storage of produce such as fruit, vegetables, and dairy products.

The recent fire at this site has not been the first. In 1985, before it was owned by Icepak, a fire occurred at the site and the complex was completely destroyed.

## **9.3 Resource consents**

Applications for resource consent for the Tamahere site have occurred since the early 1970s and have continued up to 2003. A summary of the history of resource consents for the site can be seen in Appendix C. A further consent was applied for in 2007; this included the establishment and

operation of a four-cell cold store and associated plant room adjacent to the existing cold store to the north-west of the site. It was proposed that this new cold store facility would be used in conjunction with the existing site, storing produce and products as bulk storage with a capacity of an additional 7,520 pallets. This application, however, was withdrawn and did not go ahead.

The resource consent applications since 2002 were triggered and publicly notified for bulk and location reasons (i.e. controls relating to side yards, location and height of buildings, etc), not for the activity of being a coolstore or for the presence of any hazardous materials. Submissions were made in favour of and in opposition to the proposed works. In addition, specific matters relating to these submissions were also addressed via resource consent hearing meetings.

Of the resource consents received since 2000, public submissions received in favour of the developments centred on the fact that the Icepak site provided a needed resource to local industry and businesses. Submissions opposing the developments centred mainly on the potential increases in traffic and heavy vehicle movement within the local area, poor aesthetics and visual outlook, increased hours of operation, use rights and zoning, and an increase in noise production.

In relation to fire risk, submissions received by Waikato District Council objecting to some of the resource consent applications expressed concern at the potential for fire given the presence of a polystyrene-clad building structure and the possible presence of hazardous substances. Moreover, submitters also raised concerns regarding a perceived lack of additional precautions (such as an extra water supply) to mitigate the perceived fire risk for firefighters and potential risk to nearby residential properties. The council's practice was to address these matters as part of the building consent (rather than the resource consent) process. The council told the inquiry team that it relied on evidence presented by Icepak during the resource consent hearings that Icepak had appropriately mitigated fire risks which, in combination with the building consent regulatory process, meant that resource consent conditions dealing with fire risk were unnecessary. Icepak commented to the inquiry team that it met all building code requirements and that all of its coolstores had a code of compliance.

In the conditions stipulated with the granting of RMA 69/03/020 in 2003, the council placed a condition pertaining to the use of hazardous substances. This stipulated that no hazardous substances that exceeded the quantities for permitted activities should be stored or used on site without prior approval of the council's district hazardous substances officer. This was the only condition pertaining to hazardous substances that was evident in the granting of any resource consent application.

No resource consents contained conditions in regard to firefighting water supplies. However, there was no legal requirement that they should; although the Fire Service has published a code of practice for firefighting water supplies, this code applies only to urban fire districts and its use is not mandatory under any legislation.

Since 2000 Waikato District Council has notified the Fire Service of all resource consent applications it has received, by sending copies to the chief fire officer ("CFO") for the Hamilton Fire District. The Fire Service, however, did not make a submission on any resource consent application involving Icepak.

It should be noted here that matters concerning the storage or use of hazardous substances on a site would arise in a resource consent process under the RMA only if specifically addressed in a district plan. However, proposed storage or use of hazardous substances rarely triggers the requirement for a resource consent and hence is rarely the subject of a submissions process. If it is, the conditions for a specific facility are usually achieved through the determination of



appropriate locations or zoning for the storage or use of the substance, rather than by a process of registration.

The registration of hazardous substances is covered by the HSNO regime, which is not open to submissions on applications from outside parties. Therefore, the main opportunity for public involvement in matters relating to storage of hazardous substances is through local government plan changes.

#### **9.4 Building consents and fire engineering designs**

Buildings in New Zealand must comply with the provisions of the New Zealand Building Code. In respect of fire safety, compliance with this code may be demonstrated by following a set of compliance documents (known as C/AS1) or by undertaking a specific design making use of fire-engineered solutions. In the case of storage buildings, such as are relevant here, the provisions of C/AS1 vary depending on the fire hazard category (“FHC”) of the material being stored; for example, fruit falls into FHC 1 category and is treated as a much lower fire risk than cheese, which is FHC 4 (the highest category).

##### ***Building consents***

In all, 26 building consents have been issued for the site at Tamahere. These consents cover the period from the late 1960s to 2004 with Code Compliance certificates and permits issued up to 2007. A summary of the building consent history for the site can be seen in Appendix C.

The site at Tamahere underwent considerable change throughout the 1960s and 1970s, during which period a number of building consents were received. However, a fire in 1985 saw the complete destruction of the building facilities. The building facilities present at the time of the 2008 fire, therefore, have resulted from building work and associated consents since 1985.

The 1990s saw very little change to what had evolved in the preceding years apart from the inclusion of an additional freezer. Since 2000, consents were granted to expand the number of coolstores on the site as well as for an office addition.

##### ***Fire engineering designs***

Documentation held by Waikato District Council showed that three separate fire engineering reports were completed for the buildings on the site since 2002. These reports were submitted for the purposes of obtaining a building consent for the following developments:

- 2002. A new single-level building of 510 m<sup>2</sup>, to be used as a coolstore for storing fruit. A new 302 m<sup>2</sup> canopy was to be attached to the front of the coolstore. The coolstore was designed as an FHC 1 facility.
- 2004. The construction of two new coolstores with the ability to have racking systems in excess of 3 m in height. The coolstores were designed as FHC 4 facilities.
- 2005. The construction of two new coolstores attached to each other and divided into five rooms. The buildings were also designed with the intention to have racking systems in excess of 3 m in height. The coolstores were designed as FHC 4 facilities.

The primary construction material was Bondor insulation panel. These panels were long-span, lightweight, insulated panels constructed from galvanised outer and inner steel sheeting and containing an expanded polystyrene (“EPS”) core.

Parts of the buildings stored large quantities of produce and product on wooden pallets in high-density storage. Two of the three fire reports refer to bulk storage of goods in excess of 3 m in height and to the buildings being FHC 4. The compliance documents, C/AS1, to the New Zealand Building Code, require specific fire engineering design to be carried out for a building where an FHC of 4 is present. C/AS1 provides the following comment to the requirements for FHC 4 buildings:

Specific *fire* engineering design for *fire hazard category 4* will typically commence with the design of an active protection system. This system must be purpose designed to meet the design *fire hazard* for the particular application and to control a developing *fire*.

None of the fire reports assessed the building's risk through specific fire engineering design methods. Of note here is the specific reference in the fire reports to the fitting of signs relating to "Potential Hazards such as dangerous goods and electrical hazards".

## 9.5 Evacuation scheme provisions and requirements

A building owner is required to provide and maintain an evacuation scheme for any building that falls within the definition of a "relevant building" under section 21B of the Fire Service Act. For the purposes of section 21B, the Act defines the term relevant building as one that is used (amongst other things) for the following:

- providing employment facilities for 10 or more persons (section 21A(1)(b))
- storing or processing hazardous substances in quantities exceeding the prescribed minimum amounts (section 21A(1)(d)).

The Icepak facility did not provide employment facilities for 10 or more persons. Of more significance is the requirement for an evacuation scheme triggered by the storing or processing of hazardous substances. The prescribed minimum amounts are specified in the Fire Safety and Evacuation of Buildings Regulations 2006, in terms of the property of the substance (and physical state) and the quantity. The trigger for requiring an evacuation scheme for a flammable gas such as propane is 30 kg or 20 m<sup>3</sup>. The quantity of propane gas stored in the refrigeration system at the Icepak coolstores would have exceeded this amount.

Icepak told the inquiry team that it did not consider that its use of hydrocarbon refrigerant in its refrigeration system involved "storing or processing" a hazardous substance, meaning that there was no requirement to provide or seek approval of an evacuation scheme.

## 9.6 Coolstore design

Coolstores and associated structures where temperature controlled environments are planned present design challenges. Though none appear to be called up specifically in New Zealand legislation, there are a number of guides and standards available internationally that govern coolstore design.

The guidance summarised in Appendix D recognises that the complexity encountered in the design of modern large industrial buildings with their associated processes (as exemplified by coolstores) falls largely outside of prescriptive fire codes. Although these prescriptive codes address life safety matters, they do not offer guidance on specific risks encountered only with such structures.

International guidance is aimed at those who design, construct, and provide support functions to such buildings. This guidance offers risk-based approaches for identifying and mitigating

risks associated with the design, operation, maintenance, and management of coolstores within loss management frameworks. Guidance parameters include building construction and use of materials to limit the effects of fire and smoke and to limit structural collapse; the inclusion of appropriate automatic fire alarm systems; appropriate maintenance and inspection regimes for equipment and plant; use of refrigerants and other related substances; firefighting provisions; appropriate fire safety management practices; and the minimisation of business interruption due to a fire event.

## **9.7 Use of refrigerants**

The Icepak facility had previously used ammonia- and hydrochlorofluorocarbon (“HCFC”)-based refrigerants. At some stage the use of ammonia had been discontinued, though the disused ammonia receiving equipment was still on site. This turned out to be of importance during the developing fire on 5 April.

Because of the known ozone-depleting properties of HCFCs there has been a move internationally towards what are known as “natural” refrigerants, including not only ammonia and carbon dioxide but also those based on hydrocarbons. Hydrocarbons are more energy efficient in use than HCFCs and do not have ozone-depleting properties. By formulating appropriate mixes of different hydrocarbons it is possible for refrigerant suppliers to provide proprietary mixes that have the same refrigerant properties as the HCFCs that they might replace. In this sense, manufacturers offer these mixes under various trade names as “drop-in” substitutes for HCFCs. However, this notion of “drop in” takes no account of the fact that hydrocarbons are flammable and, under various regulations, their use may call up additional safety measures in the systems in which they are installed.

Icepak’s coolstore at Waharoa, near Matamata, had been constructed with a refrigeration system using a proprietary hydrocarbon mix manufactured by HyChill in 2007, with the aid of a grant from the Government’s Energy Efficiency and Conservation Authority (“EECA”). This installation was being monitored in order to establish whether predicted energy savings could be achieved. EECA regarded this installation as a pilot, and the academic adviser on the project stated when interviewed that he was unaware of any other large-scale use of propane refrigerants. Two refrigeration experts contacted by the inquiry team confirmed that they were unaware of any others. Small-scale use of hydrocarbon refrigerants (less than 4 kg) in motor vehicles, domestic heat pumps, fridges, and commercial milk vats is known to be reasonably common.

Icepak began using propane-based refrigerants at its Tamahere coolstore facility in January 2003, when its new plant was completed under building permit 94986 (see Appendix C, Table C3). The rest of the facility continued to run on the HCFC refrigerant known as R22. The fact that propane-based refrigerants were installed came to light only later on in the evening of the incident. After the Tamahere fire the Waharoa plant was converted back to HCFC. Subsequent inquiries have revealed that there was at the time of the Icepak incident one other large coolstore installation in the country using hydrocarbons as refrigerants.

Until the Icepak incident, it appears that the Fire Service was unaware of the large-scale use of flammable refrigerants in New Zealand. It has no record of being notified of the use of such substances at the Tamahere coolstore. Icepak’s introduction of propane-based refrigerants at the facility did not trigger any notification to the Waikato District Council. The company did not consider that the change involved any change of use under the relevant building consents. (This issue is discussed further in section 23.5.)

The use of hydrocarbon refrigerants is covered within Australian/New Zealand Standard AS/NZS 1677:1998 Refrigerating systems and by a large number of international standards and guidelines. These are summarised in Appendix E.

Guidance includes details for the approach to safe design of systems containing hydrocarbon refrigerants, as well as considerations relating to key factors such as the amount of refrigerant in a system (the refrigerant charge), room sizing, and whether the system installed is in a domestic, commercial, or industrial occupancy.

For the purposes of AS/NZS 1677:1998, refrigerants are classified into three flammability groups and two toxicity groups; restrictions on the refrigerant charge are outlined against this classification. R22 is in the low flammability classification of A1. A3 refrigerants (of which propane is one) are described as being highly flammable and potentially explosive. AS/NZS 1677 recommends an assessment procedure for the use of this type of refrigerant. Recommended considerations include a site survey, the classification of all occupancies, an assessment of hazardous zones, electrical equipment suitability, exclusion zones for sources of ignition, factors preventing the dispersal of leakage, ventilation, gas detection, operation, and maintenance.

The use of suitable electrical equipment is highlighted as one of the most fundamental differences between systems that use flammable and non-flammable refrigerants. Guidance is provided for the selection of appropriate electrical apparatus for hazardous areas and highlights further references to consult. Refrigerant gases of A3 type are required under the standard to be “odourized”, and machinery rooms are required to be designed to prevent the ignition of an explosive refrigerant/air mixture.

Available guidance also highlights the need to take suitable precautions to prevent the accumulation of leaked refrigerant.

## **9.8 Services to the facility**

The Icepak site and immediate surrounding area was served by a 100 mm diameter water pipe. Waikato District Council installed this water main in 2004 with the intention of servicing future residential developments in the area. The water supply line occupied the road reserves of Devine and Koppens Roads. Although this main exists, it is understood that the Icepak site itself was served by a trickle feed supply, as were local dwellings. A 20 mm line ran from the main 100 mm line and terminated at the site boundary. It is understood that a water meter and a flow restrictor were also put in place to monitor and restrict the supply to the main site.

Documentation held by Waikato District Council highlights that, prior to the fire event, the Icepak site had obtained the remainder of its water supply from stormwater roof and gutter collection. This water was then collected within three on-site water tanks, which were located near Koppens Road. The documentation highlighted that this water supply also served as a back-up supply to the Tamahere School in case of a fire hazard. The size of the water tanks on the Icepak site is not certain. Estimates conclude that storage of the order of 18,000 litres was present in each tank.

Waikato District Council has confirmed that no fire hydrants were installed along the 100 mm water pipe. Although the council confirmed that hydrants are placed along water mains in the urban areas, this is not necessarily the case for rural areas such as that of the Tamahere site. Such installations are at the cost of the owners/developers.

This water supply did not provide firefighting capacity in the Tamahere area. It was noted as part of the resource consent application process (RMA 69/03/020) that if a firefighting water supply

was desired, then water storage would need to be provided on site, or alternatively tankered to the site. No further details were provided in this regard and (as noted in section 9.3) no stipulation was made via the resource consent process to make provisions for firefighting water.

Historical information from Fire Service fire safety and operational officers indicates that there has been very little involvement of Fire Service staff in matters pertaining to firefighting and water supplies at the Icepak site. It is understood that the water tanks on site were provided with 120 mm round threaded fittings so that they would be available for firefighting, on advice from the Fire Service after an officer visited some years ago.

## 9.9 Hazardous substances

Icepak was understood to be using about 400 kg of Hychill Minus 50 as a refrigerant in its coolstores. This substance is a form of liquefied petroleum gas (“LPG”) containing approximately 95 percent propane and 5 percent ethane, with small amounts of other hydrocarbons and additives. Under the HSNO Act it is a hazardous substance with the classification 2.1.1A.<sup>3</sup> It is approved for use under HSNO, by virtue of

- the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (“Transfer Notice”),<sup>4</sup> approval code HSR 001009
- the Compressed Gas Mixtures (Flammable) Group Standard 2006 (“group standard”),<sup>5</sup> approval number HSRO02532.

The Transfer Notice applies a number of the controls under the HSNO regime to the substance, irrespective of the mode of its use. Importantly for this report, those controls include the Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001 and the Hazardous Substances (Identification) Regulations 2001 (see more detail below).<sup>6</sup> The Hazardous Substances (Emergency Management) Regulations also apply to the substance.<sup>7</sup>

Schedule 8 of the Transfer Notice contains a number of controls relating to the containment of a substance in a stationary container system. Those controls include engineering and performance requirements for the system, standards for design, construction and installation, and pressure management controls. However, significantly for this report, Schedule 8 does not apply if the stationary container forms an integral part of a refrigerating unit.<sup>8</sup> ERMA informed the inquiry team that this is because refrigeration equipment is considered to be “pressure equipment”, which is regulated by the Health and Safety in Employment (Pressure Equipment, Cranes and Passenger Ropeways) Regulations 1999 (discussed below).

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3 Pursuant to the Hazardous Substances (Classification) Regulations 2001. The Environmental Risk Management Authority’s current classification document for LPG is available at [www.ermanz.govt.nz/appfiles/orgctrl/pdf/HSRO01009con.pdf](http://www.ermanz.govt.nz/appfiles/orgctrl/pdf/HSRO01009con.pdf).

4 Gazetted on 26 March 2004, and subsequently amended. The purpose of this notice was to transfer certain substances from the transitional provisions of HSNO (in Part 14) to full application of the HSNO regime. On transfer, those substances were deemed to be approved for import or manufacture under section 29 of HSNO; see clause 3(3) of the Transfer Notice. The consolidated text of the Transfer Notice, incorporating amendments since 2004, is available at [www.ermanz.govt.nz/resources/publications/pdfs/consolidatedGN35and128.pdf](http://www.ermanz.govt.nz/resources/publications/pdfs/consolidatedGN35and128.pdf).

5 The group standard is available at [www.ermanz.govt.nz/appfiles/orgctrl/pdf/HSRO02532Con.pdf](http://www.ermanz.govt.nz/appfiles/orgctrl/pdf/HSRO02532Con.pdf).

6 Transfer Notice, clause 5(1)(a), (c). Schedule 3 of the Transfer Notice amends the application of these regulations in certain respects.

7 Transfer Notice, clause 5(1)(f). Schedule 3 of the Transfer Notice amends the application of these regulations in certain respects.

8 Transfer Notice, Schedule 8, clause 1(2)(d).

A similar exclusion exists in respect of the Hazardous Substances (Compressed Gases) Regulations 2004. Those regulations include provisions in respect of fitting, labelling and marking, testing, and the charging both of cylinders and of stationary tanks. However, for the same reason as in respect of the Transfer Notice, the regulations do not apply to a compressed gas container that forms an integral part of a refrigerating unit.<sup>9</sup>

The group standard applies to compressed gas mixtures such as Hychill Minus 50. The standard covers such matters as labelling and advertising, site and storage requirements, approved handling and tracking, packaging, and the use of equipment when handling a substance. Clause 4(4)(b) of the standard provides that it does not apply to LPG.<sup>10</sup> This exclusion is different, in both scope and effect, to those in Schedule 8 of the Transfer Notice and the Hazardous Substances (Compressed Gases) Regulations. However, as with the Transfer Notice, the conditions of the standard do not apply to a substance that is used as a refrigerant when that substance is contained within a refrigeration system.<sup>11</sup>

The effect of these provisions in respect of an LPG-based refrigerant is that the HSNO regime has only limited application to the substance to the extent that it is used in a refrigeration system. Between the Transfer Notice and the group standard, the former provides a greater level of coverage.

The following HSNO controls do appear to have applied to the substance as used in the Icepak refrigeration system:

- The Hazardous Substances (Identification) Regulations require the use of priority and secondary identification, and the use of signage where the amount of the substance in a place exceeds 250 kg.<sup>12</sup>
- The Hazardous Substances (Classes 1 to 5) Controls Regulations require a hazardous substance location to be established and a location test certificate obtained for flammable gas contained in a refrigeration system if more than 100 kg in quantity.<sup>13</sup>
- The Hazardous Substances (Emergency Management) Regulations require an emergency response plan to be in place when the quantity of the substance exceeds 300 kg.<sup>14</sup>

As stated above, the Health and Safety in Employment (Pressure Equipment, Cranes, and Passenger Ropeways) Regulations cover the pressure vessels used in a stationary refrigeration system.<sup>15</sup> These regulations are administered by the Department of Labour. They impose a number of duties on the controllers of pressure equipment, including the requirement for certificates of inspection.

In addition to some 400 kg of Hychill Minus 50 refrigerant contained in the refrigeration system, it was established that there were on site

- oxy-acetylene gas set
- 1 × 9 kg LPG cylinder

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9 Clause 3; paragraph (c)(iv) of the definition of “compressed gas container”.

10 If the substance is not covered by the approval of LPG under the Transfer Notice, then the effect of clause 4(4)(b) of the group standard would be to exclude it from the coverage of the standard.

11 Clause 22 of the group standard.

12 Regulations 7, 51; Schedule 3.

13 Regulations 77, 81. The minimum amount of a class 2.1.1A substance is specified in Schedule 3, Table 4.

14 Regulations 25(1), 27, and 42; Schedule 4.

15 See regulation 4, the definition of “pressure fittings” in Schedule 1, which includes piping that holds gases at pressures exceeding 50 kPag, and the limited nature of the exemptions in respect of refrigeration systems in Schedule 2.

- 1 × 45 kg LPG cylinder
- 2 × 13.6 kg cylinder HCFC refrigerant.

These quantities fall under the threshold requiring a location certificate. Even so, the person in charge had to ensure that they were stored in compliance with the Hazardous Substances (Classes 1 to 5) Controls Regulations. This included the requirement for a hazardous atmosphere zone (with additional and very important requirements under the Electricity Act 1992 involving electrical installations), and the need to reduce the likelihood of unintended ignition.<sup>16</sup>

Stenching agents are normally required as additions to flammable gases, which often have no odour of their own to alert the user to a leak. The concentration of the added stenching agent is designed to provide warning before a potentially explosive mixture develops. Technical information provided by the manufacturer concerning Hychill Minus 50 says it is odourised before transport handling and is detectable to 20 percent of its lower flammable limit. The manufacturer also says that “unodourised Minus 50 does not have good warning properties”. Stenching agents can dissipate during handling and use, and need to be checked and refreshed if necessary.

## 9.10 Signs

The issue of signage was of importance to the inquiry. To summarise, the signage requirements concerning the use of a flammable substance in a building include the following:

- The New Zealand Building Code requires signs warning of dangerous goods, in the form of caution signs (the requirements for which are set out in the compliance document for clause F8).<sup>17</sup> All building work must comply with the building code, whether or not a building consent is required in respect of that building work.<sup>18</sup>
- The Hazardous Substances (Identification) Regulations require the use of priority and secondary identification, and the use of signage where the amount of a hazardous substance present exceeds the stipulated amount. In the case of a 2.1.1A substance, the minimum amount is 250 kg.<sup>19</sup>
- Health and safety in employment legislation requires information to be available to employees about the safe use of equipment. In the case of pressure vessels (such as a sealed refrigeration system storing refrigerants at pressure), the controller of such equipment must take all practicable steps to ensure that information is obtained and accessible, to ensure that every activity involving the equipment can be carried out safely.<sup>20</sup>

A fire crew attending an incident at a building where hazardous substances are present would normally rely on the existence of signs to alert them to the presence of such substances, and operational instructions would then dictate how the crew would respond. This is of particular importance if the building is unoccupied or no staff are present at the time of the alarm.

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<sup>16</sup> Regulations 6, 58, and 59.

<sup>17</sup> Compliance Document for New Zealand Building Code, Clause F8 Signs, paragraphs 2.2.2, 6.1.2. The term “dangerous goods” means any materials included in the UN classification, and in effect has the same meaning as “hazardous goods”.

<sup>18</sup> Building Act 2004, section 17.

<sup>19</sup> Regulations 7, 51; Schedule 3.

<sup>20</sup> Health and Safety in Employment (Pressure Equipment, Cranes, and Passenger Ropeways) Regulations 1999, regulation 8.

**Table 1: Products estimated to be within the coolstores on 5 April 2008**

Room name	Temperature (°C)	Product	Storage method	Other information
<b>Building 1 (“Waikato-Transit Building”)</b>				
West	20	Cheese	Racked	
Chestnut	20	Cheese	Racked	
Waikato	20	Cheese	Racked	
Okato	4	Cheese	Racked	
Transit	4			
Ohaupo	20	Cheese	Racked	
Gouda	4	Cheese	Racked	
Ozone				
East	4			
Cambridge				
Hamilton	10			
<b>Building 2 (“F3-F4 Building”)</b>				
F1	-18	Venison	Racked	
F2	-18	Venison	Racked	
F3	4	Bulk cream	Pallets	Tatua Dairy Company dairy whip in aerosols
F4	-9	Butter/Anhydrous milk powder		
F5	10	Not running		
<b>Building 3 (“Lichfield-Tatua Building”)</b>				
Lichfield	20			
Tatua	4			

Note: Despite the use of the term “coolstore”, some rooms were maintained at temperatures as high as 20°C.

### 9.11 Products stored

Information on products stored at the site on the day of the fire was obtained at the fire scene. Exact records are thought to have been destroyed in the fire, and Table 1 contains what was believed to be there at the time. Though exact quantities are unavailable, there was thought to be 2,000–4,000 tonnes of cheese in total.



## **10 Background to the New Zealand Fire Service**

This section of the report summarises the regulatory, organisational, and operational characteristics of the Fire Service that have a bearing on the inquiry.

### **10.1 Mandate and responsibilities of the New Zealand Fire Service Commission**

The Fire Service Act 1975 and the Forest and Rural Fires Act 1977 charge the New Zealand Fire Service Commission with the protection of life and property from the dangers of fire. The board of the Commission is responsible for the good governance and general control of the Fire Service and is the National Rural Fire Authority for the purposes of the Forest and Rural Fires Act. The Commission is a Crown agent under the Crown Entities Act 2004, reporting to the Minister of Internal Affairs, and is subject to the accountability framework prescribed for Crown entities.

### **10.2 Role**

The mission of the New Zealand Fire Service is to reduce the incidence and consequences of fire and to provide a professional response to other emergencies. To discharge that duty, the Commission can call on about 10,000 (paid and volunteer) people and 800 fire appliances throughout the Fire Service to respond to fire emergencies. Rural fire authorities have an additional 3,500 volunteers at their disposal to respond to emergencies in rural areas. The Fire Service also responds to a wide range of non-fire emergencies including motor vehicle accidents, hazardous substance emergencies, medical emergencies, and local and national civil emergencies, as well as providing a range of specialist services such as collapsed trench rescues, irrespirable atmosphere rescues, and animal entrapments.

### **10.3 Legislative context**

Fire legislation draws a strong delineation between urban and rural fire control. In essence, responsibility for urban fires rests with the Fire Service, and responsibility for rural fires rests with rural fire authorities. The Commission has an overarching responsibility, being responsible both for the general control of the Fire Service and (in its capacity as the National Rural Fire Authority) for the coordination of all matters relating to national rural fire control.

The jurisdiction of the Fire Service is exercised through fire districts, which are established under section 26 of the Fire Service Act. A fire district is established in respect, and for the protection, of an “urban area”, which is defined to mean an area used mainly for commercial, industrial, or residential purposes. The Commission has power to establish, abolish, or alter the boundaries of a fire district. Each district is under the command of a CFO, who has certain defined responsibilities under the Fire Service Act. In terms of fire safety, the Fire Service Commission has responsibilities that apply across the country irrespective of the geographical limitations of fire districts.

Areas of the country outside urban fire districts are organised into rural fire districts, each of which falls under the jurisdiction of a rural fire authority (typically, but by no means exclusively, the local territorial authority). A rural fire authority has a legal duty both to prevent and to respond to, and extinguish, any fire in the area of its jurisdiction – including a fire in a building.

The Fire Service has jurisdiction for firefighting in rural fires in rural areas only to the extent that agreements or arrangements made by the Commission allow. Nevertheless, section 28A(1) of the Fire Service Act provides that in the event of a fire or other emergency occurring outside the fire

district, the CFO (or deputy or person in charge) “may proceed ... forthwith to the emergency, to take whatever action is necessary to save lives and property in danger”.

#### **10.4 Management structure**

The Fire Service is a national organisation, divided into eight geographical regions, each under the management of a fire region manager reporting to the chief executive.

The Chief Executive of the Fire Service is also the National Commander, the most senior operational officer, who has responsibilities under section 17O of the Fire Service Act to “make provision in every Fire District for the prevention of fire, the suppression and extinction of fires, and the safety of persons and property endangered by fire”. He is also required to ensure that the Fire Service is maintained in a state of operational efficiency.

There are 346 urban fire districts and 436 fire stations. Some employ paid staff, some use volunteers, and some a mixture of the two, each under the command of a paid or volunteer CFO.

The operational ranks in order of seniority are

- National Commander
- fire region commander
- assistant fire region commander
- chief fire officer
- deputy chief fire officer
- senior station officer
- station officer
- senior firefighter
- qualified firefighter
- firefighter.

Most standard fire appliances carry a crew of four firefighters including an officer, while many specialist appliances have a two-person crew. At an incident where multiple appliances attend, overall command rests with the first arriving officer unless a more senior officer arrives and assumes command.

#### **10.5 Hamilton Fire District**

The Hamilton Fire District contains three fire stations named Hamilton, Pukete, and Chartwell. Paid firefighters staff these stations, working day and night shifts across four watches to provide 24/7 coverage. Each shift has four staff on duty at Pukete and Chartwell and eight staff at Hamilton. Hamilton station has two standard pumping appliances with calls signs of Hamilton 411 and Hamilton 412.

Hamilton station is also resourced with a volunteer operational support unit.

Other appliances based at the station include a combination hazardous material and command (“hazmat-command”) vehicle and an aerial appliance. These vehicles are staffed by the on-duty crew and by staff called back to duty, depending on the requirements of a particular emergency situation.

A CFO and a deputy chief fire officer (“DCFO”) manage the Hamilton Fire District. The CFO reports to the Waikato assistant fire region commander (“AFRC”) based in Hamilton, who in turn reports to the fire region manager (“FRM”) of Bay-Waikato based in Tauranga.

## **10.6 Operational readiness**

This report now describes how the Fire Service prepares itself to manage emergencies effectively. This is called “operational readiness”. Readiness includes all the resources and processes that contribute to mobilising resources quickly to an incident and dealing with it safely and effectively on arrival.

The elements of readiness detailed below (section 10.7 to section 10.16) are those aspects most relevant to the Icepak incident. However, they do not relate to the Icepak incident specifically. Rather they provide a framework for the inquiry team to analyse the performance of the Fire Service at the incident (see Part 5).

## **10.7 Operational instructions**

As required by the Fire Service Act (section 27A), the National Commander issues operational instructions for the guidance of all members of

- the Fire Service who hold Fire Service rank
- volunteer fire brigades
- defence fire brigades
- industrial fire brigades.

These operational instructions are notified in the Fire Service Gazette and published on FireNet (the Fire Service intranet), and then accessed under *Manuals – Operational Instructions Series*.

Documents that may be issued as operational instructions include policies, procedures, technical manuals, and notices.

Most of the operational instructions are contained in the Manual of Operations, which comprises two volumes:

- Volume 1: Operational Management  
This volume covers policy, instructions, and information that are necessary for the operational management of fire regions and fire districts.
- Volume 2: National Commander’s Operational Instructions  
This volume contains the National Commander’s instructions to fire region commanders, chief fire officers, and personnel on incident management. It also contains best practice guidelines.

These are supported by local procedures, which are developed by chief fire officers and/or fire region commanders in accordance with the National Commander’s instructions.

## **10.8 Personnel training and qualifications**

The Fire Service provides training for its operational staff to equip them with the skills and knowledge to respond safely to incidents and to conduct operations in accordance with organisational policy and procedure. The Fire Service is an accredited Government training establishment and as such is audited by the New Zealand Qualifications Authority (“NZQA”).

Fire Service training consists of progression training, where new skills and knowledge are acquired, and maintenance training.

The organisation's training and progression system addresses the training needs of operational firefighters and officers. This is a structured, national training system, and firefighters must demonstrate competency before progressing to the next rank. Firefighters start on a recruit course and then progress by qualification through the ranks of firefighter, qualified firefighter, senior firefighter, station officer, and senior station officer. Their operational skills are maintained by regular refresher training conducted while on duty. Officers are required to develop a training plan as part of the station's annual business plan, and all training must be recorded.

Ranks above senior station officer are not shift-based. These executive officers are on call to respond to major incidents by car and to undertake a command and control role. Executive officers have an operational background and build and maintain their incident management skills through participation in multi-agency exercises, simulation training, attending training courses, and filling a variety of incident management roles at incidents.

Fire Service communication centre staff work in the three joint Fire Service/police communication centres located in Auckland, Wellington, and Christchurch. They start as trainee communicators and progress by qualification through the roles of communicator grades 1 to 3, senior communicator/acting shift manager, and shift manager. Progression is achieved through achieving NZQA unit standards, length of service, and Fire Service examinations.

## **10.9 Incident management**

The Fire Service fully subscribes to the Co-ordinated Incident Management System ("CIMS"). This is the standardised system used by all key New Zealand agencies to manage emergency incidents. It provides a means of coordinating the efforts of different agencies as they work towards the common goal of stabilising an incident and protecting life, property, and the environment. CIMS can be scaled to deal with any type or size of incident.

CIMS is based on the four broad functions required to manage a major incident. These are incident control, planning and intelligence, logistics, and operations.

There is an incident controller at all incidents. At the early stages of the incident, the incident controller will take responsibility for all CIMS functions. As the incident expands, the incident controller may appoint individuals to fill the key roles of planning and intelligence manager, logistics manager, and operations manager. Numerous other roles are also used, depending on the scale and nature of the incident.

Large-scale Fire Service operations usually involve the incident ground being divided into sectors, each under the command of a sector commander, who reports to the operations manager.

Effective incident management encompasses the following actions:

- ensuring safety for all persons on the incident ground
- applying dynamic risk assessment
- taking appropriate immediate actions
- carrying out size-up
- establishing scene management
- establishing and maintaining communications
- selecting strategy and tactics

- formulating an incident action plan
- scaling up the response as required
- structuring the incident ground to support selected strategy and tactics
- tasking of personnel
- managing resources
- adapting strategy and tactics as needed
- scaling down and handing over.

### **10.10 Safe person concept**

To keep firefighters safe at incidents, fire services require health and safety processes that differ from the usual arrangements in the workplace. Building owners can manage the safety of staff and visitors on their premises by measures such as controlling entry, providing training to staff, and providing safety briefings to visitors. However, these would not be relevant to firefighters, who often respond to incidents at buildings after hours, with no staff on site. Furthermore, they may not know the building well, if at all, and may need to act with urgency. The same situation applies when firefighters respond to motor vehicle crashes, hazardous substance emergencies, or rescues. They will often know little of the risks associated with the incident until they arrive and make an on-scene risk assessment.

To manage the problem of firefighters operating in an unfamiliar “workplace” the Fire Service has developed a risk management process known as the “safe person concept”. It is based on training all firefighters to evaluate risk in any situation, and to select the appropriate tactics to optimise safety. This process should continue throughout an incident, and therefore is referred to as dynamic risk assessment.

A summary of the concept is communicated to firefighters in the following statements:

- We may risk our safety, in a highly calculated manner, to protect saveable lives.
- We may risk our safety a little, in a very careful manner, to protect saveable property.
- We will not risk our safety for lives or property that are obviously lost.

The safe person concept is included in structured firefighter training courses.

### **10.11 Communication centre processes**

Emergency 111 calls requesting Fire Service attendance arrive (via a Telecom call centre) at call taker desks in the Fire Service communications centres (“Comcens”). There are three Comcens around the country (Auckland, Wellington, and Christchurch) receiving calls, though should one of these become busy, any one of the others can pick up a call and forward that call to dispatch appliances from anywhere in the country.

At the first notification of an incident, the call taker establishes the location and nature of the emergency, accepts the event into the Intergraph Computer Aided Dispatch (“ICAD”) system, which assigns it an incident number, and passes it to a dispatcher (using the same system), who will turn out the relevant fire appliances. The location of the incident is established using a proprietary mapping environment whereby the call takers pick an address point from a series of predefined legal address points, or by selecting from a digital map. The location of the incident can be established using its street address, though in some cases this may not be clear and the call taker may have to query the caller for more information. The system also holds a number of

common place names for many buildings (for example, Te Papa, Museum of New Zealand, Te Papa Tongarewa, 55 Cable Street, are all the same building).

All incidents wherever they occur in the country and no matter what type they are have a predetermined attendance (“PDA”) loaded into the system. The PDA determines which appliances from which stations attend each incident. This depends on where an incident is located and whether it is a fire in a structure, a car accident, a hazardous substance spillage, a rescue, or other circumstance. An enhanced PDA can be attached to a specific building if the risk is exceptional.

PDA planning work is carried out locally in advance to determine where the nearest and most appropriate appliances are located to attend any type of incident, depending on its seriousness. The recommended PDA saves the dispatcher having to determine the best turnout for an incident, though it can be altered at the time according to circumstances. PDAs are planned in dispatch zones that cover the country. Within any one dispatch zone the attendance at a specific incident type is the same. The system also knows at any one time which appliances are already busy, or otherwise unavailable for any reason, and which can be substituted from another location in that event. In addition to the PDA, the standard operating procedures in the system also store a series of notifications for each incident type depending on its location and seriousness. These notifications are usually pager messages sent, for example, to Fire Service executive officers or local council officials.

Once the dispatcher has approved the recommended attendance, the dispatcher alerts the attending crews. On paid stations this is done by a radio message to the fire station (or to the appliance if it is not on station) and by pager to the responding crews. For volunteer crews, station sirens are activated and individual firefighters are paged. Once the appliance is under way, all communication with the Comcen is generally by radio. To save time, coded messages can be sent from the appliance to indicate its status (known as K codes), or the appliance can call the Comcen on the radio. All incoming and outgoing voice information concerning the incident is recorded to an audio tape. The Comcen assigns each received radio message to the incident number as it is received, as well as typing the received message and the action taken onto the screen at the same time. Each radio communication is time-stamped and placed automatically in a message log.

During the course of an incident, the incident controller can call for more resources by raising what is known as the alarm level. The lowest alarm level is 1 and the highest in ICAD is 5. However, this does not preclude the incident controller from requesting additional resources on top of this. The PDA for each higher alarm level, commonly two additional pumping appliances per alarm level requested, will allow the dispatcher to turn out more resources, typically from further away. Additionally, the officer in charge can call for specialised resources such as water tankers.

After the incident has started, it is possible to get a printout of the progress of the incident in an incident report. This details what appliances have been dispatched and when, what personnel have been notified and when, and provides the full message log. After the incident, this report represents the most complete record of what happened.

## **10.12 Connection to monitored alarms**

Fire alarm systems in buildings are of several types. In the simplest case, the fire alarm upon activation simply sets off sounders that alert occupants of a building to leave. Someone has to call the Fire Service via 111 to make them aware that a fire has occurred.

Many fire alarm systems, particularly in larger commercial premises, are monitored. This means that as well as setting off the sounders in the building, a signal is sent from the fire alarm

system to a monitoring company that then undertakes agreed procedures. These might include calling the premises to establish whether the alarm is the result of a real fire or false alarm, or dispatching someone to the premises to check out the situation and/or calling 111 to turn out the Fire Service.

Finally there are directly connected alarms. These alarms send a signal directly into the Fire Service Comcens, where the alarm appears immediately on the dispatcher's screen. The address and PDA are already in the system, and the dispatch of fire appliances is therefore very rapid.

### **10.13 Appliances and equipment**

The Fire Service operates a wide range of fire appliances. Most are standard pumping appliances, which are crewed by four firefighters. The four riding positions are the officer, driver, firefighter 1, and firefighter 2.

The pumping appliances have a water tank for initial fire attack and a standard range of equipment for firefighters to use in their operational role. Some of the pumping appliances are combination pump/rescue tenders, which carry rescue tools and other specialist equipment.

There are also various specialist appliances such as command units, hazardous materials vehicles, tankers, aerial appliances, breathing apparatus tenders, foam tenders, and canteen units. These appliances are usually crewed by two firefighters.

### **10.14 Pre-incident planning and familiarisation**

The Fire Service requires firefighters to carry out risk assessments in their community to enable them to target and prioritise their risk reduction initiatives effectively. It is also an important way for firefighters to become aware of the safety risks associated with particular buildings.

The Fire Service does not have the resources to develop specific risk plans for all buildings, and for many low-risk buildings this is unlikely to prove to be a productive or cost-effective exercise.

Therefore, a prioritisation system is used to identify the higher-risk buildings that warrant a specific risk planning exercise. The Fire Service has a risk-scoring guide in its station management system ("SMS") to assist staff to prioritise buildings for their risk planning work.

However, buildings must be identified before they can be scored and prioritised. There are two main ways in which the Fire Service identifies buildings for risk planning: through legal/regulatory processes and by physical sightings. Legal and regulatory processes include evacuation scheme applications and plans submitted to the Fire Service Design Review Unit. (The review unit receives copies of applications for building consent in order to comment, on behalf of the Fire Service Commission, on buildings other than houses where the design uses engineering as opposed to prescriptive approaches to fire safety.) Physical sightings of buildings involve a street scanning process in which fire crews drive down streets in a planned way, identifying buildings of potential risk. Buildings may also come to the notice of the Fire Service through other channels.

Once a building has been assessed as being suitable for a risk plan, a Fire Service representative or representatives (usually an operational on-duty crew) visit the premises. They meet with the building representative and obtain the information required for a risk plan.

The standard risk plan produced using SMS includes

- a diagram of the building/s with standard symbology indicating hazards, fire alarm panels, fire detection and suppression systems, fire hydrants, access and entry points, etc.

- key information presented under the headings of critical information, deployment, hazards, exposures, building construction, safety features, water supply, and notes
- optional appendices, such as photographs of hazards and building features.

Completed risk plans should be regularly reviewed and are used by local operational staff to familiarise themselves with a particular building prior to an incident occurring there.

Risk plans are saved in SMS on FireNet and printed copies are carried on the first responding fire appliances.

## **10.15 Personal protective equipment**

The Fire Service issues a range of personal protective equipment (“PPE”) to firefighters so they are suitably equipped for the wide range of emergency situations they deal with. The protective clothing is detailed in Table 2, along with its construction and the standards it meets.

### ***Working uniform***

A firefighter’s standard working uniform is the work shirt and wildfire/rescue trousers.

### ***Wildfire/rescue ensemble***

The wildfire/rescue ensemble is designed for use in vegetation fires, rescues, and general non-fire operations. It is also common practice for fire appliance drivers to wear this clothing when responding to emergency incidents. A driver’s normal duties are driving, operating the pump, managing breathing apparatus (“BA”), entry control, and transmitting radio messages. This involves working around the vehicle and on the road, and the wildfire/rescue jacket’s high visibility is designed for this role. Drivers do not usually get involved in structural firefighting, unless required for emergency rescue operations. In such a situation, they would don their structural firefighting jacket and trousers, which they carry on the appliance.

### ***Structural jacket and overtrousers***

This ensemble is worn for internal structural firefighting and where high levels of radiated heat may be experienced.

### ***Gloves***

The structural gloves are designed to provide a similar level of protection as the structural jacket and trousers. Because they are thick and give a relatively poor sense of touch, they are generally put on only when the firefighter is preparing to approach a fire situation.

The wildfire/rescue gloves give the wearer a good sense of touch and are used for general work, wild land fires, and rescue incidents.

### ***Flash hoods***

These balaclava-style hoods are donned when firefighters are wearing BA and entering a fire situation. Before use they are worn around the neck, ready to pull up over the head when needed.



**Table 2: Personal protective clothing issued to New Zealand Fire Service firefighters**

Ensemble	Item	Construction	Standards
Structural	Helmet	Kevlar shell. Polystyrene inner dome. Double-layer Proban cotton neck protector. Polycarbonate face shield. All components are fire- and heat-resistant.	AS/NZS 4067:2004
	Flash hood	Double-layer 20%–80% PBI Gold – FR Lensing fabric.	NFPA 1971:2000
	Jacket and overtrousers	Three-layer fire- and heat-resistant component assembly: <ul style="list-style-type: none"> <li>● Outer – PBI Gold Plus</li> <li>● Middle – Gore-Tex Fireblocker</li> <li>● Inner – Isomex and Nomex.</li> </ul>	EN 469:1995
	Gloves	Three-layer fire- and heat-resistant component assembly: <ul style="list-style-type: none"> <li>● Outer – PBI and leather</li> <li>● Middle – Gore-Tex Fireblocker</li> <li>● Inner – Seiz-Tech felt.</li> </ul>	EN 659:2003
	Boots	Multilayer polymeric – rubber. Steel toecaps and midsole. Steel shank. Orthotic inner. Kevlar-lined.	AS/NZS 4821:2006, Type 3
Wildfire/Rescue	Jacket	Single-layer Proban cotton. Fire- and heat-resistant. High visibility fabric.	ISO 15384:2003 AS/NZS 4602:1999
	Trousers	Single layer, Kermel. Fire- and heat-resistant fabric.	ISO 15384:2003
	Gloves	Single-layer leather. Kevlar stitching and cuffs.	AS 2161.6:2003, Type 1
	Boots	Single-layer leather. All components fire- and heat-resistant. Steel toe caps and midsole. Steel shank. Orthotic inner.	AS/NZS 4821 – 2006 Type 1
Work	Work shirts T-shirts	Single-layer cotton garments containing no fusible components.	ISO 17493:2000

### ***Breathing apparatus***

Each standard fire appliance carries four compressed air BA sets, one for each crew member. BA is worn when firefighters work in smoke, toxic, and irrespirable atmospheres.

## 10.16 Safety and wellbeing

The Fire Service has safety and wellbeing policies and programmes in place to

- reduce the risk of injury and illness for employees, volunteers, contractors, and others affected by its activities
- comply with the Health and Safety in Employment Act, including subsequent amendments and associated regulations.

The policies and programmes are implemented through a structure that includes

- full-time health and safety staff
- other staff with specific health and safety roles and responsibilities
- workplace representatives
- staff trained to provide critical incident stress management services.

Activities are coordinated via an employee participation programme that promotes and supports involvement from all stakeholders through formal and informal meetings and reviews.

The Fire Service has been an accredited employer in the Accident Compensation Corporation partnership programme since 2000. This is a standards-based approach to safety management systems based on AS/NZS 4801:2001. The Fire Service has achieved tertiary-level status since 2003, the highest of the three-level system.

Fire Service operational instructions are developed to incorporate safe working practices in a dynamic risk environment. These instructions include the command and control aspects of operational management and the National Commander's instructions.

The safety and wellbeing national manager is responsible for overseeing the development and implementation of safety and wellbeing programmes. The operational standards national manager is responsible for overseeing the development and implementation of operational instructions. Together these provide the environment for safe working.

Key documents in managing organisational safety and wellbeing include the following:

- operational instructions, Volume 1: Operational management  
Includes 29 instructions and guidelines on managing operations.
- operational instructions, Volume 2: National Commander's operational instructions  
Includes 48 instructions for predetermined operational activities. The safe person concept relates to all dynamic risk environments.
- command and control technical manual  
Details command and control practices to be utilised for all Fire Service operations.
- health and safety manual  
Includes the practices and procedures required to maintain the Fire Service health and safety management system and to maintain legal compliance.
- critical incident stress management ("CISM") – administration manual  
Provides guidance on how the Fire Service provides support for those who have been exposed to traumatic or highly stressful events in their role.

- health management programme (Hauora)  
Provides details on the Fire Service wellness programme, which is aimed at the early identification of both occupational and other chronic medical conditions.
- accident investigation and operations review manual.  
Details the practices and procedures the Fire Service will use when investigating incidents that have caused or could have caused serious harm and when undertaking formal operational reviews.

All managers and officers have a responsibility to be familiar with both the safety and wellbeing programmes and the operational instructions and are expected to implement these when appropriate.



## PART 3: THE INCIDENT

This part of the report chronicles the events that unfolded at Tamahere. Photographs provide dramatic illustration of the severity of the fire at the coolstore facility. Part 3 then covers particular aspects of the incident: mobilisation and communications; incident management; environmental protection; logistics; personal protective equipment; traffic and crowd control; welfare; and communication and liaison.

### 11 Chronology

The following is an account of events that took place over the time from immediately before until immediately after the explosion and the following evolution of the incident. It has been compiled from the ICAD message log, from the accounts of local people interviewed by the inquiry team, from police and St John Ambulance staff, from the site investigation, and from statements given by the injured and other attending firefighters. This information was supplemented by photographs provided by a number of professional photographers who were at the scene early. The times at which certain events occurred are accurate as recorded by the message log; other events as recalled by individuals are interpolated between these points in time.

Figure 3 (section 9.2) and Figures 4 to 20 provide a graphic context for the events described.

<p>16:00 At Hamilton Fire Station</p>	<p>It was four o’ clock in the afternoon on Saturday, 5 April, a Red Watch day shift. The weather was sunny with light winds. The eight staff on duty at Hamilton Fire Station had completed their Saturday checks of appliances and equipment. (This is a comprehensive weekly check of all the equipment carried on the appliances.) Four of the crew were from the usual Red Watch crew, while the other four were from other watches and filling in for Red Watch staff who were away.</p>																														
<p>Experienced crews</p>	<p>Collectively the eight firefighters concerned had considerable firefighting experience as shown in the table below.</p> <table border="1"> <thead> <tr> <th>Appliance</th> <th>Position</th> <th>Rank</th> <th>Service</th> </tr> </thead> <tbody> <tr> <td rowspan="4"><b>Hamilton 411</b></td> <td>Officer in charge</td> <td>Station officer</td> <td>33 years</td> </tr> <tr> <td>Firefighter 1</td> <td>Senior firefighter</td> <td>7 years</td> </tr> <tr> <td>Firefighter 2</td> <td>Senior Firefighter</td> <td>15 years</td> </tr> <tr> <td>Firefighter/driver</td> <td>Senior firefighter</td> <td>7 years</td> </tr> <tr> <td rowspan="4"><b>Hamilton 412</b></td> <td>Officer in charge</td> <td>Senior station officer</td> <td>25 years</td> </tr> <tr> <td>Firefighter 1</td> <td>Qualified firefighter</td> <td>3 years</td> </tr> <tr> <td>Firefighter 2</td> <td>Senior firefighter</td> <td>12 years</td> </tr> <tr> <td>Firefighter/driver</td> <td>Senior firefighter</td> <td>23 years</td> </tr> </tbody> </table>	Appliance	Position	Rank	Service	<b>Hamilton 411</b>	Officer in charge	Station officer	33 years	Firefighter 1	Senior firefighter	7 years	Firefighter 2	Senior Firefighter	15 years	Firefighter/driver	Senior firefighter	7 years	<b>Hamilton 412</b>	Officer in charge	Senior station officer	25 years	Firefighter 1	Qualified firefighter	3 years	Firefighter 2	Senior firefighter	12 years	Firefighter/driver	Senior firefighter	23 years
Appliance	Position	Rank	Service																												
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	Firefighter 2	Senior firefighter	12 years																												
	Firefighter/driver	Senior firefighter	23 years																												

<p>16:04:38 Station crews respond to fire alarm</p>	<p>At 16:04:38 the communications centre (Comcen) turned out Hamilton 411 and 412 to Icepak Coolstores to investigate a fire alarm activation from a privately monitored alarm system. Comcen also advised that the alarm company had informed it that neither a key holder nor security guard would be attending the premises and that the alarm company would phone back with further instructions.</p> <p>Hamilton 411 transmitted a K1 radio message at 16:05:47 (K1 means “proceeding to incident”) with Hamilton 412 following at 16:06:28. While the appliances were en route Comcen informed the responding crews by radio at 16:07:44 that the alarm company had given permission for the Fire Service to enter the premises if required. At 16:09:13 Comcen called the officer of 412 by radio asking if he required a watch recall. (This means calling back off-duty staff for coverage.) He declined, but asked for Pukete 431 to move and stand by at Hamilton station.</p>
<p>16:14:00 Appliances arrive at Icepak</p>	<p>Appliance 411 arrived at Icepak first at approximately 16:14, with 412 arriving shortly after. At 16:15:32, 411 transmitted a K77 radio message, which means “nothing showing”.</p> <p>On arrival, the crews went to the office area of the building to access and view the alarm panel. There were no building owners or occupiers at the scene. The crew members had little or no knowledge of the premises, so did not know whether an alarm panel existed or where it would be located. (The inquiry team has not been able to ascertain if there was an alarm panel.) It appears the crews did not find a panel or anything at the office area that helped them establish where in the premises the fire alarm had activated.</p> <p>The 411 officer and two crew members then commenced a general exterior search of the premises on foot, looking for anything that would indicate the source of the alarm. It is unclear what first drew the attention of the crew to the plant room area. One of the crew members interviewed reported hearing an alarm ringing, while another said they saw mist or steam around that part of the building.</p> <p>The officer then called the driver of 411 to bring the appliance around to the plant room area. Shortly afterwards 412 arrived and parked in front of 411 (see Figure 4). The driver of 411 contacted the fire alarm monitoring company by cellphone and was advised that a key holder would not be able to arrive for over an hour. Having received confirmation from the building owner (via the alarm monitoring company) that no key holder would attend, the two officers then decided to force entry to the building to investigate.</p>
<p>16:21:13 Attempts to gain entry</p>	<p>At 16:21:13, 411 transmitted a SITREP (situation report) by radio to the Comcen, stating from the officer of 411 that <i>the brigade was attempting to gain access to the building, appears to be smoke coming from building, possible leaking refrigerant, investigating further.</i></p> <p>Several of the firefighters variously reported seeing smoke, gas, mist, haze, steam, or vapour coming from the plant room area. Two firefighters on 412 said they noticed a smell that seemed to get stronger as they got closer to the mist or haze that was near the doorway. They described the smell as similar to lemon or almonds and said that it was strong in places. However, the firefighters on 411 do not recall the smoke or vapour having any smell throughout the incident. None reported a smell of gas. It is unknown whether the two officers were aware of a smell. One, and only one, of the firefighters reported that there was a civilian at the scene who said “That’s normal ... it happens all the time ... it’s just a refrigerant.”</p>

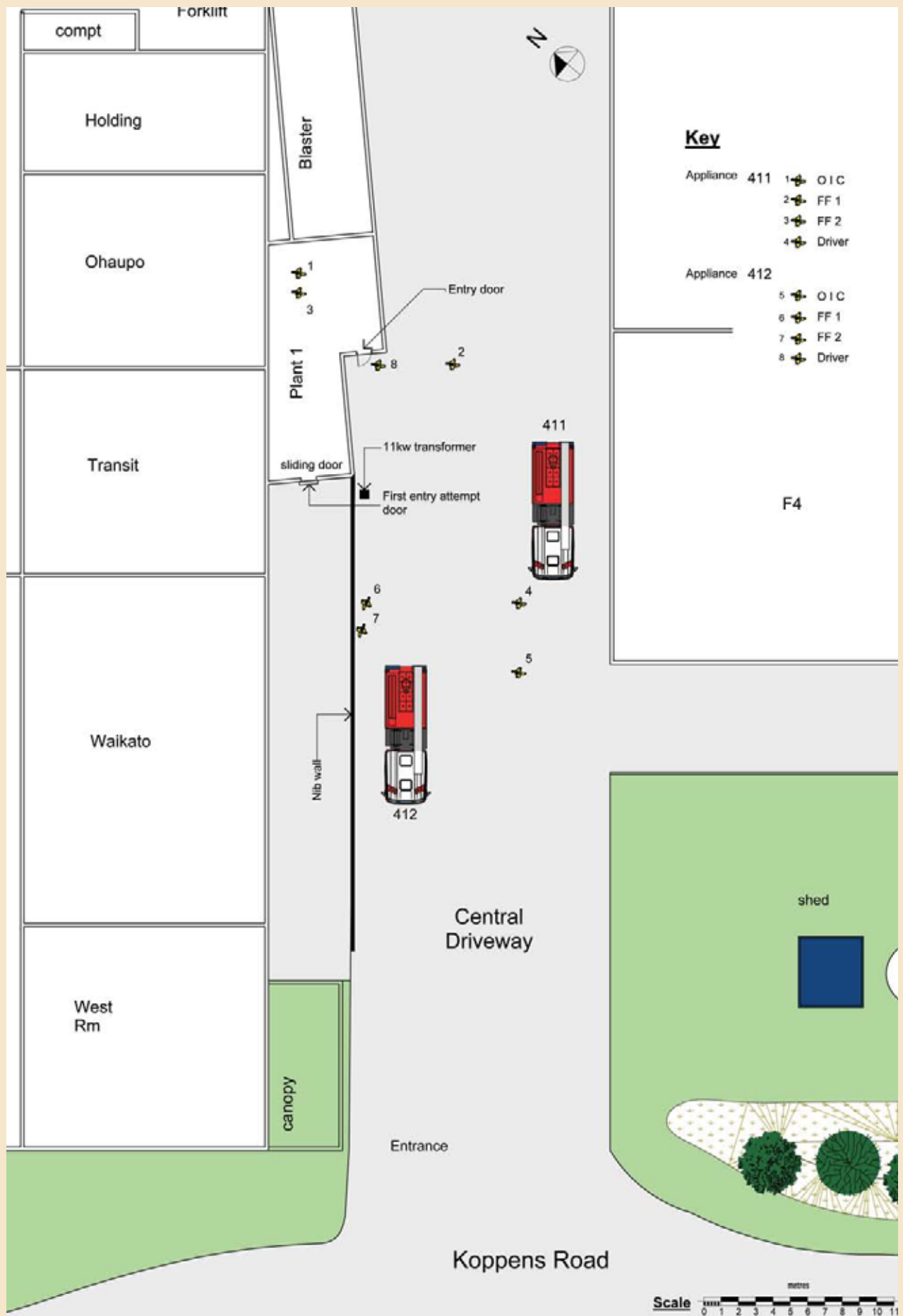


Figure 4: Firefighter positions at the time of the first explosion, deduced from transcripts of interviews

	<p>The crews first tried to open a door that was near the end of the plant room, but because the door was latched closed from the inside it was not possible to open it. They then tried a door further down the side of the same building and, after removing some bolts with cutters, were able to get a reciprocating saw blade in through the gap between the door and the frame. The door was opened with some effort and entry was achieved.</p>
<p>16:28:00 Firefighters gain entry</p>	<p>The officer in charge of 411, and firefighters 1 and 2 from 411 made entry to the building at approximately 16:28. They split up and began searching the room. All were donned in their breathing apparatus, but it appears unlikely any of them had them started (i.e. mask fitted to face with air flowing).</p> <p>The room was an open area and there was enough natural light so that torches were not needed. The room contained a row of what appeared to the firefighters to be refrigeration motors and compressors. Firefighter 1 from 411 noticed a loud hissing noise and found a small pipe leaking gas. He called out to advise the others. The officer in charge of 411 joined him. The pipe was about 5 mm in diameter. The leak was coming from around a joint in the pipe that was secured with a small hexagonal nut. Firefighter 1 from 411 informed the officer that he would go back outside to the fire appliance and get a crescent spanner to tighten the connection to stop the leak.</p> <p>Firefighter 2 from 411 then joined the officer shortly after firefighter 1 had left to get the crescent. The officer in charge and firefighter 2 then examined the pipe and waited for firefighter 1 to return.</p> <p>Firefighter 1 from 411 had some trouble reopening the door through which they had entered. The officer and driver from 412 were standing together behind their appliance and the officer directed the driver to get a crowbar to assist. This he did, and eased open the door. He stood in the doorway, could hear the hissing (“a high-pressure type sound”), and turned to walk away.</p>
<p>16:29:47 Entry gained message</p>	<p>From the firefighters’ subsequent statements between 30 seconds and three minutes had elapsed from the moment they made entry. The driver of 411, outside the building, transmitted a radio SITREP at 16:29:47 from 411 saying <i>entry gained, brigade investigating using BA</i>, but there would have been some delay between actual entry occurring and the message being transmitted. After putting in the message he got down off the appliance and started to walk towards the officer of 412.</p>
<p>16:30:00 Explosion occurs</p>	<p>At that moment the explosion occurred.</p> <p>The driver of 412, standing in the doorway of the building, described a loud explosion and flames erupting right beside him from behind the door (“it was like a double bang”). The force of the blast blew him tumbling about 8 m, and when he stood up he did not know which way to run because he was surrounded in flames. The fireball evaporated; he saw 412 and headed for it.</p>
<p>16:30:29 Second alarm message – <i>major explosion</i></p>	<p>The driver of 411 was not, as he recalls, knocked over by the explosion, and he must have gathered himself, assessed the situation, and reacted very quickly. He too headed for 412 and found the driver of 412 sending a priority radio message. That was at 16:30:29. He took over the radio and transmitted a voice message at 16:30:52 – <i>transmit second alarm, major explosion</i> – followed immediately by K11, a radio message code requesting ambulance attendance.</p>



16:30:30  
First members of the  
public arrive

By eye-witness accounts the explosion was very large. People who were not looking that way heard the noise, described as a massive rumble. People said that they physically felt the blast (“like a shove”; “a push on the chest”; “made me stagger”). It passed through them and then passed back again. People who did see the explosion reported debris being thrown tens of metres into the air. One witness described a column of flame 30 m across and 50 m high, “topped by the roof of the building”. Other witnesses also describe the roof and debris flying high into the air.

Some of the witnesses lived in the locality. There was also a wedding party nearby at the Gails of Tamahere function centre. The local Tamahere Model Country School had just started its annual “Pumpkin Night” fundraising event and there were about 300 parents and students there. Because of its location within 15 minutes’ drive of Waikato Hospital, many of the parents of children at the school are trained medical staff, a fact that was to prove of great significance as the events of the next hour or so unfolded.

After the explosion, many of the people in these locations started to move towards the scene, some walking but some running as fast as they could. The fact that there were already fire appliances on scene confused some of the first people arriving. But a few had seen the fire appliances entering the site 20 minutes earlier. After the explosion, early 111 calls to the Fire Service caused similar confusion as Comcen operators assured callers that firefighters were already at the scene. This confusion did not affect the progress of the event because the message from the driver of 411 asking for assistance was the first received after the explosion, and was acted on at once.

Given that the Icepak facility was very close to local houses, the school being only 150 m away from where the explosion occurred (see Figure 3) and Gails being not much further, as well as the fact that witnesses by their own account started to run as fast as they could, it seems likely that the first people on the scene were there possibly within 30 to 40 seconds of the explosion. The first few witnesses are very consistent about what they saw.

The two appliances were parked, one behind the other, between F3-F4 Building and Waikato-Transit Building (see Figure 4). There was a large amount of debris that had landed behind both appliances and on top of 411. The roof of 411 was starting to burn in small pockets. It was “raining” pieces of polystyrene, some of which were burning. There were many small fires, but at this stage nothing appeared too serious. The plant room was totally destroyed. Waikato-Transit Building was badly damaged with the wall rippled and large chunks missing. The wall of F3-F4 Building was also badly buckled and tilted outwards by about 20 degrees. The roof of F3-F4 Building was ripped off at the edge and fires were observed to be starting at that level. Early photographs taken from the service road through the canopy on the site (see Figure 5) verify these descriptions of the damage. One of the first members of the public on the scene saw the driver of 411 on the radio (which could have been 16:30:52).

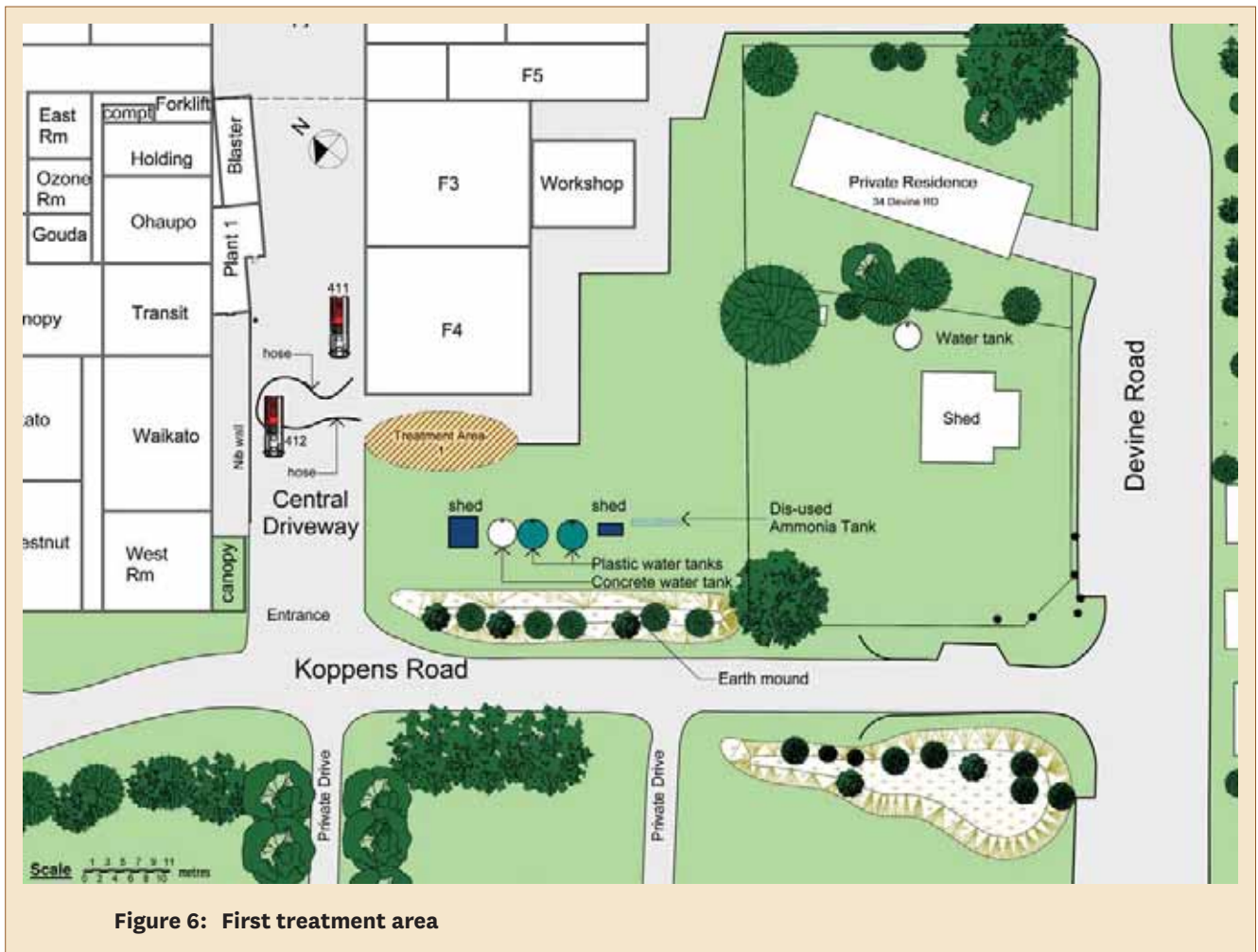
Almost all of these first arrivals saw the officer in charge of 412 lying on the ground at the corner of building. He was attended very early on by a number of people, including a specialist intensive care doctor who initiated CPR. The doctor then handed over to others to continue treatment whilst he sought to provide assistance to the other injured firefighters. He took control of the situation, and those helping brought the injured to the front of F3-F4 Building close to the officer in charge of 412 so that the doctor could undertake preliminary triage (treatment area 1, Figure 6). Witnesses report seeing the driver of 412, badly burned but walking around and speaking, and even acknowledging people he knew. Everyone noted the driver of 411 and the range of actions he undertook.



Source: Christine Cornege, Waikato Times

**Figure 5: View through canopy from service road at 16:39**

Explosion debris blocks the central driveway. The damage to F3-F4 Building and the rapidly developing fire are clear on the left. The door of the blast freezer is in the right foreground. The rear of Hamilton 411 is just discernible through the debris, just left of centre.



**Figure 6: First treatment area**

16:31:52  
Third alarm message

Another member of the public jumped into 412 beside the driver of 411 and, with his help and that of the driver of 412, managed to turn the water on to the hoses. The driver of 411 was reportedly on the radio at this time asking for assistance, which puts the time at 16:31:52, when the driver of 411 put in the third alarm message. He showed people how to get a soft stream from the hoses to cool the firefighters' burns. The member of the public used the hose to cool the burns of the driver of 412. Small groups of the arriving people immediately set about helping the other firefighters out of the debris.

Several people initially noticed two firefighters buried under debris behind 412. A large piece of metal sheeting had to be lifted away before these firefighters could be helped. They were found to be about 1 m apart wearing BA sets. One was found to have extremely severe facial injuries and the other was badly burned. These two firefighters (firefighter 1 from 412 and firefighter 2 from 412) were carried to the treatment area in front of F3-F4 Building. Firefighter 1 from 412 was immediately put in the care of a specialist in facial injuries, who, together with an anaesthetist, cared for him until he reached hospital, where the same specialists conducted surgery to repair the damage.

Two firefighters (the officer in charge of 411 and firefighter 2 from 411) were seen emerging from a gap in the remains of the plant room and were assisted over the debris. They reported one more left in the rubble. He (firefighter 1 from 411) was spotted in the debris behind 411 moving his legs, wearing BA, and with a helmet close by. Some members of the public went between 411 and the wall of F3-F4 Building to get to him. He was pulled out of a gap in steel rubble by straps on his BA set. He was carried to the treatment area in front of F3-F4 Building.

16:34:15  
All accounted for  
message

At this stage people reported that the steel in the rubble was hot enough to burn exposed skin.

One witness noted that the doctors did not have any first aid kits in the treatment area and, with the help of the driver of 411, he retrieved several boxes of bottled water and the first aid kits from 411 and 412.

A number of witnesses involved in the rescue noticed that both appliances had their hoses extended behind them. The driver of 411 handed a hose to one of the rescuers and asked him to try and control the sporadic fires that were burning on the roof of 411.

The driver of 411 at this stage carried out a head count. He put in a message to the Comcen, confirming injuries of the firefighters. This was at 16:34:15.

One of the people at the school event was a senior St John officer and trained paramedic. He did not run across to the explosion site immediately; instead he went to his car to pick up the medical kits he carried while off duty, plus a reflective jacket, and then made his way over to the scene of the incident. These first aid kits contained intravenous drips, oxygen masks, and bandages, and were put to use as soon as they were taken to the injured. Several people attending to the injured commented on “suitcase-sized” first aid kits appearing on the scene without being quite clear where they had come from. At about the same time, a call went out at the school fair for medical assistance at the scene, and many more people turned up. It was estimated that there were five or six people looking after each firefighter, up to 50 people in all, a large proportion of whom were medically qualified.

Two of the people who arrived on the scene within the first 10 minutes of the explosion were professional photographers who very generously made their photographs available to the inquiry team. Another chartered a helicopter at the nearby Hamilton Airport and took aerial photographs from an early stage. From these photographs it is clear that the fire developed extremely quickly after the explosion. The helpers were so focused on treating the injuries of the firefighters that by many accounts they were not aware of the developing fire around them, and the increasing danger to which the injured patients were becoming exposed.

One of those who did spot the danger was the driver of 412, who, though badly burned himself, reportedly frequently but quietly urged people to move. It was assumed by those nearby that he was in shock, and it took some time before he was able to convey the seriousness of the situation that was developing. The fire started to spread intensely in the roof of F3-F4 Building. When the problem was finally recognised, one of the people there very loudly warned everyone to pick up the injured and to move them away.

16:35:00  
Injured moved

The injured were moved quickly but with great caution to a new position, treatment area 2 (see Figure 7), close to the cylinder (the disused ammonia receiving plant referred to in section 20.6). They were laid on the ground, and care resumed. The hoses from 412 were used to reach the injured so that cooling of the burns could be continued. The driver of 412 started to collect up discarded firefighters’ equipment to a point on a grassy landscaped mound near Koppens Road. Although people kept trying to encourage him to rest and allow himself to be treated, he did this only briefly before resuming his work. A priority message was transmitted from 411 at 16:35:47 saying *activate Green Watch call back, call on duty executive* (essentially calling for more personnel). It is not clear who gave this message. (Note the officer of 411 has no recall of the period between approaching Icepak and when he woke up in Waikato Hospital.)

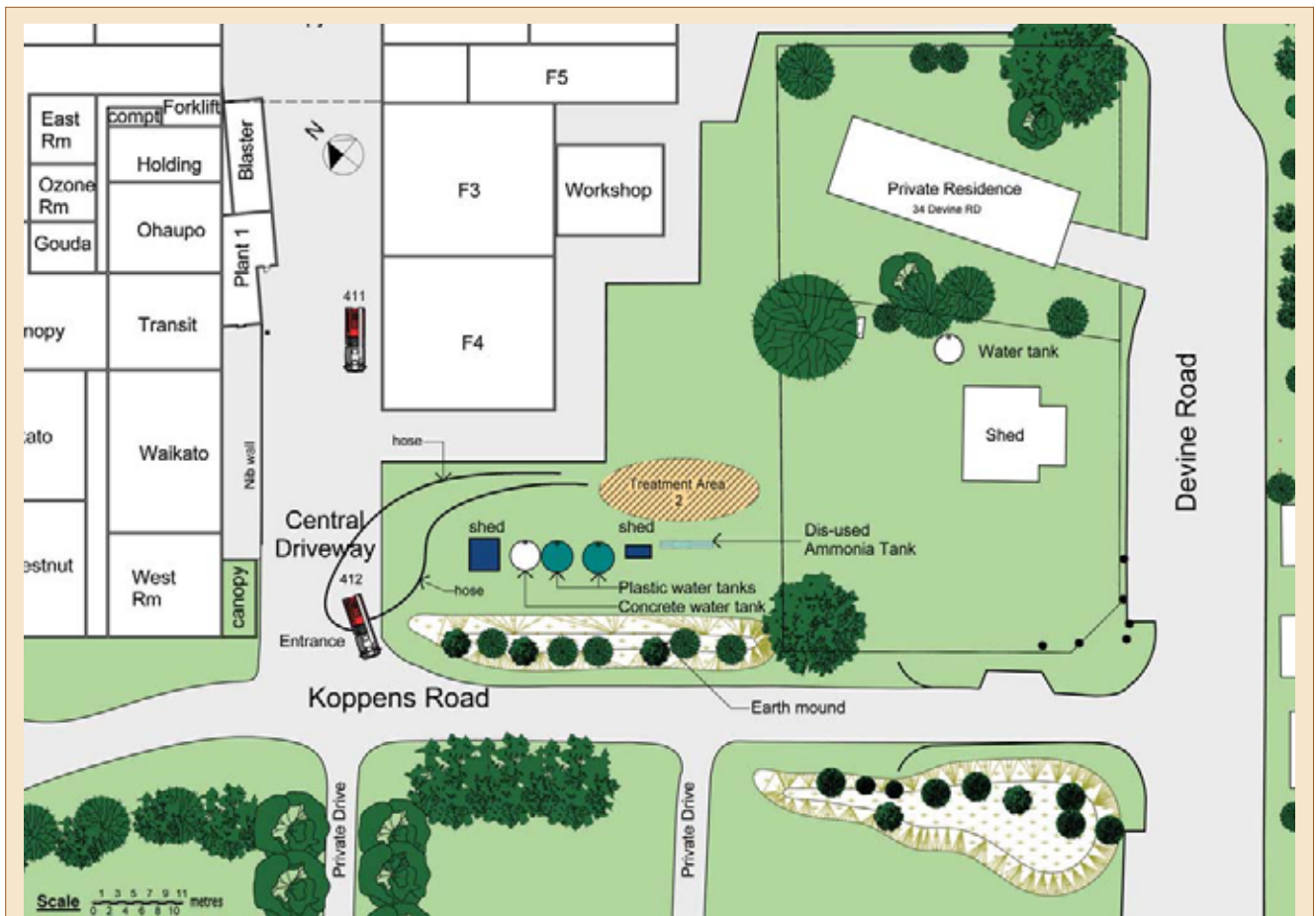


Figure 7: Second treatment area

16:36:00 412 moved	The driver of 411 drove 412 to end of the drive, on Koppens Road at about 16:36.
16:38:00 Injured moved again	Treatment area 2 (Figure 7) for the injured by the cylinder was short-lived. With the fire growing ever more rapidly, within a few minutes it was recognised that even this was not a safe place, and a decision was taken to move the injured a second time. Those assisting picked up the patients, moved them through a gap at the end of the landscaped mound, and placed them on the verges either side of Koppens Road as shown as treatment area 3 in Figure 8. Care continued in these locations. The officer in charge of 412 was resuscitated and was heard giving his name.
16:38:47 411 abandoned	At 16:38:47 the driver of 411 made a SITREP on the radio confirming eight firefighter casualties – <i>seven firefighters status 2, one firefighter status 3.</i> (Patient status codes are used by ambulance personnel. Status code 2 means patient unstable, requires IV fluid; status 3 means patient stable, but likely to change.) He followed this up with a 111 call on his cellphone shortly afterwards requesting an update on the ETA of the ambulances. Thereafter, attempts to save 411 were abandoned because of the increasing severity of the fire that was developing in F3-F4 Building.
16:39:00	One of the local residents, a professional photographer, was very close to the explosion when it occurred, and immediately went to get her camera. She took photographs from close to Koppens Road, starting at 16:39. A newspaper photographer was passing on the highway and arrived on the scene at about the same time, but initially taking pictures from the service road alongside State Highway 1. Both these photographic records illustrate what happened over the next half hour.

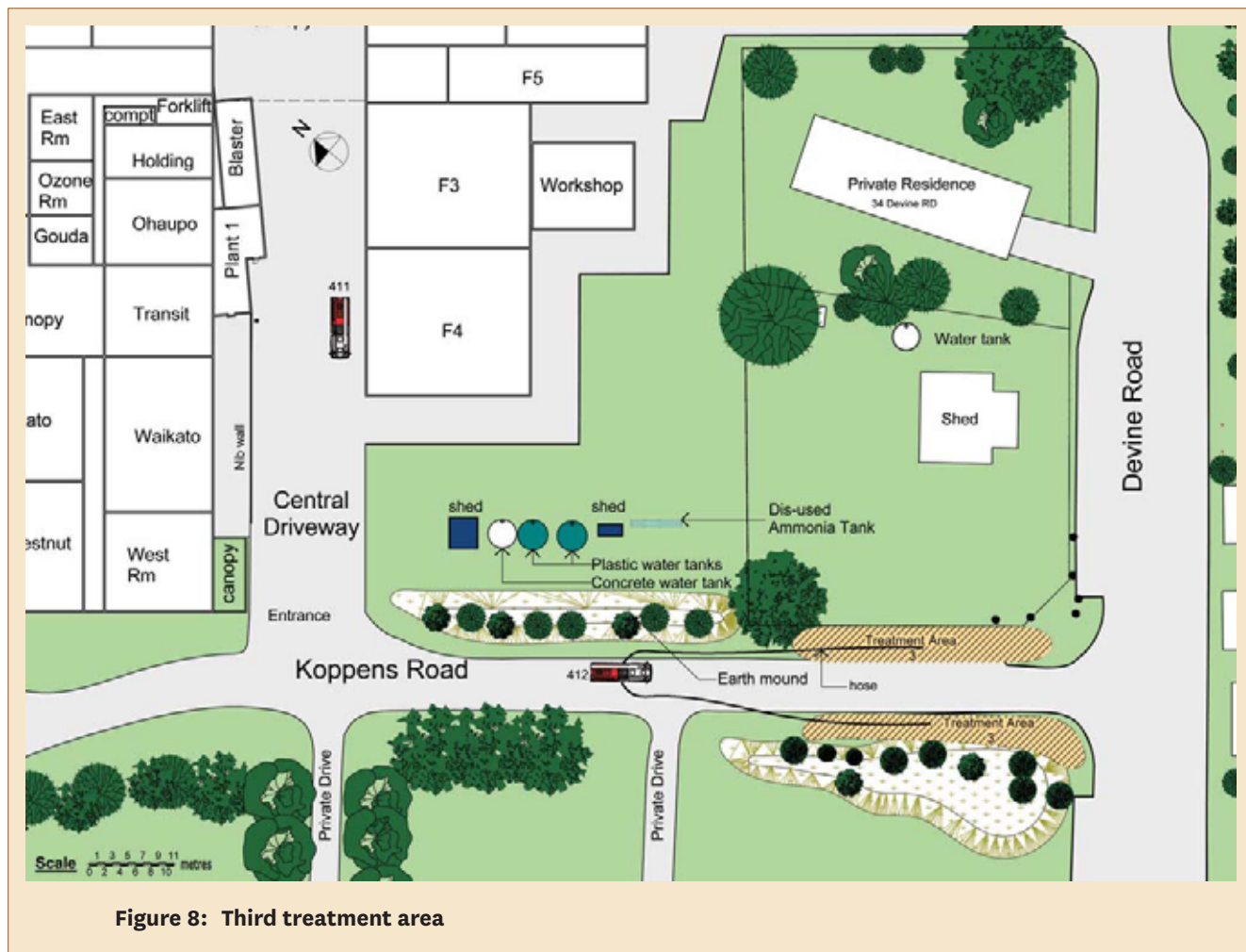


Figure 8: Third treatment area

16:40:00  
412 moved again

In order to keep the injured within reach of the hoses to maintain cooling of burns, 412 then was moved to a position halfway along Koppens Road towards Devine Road.

16:41:06  
Pukete 431 arrives

The first second-alarm appliance to arrive was Pukete 431, shown in the message log as arriving on scene at 16:41:06. The officer of 431 reported being directed into the scene by the driver of 412 who was lucid, in spite of his extensive burns. The appliance stopped at the corner of Devine Road and Koppens Road, the crew somewhat dismayed by what confronted them. The officer in charge stopped to ascertain the situation and was briefed by the off-duty St John officer. He was told that all eight injured firefighters were accounted for and that all were in the care of experienced medical staff. The appliance therefore left its first aid kit and proceeded along Koppens Road to attempt to fight the fire. As it did so, it passed 412 coming the other way. A photograph taken by a local resident shows Pukete 431 parking in the driveway of a dwelling, opposite where the explosion occurred, at 16:42 (see Figure 9; Figures 10 and 11 were taken two and three minutes later).

16:42:48  
Chartwell 427 arrives

The next second-alarm appliance was Chartwell 427, which put in its arrival message at 16:42:48. The crews set about putting water on the burns of the injured and establishing that all were accounted for. The officer of 427 reported fire moving towards them “at walking speed” and “balls of flame” rolling out of F3-F4 Building.

Photograph: Philippa Stevenson



**Figure 9: The fire as confronted by Pukete 431 when the appliance halted – 12 minutes after the explosion**

16:46:51  
Cambridge 441  
Cambridge 4411

Cambridge 441 and Cambridge's water tanker were next on scene. They met the driver of 412 standing at the end of Koppens Road, directing them. He spoke to the officer of Cambridge 441, whom he knew, and briefly explained the situation. Cambridge crews assisted Chartwell initially and then relocated at the far end of Koppens Road to help Pukete.

16:46:58  
Hamilton CFO arrives

Hamilton CFO arrived on scene just afterwards and assessed the situation. He was faced with seriously injured colleagues, a huge and growing fire (see Figure 12), and no reticulated water. He described flames corkscrewing tens of metres into the air and rivers of fire as melted butter flowed out of F3-F4 Building. The cylinder lay in its path; at this stage no one knew what it might contain. He directed Chartwell 427 to commence cooling it using water from the Cambridge tanker.

16:47  
First ambulance arrives

The first ambulance arrived immediately afterwards at 16:47, the second one three minutes after that, and the third right behind. The ambulance crews had encountered significant traffic congestion due to sightseers as they approached the incident. When they arrived on scene there was a good deal of confusion with large numbers of people attempting to explain the situation. Fortunately, the off-duty senior St John officer who had been assisting on scene was in a position to convey the extent and seriousness of the injuries.

16:51

An ambulance departed with firefighter 1 from 412, who had severe facial injuries.

Photograph: Phillipa Stevenson



**Figure 10: The central driveway from Koppens Road at 16:44**

Explosion debris is visible on canopy roof.  
Fire is starting in Waikato Room on left.

16:52  
St John regional  
executive officer arrives

The clinical standards manager for St John Midland Region was the regional executive officer on call. He had been called out by ambulance northern communication centre and arrived at 16:52. At that stage he knew there were eight firefighters injured and their status. At the scene he found the large numbers of people attempting to brief him something of a challenge, but finally spoke to the specialist intensive care doctor who had been looking after the injured firefighters from the earliest time. They knew each other, and the ambulance executive was able to get a clear picture of what he faced. He then took control of organising the ambulance crews.

At about this time, the first police officer arrived and started to manage members of the public who had congregated to see what was going on and who were getting in the way of dispatching the injured to hospital.

16:53  
Injured moved again

Hamilton CFO determined that treatment area 3 along the sides of Koppens Road could not be regarded as safe with the possible threat of rupture from the cylinder. He ordered the injured to be moved once again to various locations in the school grounds. They continued to be cared for, but their positions had become scattered so it became more difficult for any one person to have a view of where they were and who had been taken to hospital.

16:56

Hamilton CFO directed the Chartwell crew, to put in a radio message – *make tankers 6*.

16:58

Waikato AFRC arrived and assumed incident control shortly afterwards. Hamilton CFO took responsibility thereafter for operations. Hamilton DCFO also arrived and took responsibility for safety.



Photograph: Philippa Stevenson



**Figure 11: Coolstore F4 at 16:45**

The area in the foreground had been the first treatment area for the injured firefighters 10 minutes previously.

	<p>Chartwell 427 was reversed around the corner into Devine Road, and the crew set about installing a portable pump to take water from the school swimming pool to supply an unmanned monitor set up to cool the cylinder. A member of the public jumped into 412 and reversed it round the corner to park behind 427, so that cooling of firefighters' burns could continue using its pump.</p> <p>A second explosion is said to have occurred. This was less powerful than the first, reportedly two-thirds of the power, but still a very significant event ("buckled my knees"). The wall of F3-F4 Building came down, and the area where the initial treatment had taken place was engulfed in flame (see Figure 11).</p>
17:01	The fourth ambulance arrived, together with a St John advanced paramedic.
17:02	An ambulance departed with officer in charge of 412 and officer in charge of 411.
17:06 Control point set up	Hamilton hazmat-command unit set up at the eastern entrance to the Icepak site and became the incident control point. The unit had been fitted with prototype software for major incident control. This repeatedly crashed, and the control point crew had to resort to tried and tested methods of recording the incident on whiteboards. This, added to the fact that there were communication difficulties with the Comcen because of radio and cellphone congestion in the area, made the management of the early stages of the incident a challenge for the crew.
17:09	An ambulance departed with driver of 412 and firefighter 2 from 411.

Photograph: Philippa Stevenson



**Figure 12: Fire size just after Hamilton CFO arrived**  
Coolstore walls of Room F4 have failed.

Photograph: Philippa Stevenson



**Figure 13: Last picture of Hamilton 411 at about 17:10**



Source: Christine Corrigan, Waikato Times

**Figure 14: Aerial photograph from the south-east shortly after 17:30**

The scale of the fire is evident. The blue disused ammonia cylinder is visible on the left (and in inset) engulfed in flame. On Koppens Road is the portable monitor installed to cool it using water from the school swimming pool (school buildings on Devine Road in foreground). The hazmat-command vehicle (white roof, bottom right) had been established as the incident control point.

17:10 Fifth alarm message	The incident controller raised the alarm level to 5.
17:15	An ambulance departed with firefighter 1 from 411.
17:20	The Hamilton airport rescue tender arrived with 6,000 litres of water and located in place of the Pukete appliance on Koppens Road. Pukete moved down the road to join Cambridge. The airport tender made several attempts to extinguish the fire, first with foam and then with water over the next two hours, supported by a shuttle relay of water tankers that successively refilled Cambridge's water tanker. Hamilton's hydraulic platform arrived shortly afterwards and got into position to establish a water curtain between the Waikato-Transit Building and the Lichfield-Tatua Building.
17:26	The second water tanker arrived and was sent down to the airport tender.
17:28 Last ambulance with injured firefighters departs	The last ambulance departed with driver of 411 and firefighter 2 from 412. However, other ambulances arrived at the scene and remained on standby until the next morning.



**Figure 15: Aerial photograph from the north-west showing extent of fire spread at 17:40**

The airport rescue tender is using foam on the right. Coolstores F1, F2, F3, and F4 are fully involved in fire and starting to collapse. Ohaupo, Transit, and Waikato Rooms are also fully involved, threatening the Holding and West Rooms as well as the forklift area (brown roof).

17:30  
Further large explosion

The fire was seen to spread into the shed. A final large explosion occurred of about same magnitude as the second explosion. Many small explosions continued.

17:35

Interviews were held with members of Icepak management at the control point. They let the firefighters know that the site was using a refrigerant known as HyChill. They also confirmed that the cylinder was disused plant. Accordingly Chartwell 427 was moved away from cooling the cylinder and relocated on the service road near the control point in order to start to protect the house at 34 Devine Road; the fence was just starting to catch fire at this point (see Figure 16). Hamilton DCFO helped Icepak management to retrieve files and folders from their offices. A large LPG cylinder was rolled away from the forklift room.

17:36–17:50

Over the next 15 minutes five tankers arrived in quick succession. They were deployed initially to the airport rescue tender, and the hydraulic platform was moved into position supported by tanker Cambridge 4411. This started to fight the fire shortly before 18:00 and continued to be supplied with water from a shuttle relay of tankers throughout the night as it sought to provide a water curtain to protect the Lichfield-Tatua Building.



Source: Christine Cornage, Waikato Times

**Figure 16: Aerial photograph from the east showing extent of fire spread at 17:55**  
The fence of the dwelling at 34 Devine Road, bottom left, is just starting to burn. Chartwell 427 in the foreground has been brought around to start a defence on the house. On the right, the roof of the forklift area has just caught fire. Throughout the incident smoke tended to rise straight up and disperse, minimising any airborne contamination in the locality.



**Figure 17: The office building fully involved at 18:40**

18:30	Hamilton DCFO organised the evacuation of the wedding party at Gails, whose only way out was along the service road alongside State Highway 1. The cars from the party were all lined up and then drove out in procession under Fire Service supervision. A total of 76 people evacuated.
18:45	Discussions were held with officials at the control point concerning environmental management of the incident and, in particular, control of runoff. Visible drains had already been blocked off with tarpaulins and Fire Service personnel had dug small earth bunds to contain runoff at the northern corner of the site.
19:00	At about 19:00 Fonterra offered milk tankers to assist the water shuttle relay. Because of the traffic congestion, it was difficult for them to approach the site. Police arranged a meeting point and escorted them to the incident.
20:00	A digger on site was set to work excavating earth to block the flow of firefighting water off the site and direct it into the paddock on the north-west boundary.
22:00	Spill response equipment was brought onto site, and booms were put in place to control the flow of water into the local streams. These booms were overwhelmed in the early hours of Sunday morning.
23:00	As midnight approached, the focus of operations shifted to protecting the Lichfield-Tatua Building from fire spread, damping down hotspots elsewhere on site. Officers and firefighters arrived from Auckland to take control of the incident and allow local officers and firefighters some relief.



Source: New Zealand Fire Service

**Figure 18: Stored product burning in racks, even though the building structure has disappeared (18:50)**

6 April	<p>At 1:30 on Sunday the Fire Service announced the death in Waikato Hospital of the officer of 412.</p> <p>By the morning of 6 April, the worst of the fire was over. Early in the morning the Fonterra tankers were released. Environment Waikato inspected the site as soon as it was light and noted that the discharge had overwhelmed the booms placed in the local stream. Arrangements were made to put earth dams in place by mid-morning. St John officers were still standing by. The National Commander and the Minister of Internal Affairs arrived on scene mid-morning.</p>
7 April	Diggers, supported by aerial appliances, work to uncover and extinguish still-burning material.
8 April	The Fire Service investigation team starts work (see Part 4 for more detail).
9 April	Demolition contractors start work at 15:00.
10 April	Deep-seated fires persist.
11 April	The Fire Service funeral for the officer of 412 held in Hamilton.
12 April	Stop message sent at 18:00 and the scene handed over to the Department of Labour.

Photograph: Philippa Stevenson



**Figure 19: Delamination of wall panels of the West Room at about 19:45**

Source: New Zealand Fire Service



**Figure 20: Firefighting continued through the night from the hydraulic platform to provide a water cut-off curtain to the Lichfield-Tatua building.**



## 12 Mobilisation and communications

The fire alarm system at the Icepak Coolstores facility was monitored by Signature Security Group. This was a privately monitored alarm, not directly connected to the Fire Service, as described in section 10.12. Signature was unable to provide the inquiry team with detailed drawings of the layout of any sensors that were monitored at the facility, but it is understood that the system was primarily a security system, with possibly a few smoke detectors. It is understood that the smoke detectors were an optical type, which means that its sensitive element is set off by obscuration of a light beam.

Any operation of the smoke detectors sent a signal to Signature's monitoring centre. Signature has made available to the inquiry team the message log that covers the incident in question. The inquiry team also has the recordings of all the 111 calls that went to the Comcen on the day in question.

### 12.1 Communications with alarm monitoring company

The Signature message log shows that a smoke detector operated in a machine room at the Icepak facility at 15:56:35 on 5 April. The monitoring centre operator called Icepak management to inform them and then called the Fire Service. The call was received by the Fire Service at 16:00:49. The call taker at the Comcen received the call and asked for the address of the premises, which was given as Icepak Coolstores, Cambridge-Hamilton Highway, Tamahere. The call taker had great difficulty finding this location in the system for several reasons. Firstly, Icepak Coolstores did not appear in the proprietary mapping environment that the Fire Service uses for dispatch. Buildings are identified by legal address points, and often by an associated name as well, but there was no address point for the Icepak building. Secondly, the name Cambridge-Hamilton Highway does not appear as a road in the map.

From the point of view of access, the Icepak site is not in fact on the highway but is on Devine Road, which is on the map. Its address is 30 Devine Road, but this information was not supplied by Signature until later that evening. In the absence of other information, the call taker "attached" the incident to the address of the most prominent building found in Tamahere – the school. All of this took over two and a half minutes, but could have taken significantly less if the right address had been available and/or if the Icepak Coolstores facility had been on the map. (Indeed, it was not until 19:16, more than three hours after receipt of the call, that the correct address for the premises was established.)

The Comcen call taker passed the incident to the dispatcher who, in accordance with predetermined attendances (see section 10.11), turned out Hamilton 411 and Hamilton 412 from Hamilton Fire Station. The Comcen call taker asked Signature if a key holder were going to be available at the premises. Signature responded that the key holder was an hour away, but that it would contact him and come back with instructions. Signature called back at 16:06:25 to say that the key holder had given the Fire Service permission to enter, a message that was relayed by radio to the appliances en route to the incident.

The Signature operator received a call from the scene at 16:20:06. This was a call from the driver of 411 using the appliance's mobile phone saying that it was not possible to get access to the building and asking if they should break in. After a further call to Icepak management the operator called the firefighter back and confirmed that they should. The driver of 411 advised that they had already cut a few locks. That was at 16:28:04.

Icepak management called Signature at 16:38:30 advising that there had been an explosion.

## 12.2 Notifications

All notifications to be made in the event of an incident are determined in advance depending on the location, nature, and alarm level of the incident. All notifications for this incident were made at the appropriate stages in the incident.

A key notification for this incident, given that it was in a rural fire authority district, was that given to the Waikato principal rural fire officer (“PRFO”). The Comcen log shows that a pager message was sent to the PRFO at 16:35:58, and that the page was acknowledged by telephone call to the Comcen at 16:40:36. The Waikato District Council (which is also the rural fire authority) explained to the inquiry team that after hours calls to the PRFO are handled by the Hamilton City Council. The city council’s log showed that its after hours operator acknowledged the page at 16:43. The prescribed procedure was for the operator to ask the Fire Service whether it required the PRFO to attend. The city council maintained that the Fire Service responded that, at that stage, attendance was not required.

The inquiry team was unable to verify that response from Fire Service records, or to reconcile the different times recorded for the acknowledgment of the page.

## 12.3 Predetermined attendances

The predetermined attendances (see section 10.11) for a fire in a structure in Tamahere were the following appliances:

- Alarm level 1: 2 pumps
- Alarm level 2: *plus* 2 pumps, 1 operational support unit, 1 tanker
- Alarm level 3: *plus* 2 pumps, 1 hazmat-command vehicle, 1 hose layer
- Alarm level 4: *plus* 2 pumps
- Alarm level 5: *plus* 2 pumps.

All units were turned out by the Comcen in the prescribed manner. The only question, which arose later, related to the Hamilton hazmat-command vehicle, which should have been turned out at the third alarm and was not. It was taken to the incident by off-duty staff, who returned to work on hearing of the incident. It emerged on investigation that the unit was reported as having a flat battery, and the officer in charge of 412 called the Comcen about an hour before the Icepak incident to ask that it be marked as unavailable until the battery was replaced. The battery problem had been rectified shortly before the incident but the Comcen had not yet been notified. Accordingly on the third alarm, the next nearest hazmat-command vehicle, from Rotorua, was turned out.

## 12.4 Escalation of alarm levels

Following on from the original transmission of the third alarm by the driver of Hamilton 411, Hamilton CFO arrived and made an immediate appraisal of the situation. He spoke to the officer in charge of Chartwell 427, who advised him that they were in the process of establishing triage for the injured firefighters. On witnessing the rapidly developing nature of the incident, together with an obvious lack of available water supplies, he instigated a request from Chartwell 427 to *make tankers 6* at 16:56:16.

Subsequently, Waikato AFRC arrived, and the incident was increased to a fifth alarm at 17:11:54. The AFRC took over the role of incident controller from the CFO, and in turn, the CFO took command of operations. A request was made for the attendance of the Hamilton Airport rescue

fire appliance at 17:13:05. Further tankers were requested at 18:16:59, with additional tankers being offered by the dairy company Fonterra as the incident progressed.

## **12.5 Hazmat-command vehicle**

Hamilton's hazmat-command vehicle (Hamilton 4116) arrived at 17:03:28 and was established as the incident control point on Devine Road near the eastern entrance to the Icepak site (see Figure 14) at 17:06:35. Once established it became the focal point for the incident, providing the necessary support for the incident commander with all subsequent radio messages being transmitted from the vehicle's crew. It was also utilised for regular inter-agency briefings as the incident progressed.

## **13 Incident management**

This section concerns the management of the incident post-explosion.

### **13.1 Command and control structure and procedures**

The first executive officer to arrive at the scene (Hamilton CFO) took over as incident controller from the officer in charge of Chartwell 427. This was quickly followed (because of the scale and complexity of the incident) by a change in command to Waikato AFRC on his arrival and the establishment of the Hamilton hazmat-command vehicle as the incident control point. The AFRC utilised CIMS to establish the four main components of control, planning/intelligence, operations, and logistics. These roles were allocated according to the diagram (Figure 21), which was retrieved from the command vehicle incident log.

In this respect Waikato AFRC took on the role of incident controller and assigned the CFO to take over the role of operations manager. In turn, the CFO established four sector commanders to oversee the activities within their designated areas.

Responsibility for safety was designated to Hamilton DCFO, whilst oversight of logistics was carried out by a station officer.

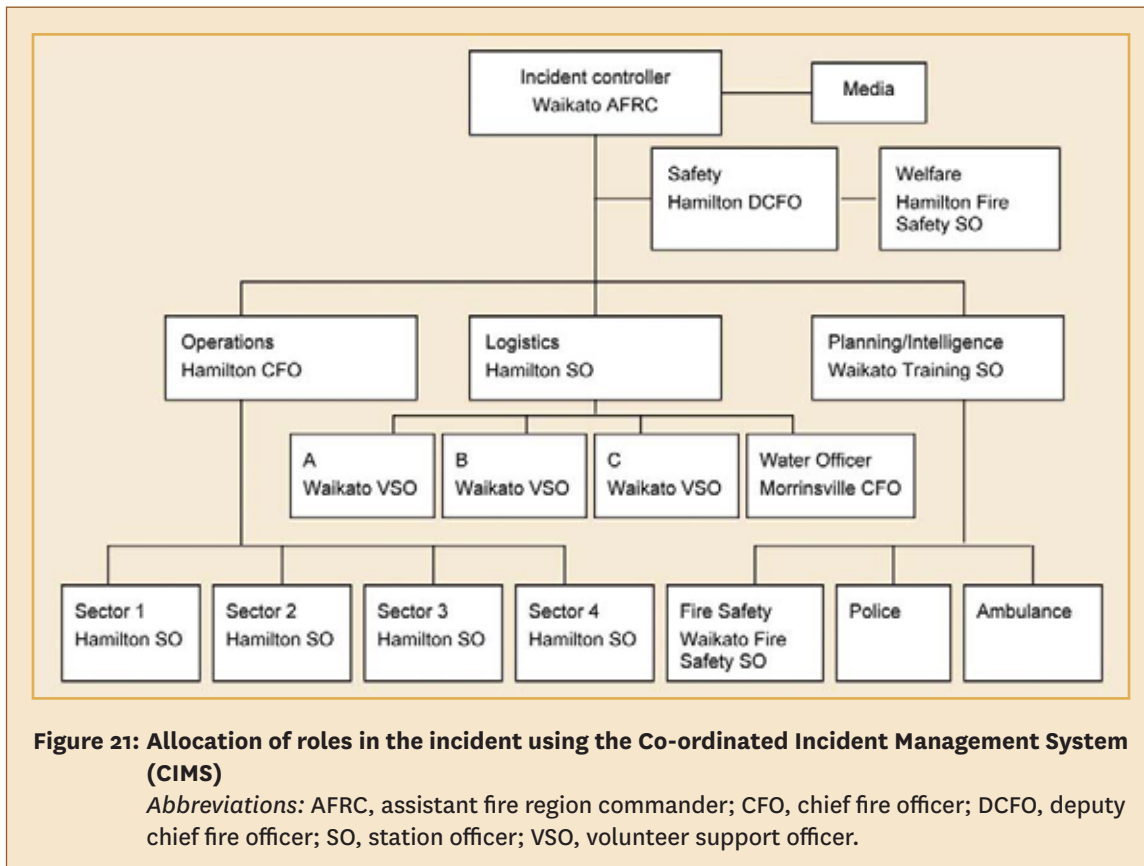
The planning and intelligence role was carried out by a training officer, who in turn ensured liaison with fire safety (Fire Service), police, and ambulance.

Because of the nature of the incident there was an extremely high level of media interest falling upon the responsibility of the incident controller. Waikato AFRC utilised the services of a police liaison officer to assist with this function.

At approximately 18:30 Hamilton CFO was released as operations manager in order for him to proceed to the hospital to liaise with the families of the injured firefighters. He was relieved by Tauranga AFRC.

Waikato AFRC relinquished responsibility as incident controller at 01:12 on 6 April, and Auckland City CFO took over.

This incident management system remained in place with regular changeover of responsibility for the next few days, eventually being scaled back in normal fashion to incident/operational command functions.



In many ways the ongoing management of the event was carried out no differently from any of the other large-scale incidents that are attended by the Fire Service each year. The size and protracted nature of the incident entailed regular changeovers of appliances, crews, and senior officers. A great deal of assistance was afforded from adjacent regions. Once the majority of the fire had been extinguished on Sunday, 6 April, the prime role of the Fire Service was confined to damping down and turning over numerous hotspots. This work continued until the following Saturday (12 April) when the last appliances were released.

### 13.2 Incident strategy and tactics

The incident strategy and tactics were based on a series of competing demands and operational factors that altered rapidly throughout the early progression of the incident. Initially the focus was split between the desire to apply water to the rapidly escalating coolstore fire and the requirement to cool what was thought to be a pressurised gas cylinder in close proximity to both the burning structure fire and the casualties. These tactics were seriously hampered by the lack of a reticulated water supply and were heavily dependent upon the arrival of water tankers and the limited access to the adjacent school swimming pool.

Once it had been determined that the supposedly pressurised cylinder was in fact disused and empty, the available resources were used to protect the dwelling (34 Devine Road) that was situated on the eastern boundary of the coolstore facility. In addition, the hydraulic platform was utilised to provide the first of a number of water curtain monitors to protect the undamaged western coolstore (Lichfield-Tatua Building), all of which were fed by a water supply from Cambridge’s tanker, which in turn was supplemented by the shuttle relay of tankers.

Further consultation with officials of Environment Waikato (Waikato Regional Council) confirmed the requirement to use a “non-attack strategy” on the buildings that were heavily involved in fire. This decision to allow the buildings to burn was implemented to mitigate the amount of contaminated runoff from the incident and the subsequent potential environmental impact on surrounding watercourses.

Once sufficient protection in the form of temporary bunds and storage traps had been created, a concentrated foam attack was initiated the following day. Thereafter crews were utilised to dampen down hot spots until 18:00 on 12 April.

## **14 Environmental protection**

This section describes the effort invested in protecting the environment in the incident at Icepak Coolstores. The inquiry team reviewed matters relating to runoff from the site; risk management of potential water-borne, airborne, and surface contamination; and liaison between the various organisations involved, most particularly between Environment Waikato and the Fire Service.

### **14.1 Early stages of the incident from an environmental standpoint**

Representatives of Environment Waikato were alerted at 16:40 on 5 April by an employee of the regional council. An officer on after-hours duty responded to the incident and arrived at about 17:15, but experienced some difficulty getting through the police cordon. About an hour and a half later he was invited to the incident control point to discuss the environmental situation, together with the environmental health manager and the contracted hazardous substances inspector, both from Waikato District Council, who had also responded. By that time the Fire Service hazardous material technical liaison officer from Auckland had also arrived.

There was discussion between all parties about melted cheese possibly getting into the drains, but it was not clear at that point where the drains were. The resource officer was called out from Environment Waikato. He responded, but was delayed by the traffic and the police cordon, finally arriving about 19:30, when he signed in at the incident control point.

Assisted by Icepak management, the team listed the hazardous substances that were present on site (see section 9.9). Since these were all gases and several large explosions had already occurred, it was concluded there was no environmental or other threat from escape of hazardous substances.

### **14.2 Control of runoff**

Hamilton DCFO had noted at a very early stage that there was a risk of contaminated fire water runoff going down the drains and had taken steps to control the problem. The visible drains were blocked off using tarpaulins, and efforts had been made to establish small earth bunds to contain the runoff. In the first instance these were dug by Fire Service personnel using shovels at the northern corner of the site. At that stage it was noted that melted cheese was accumulating in an unnamed, dry stream located north-west of the site at Camdon Place.

Though no one present had been on site before, a member of Waikato District Council was able to describe the drainage because he had worked previously with the nearby Gails of Tamahere; he confirmed the drainage was into the unnamed stream on the north-west of the site. The council was called, and an engineer arrived with plans about 20:30.



Source: Jonathan Caldwell Pictures

**Figure 22: Fatty mousse accumulating in streambed**

There was one small excavator contracted to Icepak that began work at about 20:00. The driver started by digging up earth and blocking what stormwater drains could be found on site, then set about blocking the west- and east-side culverts so the flow was diverted into the back paddock. However, the bulk of the runoff was still flowing into the stream at Camdon Place via an underground stormwater drainage system. The accumulated fat on the surface of the dry streambed was a couple of centimetres deep.

Environment Waikato asked the city council to bring in spill response equipment, including booms. These booms were in place by about 22:00 and controlled the flow of fat down the stream. The accumulated fat behind the boom was about 40 cm deep. By about 02:00 on 6 April, flow in this direction became uncontrolled, and the nature of the runoff grew worse as time went on.

What was described as a “fatty mousse” totally overwhelmed the booms some time in the early hours of Sunday. The next morning, the environmental officers returned to survey the stream (see Figure 22). Fat and scum were found about 1 km downstream from the point of discharge at Camdon Place, having come off the site via the underground stormwater drains. An earth dam was established across the stream immediately upstream of the discharge point. Icepak management worked to help contain runoff, organising excavators and drivers on site to dig large runoff ponds in the adjacent paddocks.

Sucker appliances went on site Saturday night (5 April), and more went in on Sunday. They removed the fat and scum from the stream. Koppens Road was very congested with fire appliances, so sucker appliances went in and then ferried back and forth and dumped their loads into the



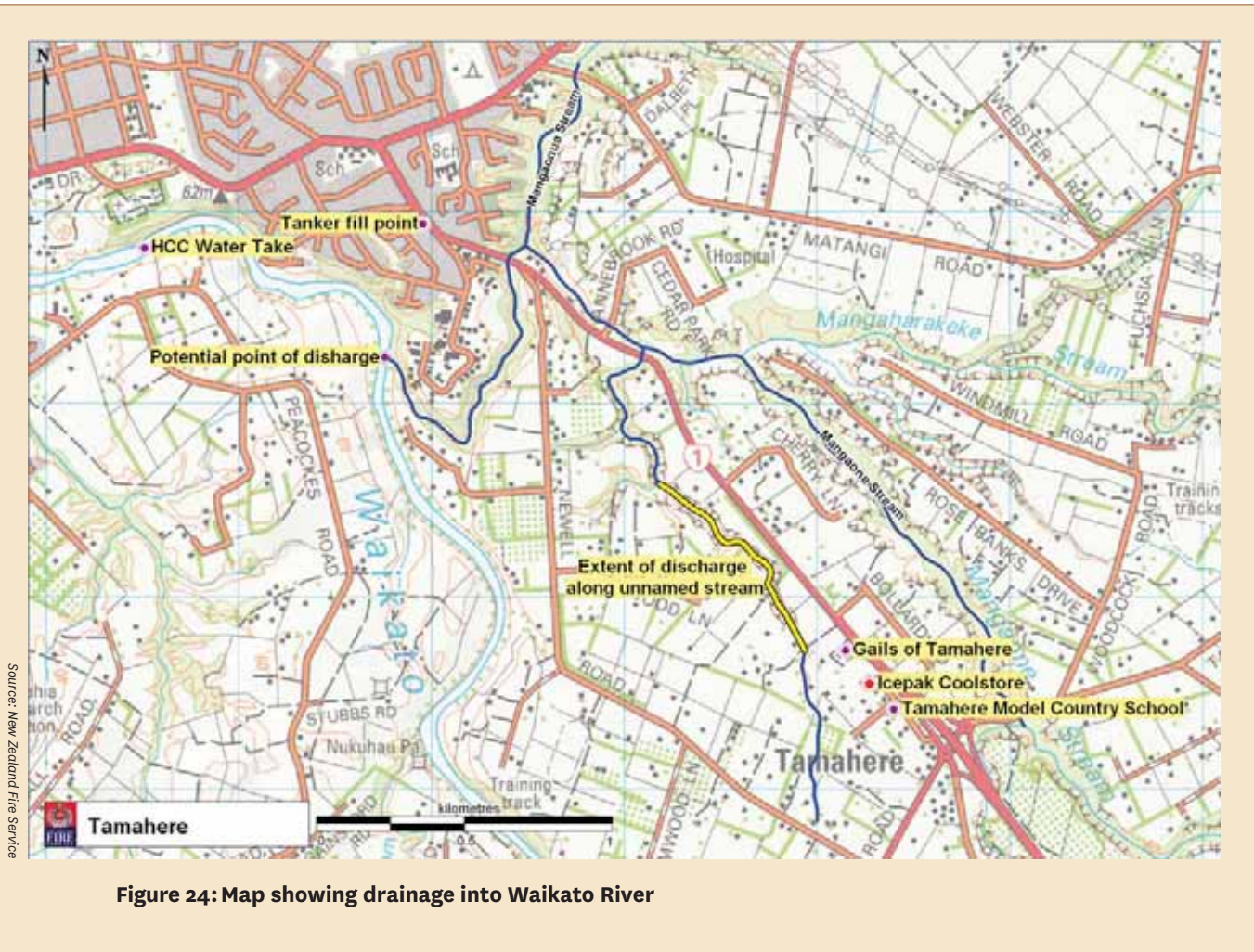
**Figure 23:**  
Sucker truck discharges  
into trenches dug in  
paddocks adjacent to  
Icepak facility

deep ponds that had been dug in the paddocks (see Figure 23). The ponds were now 1 m deep, and environmental officers arranged for high-visibility fencing to be placed around them.

Icepak management continued the clean-up under instruction from Environment Waikato, which had been consulting with site neighbours about the containment operations and the desired outcomes. The sucker appliances started to empty the ponds on Sunday, continuing through into Monday. The removed fatty material went into the local sewage system and waste-water treatment plant.

### **14.3 Water-borne contamination**

The unnamed stream that was most affected by the runoff was described as possessing low ecological or amenity value. The only notable effect on wildlife was the presence of dead eels some 1 km from the Icepak site. The stream joins with the Mangaone Stream to the north, which in turn joins with the Mangaonua Stream, before finally discharging to the Waikato River just upstream of Hamilton City's water intake (see Figure 24). Despite the stream bed being dry at the time, cheese residue managed to discharge about 1 km north of the site at Camdon Place (see Figure 25). After the earth dam was put in place all further discharge was contained. Water flows were



**Figure 24: Map showing drainage into Waikato River**

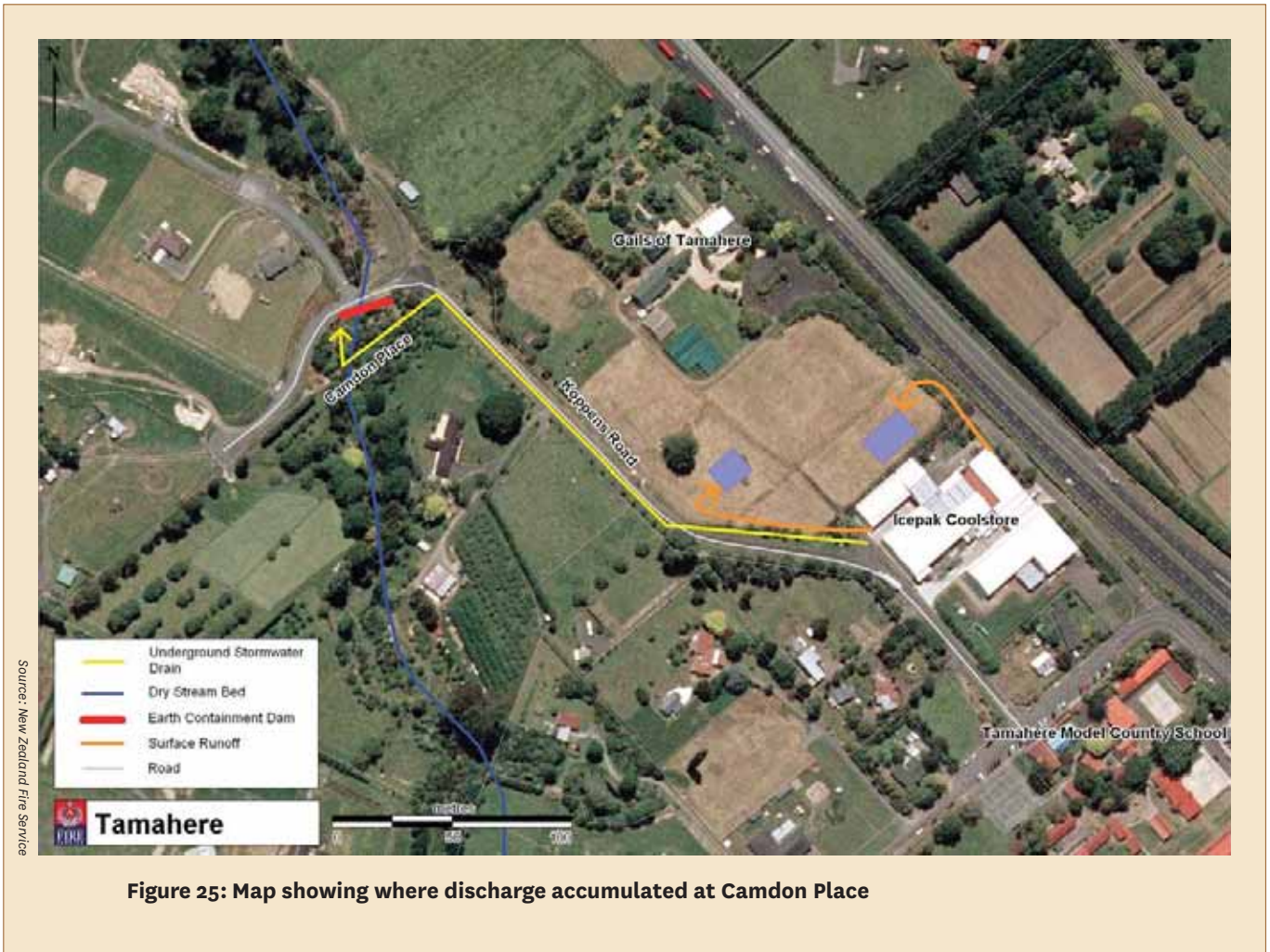
monitored down to the Waikato River to check for any sludgy discharge, but none was found. The conclusion was that on-site control measures were largely effective and the overgrown waterway sieved out the remaining fat. Without the control measures put in place contaminants would have entered the Waikato River, which supplies Hamilton’s drinking water.

The significance of the environmental impact of water-borne organic contaminants may be characterised by the biological oxygen demand (“BOD”), which is a measure of the amount of oxygen needed by aquatic organisms to break down solids and other readily degradable organic matter present in waste water. Whereas the BOD for raw sewage may be several hundred milligrams per litre, that for cheese rises to tens of thousands. The BOD of drinking water is less than 1 milligram per litre. The environmental impact of the runoff could therefore have had a severe impact on Hamilton’s drinking water had it not been adequately controlled.

**14.4 Airborne contamination**

Throughout the incident the weather was calm. Nevertheless, the size of the smoke plume gave rise to concern on the first evening that the smoke would come down. A representative of the district health board on site discussed with Environment Waikato the possible need for evacuation of areas of Hamilton.





Some discussion took place between the parties about the nature of the airborne products of combustion. Advice was provided that the products burning were organic rather than hazardous substances and that the smoke was not a significant threat to the public, the key products being smoke particulates, carbon monoxide, acid gases, soot, and oil residues.

An environmental chemist was called and arrived around 22:00; he supported the view that plume was sufficiently high for it not to be a threat. Smoke was dispersing quite well. Hamilton City Council set up a telephone health line at about 23:00 for people to call with environmental concerns. Local residents came to ask what was going on, and there was significant communication with affected households. Waikato District Council sent out a newsletter on 8 April.

Many houses in the locality collect roof water for drinking water supplies. Therefore the Waikato medical officer of health agreed to put out a statement that a first flush diversion approach should be used for roof water supplies.

There were continuing problems with odour for many weeks after the fire was extinguished.

#### 14.5 Surface contamination

At the time of the incident grease and fat contaminated the roadways, which became very slippery. A sand appliance was requested to come in and spread sand over all the roadways to provide safety for all operating on site.

The soil on the surface of the paddocks and the affected stream banks was turned over and covered with clean soil once the incident was over to allow natural degradation of organic contaminants to occur. Soil samples taken locally showed that the fire and runoff caused no significant contamination of local soils.

## **15 Logistics**

This section outlines the considerable logistical impact of the incident upon the Fire Service. The inquiry team reviewed the firefighting resources in terms of firefighting media, appliances, and crews, as well as the provision of refreshments and site security.

### **15.1 Water and foam**

As already outlined, there was no reticulated water supply on site. The two plastic and single concrete static water tanks (each with a capacity of approximately 18,000 litres) were rendered entirely unusable because of their proximity to the fire. This placed serious constraints upon the firefighting procedures that could be used in the initial stages of the fire. Initially, storage tanks from adjacent dwellings and subsequently the nearby school swimming pool were utilised to provide limited sources of supply for the appliances.

A fleet of nine rural fire tankers, as well as some seven tankers offered by Fonterra, provided the principal supply.

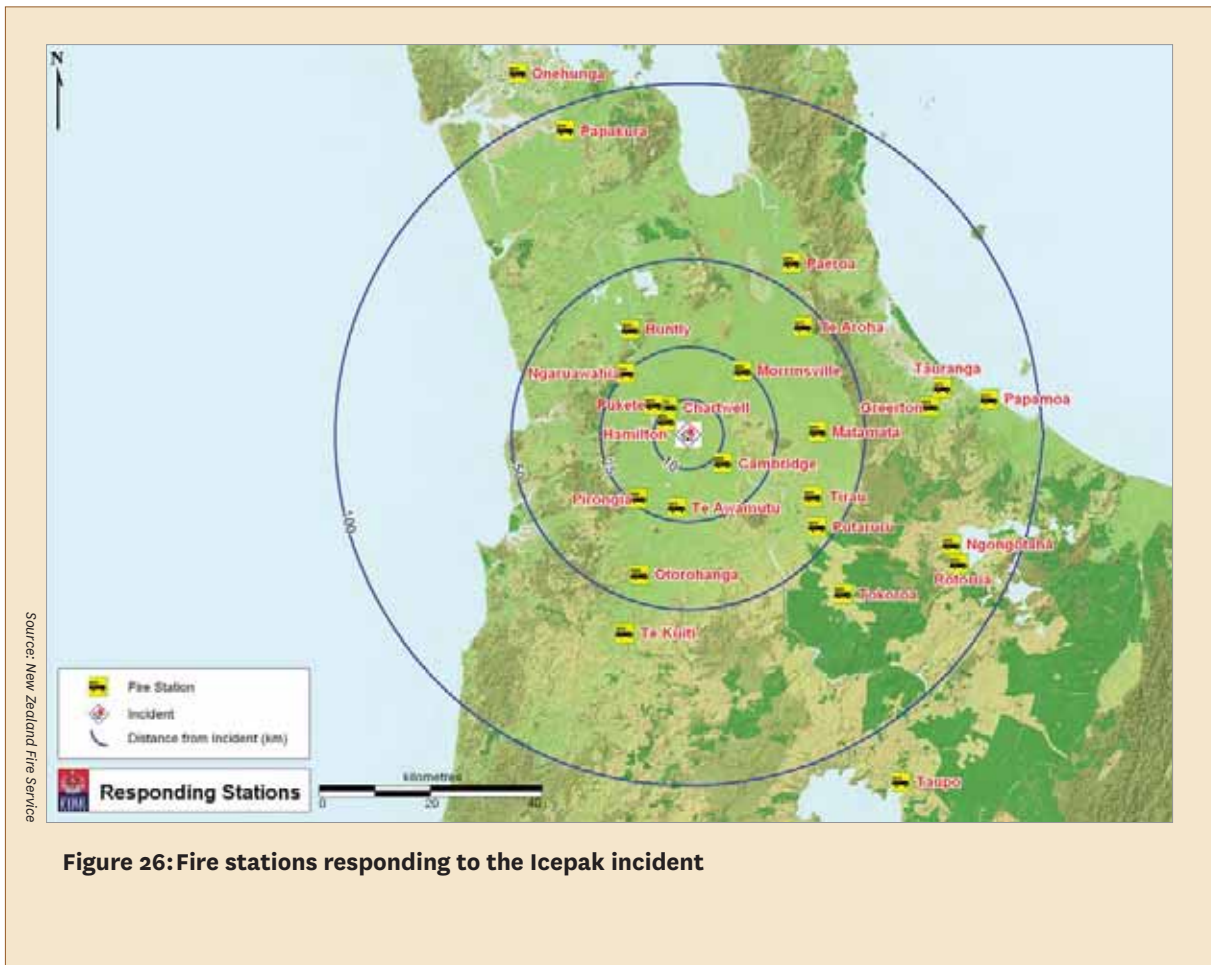
A shuttle relay of tankers from a hydrant on State Highway 1 was established to supply to a Fire Service improvised dam set up adjacent to the State highway on the north-east corner of the site. This provided water supply for firefighting on the north-east corner of the Icepak buildings and for the defence of the house at number 34 Devine Road.

A further shuttle of tankers supplied water to a base tanker (Cambridge 4411), which, in turn, provided the necessary supply for the hydraulic platform and other monitors used to provide a water curtain to prevent the fire spreading to Lichfield-Tatua Building.

An initial attempt to mount a foam attack on the Waikato-Transit Building utilising the airport rescue tender was ineffective. This appliance proved to be unsuited to this type of fire. No further foam attack was commenced until sufficient foam stocks were on site the following afternoon (Sunday, 6 April) and the fire was starting to abate. This attack was carried out after liaison with Environment Waikato and proved to be satisfactory in extinguishing the main body of the fire.

### **15.2 Appliances**

More than 40 appliances and tankers attended the scene over the course of the incident. Given the protracted nature of the event, numerous relief appliances were mobilised from as far afield as Rotorua and Taupo. All of the appliances operated satisfactorily, with damage being limited to the loss of Hamilton 411 (damaged by explosion and fire) and slight heat damage to Pukete 431 and the airport rescue tender. The use of the hydraulic platform proved to be particularly beneficial in the early stages of the fire when used to provide a water curtain and later on when extinguishing deep-seated hotspots. The Type 4 combination pump/aerial appliance from Rotorua was also used at the incident over the course of several days to assist with damping-down operations across the incident site.



**Figure 26: Fire stations responding to the Icepak incident**

### 15.3 Staffing

Any incident that extends over seven days will, by the very nature of Fire Service operations, be extremely labour-intensive. As a result, relief crews were utilised from beyond the Bay-Waikato Fire Region, coming from as far afield as Auckland (see Figure 26). Similarly, reliefs for senior officers were also supported from the adjacent fire regions of Auckland and Western to assist with the demands placed upon the executive officers from Bay-Waikato region. These demands included not only the operational management of the incident but also the extensive media interest and obvious welfare considerations of crews and families.

### 15.4 Refreshments

Normal procedure entails crews being relieved from incidents in order for them to receive appropriate refreshment at their own station; however, the size and protracted nature of this incident inevitably led to a requirement to provide such refreshment adjacent to the fireground.

The duty civil defence and emergency management officer from Waikato District Council arrived shortly after 19:00 on 5 April and quickly took over responsibility for coordinating fireground feeding. Initially the food and drink supplied to crews was that which had been prepared for the “Pumpkin Night” function at the adjacent school. Thereafter a catering caravan was supplied and crewed by the Cambridge Lions organisation alongside further catering support from the canteen unit from Auckland Fire Police. The Salvation Army took over the provision of catering facilities on Sunday morning, remaining in place until Wednesday, 9 April.

## 15.5 Site safety and security

Hamilton DCFO was appointed as the initial safety officer for the incident as part of the CIMS structure. In turn the police were utilised to control access to the site, with authorised entry being made via the incident control point. The sheer scale of the incident and its associated smoke plume attracted large numbers of onlookers, which, combined with the length of the incident perimeter, provided a high workload for those tasked with controlling access to the site. A number of insurance investigators attended the scene on Sunday, 6 April, all requiring access to specific sections of the incident ground.

Ongoing site safety and security was maintained by the continuous Fire Service presence until withdrawal of the final crews on Saturday, 12 April. Handover of the incident ground on that Saturday gave rise to some uncertainty concerning the legal position as to which entity should assume control. In the event, on advice from the Fire Service solicitor, the site was handed over to Department of Labour representatives. Environment Waikato expressed surprise afterwards that it had not been consulted.

## 16 Use of personal protective equipment

The focus of the inquiry team was on the PPE worn by the first attending firefighters, rather than those who attended subsequently.

When responding to the incident the drivers of 411 and 412 wore their wildfire/rescue uniform, consisting of wildfire/rescue boots, trousers, and jackets.

The other firefighters were wearing structural firefighting jackets, overtrousers, and firefighting boots. It appears they were all wearing flash hoods around their necks, ready to pull up if they were required to wear BA.

Up until the time of the explosion some of the firefighters said they had their gloves on or off, depending on what they were doing at the time. All firefighters had their helmets available, but not all were wearing them at the time of the explosion.

Table 3 summarises what the eight firefighters were wearing at the time of the explosion.

Because of the severity of the incident all fire crews subsequently on site were wearing full structural firefighting clothing.

## 17 Traffic and crowd control

Police officers first arrived on scene just after the first ambulances arrived. The immediate problem was controlling spectators who had already arrived by car from State Highway 1 and also from some distance away having seen the smoke plume. These people were getting in the way of the process of dispatching the injured firefighters to hospital, as well as placing themselves at personal risk, there being a succession of minor explosions later attributed to exploding aerosol cans.

The next problem was controlling traffic on the highway. The traffic was moving slowly as drivers tried to see what was happening, and cars were diverting round the back way via Newell Road to have a look. As more police officers arrived a cordon was established around the incident, all

**Table 3: Personal protective equipment worn by the firefighters at the time of the explosion**

Appliance	Position	PPE worn at time of explosion
<b>Hamilton 411</b>	Officer	Helmet Structural jacket and overtrousers Boots BA donned
	Firefighter 1	Helmet Structural jacket and overtrousers Boots BA donned
	Firefighter 2	Helmet Structural jacket and overtrousers Boots BA donned
	Driver	Wildfire/rescue jacket and trousers Boots
<b>Hamilton 412</b>	Officer	Structural jacket and overtrousers Boots
	Firefighter 1	Helmet Structural jacket and overtrousers Gloves Boots BA donned
	Firefighter 2	Structural jacket and overtrousers Boots BA donned
	Driver	Wildfire/rescue jacket and trousers Boots

traffic being diverted northbound on State Highway 1 away from the incident. Anyone attempting to come down Newell Road (apart from residents) was turned away.

The Hamilton duty police inspector was alerted at 17:45 and arrived at about 18.30. Having heard that the State highway was jammed with sightseers, he came in the back way via Newell Road and Airport Road. He went to the incident control point, met the incident controller, and took over the police operation on site at 19.00. At that stage there were about 24 police officers at the scene taking various roles in managing the traffic and managing spectators. Police units needed to be allocated to keep traffic moving on State Highway 1 southbound, where people were stopping. Spectators on foot were observed sneaking through private property to try to get to the scene. There were spectators three to four deep along the roadside.

It was noted that water supply via tankers was going to be a big issue at this incident, and police closed the northbound lane of State Highway 1 to ensure that tankers had free access to the site and to a hydrant on the highway for refilling.

Police were involved in CIMS processes set up by the incident controller, and agencies met outside the incident control point about every half hour in the early stages. Thereafter police participated in about four SITREPS during the night. The timings of these were communicated to the various parties by cellphone. Police withdrew about 05:45 on the Sunday morning satisfied that the site was secure. However, police assistance was requested several times over the next few days to control traffic.

## 18 Welfare

Arrangements to deal with the welfare of the families of the injured firefighters were put into place within an hour of notification of the explosion having taken place.

A Hamilton senior station officer was despatched to the hospital to liaise with the injured crews and to provide a point of contact for information. Hamilton administrative staff joined him to assist. The fire region manager also elected to proceed directly to the hospital to establish welfare arrangements for the families affected.

Two off-duty senior station officers also quickly established facilities to coordinate communication, information, and welfare arrangements at Hamilton Fire Station utilising a CIMS-based structure. This included contacting the families of the injured firefighters or those who were going to be delayed for some considerable time at the incident. They also dealt with the many media enquiries that were being received by the fire station.

At 20:38 Hamilton CFO left the incident ground and, accompanied by his wife, who is an experienced counsellor, proceeded to the hospital on a welfare basis.

The fire region manager arranged further welfare support in the form of a team from Auckland, which arrived on Sunday morning. This team included the health and safety manager for the Auckland region, the national clinical director for CISM, and peer support. They quickly established themselves at Hamilton Fire Station providing support for all those there. They also visited adjoining stations, the communications centre, the incident site, and the families at the hospital to provide as much assistance as they could over the days following the event.

Staff from Hamilton station supported the families with immediate financial assistance within hours of the incident. Within the next few days the Fire Service made ex gratia payments to the firefighters to assist the families through the difficulties of everyday life over the time immediately following the incident. The New Zealand Firefighters Welfare Society looked after affected members and non-members alike with gift boxes and fuel vouchers.

Because the Fire Service is an accredited employer in the Accident Compensation Corporation partnership programme, and the injuries sustained by the firefighters were the result of an accident, the well-being of the firefighters and affected families was dealt with by the specialist claims management unit based in Fire Service national headquarters. A team responded within 10 days to Hamilton to establish contact with those affected and set up regular liaison, support, and rehabilitation, which continued even after firefighters started to return to work. Over the following weeks more than a dozen visits were made by the team in this role.

The Minister for Internal Affairs, the National Commander, and members of the Fire Service Commission displayed a personal interest in the welfare of the firefighters and their families and visited the hospital as well as making regular contact with those affected.

## 19 Communication and liaison

The nature of the Icepak incident meant that a great many parties were involved over the course of the week from 5 April, and some groups thereafter. Managing the flow of appropriate information and establishing relevant links between parties was an important part of the Fire Service's involvement, as well as that of other organisations.

### 19.1 Media

Media interest was intense.

Within minutes of the explosion occurring calls to Comcen started asking for details. A Hamilton-based police communications manager answered a media call at 16:35 and a number of calls over the next half hour. He responded to the scene from Auckland, arriving shortly after 18:00. He reported to the incident control point and offered to assist as media liaison officer to free up the incident controller. He was issued with a "media liaison" jerkin, and proceeded to deal immediately with the misinformation that had already found its way into the media. This included confirming with radio networks the number and then status of injured firefighters and that there was no need for all off-duty medical staff to respond to Waikato Hospital. One challenge was trying to corral the media for their own protection and in order to give single briefings. It proved difficult to establish who among the large crowd were media representatives because there is no accreditation process and ID card system. Many of the people arriving claimed to be freelance media but were turned away.

Groups of media representatives were given tours around the site under escort. This proved to be a demanding task. For example, one TV crew was caught creeping through a hedge trying to get closer to the incident. Media were offered refreshments and given timed briefings. Nevertheless, the media still tried to get quotes from individual firefighters. Because of the pressure they were under, it was often difficult for firefighters to resist making spontaneous remarks.

The Fire Service corporate communications manager was notified of the incident at approximately 17:30 on 5 April. He immediately went to national headquarters in Wellington and started to arrange and coordinate national media and internal communications. He maintained regular contact with the Bay-Waikato managers, offering advice and support with media issues. He issued a media release at 01:25 on Sunday morning advising of the firefighter fatality and injuries. During Sunday three communications staff at national headquarters fielded calls for the media and worked on updating the Fire Service website and FireNet to provide information on the incident.

The Bay-Waikato region media and communications adviser travelled from Tauranga to Hamilton on Monday, 7 April to take up a local coordination and liaison role with the media. She remained in this role until Friday, 11 April. On the Monday alone she fielded over 100 calls from the media. Daily contact between national communications staff and Bay-Waikato was maintained for several days after the incident.

National media coverage was very extensive for over a week after the incident. For example, over 120 articles about the incident were published in New Zealand newspapers over this period. Media coverage included interviews with the injured firefighters and their families, and live television coverage of the funeral on Friday, 11 April.

## **19.2 Fire Service internal communication and support**

The communication centre followed the notification procedure and notified the National Commander's group by pager at 17:12:28 on 5 April. (The National Commander's group consists of the National Commander and five senior officers based at Fire Service national headquarters. They operate a 24/7 roster to provide strategic response to events of national significance and undertake a national command function when required.)

The National Commander's group on-call officer had commenced telephone communication with the incident controller and Bay-Waikato FRM by 17:20 and ensured that all other senior managers were advised of the incident. Regular communication between Bay-Waikato region and national headquarters followed from then on.

The Bay-Waikato and Auckland region managers were in telephone contact with each other within an hour of the explosion occurring. The Auckland region responded immediately to the request for support and sent a CFO to the incident on Saturday night to relieve the local incident controller. This allowed Hamilton's senior officers to leave the incident ground and focus on supporting their staff and the families of the injured firefighters. Executive officers from Tauranga, Rotorua, Palmerston North, and Taupo assumed the role of incident controller over the ensuing days.

Almost all the Hamilton firefighters had left the incident by midnight on Saturday, 5 April and were not asked to return there again. Rather they were able to spend time with the injured and their families, deal with media inquiries, and plan the funeral for the deceased officer. Firefighters from other stations in Bay-Waikato and Auckland managed the incident until it was cleared a week later on Saturday, 12 April.

The National Commander travelled to Hamilton on Sunday morning with the Minister of Internal Affairs, who is the Minister responsible for the Fire Service. They visited the incident ground and the injured firefighters at Waikato Hospital, and met with managers, staff, and families at Hamilton station.

Auckland region's CISM team travelled to Hamilton to assist the brigade on Sunday morning and maintained daily contact with them for several days.

Communication with all Fire Service personnel was achieved through the FireNet. A special site was set up for the incident on Sunday, 6 April and this was regularly updated over the following weeks with information on the status of the injured firefighters, the funeral, and issues relating to the fire and the inquiry.

## **19.3 Communication and support for affected families**

The families of the injured firefighters were notified of the event by a range of mechanisms. There was some difficulty at Hamilton Fire Station in gaining access to what were regarded as confidential contact details for next of kin. Some family members were notified because Hamilton staff had their phone numbers personally. Some had to be found in the phone book.

The publicity surrounding the incident was so intense that many family members first heard of the incident and suspected a relative may have been involved when they heard it on the radio or TV. In one particularly harrowing instance, an injured firefighter's children were highly distressed to learn of his involvement when they discovered a picture of his serious injuries on the Internet. Some family members inevitably were not in Hamilton when they were notified and had to struggle through traffic on the State highway clogged with sightseers in order to make their way to Waikato Hospital.



Family members who had not been reached started to phone the station as soon as they became aware of the event. The problem then for those staffing the phones was how to establish the bone fides of those calling, and how much information to release. Some families felt that they were not being told the whole story, or had to call repeatedly before they found someone they knew who could fill them in. However, it may just have been that the staff answering the phones simply did not have the firefighters' status at that stage and indeed may not have known exactly who was involved.

At the hospital several staff from Hamilton station set up liaison with the families and arranged for a room to be set aside for them. However, good as they were, even these arrangements were not perfect. One firefighter's spouse was excluded from being allowed in to see him for reasons that were not entirely clear at the time, resulting in great personal distress. The families did not necessarily have information on the extent and seriousness of the injuries to the firefighters.

Communication from the Fire Service to families improved when the national headquarters claims management unit became involved. Many of the families appointed a contact person to act as a conduit, which helped them to manage media interest in particular and acted as a filter for external communication. Gradually the firefighters started to be released from hospital as time went on, and the problems the families experienced eased. However, one injured firefighter was still in hospital at the time of writing the report. The issues faced by his family, including being uprooted from their family home for 15 weeks whilst he was treated in Auckland, were extreme. Local help and support was put in place for them.

#### **19.4 Local community**

The local community associated with the Tamahere school organised a debriefing session on the Monday evening after the start of the fire. That was at the home of one of the couples who lived in the neighbourhood and who had assisted the injured firefighters. Hamilton DCFO was there, and people organised a question and answer session amongst themselves to try to clarify what had happened and what they had experienced. Many witnesses spoke of how useful they found the session and how it helped to talk things through. They were glad that Fire Service representatives had turned up.

There were several other events over the next couple of weeks where the Fire Service was represented. On Tuesday, 8 April a special prayer service was held at St Stephen's Anglican church at Tamahere, which was attended by 120 people including Fire Service personnel. On the following Tuesday night Hamilton DCFO attended an open community meeting of 30 to 40 residents at Tamahere and took the opportunity to provide an overview of the incident and to thank the residents for their assistance. On the Thursday night AFRC Waikato and Hamilton CFO attended a meeting of the school board, which was opened to the public for the purpose of considering the school's response to the fire. Again, the opportunity was taken to express to the 40 or so people present the Fire Service's sincere thanks to the school community for their support and assistance.

A number of the children had been deeply affected by the events of the Saturday, not necessarily because they saw anything disturbing, but because they had seen adults (in some cases their own parents) run into what was clearly a frightening event and not return for a very long time. On the Wednesday after the fire was finally extinguished, on-duty and off-duty firefighters attended a special fun day organised by the school to mark the end of term on a positive note. The firefighters played with the children. This event was extremely popular. The Ministry of Education organised counselling for the children, which continued for those who needed it over the ensuing weeks.

The firefighters also talked to staff and expressed their thanks for the way in which the school community responded to the incident and conducted itself in the hours immediately after the explosion.

The New Zealand Fire Service Commission organised a function to provide the injured firefighters, the Hamilton brigade, and the Commission with a more formal opportunity to express their thanks to all those groups that played a part in the incident. This was held at Hamilton station on 15 May. Recognising that the community affected by the event was very broad, and since numbers were necessarily limited, a representative cross-section of the various parties affected was invited.

### **19.5 Māori response to the event**

There were a number of tikanga Māori that were observed during the Tamahere incident. The Fire Service's national adviser Māori was notified on the morning of Sunday, 6 April. From a Māori perspective, a fatality creates a spiritual imbalance in the environment where such an event occurs. A fatality automatically places a tapu on the area. According to Māori custom, to restore the balance to the environment, a karakia whakanoa needs to be performed by an appropriate person before the resumption of normal operations. At the request of several staff members, this ceremony took place at the site as soon as practicable, on Monday, 7 April, while damping down operations were still being undertaken.

All Fire Service staff and whānau were invited to the karakia whakanoa ceremony by Hamilton CFO. Icepak was also advised. The local school principal heard of the blessing ceremony and requested that the Tamahere school also be included in the event. Therefore the primary school and preschool were also blessed by local tangata whenua. At the request of Hamilton staff, a blessing was also undertaken at the Hamilton Fire Station on Sunday, 13 April.

## **PART 4: CAUSE AND NATURE OF THE EXPLOSION AND FIRE**

This part of the report describes the evidence gathered and conclusions reached by the specialist site investigation team (“the team”) that was given the task of establishing the cause of the explosion and fire at Tamahere.

### **20 On-site investigation process**

As noted in the inquiry team’s terms of reference the Fire Service National Commander invited an experienced and respected independent fire investigator from the New South Wales Fire Brigades in Australia to assist and advise the site investigation team. He was joined by three people from the Fire Service, selected for their experience and background, to make up the team of four.

#### **20.1 Initial briefings**

The Fire Service investigation team arrived in Hamilton on Tuesday, 8 April. A briefing meeting for the team was held at Hamilton Fire Station at 11.00.

At 12.30 a meeting was held in the Tamahere community centre hall where Fire Service personnel, including the team, introduced themselves and began establishing working relationships with the interested parties. Present at this meeting were officers of New Zealand Police, representing the coroner, the Department of Labour, Waikato District Council, and Environment Waikato. Representatives introduced themselves and then outlined the extent of their interest in the incident. Also present were staff from Icepak and their legal representatives and a large number of investigators representing private insurance interests.

It was agreed by all parties that the police, because of their experience in interviewing techniques, should conduct all interviews with the injured firefighting crews of Hamilton 411 and 412 as soon as the firefighters were well enough. Any questions that were additional to those routinely asked during police inquiries would be put in writing to the police to enable them to be included within a single interview.

The representatives from both the Department of Labour and the police indicated they were happy for the Fire Service to continue controlling the site, continue firefighting, and begin a site investigation. The Department of Labour indicated it was awaiting the arrival of further experts and more detailed instructions from its head office.

A general discussion of what was currently known followed, with all personnel sharing some preliminary information. The information tabled included the following:

- The site was unmanned at the time of the call.
- An Icepak staff member had been on site earlier in the day before midday.

- A security and fire system monitored by Signature Security on behalf of Icepak had activated. The Fire Service was alerted via a 111 phone call from Signature Security. Subsequently Signature Security, because of delay in getting a key holder to the site, obtained permission from Icepak management for the Fire Service to force entry.
- Evidence suggested that power outages had occurred earlier on the day of the incident, and an Icepak staff member attended the site at approximately 10:00–10:30 on the morning of 5 April.
- The refrigerant in use in the plant was of two types: R22 and a product described as “High Chill 50”. Because of a spelling error, the product could not be located in the HSNO chemical classification information database.
- Environment Waikato expressed satisfaction with waste containment measures in place at the time.
- Requests for further information from Icepak staff or contractors were directed to be sought from their legal representatives.

The meeting concluded at approximately 13:30. It was agreed that a site tour would be held at 15:00.

## **20.2 The scene**

The preliminary tour of the site revealed that the complex comprised three interlinked cold storage warehouses, associated plant rooms, and a workshop building, all of which had been subject to an explosion and fire. This resulted in the destruction of two of the coolstores, plant rooms, office, and the workshop. The coolstores contained a range of foodstuffs. Several small fires continued to burn for a number of days where high densities of foodstuffs were located in inaccessible spaces shielded from direct extinguishment from a hose stream. (See Figure 27.)

## **20.3 Meeting with Icepak representatives**

The following day, whilst the scene was being photographed by a police photographer and a preliminary site investigation was taking place, a few members of the team had an information-gathering interview with the Icepak management, together with counsel for Icepak. A number of points in relation to the coolstore emerged at that stage:

- There were two plant rooms (refer Figure 3).
- Plant Room 1 contained three compressors used to deliver the cooling required to the cool rooms.
- The blast freezer, which adjoins Plant Room 1, was not in operation.
- The temperatures in the coolstore varied from  $-4^{\circ}\text{C}$  to  $+20^{\circ}\text{C}$  depending on the function of the storage room at that time.
- The refrigeration plant was on occasion used to raise the temperatures in the cool rooms, where a number of 3 kW heaters were also installed for this purpose.
- A refrigerant with the proprietary name Hychill was used in the system. This was used to replace the environmentally damaging HCFC refrigerant formerly used.
- The only containers used for storage of spare gas were some spare R22 containers.
- It was understood that a power brownout had occurred on the morning of the explosion. (A report from consulting electrical engineer and printouts from the facsimile machine of the adjacent function centre, Gails of Tamahere, supported this view.)



Source: Investigation Team

**Figure 27: Aerial view of the scene taken about noon on Tuesday 8 April**

State Highway 1 is at the top of the picture. The school buildings can be seen on the right. The surviving Lichfield-Tatua Building is on the left. The trenches and sludge pond dug to contain runoff are clear on the far left.

- The coolstore rooms were used to store a variety of products including venison (frozen), cream, cheeses, and butter.
- The coolstore walls consisted of EPS panels 150–200 mm thick and the roof of the same size. Plant Room 1 was constructed from 50 mm EPS panel; the team understood the reason was to reduce refrigeration equipment noise. An aerial photo of the site was made available, and this showed the presence of a sound baffle on the plant room roof.
- The site engineer provided a marked-up plan of the site showing coolstore names, storage type, refrigerant types, temperatures, and refrigeration equipment in the two plant rooms.
- Icepak management offered the following responses to the questions shown in italics below:
  - *Was power to the compressors on?* Management did not know.
  - *Were there any electrical problems that had occurred, and if there were, did they require any maintenance?* There were no electrical problems.
  - *Were there any disgruntled employees?* There were none.
  - *Were there any issues with the refrigerant system?* There had been some work done on the “twins” and there was also an oil leak in the “triplets” [referring to components of the Copeland compressor rack in Plant Room 1].



**Figure 28: Aerial view of site showing calculated force vectors**  
Plant room panels are lodged on the canopy.

#### 20.4 Preliminary investigation

While the interview with Icepak representatives was under way other members of the team began documenting the fire scene and gathering information from local witnesses. The team also discussed scene preservation and security with Fire Service operational staff.

Environment Waikato representatives were anxious for the rotting carcasses of venison to be removed before they became noxious. Access for demolition was discussed to allow the removal of the carcasses. This was delayed by a late change in the demolition company appointed to undertake this work. One company had already begun work only to be replaced by another organisation. This required the removal of one set of heavy equipment and the delivery of another set.

Demolition was important so that the deep seats of fire could be exposed and extinguished without disturbing evidence.

The team began documenting from the north side, beginning in the area of the central driveway (under the canopy) and working towards Plant Room 1. The fire was still burning on site and producing copious quantities of smoke. The ground was very slippery because it was covered in dairy residue.

A decision was made to begin removing firefighting water residue and dairy product from pools within the fire scene. There were many deep trenches on site full of residue.

The investigation team was able to identify several items of plant and structure that had been damaged as the result of excessive force. It was also noted that a number of EPS panels, known to be from the plant room because of their construction (i.e. 50 mm thickness), had been propelled onto the roof of the canopy between the two buildings (see Figure 28). A number of panels were



Source: Christine Cornege, Waikato Times

**Figure 29: View from the service road of deformed wall panels of Room F4 shortly after the explosion at 16:39**

also located around the site. The investigation team concluded that these items were indicators of an explosion but could not conclude that these panels were still in their original position because of the amount of site traffic before the arrival of the team.

From their observations on scene the team members deduced that the explosion had occurred first and the fire subsequently. They based their deductions on the fire damage evident on items that had been dislodged and translated by the explosion before the deposition of soot or other signs of combustion.

After this preliminary examination the team agreed on a strategy for scene investigation. It commenced by dividing the total scene into principal areas of interest. A more detailed scene examination started on Thursday, 10 April.

The first area to be examined was under the canopy between Room F1 and the Cambridge Room. The team approached from the service road running parallel to Stage Highway 1 commencing its examination of this area by conducting first an outer sweep to identify any items on adjoining property to establish an outer perimeter of interest. Team members located items such as external wall and roof panels in both burnt and unburnt condition. The location of these items did not offer any indication as to their place of origin, mode of travel, or the timing of deposition.

## **20.5 Canopy area**

The investigation team then entered under the canopy structure and proceeded to examine this area in a clockwise pattern commencing with the corner of Room F1. The first item located consisted of charred timber and steel nails. It became evident that this was the remains of a stack of wooden forklift pallets. These pallets had been almost completely destroyed by fire. The wall



Source: Investigation Team

**Figure 30: View of Plant Room 1 showing blast chiller wall folded over stillage**

lining in this area (Room F1) had failed and exposed steel stillage racking containing packaged meat products. Heat damage patterns indicated the fire had travelled internally within the room. The team was unable to determine at the time if blast damage had occurred to these panels prior to fire impingement because of the excessive level of deformation. However, later study of photographs taken from the service road through the canopy, less than 10 minutes after the explosion occurred, show the wall panels of Room F1 badly deformed (see Figure 29).

As the team continued its examination of this area in a clockwise direction it encountered a large number of steel stillage frames, which had toppled from their original position and were lying with the top section facing Room F3. The team continued to extend its search to the extent of the canopy and at this point turned right because access through the roadway was completely blocked by steel stillage frames.

Working toward the right the team established the wall line of an insulated building, later identified as the blast freezer wall, which was lying outwards over the top of the stillages, toward Room F3 (see Figure 30). A concrete-filled steel bollard was positioned at the end of this wall, and as the investigation team moved right it located a second bollard lying underneath some steel sheet (see Figure 31). The team noted the position of this bollard as being approximately 2 m parallel out from the other bollard, indicating the explosive force. The team concluded its examination of this area by making its return along the wall of the Cambridge Room.

Toward the service road on the north-east of the site just under the canopy the investigation team discovered a large EPS panel, which was subsequently identified (by comparison with photographs





Source: Investigation Team

**Figure 31: Concrete-filled steel bollard in the canopy area**

obtained later) as the blast freezer sliding door (refer Figure 5). The door panel measured approximately 2.4 m in width and was 3 m high with a depth of approximately 180 mm. The team noted the position of this door and recorded its exact location on a plot map as a displacement of 27 m. This door panel is estimated to weigh approximately 100 kg. Simple mass-distance analysis suggests that the force required to cause such a displacement is approximately 19 kPa. (Details of these calculations are included in Appendix F, Table F1.) Adjoining this door the team located a hasp and padlock (see Figure 32); the hasp had been torn and, when aligned with the padlock, demonstrated that the padlock had been forced through the steel hasp. This would require significantly more force than that estimated by the aforementioned mass-distance calculation, and it is therefore more likely that extreme force was required at the moment of separation.

## **20.6 Open ground around Room F4**

On Thursday, 10 April, in an effort to obtain greater site information, a helicopter was arranged to enable aerial observations and photographs of the site to be made. From this aerial vantage point, the investigation team was able to see additional items that had been translated by the explosion. As already discussed, lying atop the canopy were two large panels of EPS material, which appear to have been projected by the force of the explosion. After returning, the investigation team met and commenced an examination of the area of open ground on the right of the West Room as viewed from Koppens Road. As the investigation team entered this area members proceeded to conduct their examination in an anticlockwise direction making their way along the northern side (inside) of the landscaped mound running parallel to Koppens Road.



Source: Investigation Team

**Figure 32: Hasp and padlock from sliding blast freezer door**

The first item encountered was the base of a small storage shed approximately 12.6 m from the Koppens Road roadway edge. The base measured 4.0 m × 3.1 m. The walls of the shed had been laid flat and the roof had collapsed. Adjoining the shed approximately 1.2 m away was a concrete water tank of 3.4 m diameter. Next to this were two green plastic water storage tanks of 4 m diameter. These had melted down to the level of the surrounding ground. A distance of 2 m from these tanks was another small shed measuring 4.1 m × 2 m. This shed had collapsed. Within 1 m of this shed was a large piece of plant equipment, which was subsequently identified as a previously used receiver for ammonia. The receiver vessel of this plant, the largest part, measured 1 m in diameter and 6 m in length (referred to elsewhere in this report as the cylinder). The remainder of this area was examined for blast debris; however, because of the runoff of dairy products covering the ground, a detailed search was unable to be conducted.

Team members then proceeded to examine the items around the boundary fence. They located a window, which the investigation team considered (by examining historical photos of the pre-fire buildings) had been ejected from the workshop to a location approximately 13.4 m from the wall of the workshop. Members of the team had been made aware of the damage that had occurred in the adjoining property, 34 Devine Road. They had previously spoken with the owner and had determined areas of damage around the property. The majority of damage related to the breakage of glass in windows and distortion of the window frames, which, the investigation team was able to conclude, illustrated that the explosive overpressure at this distance had exceeded 5 kPa. Although references quote figures as low as 1 kPa for glass breakage, most references quote a minimum of 5 kPa as being necessary for distortion of the frame.

The team then reviewed the damage within the workshop building and observed that a floor-mounted vertical drill/milling machine had been translated approximately 0.5 m around one point and tipped over. The team observed a fork hoist appliance, which was powered by an



Source: Investigation Team

**Figure 33: View of Plant Room 1 from the north, showing unburnt polystyrene and unburnt electrical control gear (lower left)**

internal combustion engine. On the rear of this vehicle a retention strap had been deformed. The investigation team concluded that this was most likely to have been a strap for securing a cylinder of LPG, which was used as the fuel for this unit. The cylinder was not located. The investigation team was able to identify the remains of several high-pressure gas cylinders, which had all vented in both controlled and catastrophic failure manners. The displacement of the drill machine and the damage to the adjoining house the investigation team attributed to an explosion occurring as the result of failure of the pressure vessels located within the workshop and therefore an event that had occurred after the initial explosion and resultant upon later flame impingement.

## **20.7 Hamilton 411**

On Saturday, 12 April the investigation team commenced an examination of the area in and around the remains of the destroyed appliance 411. The investigation team was able to locate most major tool items and several minor equipment items in their original stowage position on the appliance. Three items were not located. These were a set of large bolt cutters, a battery-powered reciprocating saw, and an adjustable spanner. All other items known to be on the appliance appeared to be in their original position.

## **20.8 Plant room area**

After the completion of the examination of 411 and in the presence of the larger investigator group, the investigation team began a systematic examination of the items in and around the plant room. The epicentre of the damage was evident in this room, which was located in the central driveway between the two major cold storage warehouses. Several Icepak staff confirmed that this room



**Figure 34: Electrical equipment from Plant Room 1 in location, close up**

was one of the plant rooms (labelled “Plant 1” in Figure 3), which supplied refrigeration around a number of the cold storage rooms. Damage within this room included the displacement of the walls and framework, and of the lightweight panels that constituted the roof (see Figure 33). Externally, numerous storage stillages had been displaced.

Located in the debris were two electrical service panel steel doors under the displaced EPS panels. These two items, marked as DB 7 and DB 9, were confirmed by their markings to have been located in Plant Room 1. These doors, although severely distorted, showed no evidence of any fire damage including sooting. It is apparent, therefore, that they were ejected from the plant room prior to any fire development and that this occurred before the EPS panels were deposited. These doors are almost certain to have been mounted on the electrical panel located within the plant room adjacent to the Copeland compressor rack. The examination of the supporting framework for the electrical supply panels demonstrates distortion within the upper right quadrant, possibly the location of these panels.

These doors were located at a distance of 37 m for DB 7 and 27 m for DB 9 and were significantly distorted.

Investigators discovered several items that had been dislocated by the initial blast including an electrical switch panel cover, an 80-amp fuse, and various pieces of electrical componentry; the latter included a steel switchboard assembly, which had no remaining internal components, and a large electrical device with attached liquid containers again undamaged by fire (later identified by an electrical engineer on site as being part of a soft start system to allow for reduced electrical load upon start-up). (See Figures 33 and 34.)

The various items in Plant Room 1 had been identified on a sketch provided by the plant engineer. The air-cooled condensers for the plant room, originally located on a frame above the plant



Source: Investigation Team

**Figure 35: Walls and roof of the plant room have gone leaving air-cooled condensers lying on top of compressor units**

room roof, were lying directly on top of the compressor units, and all the walls to the plant room building had disappeared (see Figure 35). Three banks of compressors were visible. One bank was located adjoining the wall to the Transit Room (see Figure 3 for room designations). This bank contained five Copeland compressors of various sizes mounted on a steel frame also supporting a liquid receiver running transversally under the compressor units. Perpendicular to this unit was an electrical distribution centre; this was identified as such by its shape because all obvious signs of electrical connection were invisible. Also within this room was a Vilter compressor unit, which consisted of three motor units, as well as a smaller Budge compressor of two motor units. Both the Vilter unit and the Budge unit had received fire damage but were for the most part intact. They exhibited significantly less fire damage than the five Copeland compressors arranged in the rack (see Figures 36 and 37).

The level of fire damage within the five-compressor rack appeared more severe at the southern end; furthermore, there appeared to be no connection pipe work remaining between the receiver vessel and the compressors. The team also noticed amongst the steel stillage the remains of two pressure switches believed to have come from the five-compressor rack unit. By agreement of all parties, evidence collected was received by an evidence officer appointed by Corporate Risks Ltd acting under the authority of Lumley Insurance. These items were held securely until all parties, including the Department of Labour, had had an opportunity to photograph and document them. Both the main switchboard and the Copeland compressors were physically removed from the plant room and also collected by Corporate Risks. The Department of Labour also removed a refrigerant storage vessel (see Figure 38) and an item of electrical componentry located in the vicinity of the plant room door.



Source: Investigation Team

**Figure 36: Copeland compressor unit from Plant Room 1 in location**

## 20.9 Compressors and electrical switchboard

On 29 April the investigation team met at the premises where several items relating to the refrigeration system and plant room contents had been removed for secure storage. A detailed examination was undertaken on both the Copeland rack (compressors) and the electrical switchgear.

Present at this examination were several representatives of insured parties and specialist refrigeration and electrical engineers. Together all parties developed a plan to dissect the compressor rack while tasking the electrical engineers with the examination of the switchgear.

The result of these examinations identified that not all of the compressors within the Copeland rack were of the same size or manufacture. Three compressors were 40-hp six-cylinder units, the remaining two 15-hp twin-cylinder units. The most severely damaged compressor was at the left-hand end of the rack as positioned within the plant room at Tamahere.

With the assistance of specialist cutting gear investigators were able to remove all five compressors from the steel rack and examined the liquid receiver, which was located under the rack. This receiver unit is approximately 350 mm in diameter and approximately 3.5 m long. It is estimated to have contained up to 250 litres of refrigerant in a liquid phase. Both top connections for fill and withdrawal had become detached from the pipe work. There was evidence of high heat exposure towards one end of the receiver and at this point molten copper that had solidified was present. The receiver showed no signs of failure save the disconnection of all pipe work.

The disassembly of two compressor units was then undertaken. The two units chosen were the two-cylinder 15-hp units; the least damaged unit was disassembled for the purposes of comparison. Upon removing the head it was evident that this unit had been exposed also to significant heat



Source: Investigation Team

**Figure 37: Copeland compressor unit from Plant Room 1 in location, close up**

because the pistons had melted leaving the steel rims embedded in the bore. The end case was then removed and the motor windings examined. In examining the motor windings a strong ammonia-like smell was noted. No odour of mercaptan was noticed within the steel. The second compressor, the most heavily fire damaged, was then dissected in a similar manner. This unit had suffered from intense heat exposure and many of the studs had become loose within the block, with large amounts of parent metal being eroded by temperature. The cylinders within this unit were damaged to the same extent or closely similar to the first unit that was pulled apart. (See Figure 39.)

The electrical switchgear was then examined and this demonstrated significant deformation, with bending and twisting of metal supports away from the electrical equipment within. Approximately 450 mm up from the base of the unit was a main switch, which was a knife-type switch; it appeared to those present at the inspection to be in the off position.

It was noted that the switchboard did not appear to be either flame-proof or intrinsically safe.

This switchgear was then retained by the Department of Labour for further investigation. Subsequent examination by Maunsell Ltd, an electrical engineering consultancy engaged by the Department of Labour, led to the conclusion that the switchgear was a circuit breaker, not merely an isolator, and that the actuator carriage was in the intermediate position associated with the “tripped” position.

### **20.10 Reconstruction of sequence of events**

Over the next couple of weeks, the transcripts of the interviews undertaken by police of the injured firefighters were made available to the site investigation team. These allowed a preliminary



Source: Investigation Team

**Figure 38: Refrigerant storage vessels**

reconstruction of events, as sketched out in the chronology (section 11), but left certain questions unanswered.

On 9 May at Hamilton Fire Station the investigation team met with two of the recovering injured firefighters and their representative. The cause and origin process was explained to them to give them some indication of the work that this team was undertaking and its purpose. After discussions with the legal representative for the firefighters it was agreed the fire investigation team would work within the agreed parameters of set questions being asked, namely

- What did you see at the time of and just preceding the explosion?
- What did you do during this time?

Firefighters 1 and 2 from 411 were shown a sketch of the plant room (this was not to scale) and some images that were taken during construction of the plant room. This helped refresh their memories. The following points emerged from the discussion:

- Firefighter 1 said he located a leaking tube on the top of the compressor.
- Firefighter 2 said he did not need to bend down to hear this and the other firefighter confirmed this.
- They were shown a nut and tube arrangement that had been put together by a refrigerant mechanic. When shown this they agreed that it was the same as that which had been leaking in the plant room. This was a long hexagonal headed nut on a copper tube.
- Firefighter 1 said he could not recollect hearing any engine sound and saw no ice that he was aware of on the compressor.





Source: Investigation Team

**Figure 39: View of motor end of semi-hermetic Copeland compressor, with suction plate removed**

- Firefighter 2 said he thought it may have been a little lower than the top of the compressor and that he could compress the gas leak with his hand and it would stop.
- He said both he and the officer from 411 compressed this leak with their fingers.
- The position of the leak and the probable compressor on which it occurred was also confirmed. The indication was that it was up high on the compressor and on the high compression side of the compressor.

From this information the team constructed a time line and movement plan of the firefighters. This has been included in the incident chronology described previously in section 11.

## **21 Explosion**

The site investigation team then reviewed the theory and evidence for the conditions leading to the explosion at the coolstores. In particular, it looked at the nature and severity of the blast, the cause of the explosive atmosphere, and the possible source of ignition.

### **21.1 Nature and severity of the blast**

From analysis of the blast damage evident at the scene it becomes apparent that the force of explosion has radiated outward from Plant Room 1 and has been channelled by the layout of the buildings in such a way that the majority of force has travelled lengthwise through the plant room

**Table 4: Estimated force of the explosion based on position of debris collected in during the site investigation**

Item	Evidence number	Projected distance (m)	Estimated force (kPa)
Blast freezer door	Not taken	27	19.44
50-mm EPS panel	exb # 3	78	41.04
50-mm EPS panel	exb # 1	53	27.89
50-mm EPS panel	exb # 2	50	26.31

Details of the calculations are provided in Appendix F, Table F1.

destroying the blast freezer and rear of the plant room. The nature of this damage tends also to suggest that the explosion has occurred as the result of an ignition of a heavier-than-air gas such as propane. Had ignition occurred of a lighter-than-air gas such as hydrogen it is more common for damage to occur within the upper quadrant of the space.

It is possible to calculate the minimum force presented by the blast wave (see Table 4). This calculation is based simply on force versus distance ignoring the separation moment and aerodynamic profile of the object. In this instance, measurement of several structural panels were taken enabling radial pressure lines to be established.

By examining the force vector diagram (see Figure 28), the investigation team was able to confirm its opinion that the epicentre of the explosion was within the plant room adjacent to the blast freezer. This was further evidenced by the displacement of the wall between the blast freezer and plant room, which was observed to have been pushed out from the plant room side. By following the lines of displacement for various items a common area was established that centred on the plant room.

The explosion can be looked upon in two ways:

- a deflagration and a resultant fire
- a deflagration, initiating a detonation resulting in the fire.

The latter is an extremely rare occurrence. As discussed below the geometry of the structure may have contributed to this and some of the physical evidence may support it.

## **21.2 Cause of the explosive atmosphere**

The fact that material that originated from Plant Room 1 was located under other items and did not exhibit direct fire damage acts to confirm that the explosion had occurred prior to the fire and that it had originated from within the plant room. The clean state and lack of sooting on these items support this theory; had the fire occurred first, deposition of soot would have occurred before displacement.

It seems highly unlikely that the activities of the firefighters responding to this incident would introduce any fuel capable of explosive decomposition into the plant room. As a result, only three possibilities have been identified.

Firstly, an adjoining room contained two electric forklifts with battery chargers attached and operating. This process allows the generation of hydrogen gas to occur; however, the blast



Source: Investigation Team

**Figure 40: Forklifts among the steel stillage**

damage suggests that the explosion has occurred within the plant room and radiated outwards. The forklifts also showed no blast damage having been sheltered from the blast by steel stillage racking (see Figure 40).

Secondly, an ozone explosion that occurs within the electrical switchgear must be considered as a possibility. The mechanism for such an explosion is influenced by the humidity of the air within the room. Such conditions may exist when moist air has been ionised across the switching conductors and reacts by rapid oxidation. The force of such an explosion is dependent upon the voltage and current-carrying capacity of the switchgear at the time (these affect both the production rate and purity of the produced ozone).

For this type of explosion to result in the fire that occurred at Icepak would require the initial explosion to sever or perforate the feed line of another fuel source. Because of the level of destruction within the plant room, the credibility of this mechanism can be proven only by the examination of the electrical switching components. Such componentry should demonstrate fault conditions such as arc splashing. No evidence of this is visible within the switch cabinet, and so this can be discounted as a likely circumstance.

Thirdly, and most likely, is the release and accumulation within the plant room of the flammable refrigerant and its subsequent ignition. This theory is supported by the witness evidence supplied by responding firefighters; their evidence indicated that a connection to one of the compressors

was loose. For this third possibility to be the case, the vapour concentration of fuel to air must lie within the flammable range of the refrigerant gas.

Manufacturer's information states that Hychill Minus 50 is a mixture of propane and ethane in proportions of 95 to 5. These two gases are both flammable and have differing minimum energy requirements and differing explosion limits. An explosive mixture of this mixed refrigerant gas lies within the range of 1.9 percent to 9.5 percent by volume in air at 20°C.<sup>21</sup> Although other fuels existed within Plant Room 1, the most likely fuel that would give rise to the pressure conditions resulting in the failure of the structure is the ignition of a propane-air mixture.

### 21.3 Mixing of the gas

Firefighters commented that smoke/mist/vapour/refrigerant was observed wafting out around the doors and seemingly floating away.

Utilising statements obtained from the firefighters who entered the plant room it becomes evident that a leak of refrigerant gas was apparent from one of the compressors within the Copeland rack. The high-pressure outlet from the cylinder of the Copeland rack compressors operates at a pressure determined by the operator but expected to be around 1,700 kPa. In this particular case it is probable that there was failure of the high-pressure sensor line connecting the pressure switch to the compressor cylinder. Given that the internal diameter of the sensor line is around 2 mm it can be assumed that conditions within the room were the result of propane released at 1,700 kPa through a 2 mm orifice.

By calculation (using a fire release explosion dispersion model) this would produce an exit velocity of gas from the 1,700 kPa line of around 200 m/sec. This indicates that turbulent mixing of the refrigerant and the surrounding air would occur rather than stratification or layering of the heavier flammable refrigerant gas. This would have the effect of producing at least localised ideally mixed conditions.

The minimum volume of gas required within the plant room to achieve an explosive atmosphere is 7.2 m<sup>3</sup> and the maximum to achieve a 10 percent concentration is 36 m<sup>3</sup>. A leak of refrigerant that flows from a 2 mm orifice at a discharge pressure of 1,700 kPa would take approximately an hour to establish a 7.2 m<sup>3</sup> vapour cloud; to achieve a volume of 36 m<sup>3</sup> would require the leak to flow for nearly five hours requiring the release of 6.8 kg of gas. Should the leak be from a larger diameter line, say 5 mm, then the corresponding times would be reduced to approximately 20 percent of the above values. (See Appendix F, Figures F1 and F2, for the calculation of these values.)

If the gas had been leaking for some time in this room before the door was opened there may have been a concentration of the refrigerant gases in the lower portion of the room (propane vapour is heavier than air). Opening the door and the movement of the firefighters could have allowed fresh air to dilute the refrigerant gas thereby bringing the mixture within its flammable range at some low point in the room.

In terms of a fan-cooled switchboard, the convection currents would draw in air at the bottom including any heavier-than-air gases and lift them through the switchboard to replace the displaced air. The switchboard in the plant room was over a trench and thus the lowest point in the plant room and the natural location to which heavier-than-air vapour would seep and collect.

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21 Manufacturer's information from the HyChill Minus 50 Datasheet.

## 21.4 Evidence as to the source of ignition

If it is accepted that the flammable refrigerant was the fuel source for the explosion then the more difficult task is the determination of the source of ignition. To establish the combustion process it is important to establish a competent ignition source. A competent ignition source is defined as one that contains sufficient energy to exceed the minimum ignition energy (“MIE”) for ignition. Although some energy sources have outputs well in excess of the required MIE, it is not easy to identify the exact source because a source that has the most available energy does not make it any more or less credible than other sources that potentially only slightly exceed the MIE. The published information gives an MIE of 0.25 mJ of energy required for the ignition of the refrigerant gas.

Five main sources thought to be competent ignition sources are listed below with discussion of their potential:

- The most prominent must be the electrical switchgear, which appears to be of an unprotected type.
- Firefighters entering the gas mixture commonly offer four potential sources of ignition: a torch, a radio, a distress signal unit, and a pager. Although it is unlikely that any of these items were capable of producing ignition from heat (the ignition temperature of propane is around 470°C), any internal arcing across conductors might result in spark energy exceeding 0.25 mJ.
- The required 0.25 mJ energy is also likely to be exceeded by the generation of static electricity from clothing. Although firefighting protective clothing is manufactured to minimise static charge, firefighters can get static shocks because of high synthetic content in appliance upholstery, but the discharge generally occurs on alighting.
- The ignition of propane-ethane mixtures is also possible by compression. Should a compressor malfunction in such a way as to allow an aerated mixture of refrigerant gas to be conducted within the cylinder of the compressor then pressure within the cylinder could cause the ignition of the gas. Consequent failure of the supply lines would allow the escape of more gas.
- The location of the parked fire appliances and their low exhaust mount may allow for ignition of gas as it travels through the open plant room door. For this to occur the critical ignition temperature of the gas must be exceeded, requiring 470°C. Given that the appliances had travelled approximately 12 km and then idled for approximately 10 minutes it is unlikely that the surface temperature of the exhaust had reached this temperature.

Prior to the firefighters’ arrival electrical brownouts had occurred that day. This may have impacted on the functioning of the electrical system at the coolstores.

## 21.5 Scenario

The theory developed by the investigation team into the explosion and fire that occurred at the Icepak coolstores is as follows.

Upon receiving a call to a smoke detector operating, the firefighting team entered Plant Room 1 via a doorway marked on the plan (see Figure 4). The evidence of the firefighters suggests that they could not hear the compressors running but that they could hear a hiss. This appeared to have been coming from a leak of refrigerant gas. Calculations show that filling rate from the leak to achieve even the lower flammable limit would be of the order of many minutes to an hour. Mixing of the flammable gas with air could have arisen as a result of turbulent mixing from the leak itself,

flow of gases drawn through the fan-cooled switchboard, or movement of the firefighters. Or a combination of all three.

An as yet unspecified ignition source ignited the gas mix. Contained in the room were a number of electrical devices that may have initiated the deflagration. The main electrical switchboard, which had a series of switches built into it, may have been operating. This is the most likely ignition source for the explosions because of the damage to the switchboard.

The explosion was violent, as evidenced by the distances moved by large and heavy items, and damage to local buildings.

The physical evidence supports this theory. The blast damage unearthed at the centre of the explosion showed minor signs of fire damage. Items such as the metal covering of the electrical sub-board were bent and not burnt. Sections of the wall that were located at various points of the scene were undamaged by fire. The directional indicators as mapped and laid out on the overhead grid plan also show evidence of the direction of the explosion. All of this suggests that there was no fire before the explosion.

## **22 Subsequent fire**

The nature and development of the fire that followed the explosion was severe. Because of the destruction of much of the coolstore facility there was little site evidence that contributed to an understanding of what were the major fuels that were burning.

### **22.1 Fire loadings**

From interviews with Icepak management at the site investigation, it was possible to establish with some degree of certainty at least the broad categories of foodstuffs that were stored in the different coolstores (see Table 1, section 9.11), which were consistent with the burnt debris found on site.

From this information it is possible to estimate what these materials might have represented in terms of fire loadings.

The coolstore buildings used racked storage and stored food products in steel racks several metres high, often enclosed in cardboard or plastic packaging materials. This arrangement permits very efficient use of floor space, but also results in a high load of combustible material (fire load) per unit floor area.

For the purposes of fire safety design, it is common to assess the potential severity of a fully developed fire in a building by estimating the total fire load (the quantity of energy that would be released if all of the material in the building burned efficiently). It may be estimated by summing the heat of combustion for each potential fuel (measured in MJ/kg) and multiplying by the mass of the fuel present. Foodstuffs that are high in fat, such as butter and cheese, have a high heat of combustion.

The heat of combustion of cheese is about 17 MJ/kg. With about 2,000–4,000 tonnes of cheese reportedly present, the overall fire load at the facility would have been 30,000–60,000 GJ. If this burnt out uniformly and efficiently over a period of, say, 10 hours, this would give an average heat release rate of the order of a gigawatt. The fire did not burn in this manner, but the figure is at least indicative of the scale of the event.

## 22.2 Fire spread

Early reports of “raining pieces of burning polystyrene” suggest that there were many sources of ignition present after the explosion. The force of the explosion severely damaged the exterior walls of Rooms F3 and F4, which were bent outwards at roof level, exposing the polystyrene construction panels and the contents of the coolstore to potential ignition. The steel that fell after the explosion was reportedly hot enough to burn skin. The deflagration front was seen extending tens of metres into the air at the time of the explosion; and presumably if it passed into the coolstore rooms, it could have ignited flammable content. There were potentially multiple sources of ignition for the fire that ensued.

Once ignition of the gaseous cloud had occurred, the release of heat, expected to raise the temperature locally to above 1,400°C, would allow ignition of the polystyrene located within the structural building elements. The fire behaviour characteristics of the structural elements is such that ignition of the polystyrene would occur almost instantaneously. This results in the melting and boiling of the polystyrene within the lining material and subsequently the failure of the metal cladding and therefore greater involvement of the polystyrene. This in turn generates more heat and involves more of the building structure and ignition of the products stored within. There is potential for animal fats, such as those stored, to decompose to very rapidly produce flammable vapours which, when heated by the surrounding fire, may ignite and generate a fire that spreads with huge speed.

Those first on the scene started to treat the injured firefighters on the grass in front of F3-F4 Building. Witness statements suggest that this building was seen to be burning at roof level at a very early stage, but it was not clear initially to those outside the building that this fire represented a threat. Possibly the excellent insulating properties of the EPS construction panels shielded those near the building from the heat that was potentially building up inside in the early stages. Within a few minutes, however, the threat was recognised and the seriousness of the fire that was developing began to be appreciated, causing the injured firefighters to be moved several times as the fire continued to develop.

A photograph taken by a local resident shows the view of the fire faced by Pukete, the first fire crew to arrive after the explosion (see Figure 9). This view is taken from the position where the fire appliance parked in a private driveway off Koppens Road – just opposite where the explosion had occurred about 12 minutes before. The magnitude of the fire at that stage is clear, and subsequent photographs taken by the same and other photographers over the next few minutes confirm that at this stage the fire was growing extremely rapidly.

The officer from Chartwell 427 observed when interviewed that on his arrival at 16:42 the fire was advancing in front of F3-F4 Building “at walking pace”. It later became known that Room F4 was used to store butter. It seems likely that this melted as the fire developed and started to flow out of Room F4 and ignited as the fire built up.

From that point on, no single individual could see the whole of the fire at any one time, because the fire was progressing on several fronts. However, aerial photographs made available to the inquiry team taken over the following hour or so allow a view to be built up of how the fire developed.

The fire was clearly serious in Room F4 at an early stage and spread rapidly to Room F3. Flames were reaching tens of metres into the air. Photographs taken over the next hour or so suggest that Rooms F1 and F2 and the workshops were quickly involved and continued to burn steadily; the roofs and walls collapsed but the steel racking remained in place for a considerable time allowing good access of air to the fuel items which continued to burn.

Source: Ken Holmes Pictures



**Figure 41: West Room involved in fire, 17:25**

Early pictures (for example, Figure 10) show the fire starting quite slowly in the Transit Room area but after about 45 minutes is seen to have spread into the Waikato Room (Figures 13 and 14) and ultimately the West Room (see Figure 41). It took over an hour for fire to spread into the smaller rooms above the office area, but these were involved eventually, along with the Chestnut and Okato Rooms. Because of insufficient water, the Fire Service could not establish a cut-off.

The Lichfield and Tatua Rooms were saved by a water curtain established from the hydraulic platform and maintained by a shuttle relay of water tankers.



## **PART 5: ANALYSIS OF THE INCIDENT**

The inquiry team reviewed the circumstances of Incident Number F128045 according to the areas specified in the terms of reference (see Appendix A). The terms of reference required the team to address three main areas:

- cause of the explosion and fire
- preparedness of the Fire Service to manage such an incident
- Fire Service response to, and management of, the incident.

Part 5 offers comment on the specific issues to be addressed within these three categories under the terms of reference. It then discusses matters concerning urban and rural fire authorities, which proved to be of importance in the Icepak incident. Part 6 summarises the inquiry findings in more general terms.

### **23 Cause of the explosion and fire and other related factors**

This section analyses the following aspects of the cause of the incident as listed in item 1 of the terms of reference.

#### **23.1 Location, design, and use of the facility**

The Icepak facility had grown very large over a relatively short period of time. The design provided for a large number of interconnected rooms, which made good use of available space and was doubtless well suited to business needs. The closeness of the buildings and the lack of fire separations between them ultimately reduced Fire Service opportunities to limit fire spread.

#### **23.2 Provision of water for firefighting**

Three water tanks were provided on site (see Figure 3). Two were constructed of plastic, one of concrete. The quantity of water in the tanks could only ever have been used to tackle a relatively small fire in one building. For this use, the location of the tanks was satisfactory.

For the large fire that eventuated at the Icepak site, the heat radiation rendered these tanks useless in a short space of time. In such an event and without a water supply, holding back a developing fire and saving additional structures and property were impossible.

In the event, the fire that followed the explosion grew so rapidly that it is very unlikely that it could have been controlled even with a reticulated supply.

#### **23.3 Construction materials**

The buildings at the Icepak facility were constructed in a conventional manner for coolstore design, making use of EPS sandwich panels. Building code compliance for fire safety in New Zealand and

in many other countries centres on life safety in buildings. It does not address property loss. It is in this area that international guidelines on coolstore construction set out to provide structured approaches to determine what additional protection might be required to limit fire damage and business continuity risks. This building because of its high fire load and EPS panel construction always presented a fire risk.

#### **23.4 Passive and active safety features of the facility**

Icepak told the inquiry team that the facility had several smoke detectors and gas detectors, supplementing the security system. The detectors were said to be located in various places including the office, access ways, each of the coolstores and access ways in the F3-F4 Building, and in both plant rooms. However, no information was available to the inquiry team about the extent of their coverage, the reliability of their power supply, or the testing regime applied to them. It does not appear that the installed system complied with NZS 4512:2003 Fire detection and alarm systems in buildings.

There is no evidence that a compliant fire detection system would in any way have affected the outcome of this event. There was no requirement for a sprinkler system to be installed and, had there been one, it seems probable that the explosive blast would have damaged at least some of the sprinkler heads and that such a system would not therefore have mitigated the effects of the fire that followed the explosion. However, as noted immediately above, the high fire risk that resulted from EPS construction materials, high fire load storage, and lack of firefighting water would suggest that the installation of such a system would have been prudent. The inclusion of a sprinkler system would have suppressed and contained a growing fire under other circumstances.

Had the fire engineering reports for the Icepak buildings contained analysis of these issues, as called for in the compliance documents to the building code, the result might have been the installation of a sprinkler system. Such an installation would have been particularly appropriate for racked storage, given the potential for rapid fire spread and the difficulty of fighting fires in such layouts, and the lack of firefighting water. An analysis might have suggested that a sprinkler system should have been installed. Sprinkler systems can be designed for low-temperature environments including freezers.

Installation of a Fire Service-connected detection system would also have resulted in the Fire Service having a knowledge of the facility and its exact location. Such a connection would have provided detailed and immediate information about the facility to the Comcen and the responding crews.

#### **23.5 Building consent and warrant of fitness compliance history**

In studying the compliance history of the buildings, the inquiry team relied on the information supplied to it by Waikato District Council. Icepak was unable to provide any information to the inquiry team because its records on the compliance history were destroyed in the fire.

##### ***Presence of hazardous substances***

The compliance history does not indicate the point at which large quantities of propane-based refrigerant were introduced to the site, or whether the council was notified of that introduction, which appears to have been a requirement of the resource consent granted in 2002. As noted in section 9.7, Icepak confirmed to the inquiry team that it introduced those refrigerants in early 2003.

Storage or processing of hazardous substances in such quantities would require the building owner to provide and maintain an evacuation scheme, and to apply to the National Commander for its approval. As noted in section 9.5, Icepak did not provide or seek approval of an evacuation scheme, and it commented to the inquiry team that a scheme was not required because the use of hazardous substances in a refrigeration system did not involve storage or processing of the substance. It is not for the inquiry to say whether this was a correct interpretation of the regulations, although the team's expectation was that the presence of substances in such quantities would trigger the need for a scheme. Had Icepak approached the Fire Service about the need for a scheme, this should have drawn the Fire Service's attention to the large quantities of hazardous substances present and triggered a site visit and development of a risk plan. Icepak told the inquiry team that it did invite Fire Service personnel to its sites and that they did not respond. The inquiry team found no record of such requests.

The HSNO regime applied to LPG products from 2004, when approvals under the previous dangerous goods regime were transferred (see the discussion of this in section 9.9). However, the HSNO regime has only limited application to the product Hychill Minus 50 when it is used in a refrigeration system. The inquiry team considered this an unsatisfactory situation. Hychill Minus 50 has all the characteristics of an explosive and flammable substance. The rationale for the exclusions may be that a refrigeration system is understood to be a fully sealed system. But the evidence available suggests that it is common for such systems to lose as much as 15 percent of their refrigerant over a year.

Though HSNO regulations appear to grant certain exemptions for refrigeration systems, nevertheless there do appear to be a number of provisions that should have been complied with, which would have included the installation of appropriate signage.

Part F8 of the compliance documents to the building code also requires signage to indicate the presence of hazardous substances. In light of this being specified as part of the fire report and a requirement of the compliance documents, it is reasonable to expect this would have been translated to the relevant buildings on the Icepak site.

The inquiry team found no evidence that signage was present at the site, either inside or outside the buildings. The Fire Service was informed by the Department of Labour that it inspected Icepak's Waharoa site, also using Hychill refrigerant, shortly after the Tamahere incident and that the site was found not to have hazardous substances signage. Icepak commented to the inquiry team that the Waharoa site did have signs on the plant room although not the internationally recognised ones. Such signs have now been placed in the required areas.

### ***Storage of dairy products***

The building consent granted for the Lichfield-Tatua Building in 2002 was for a building for fruit storage. As noted in section 9.4, this coolstore was designed as an FHC 1 facility.

It came to light after the fire that this building contained a large quantity of cheese product. Icepak commented to the inquiry team that the storage of cheese products did not require any change to consent conditions or firefighting requirements, as evidenced by the fact that the same requirements were accepted for subsequent consents when the coolstores were extended. The Waikato District Council commented that use of the facility for storing cheese product would have changed the fire hazard category from FHC 1 (as per the design) to FHC 4, and should therefore have triggered a change of use application.

It is not for the inquiry team to comment on whether a change of use application was legally required under the Building Act. However, it is clear that the storage of cheese products changed

the fire hazard category. The implication of storing dairy products instead of fruit is that this dramatically increases the fire load energy density and thus the fire hazard category. The fire hazard category moves from a low category 1 to the highest category of 4. The acceptable solutions define this as a change of purpose group from working light (“WL”) to working high (“WH”).

### ***Icepak’s position in respect of safety and legislative compliance***

Icepak commented to the inquiry team that it had always taken the issue of safety very seriously. The company said that it had consulted experts in relation to legislative and safety requirements and had relied on the advice provided by those experts; it had safety systems throughout the coolstores and had also worked in conjunction with the Fire Service to have water tanks on site with appropriate brigade fittings. At all times Icepak believed that it had complied with all legislative requirements.

## **23.6 Origin of the explosive atmosphere**

The evidence from the firefighters’ interviews and from the damage patterns from the site investigation suggests that the explosion originated in the plant room.

Given the description of the injured firefighters about what they saw and did, and the confirmation that the refrigerant used in the coolstore was Hychill Minus 50, it seems almost certain that the origin of the flammable atmosphere in the plant room was leaking refrigerant. It is not possible to say how long the leak had persisted or what caused it. Given the information available to the inquiry team, it is not possible to comment on whether or not the leak could or should have been detected by other equipment on site. It seems likely that the vapour escaping at high pressure cooled the atmosphere in the plant room to the extent that atmospheric water vapour started to condense, which may have set off the smoke detector.

Gases and vapours burn only when the concentration in air is within the flammable range. Propane vapour is heavier than air and would have tended to accumulate at floor level in the plant room. The refrigerant was apparently leaking around the exterior door of the plant room. The act of opening the door to the coolstore may have started to dilute the accumulating flammable vapour with fresh air, or the leaking flammable vapour may already have been within its flammable range at some point within or, indeed, outside the plant room.

## **23.7 Ignition event**

The ignition event seems likely to have been electrical. There were many items of electrical equipment in the plant room. As far as the inquiry team has been able to ascertain from investigation of the remains of electrical equipment on site and afterwards, this equipment was not designed to be flame proof.

The power supply to the area had been subject to power brownouts over the course of the day; this had already caused electrical relays at the nearby school to burn out. The inquiry team was unable to determine what effect this might have had on the electrical systems at the Icepak facility.

The report commissioned by the Department of Labour on the electrical switchgear recovered from the site (and identified as a circuit breaker) explored whether the switch could have been opened manually prior to the explosion. It determined that, as the actuator carriage was in the intermediate position, it was reasonable to conclude that the main switch was not opened manually prior to the explosion but was either tripped when it was thrown against the side of the

cabinet by the force of the explosion or opened by the heat of the subsequent fire under the action of its tripping mechanism.

The firefighters carried portable radios that are not intrinsically safe. However, there is no evidence (either from the statements they gave to the coroner or from the communications log) that they used them in the vicinity of the plant room. There is no other evidence that the firefighters did anything that could have created an ignition source.

### **23.8 Contribution of the coolstore contents to fire development**

The fire that followed the explosion spread very rapidly. The first witnesses described falling pieces of burning polystyrene and steel that had been involved in the explosion as hot. As the deflagration flame front propagated through the coolstores, it is likely that it could have ignited polystyrene within the wall panels, packaging materials, and some of the stored products. The consequence of this would be a fire with multiple sources of ignition, which started to grow very quickly.

Not only were there highly flammable construction materials in the coolstore but also the packaged foodstuffs present were supported on steel racking, which would have promoted a flow of air over the growing fire. High-racked storages are known to result in very rapid fires. In this instance the seriousness of the event was exacerbated by the likelihood of multiple ignition sources. One of the first substances to become involved in the fire is likely to have been butter, which melted and flowed across the floor and under the wall of the building.

### **23.9 Best practice on coolstore design**

Building codes usually do not specifically address coolstores. The codes of practice and guidelines for coolstore design available internationally address construction and fire safety matters that go beyond compliance with building legislation. Using these documents as guidance on best practice suggests structured risk management processes that can be applied to reduce the incidence and consequences of a serious fire. These processes would be applied at the design and construction stage of a facility and would influence how it was managed, monitored, and maintained. On the evidence available it is not possible to comment on the extent to which best practice guidance had been applied to the Icepak facility.

There also exist several standards and guidelines on the use of flammable refrigerants. Best practice recommends a range of safety measures such as use of flammable gas detection, intrinsically safe electrical equipment, and ventilated enclosures where flammable refrigerants are used. Icepak representatives met with investigators after the incident to explain what equipment and produce had been in the coolstores and plant rooms. The inquiry team found no evidence that any safety provisions, other than a gas detector, had been incorporated in the plant room.

## **24 Preparedness of the Fire Service**

This section analyses the Fire Service's preparedness to manage an incident such as the fire at Icepak Coolstores according to the terms of reference.

## 24.1 Operational instructions and local procedures

The inquiry team considered whether the operational instructions contained in the Manual of Operations provided sufficient direction and guidance to staff for the scenario and challenges encountered at the incident.

The inquiry team also considered whether the crews at the incident complied with the direction and guidance provided in the instructions.

There are several instructions that are relevant to the incident. These are detailed below. (An asterisk indicates where corresponding local procedures were also relevant.)

The relevant sections in “Volume 1: Operational Management” were identified as

- C. Operational Management, in particular
  - C1: Fire Region Commanders’ obligations
  - C2: Operational Planning
  - C4: Significant incident and post incident support
- E. Operations reviews and operational readiness audits
- F. National dress code for uniformed personnel
- J. Declaration and review of fire districts
- K. Fire Protection Agreements
- M. Operational requirements
- N. Mandatory reporting
- P. Standard tests
- Q. Code of practice for firefighting water supplies
- W.\* Protection of the environment.

The relevant sections in “Volume 2: National Commander’s Instructions” were identified as

- 1\* Operational safety
- 2\* Mobilisation
- 3 Command and control
- 4 Breathing apparatus
- 5 Radio telephone communications
- 6 Use of protective clothing and equipment
- 11 Forced entry
- 13 Nominal roll tally
- 20\* Emergency medical support
- 24\* Private fire alarms
- 32\* Bulk flammable gases
- 55 News media at incidents
- 56 Fire investigation and reporting
- 58 Driving Fire Service operational vehicles.

There were also six Bay-Waikato region local procedures that were relevant (cross-references to operational instructions are indicated above by asterisks):

- W. Protection of the environment
  - 1 Operational safety
  - 2 Mobilisation
  - 20 Emergency medical support
  - 24 Private fire alarms
  - 32 Bulk flammable gases.

The inquiry found that the Manual of Operations did contain direction and guidance to staff on all the relevant aspects of the incident.

However, in light of what occurred at this incident, two amendments to the operational instructions would improve guidance to firefighters.

Firstly, place more emphasis and give more direction on the use of gas detectors. The instructions do recommend the use of gas detectors, but this should be given greater prominence. (The issue of gas detectors and their use is covered in more detail in section 25.14 – Appliances and equipment).

Secondly, provide more detailed information and guidance on the range of refrigerants in use in New Zealand.

The degree to which the Fire Service complied with the Manual of Operations is analysed in the sections dealing with specific aspects of the incident.

The inquiry team noted that the Fire Service is currently reviewing all the operational instructions to update their content. They will be presented in a new format and presented on the Fire Service intranet (FireNet) in a more user-friendly manner than they are currently. The review is also designed to put more detail into the operational instructions and therefore to reduce the requirement for local procedures.

The inquiry team supports the work to review the operational instructions, some of which are dated. The team notes two instructions in particular:

- “NCI 3: Command and control” needs reviewing to ensure it is consistent with the recently issued Command and Control Technical Manual.
- “C.2: Operational Planning” does not refer to the risk planning methodology and scoring system introduced in the SMS since the instruction was last reviewed.

The inquiry team found that, despite any shortcomings, overall the operational instructions and local procedures provided adequate guidance for the safe and effective management of the incident.

## **24.2 Personnel qualifications and training**

The inquiry examined the personal profile and training records of the eight crew members on Hamilton 411 and 412 to determine whether they were appropriately qualified and trained to manage this incident.

These records were sourced from their personal files, NZQA, regional training databases, SMS training records, and the human resources employee kiosk database.

The eight crew members hold NZQA national qualifications ranging from the level 2 National Certificate to the level 5 National Diploma in Fire and Rescue Services (Urban Fire and Rescue Operations). Each firefighter's level of qualification was appropriate for their rank. These qualifications were achieved through passing the required NZQA unit standards. These are evidence of formally assessed competencies that meet the requirements of the Fire Service.

The eight firefighters' service ranged from three to 33 years. The way they were trained varied according to the training courses and systems in place at the time they were progressing through the ranks. The Fire Service's new training and progression system was introduced for career firefighters in July 2007. Therefore, the eight firefighters had limited involvement in this system.

Depending on their length of service they achieved their NZQA qualifications through a combination of assessment and the recognition of prior learning ("RPL") process. RPL was based on the individual's historical training records, their operational experience, and current rank. The Fire Service's training course content had remained sufficiently consistent over the years to meet the requirement for RPL.

Records show that all eight have attended the required compulsory courses for their rank and a range of elective courses. They had all passed the required theory and practical examinations to obtain their rank.

Irrespective of the varying training backgrounds of the eight firefighters, the inquiry is satisfied that they had received sufficient training to manage the situation presented at the incident. This includes how to safely manage a flammable gas risk had they known such a risk were present. Flammable gases are a potential risk encountered by all firefighters and therefore have always had a place in firefighter progression training programmes.

The inquiry also examined how the firefighters maintained their skills through ongoing training. The annual training plan for the Hamilton district was contained in the district's business plan for 2006/2007. This training plan was also used for the 2007/08 year. This plan incorporated the wide range of skills practised by firefighters. The training undertaken by the eight firefighters was recorded in the station management system. These records showed that they had all been involved in regular and varied maintenance training. However, the records were not very detailed and it was not possible to confirm whether they had all met the objectives in the training plan. The Fire Service commenced a project, before the incident, to improve its system of skills maintenance training undertaken by operational personnel. This is called the operational skills maintenance ("OSM") project. OSM will introduce a standard national system for scheduling, recording, and monitoring skills maintenance training. The inquiry team supports this initiative as it will remove local variations and make it easier to establish that all operational staff are maintaining their skills to an acceptable standard.

Because of the fatality and injuries associated with the incident the inquiry was interested in how staff were trained in the safe person concept. Given the background of the eight firefighters, the inquiry was satisfied that they had all been adequately introduced and trained in the safe person concept. However, the frequency at which refresher training on the safe person concept was provided to the eight firefighters could not be established. It may possibly have been covered during their regular health and safety training sessions, which are recorded in SMS, but insufficient detail is provided in the records to confirm that the safe person concept was covered.

The Hamilton district had scheduled safe person concept refresher training as part of the health and safety training for the first quarter of the 2008 year. Only one watch had received this training (on 25 March) before the incident occurred on 5 April. The eight firefighters concerned had not



yet attended this refresher training. It is unknown whether this refresher training would have had any influence on the officers' decisions at the incident.

From the evidence provided, the inquiry found that all eight crew members were adequately qualified and trained to perform all the tasks associated with the incident.

### **24.3 Pre-incident planning and familiarisation**

The firefighters who responded on Hamilton 411 and 412 had little or no knowledge of the Icepak facility. Furthermore, of the firefighters on second alarm appliances who were interviewed, only one or two were somewhat familiar with the facility because they had visited there on non-Fire Service business. Most knew of it only from having observed it while driving past it on the Cambridge-Hamilton highway. No firefighters reported having visited it for risk planning or familiarisation purposes. The Fire Service holds no risk plans for the premises and has no records of ever having attended an emergency call at Icepak Coolstores, nor is the facility recorded on any Fire Service mapping systems or databases.

Because of a lack of familiarisation with the facility and, it would appear, any information alerting them to the hazards awaiting them, the firefighters on 411 and 412 were exposed to a dangerous situation from the time they arrived at the incident, with tragic consequences.

The inquiry was very interested in the issue of pre-incident planning as it had the potential to have averted the incident.

Firstly, the inquiry team considered what benefits could have been gained if the Fire Service had undertaken pre-incident planning at Icepak Coolstores and developed a risk plan. Some potential benefits of a thorough risk planning process are specific to a particular facility such as that exemplified by the Icepak coolstores:

- Fire Service representatives becoming familiar with the facility's features and risks
- engagement with building representative/s to gain information on the facility, including hazards
- discovery of the flammable propane refrigerant (if informed by building representative)
- comment being made on the need for warning signage for the propane refrigerant and discussion on what other safety measures (such as gas detectors and evacuation alarms) were in place in the event of a leak
- the building owner being informed that it was required to maintain and seek approval of an evacuation scheme on the basis that the premises were storing hazardous substances in excess of the minimum quantities specified in Schedule 2 of the Fire Safety and Evacuation of Buildings Regulations and, furthermore, that the New Zealand Building Code requires signage to warn of dangerous goods in the building
- a Fire Service risk plan developed for the facility, clearly showing the propane refrigeration installation as a potential hazard.

Other potential benefits of a thorough risk planning process are widely applicable:

- Fire Service staff informed and alerted nationally that flammable propane refrigerants were being used in coolstores in New Zealand
- communication with other agencies, such as ERMA and the Department of Labour, on the use of propane refrigerants in coolstores
- risk plans encouraging operational crews to make familiarisation visits to a facility

- the risk plan being saved in SMS on FireNet and also carried on the first responding fire appliances and command vehicles.

Even without considering the presence of a flammable refrigerant, the following factors indicate that the Fire Service should have undertaken risk planning for Icepak Coolstores:

- construction of polystyrene panels, which are highly flammable and emit large volumes of smoke
- building contents of high economic value
- potential to create a significant environmental hazard if involved in fire
- no sprinkler system installed and no reticulated water supply for firefighting
- a fire having high potential impact on the local community.

Knowledge of a flammable refrigerant, as a hazardous substance, would have significantly increased the need for a risk plan.

If such a risk planning exercise could have produced such benefits, including the much reduced risk of firefighter injuries in the event of a propane leak, then the inquiry team questioned why this planning was not carried out at the Icepak Coolstores.

The Bay-Waikato Fire Region uses the risk planning process within the SMS. It has enhanced this process and documented it in a booklet titled “Station Management System – Risk Planning and Data Collection Reference Information”. This guide provides risk plan criteria to identify buildings that may require a risk plan, including the SMS risk matrix for scoring premises. The most recent published annual business plan for Hamilton district was published in 2006/07, and the same plan was intended for use in 2007/08. This plan places strong emphasis on risk planning and provides direction down to station and watch level on risk planning activities.

The Hamilton Fire District has developed 62 risk plans through its risk planning process. It appears that, unfortunately, Icepak Coolstores was not identified for risk scoring for one or more of the following reasons:

- The owner had not sought approval of an evacuation scheme for the facility.
- The facility does not appear on the proprietary mapping dataset used by the Fire Service and the police.
- It appears that the Fire Service was not informed of the presence of flammable refrigerants on site by any other agency that may have been aware of this.
- The relative remoteness of the facility from the urban fire district meant it was less likely to be picked up through the street scanning process. Although no formal distinction is drawn between urban and rural areas, it appears that Fire Service officers may be inclined to give precedence to identifying risks within the urban area before scoping rural areas. The district had received no information from the rural fire authority about the facility, and had no other information to indicate any particular fire risks. (These points are discussed further in section 26.)

This signals a clear need to improve the Fire Service’s risk planning processes. Although there are some barriers to the Fire Service identifying all high-risk buildings, the inquiry team believes there are opportunities for significant improvement.

Firstly, the SMS risk-planning process can be improved. The risk scoring process and tools contained in SMS offer useful guidance but do not provide sufficient direction to staff on what building must have a risk plan. As a result, users can apply the risk assessment processes differently. A range of different local procedures are used for determining triggers for the development of

operational risk plans. A clearer, more prescriptive risk assessment model would ensure that buildings are assessed in a consistent manner by firefighters across New Zealand. The model should also make it clear when the development of a risk plan is mandatory.

Secondly, the current street scanning process does not ensure all locations are covered. It appears that streets in the urban areas are scanned more comprehensively than those in rural areas. Roads in remote rural areas in particular appear not to be scanned in a methodical manner. There could be opportunities to involve the relevant rural fire authorities in this process. (This is discussed further in section 26.)

The benefits of effective risk planning are clear, and the Fire Service needs to explore new ways to identify buildings, such as Icepak Coolstores, that slip through the net currently.

#### **24.4 Predetermined attendances**

The communication centre actioned the PDAs loaded for a structure fire in the dispatch zone that included Tamahere.

The inquiry considers that the initial response of two pumping appliances was appropriate for the private fire alarm call.

The Bay-Waikato region has a local procedure for mobilisation (local procedure No. 2), which details the region's standard greater-alarm predetermined responses for structure fires. The communication centre actioned this procedure for the greater alarms that were transmitted at the incident.

## **25 Response to and management of the incident**

Under the terms of reference the third major area for the inquiry to address was the Fire Service response to and management of the incident. This is analysed according to specific aspects listed in the terms of reference.

### **25.1 Notification of the incident and communications centre response**

As has been described, the incident was notified to the Fire Service by Signature Security. The inquiry team listened to the tapes of the interchange between Signature and the Comcen call taker, and studied the Signature Security message log. The call taker took rather longer (at two and a half minutes) than would be normal to locate the incident on the map (compared with less than a minute for a typical 111 emergency call). The reasons were twofold: Signature Security did not have an accurate address for the facility, and the facility was not on the proprietary map used by the Fire Service.

It is not considered by the inquiry team that this delay had any effect on the outcome of the incident.

Signature Security contacted Icepak management three times over a period of 20 minutes concerning Fire Service access to the buildings. Firefighters were given permission to force entry to the premises in the absence of a key holder, which was relayed to the crews en route. This was confirmed at the scene by telephone call from the driver of 411 to Signature. From the information studied, the inquiry team found no evidence of any communication from Icepak management or Signature to alert firefighters to any hazards they might encounter.

The Waikato PRFO or the deputy PRFO had a duty under section 36 of the Forest and Rural Fires Act to attend the incident, as it had occurred in the rural fire district. As noted in section 12.2, the Comcen notified the PRFO by pager of the incident, and the page was picked up and acknowledged by an after hours service provided by the Hamilton City Council. It appears that no discussion took place between the Comcen operator and the city council operator as to the nature of the event. The council's operator appears to have concluded that attendance by the PRFO was unnecessary at that stage.

The PRFO did not attend the incident at any point. The Waikato District Council told the inquiry team that this was because the PRFO was aware that the Fire Service was present and in control. The council commented that it was not the usual practice of the PRFO or his deputies to attend a structure fire unless specifically requested to by the Fire Service, and that the response to the Icepak incident was consistent with that practice. The PRFO's approach was to ensure that the Waikato District Council should be available to respond (both as rural fire authority and otherwise) as and when the Fire Service asked for assistance. At no stage was the PRFO asked to attend the incident.

Issues relating to the management of urban and rural fires are discussed in section 26.

## **25.2 Information available to the crews on arrival at the facility**

The initial crews had very little information available to them:

- They had never been to the site previously.
- They held no risk plan information for the facility.
- The communications centre did not hold any information or data on the facility.
- They were turned out to an activation of a privately monitored fire alarm with no supporting information.
- No owner representatives were available on site.
- They found no alarm panel.
- They saw no signage to indicate the contents or hazards associated with the building.

The only information they had available was

- advice from Signature Security that the Fire Service had permission to enter the building
- advice from Signature Security that a key holder would be able to arrive on site in one hour's time
- the sound of an alarm bell ringing in the vicinity of the plant room
- the visual signs of smoke or vapour or possible leaking refrigerant in the vicinity of the plant room
- two firefighters noticing a lemon and/or almond smell in the vicinity of the plant room. (This smell is not consistent with the stenching agent commonly used in propane.)

## **25.3 Size-up and command and control procedures initiated at the facility**

This section analyses how operational decisions were reached in the developing Icepak incident. The crews of Hamilton 411 and 412 had to make some immediate decisions based on a limited amount of information. The second-alarm crews and executive officers were faced with rapidly changing circumstances.

### **Crews of 411 and 412**

The inquiry team has attempted to track the apparent decision-making process of the two officers on Hamilton 411 and 412, based on their actions and the statements of crew members.

- Based on the fact they were turned out to a fire alarm activation, they assumed they were investigating a fire.
- The alarm bell ringing on site confirmed to them that an alarm had activated. They assumed it was an alarm signalling a possible fire.
- They had little or no knowledge of the facility and there was no building representative present at the site to provide any information. (Note: One of the firefighters reported seeing a man in blue clothing at the end of the central driveway, and hearing him call out, saying something like “That’s normal ... it happens all the time ... it’s just a refrigerant”. However, the inquiry has been unable to substantiate this report.)
- The alarm company told them that a key holder was over an hour away and that they had permission to enter the premises. As they could not establish from outside the building whether there was a fire or otherwise, they decided they could not wait for a key holder and they needed to force an entry. This decision complies with National Commander’s Instruction No. 24. Private Fire Alarms:

Identifying cause of alarm:

When no fire is apparent, the incident controller must ensure that the area indicated is thoroughly searched, including locked rooms, roof spaces and cupboards.

The decision to make entry is also consistent with National Commander’s Instruction No. 11. Forced Entry:

When operational functions or duties cannot be carried out because access is unavailable:

- The incident controller must ensure that a thorough external inspection is made of the area into which entry is required
  - If the incident controller suspects an emergency exists, forced entry is to be made
- The radio message transmitted from the officer of 411 at this stage said *attempting to gain access to the building, appears to be smoke coming from building, possible leaking refrigerant, investigating further.*
  - The smoke or vapour around the plant room and alarm bell ringing nearby indicated to the officers that this was the appropriate place to make entry. They were unaware of any notable smell associated with the smoke or flammable vapour and therefore appeared to proceed on the assumption that it was either smoke from a fire, cold air, or a non-flammable refrigerant product. (Two of the firefighters reported smelling a lemon and/or almond aroma in the vicinity of the plant room, but none of the others noted this aroma.) There is no indication that the officers considered calling for a gas detector to check the nature of the smoke or vapour. If they had any suspicion that a flammable atmosphere was present they would have been expected to include this information in a SITREP to the communication centre. This would also have been consistent with the level of communication that took place with the Comcen throughout the incident.
  - It is doubtful whether the officers, or any of the firefighters present, knew that propane was used as a refrigerant in coolstores in New Zealand. It has apparently been a surprise to many refrigeration experts in New Zealand that propane was being used in coolstore facilities in this country, so it is unlikely that any of the firefighters present at the incident knew otherwise.

Nothing signalled to them that a flammable gas was present. As far as the inquiry team was able to determine there was no signage present to indicate a hazard and no stenching agent was evident in the leaking propane refrigerant. If they had any such indication, best practice expectation would have been for their knowledge, experience, and training to have led them to withdraw immediately and implement procedures for a flammable gas leak. National Commander's Instruction No. 32 on bulk flammable gases includes the following:

32.2 – Hazard identification and control

Gas leaks:

- Use only the minimum number of staff needed to conduct operations safely
- Personnel must not enter gas cloud
- Establish inner cordon (Consider wind direction)

32.3 – Operations

- Approach from upwind where possible
- Establish and evacuate the inner cordon and other operational areas as required
- Eliminate all sources of ignition in the inner cordon
- Identify the gas and its properties
- Monitor levels of flammability
- Seek advice on the shutdown or control of leaks, systems or plant.

The inquiry team noted that, according to their statements, the firefighters initiated action to attempt to stem the leak they discovered in the plant room by fetching a crescent spanner from one of the appliances in order to tighten the loose connection. The explosion occurred before the firefighter returned with the spanner.

It is clear from the firefighters' apparent intentions that they did not know the leak involved flammable gas; therefore National Commander's Instruction No. 32 did not apply in the circumstances. Nevertheless, the extraordinary circumstances experienced at this incident suggest that new content should be included in the National Commander's instructions, covering leaks of unknown substances. In such situations firefighters should attempt to gain advice before they attempt to control a leak, in case such action should prove to be hazardous.

***Second alarm onwards – size-up and method of attack***

Fire crews on the second-alarm appliances after the explosion (Pukete 431, Chartwell 427, and Cambridge 441 and 4411) were faced with an array of conflicting priorities as they arrived at the scene. Not only were they confronted with a rapidly escalating fire involving more than one building, with little in the way of ancillary water supplies, but also they had to contend with the fact that all eight of the initial attendance crew had been injured and were being treated at the scene. In addition, it quickly became apparent that a supposedly pressurised gas cylinder adjacent to coolstore F3-F4 Building was in real danger of becoming involved, a matter that also required immediate attention. Furthermore, one of the initial attendance appliances (Hamilton 411) had been ignited during the explosion.

The crew members of the first second-alarm appliance to arrive (Pukete 431) positioned themselves (after giving immediate assistance to those rendering first aid) at the entrance to the driveway of the dwelling opposite the F3-F4 Building with the intention of getting a hose line to operate on the end of the building. This was to be supplemented by using a small static water source adjacent to the house. This action was hampered by the breakage to the fuel line of the portable pump, thus

restricting the attack until the appliance could be supplemented by the arrival of a tanker. Given the rapidly escalating nature of the incident, this attempt to control the spread of the fire was considered by the inquiry team to be an operationally sound decision, albeit delayed because of the portable pump being accidentally damaged whilst being set up.

Chartwell 427, arriving shortly after the Pukete appliance, took up position to aid with the casualties initially and then sought to provide a cooling monitor on to the exposed gas cylinder. This water supply was supplemented initially using the first tanker to arrive (Cambridge 4411) and thereafter the school swimming pool. Given the information available to the crew at the time, the inquiry team considered this was also a sound operational decision, especially as all of the casualties and those who were assisting them were in dangerous proximity to the cylinder.

Cambridge 441 arrived just behind the Chartwell appliance. Crew members were quickly involved in applying first aid water to the burn victims. Thereafter they assisted the Pukete crew to get a cooling monitor to work on the cylinder, eventually aiding the set up of the water curtain from the hydraulic platform to protect the Lichfield-Tatua Building.

The arrival of Hamilton CFO at 16:46:58 and his rapid assessment of the scene quickly instigated the movement of the casualties and their helpers to a place of safety away from the potential trajectory of the cylinder. Furthermore, the decision to *make tankers 6* appeared to be a logical move to enhance the seriously inadequate water supplies that were available to fight the scale of fire that existed at that time.

An early attempt to utilise the airport rescue tender to mount a foam attack proved to be entirely unsuccessful, primarily because of its unsuitability for this type of incident. (It is designed for intensive foam application to aircraft fires.) Later attempts to use this vehicle for high-intensity water attack also proved to be of limited use, mainly because of the unavailability of supplementary water supplies. All of these actions, however, appeared to the inquiry team to be justifiable in the early stages of the incident.

The arrival of the hydraulic platform from Hamilton provided the means to mount a serious attempt at preventing the fire spreading towards the Lichfield-Tatua Building by providing a water curtain from the platform. Once further tankers arrived on site the subsequent shuttle water relay provided an almost constant supply of water allowing the water curtain to be enhanced by three further monitors. These actions effectively saved the Lichfield-Tatua Building from fire; furthermore, its contents were left undamaged and later were salvaged.

Once it had been established that the cylinder was in fact disused plant, the Chartwell crew was repositioned in order to protect the adjacent private dwelling at 34 Devine Road, on the eastern boundary of the site. This dwelling was just reaching the stage where radiated heat from the fire was igniting the fence and sections of roof. Prompt actions of the crews once again prevented any material damage to the house.

The decision to adopt a non-attack strategy on the main body of the fire was made after discussions between the incident controller (Waikato AFRC) and Environment Waikato representatives. This decision was based upon three major factors:

- The intensity of the fire was of such a scale that it would require substantial extra water supplies to extinguish. These additional supplies were not readily available.
- The potential runoff would have included a mixture of cheese, butter, and venison constituents. This could have proved to be highly damaging to the local watercourses, which in turn could have entered the Waikato River.

- The wind conditions prevailing at the time were extremely calm, thereby allowing the smoke plume to rise vertically to a safe altitude where the threat of airborne contamination was deemed to be minimal.

Given the circumstances, therefore, there would have been little other choice than to protect exposures and allow the fire to burn out under control.

Another action worthy of some merit surrounded the decision by Hamilton DCFO to lead a team to salvage a large number of important records from the administration block, which would no doubt have been of value to Icepak. In addition, early avoidance of potential runoff damage to the surrounding watercourses by the creation of soil bunds and appropriate blockage of drains by firefighting crews proved to be environmentally beneficial.

On Sunday, 6 April, once sufficient bunded areas and runoff traps had been created, a decision was made to mount a concentrated foam attack on the south-west section of the burning coolstores. This could be carried out only once sufficient stocks of foam had been assembled. This worked successfully.

### ***Command and control***

The wide array of competing demands that existed when the second-alarm crews arrived at the incident would have tested the resolve of any fire officer, irrespective of experience. The first two crews had been rendered out of action, and a number of large cool storage buildings were heavily involved with rapid fire spread invading others. All this, combined with the threat to an adjacent possibly pressurised vessel and a complete lack of reticulated water, placed huge pressure on the demand to take command and control of an otherwise chaotic situation.

In those first few minutes Pukete, Chartwell, and Cambridge crews had carried out vital actions of accounting for the injured personnel and carrying out protection of exposures. The CFO arrived and made his own assessment and requested further tankers. Once the command unit arrived, along with the next senior officer (Waikato AFRC), the opportunity arose to extend and formalise the CIMS process. This incident management process was carried out in an almost textbook fashion with subsequently arriving officers being assigned to the relevant roles of operations, planning and intelligence, and logistics. This command structure undoubtedly assisted in the effective management of the incident, and although officers were subsequently changed over as reliefs arrived, the CIMS structure remained in place until scaled down well into the incident some days later.

All of the external agencies interviewed as part of the inquiry process spoke highly of the command and control systems that were put in place, with particular emphasis placed on the series of briefing meetings that were carried out throughout the incident.

## **25.4 Escalation of alarm levels**

The original escalation to a second alarm at 16:30:52, followed one minute later by a further escalation to a third alarm by the driver of Hamilton 411, proved to be pivotal in alerting the communication centre that the situation on site had altered dramatically. This decision on escalation was made more remarkable by the fact that the driver had suffered injury in the explosion and his actions effectively led to the immediate mobilisation of urgently needed supporting appliances.



The appraisal by Hamilton CFO of the lack of a reticulated water supply and his subsequent request for six tankers also proved to be an operationally sound decision. The eventual fleet of tankers assembled provided an effective relay supply of water.

Waikato AFRC's further escalation to a fifth alarm was also entirely correct and provided the necessary level of reinforcing support for an incident of this magnitude.

## **25.5 Safety and welfare**

It would be easy to underestimate the level of welfare support required for an incident of this nature. Early identification of the potential support required proved to be highly beneficial in this particular case. Previous developmental training undertaken by the fire region manager on a crisis management course in Australia provided the necessary foundation and knowledge for welfare issues to be accounted for at an early stage. The speedy allocation of a dedicated officer and staff from Hamilton station as points of contact at the hospital was worthy of some merit, as indeed was the establishment of the welfare and communications centre at Hamilton Fire Station instigated by two off-duty officers without previous instruction or guidance.

Subsequent support from Bay-Waikato FRM and Hamilton CFO and his wife proved equally important, as indeed was the involvement of the previous and current directors for CISM and peer support, who were brought in as part of a team from the Auckland Fire Region. The provision of information and support for firefighters and their families through meetings proved to be of particular value. These meetings gave the opportunity for mutual support between all those involved.

Some difficulties were encountered in the initial stages by the lack of readily accessible personal record information on Hamilton station, which ultimately required the use of public phone directories in order to find phone numbers and addresses of families of the firefighters involved.

In addition the riding positions of firefighters had not been entered into the station management system at the start of the shift, which made early identification of crew seat location quite difficult. Some concern was also expressed in terms of the identification of CISM and other support groups so that those providing this type of involvement could be recognised readily as they gradually took over from the initial systems set up.

Particular emphasis was placed on the necessity to provide this level of welfare support from an adjacent region for any incident of this magnitude. This action immediately assists personnel who are operationally and emotionally involved with the incident from the burden of managing welfare aspects in addition to the incident itself.

The ability to provide food for personnel at the incident ground clearly assists with the overall logistics of any large-scale or protracted incident. The coordination of this aspect by the civil defence and emergency management officer and the response by Auckland Fire Police, the Cambridge Lions, and Salvation Army organisations proved to be extremely beneficial with very positive comments received by all involved.

The families were very grateful for the dedicated room set up for them at the hospital, but a suggestion was made that if just one Fire Service person had been appointed to deal with just one hospital representative, some of the confusion around access to patients by families might have been avoided. All acknowledged that the hospital staff did a wonderful job under the circumstances.

The injured firefighters and their families expressed deep appreciation for the generous support they received from fellow firefighters and colleagues in Hamilton and elsewhere. The inquiry team was impressed with the genuine fellowship evident in the Hamilton brigade and its obvious benefit to those affected by the incident.

## **25.6 Scene security**

It is imperative to ensure that the safety of the public is not compromised at any incident. Clearly in the case of this particular incident it was members of the general public who came to the aid of the injured firefighters shortly after the explosion, and their actions were entirely commendable.

As the incident developed and firefighting operations commenced it would be normal practice to create a safe working zone where all but essential entry is prohibited, thus ensuring the safety and accountability of everyone on the incident ground. In this instance site security proved to be extremely difficult, with hundreds of onlookers descending into the vicinity of the incident and blocking access to supporting emergency vehicles and delaying entry to authorised officials from Environment Waikato. In addition attempts by some members of the media to crawl through gaps in the perimeter hedge all added to the police's difficulties in maintaining a safe cordon around the incident site.

As the incident became protracted the large number of insurance investigators who turned up on the incident ground to search through the debris also compromised site security and their personal safety. This could have posed significant extra risk whilst firefighting operations were still in progress throughout various sections of the site and should have been more adequately controlled.

The Fire Service has authority over a scene while the fire is in progress. Once the fire is out, the scene must be handed over to the owner or other appropriate individual or agency. On this occasion, because of the multiple agencies already involved and the investigations in progress, there was uncertainty as to who had responsibility for the site once the Fire Service withdrew on 12 April. The consequent time and effort spent in establishing a handover process was undesirable, and revealed the need for a clear procedure for such handovers.

## **25.7 Firefighter injuries**

All eight of the firefighters who attended this call on the first alarm were injured in the explosion. One firefighter, the senior officer and the officer in charge of 412, was fatally injured. His injuries were consistent with being caused by the blast as opposed to burn injuries.

Of the other seven firefighters

- Six suffered burn injuries. These ranged from full thickness burns through to partial burns.
- Five suffered from concussion – mild brain injury.
- Four suffered from fractures.
- Four suffered from lacerations.
- Three suffered from hearing loss.

At the time of writing this report (August 2008) one of the firefighters was back at work, one was still in hospital, and five were recovering at home.

## **25.8 Water supplies**

As already outlined, there was no reticulated water supply, and the static water tanks on site were rendered unusable by their proximity to the fire. Apart from using the adjacent school swimming pool, the Fire Service was entirely dependent upon tankers bringing water to the scene. The Fire Service and rural authority tankers were assisted by tankers voluntarily provided by the nearby dairy company Fonterra.

Once assembled on site a shuttle relay of tankers was established from a hydrant approximately 3 km along State Highway 1. The tankers then decanted this water either into a dam improvised by the Fire Service adjacent to the State highway or directly to the Cambridge tanker, which in turn was supplying the hydraulic platform. This process appeared to work extremely well, the only issue being the difficulties associated with rapidly decanting water from the commercial (Fonterra) tankers whose gravity-fed discharge mechanism and couplings are entirely different from those of the Fire Service tankers.

## **25.9 Environmental protection**

The environmental officers reported constant liaison with Fire Service command; they had free access to the incident controller at all times. There were regular update meetings verbally conveyed from the incident control point. During the night of 5 April the Fire Service considered putting more water on the fire, but a joint decision was taken to wait till the ponds were complete and the effluent could be managed.

Local government officials commented to the inquiry team that Fire Service personnel appeared very conscious of potential environmental impacts of the incident and had acted accordingly. Environment Waikato had expected to be informed when the site was handed over by the Fire Service to another agency. It was not, and although in the Icepak incident Environment Waikato had no further interest in the event, that might not be true in other cases.

From the point of view of Environment Waikato this event was characterised as a Tier 4 event, one involving the whole of the Waikato region. However, the impact on the natural environment was reported as minimal, although local residents reported nuisance odours for many weeks afterwards.

## **25.10 Communications to staff and the families of injured employees**

The communications issues encountered by many of the family members in trying to find out who was involved and the nature of the injuries caused considerable distress to them in the early stages. They were grateful for the significant help and support of colleagues immediately after the incident and since. This was manifested by financial assistance, hospital visits, home visits, and acting as contact points. The sustained interest of management and senior members of the Fire Service in the affected families was noted and much appreciated.

The team from the Fire Service claims management unit came in for considerable praise, both in the attitude team members displayed and in the rehabilitation services that were offered. It was noted that assistance offered in circumstances such as these is not always taken up. Individuals may not appreciate their entitlements or understand how certain processes are meant to work. There may be a necessity to explore how better to deliver assistance to people who may not recognise their own needs and to ensure that all questions of whatever kind can be directed through a single point.

The payments made to the injured families by the Fire Service were welcomed, though the families were embarrassed that the amount in question was revealed and became common knowledge.

### **25.11 Communications to the public and the media**

Community activities in and around Tamahere where the Fire Service was involved were many, and the inquiry team received overwhelmingly positive feedback on Fire Service interaction with local people. Nevertheless, there were members of the community who did not feel that communication was adequate. It appeared that those without connections to the school, the church, and the community centre did not necessarily feel that the Fire Service had kept them informed. In general, however, people were very pleased with the way in which the Fire Service had become drawn in to the local community.

The incident attracted very extensive media coverage. Fire Service representatives spoke freely to the media and appeared to satisfy the high level of public interest and demand for information. Nevertheless, communications with the media were reportedly a challenge at times for the officers involved in managing the incident and in managing welfare at Hamilton station.

The appointment, early on, of an experienced police media adviser into the role of media liaison at the incident proved very beneficial. This provided a coordinated source of authoritative information and helped in dispelling incorrect rumours at an early stage. It also meant that media personnel could be briefed at intervals and taken around the site in safety. It was noted that it was not easy to distinguish professional media people from others who wanted to get close to the scene. Several media representatives did not carry any form of identification and their access was limited as a result. The Fire Service would be able to deal with the media more effectively if they all carried an appropriate form of identification.

Comments to the media the next day were not always well coordinated. For example, Fire Service managers' conflicting viewpoints about whether a sprinkler system would have reduced fire damage at Icepak were revealed in the media.

Although the media coverage was largely positive and well organised, it nevertheless placed considerable strain on local managers and staff who were coping with the death of a friend and colleague. In such circumstances a high level of support in dealing with the media is required. The Fire Service media liaison person based at Hamilton station from Monday, 7 April to Friday, 11 April provided valuable support, but was overwhelmed at times with the level of media activity. More specialist media support in Hamilton would have been useful during the first few days following the incident.

There were occasional difficulties with coordinating the media-related activity in Hamilton and Wellington. As a result of this experience, national headquarters communications staff intend to respond to the incident location for major events that occur in the future, so they are better positioned to provide more direct support and coordination services for local management.

### **25.12 Liaison with other agencies**

The inquiry team interviewed representatives from agencies that were involved in the incident. It should be stressed that this was not a comprehensive review of all agencies; an incident such as this has impacts on a large number of different organisations, and a representative selection of individuals was interviewed to try to establish how inter-agency liaison was managed. Mostly these came from emergency services and local government agencies.

Key themes emerged. The first was that with a strong CIMS structure in place at a large incident, involved parties recognise firstly who is in charge and where they fit in, and secondly where to go for information. There was very positive feedback from those interviewed about the significance of the hazmat-command vehicle being set up as the incident control point in providing a position for authoritative information and regular scheduled briefings for all concerned.

The second theme that the inquiry team noted was that so many of the individuals who responded to the incident from different agencies already knew each other. This is not to say that the incident could not have been perfectly well managed by strangers, but explanations were unnecessary and time was saved because people knew one another and knew one another's functions. This familiarity did not arise by accident. Informal contact and formal liaison committees, such as the Hazardous Substances Technical Liaison Committee to name only one, had performed a valuable function that underpinned relationships at the scene.

The matter of liaison between urban and rural fire authorities is covered in section 26.

### **25.13 Use and performance of personal protective equipment**

Records obtained from Yakka Apparel Solutions Ltd (YASL), supplier of Fire Service protective clothing and uniform, showed that all the PPE and uniform issued to the eight firefighters complied with Fire Service policy.

Records from Totalcare (the company responsible for laundering and repairing structural jackets and overtrousers) showed the structural firefighting items worn or available to the eight firefighters were maintained in accordance with Fire Service policy and procedures.

#### ***Jackets and trousers***

The structural firefighting jackets and overtrousers afforded excellent fire protection to the six firefighters wearing them. None of these firefighters suffered burns through this clothing, which was inspected after the incident and showed no visible signs of burn damage. The garments were subsequently condemned as a precaution but most appeared fit for service. There were a few small tears in some of the garments as a result of the explosion. The jacket of the officer in charge of 412 incurred the most damage, but even this was relatively minor. It had a torn radio pocket and tears on the sleeve and hip pocket but was otherwise in good condition.

The drivers were wearing wildfire/rescue jackets and trousers. The garments of the driver of 411 appeared undamaged, and he received no burns through them. The driver of 412, on the other hand, suffered serious and extensive burns to his back, legs, hands, and face. The back of his jacket and his trousers were burnt away. He was wearing a cotton workshirt under the jacket and this was also burnt through leaving his back fully exposed. He was standing with his back to the plant room doorway when the explosion occurred and he appears to have been exposed to the full fire blast of the explosion. Nevertheless, based on the burns protection afforded to the six firefighters wearing structural firefighting jackets and overtrousers, it appears he would have received much reduced or no burns to the body if he had been wearing the same garments.

The inquiry considered whether the two drivers should have been wearing structural firefighting jackets and overtrousers, rather than the wildfire/rescue clothing. (To provide context, refer to section 10.15 for background on the use of Fire Service protective clothing.) Although in hindsight this would have afforded them with superior protection, the inquiry concluded that the wearing of the wildfire/rescue clothing was appropriate for the situation with which the firefighters thought they were dealing. In the unlikely event that the drivers had been needed as a firefighting crew to

enter the building they would have put on their structural firefighting jacket and trousers, which they carried with them on their appliance. Firefighters are trained to position their appliances in a safe position, where they will not be exposed to the threat of fire or building collapse. Therefore, when operating near an appliance the full structural firefighting clothing is seldom required. However, they may need to wear their safety helmet, boots, gloves, and high visibility clothing, depending on the activity undertaken.

The firefighters clearly assumed that the area outside the building did not present any imminent safety risk. Therefore, the drivers' protective clothing was appropriate in the circumstances.

### **Gloves**

The eight firefighters at the incident carried gloves with them. It appears one firefighter was wearing wildfire/rescue gloves, but the others were not wearing gloves. Some of the firefighters said they were wearing their gloves at various times when attempting to make entry to the building, but the burn injuries to hands indicate they were not wearing them at the time of the explosion. Three of the eight firefighters received burn injuries to their hands.

Given that the firefighters did not consider there was any imminent risk of fire, it is not unexpected that they were not wearing gloves.

### **Boots**

The two drivers were wearing wildfire/rescue boots; the other six were wearing the structural firefighting boots. None of the firefighters received burns or other injuries to their feet.

### **Helmets**

All eight firefighters had their firefighting helmets with them at the scene. However, it is unclear how many were wearing helmets at the time of the explosion. It appears that four were wearing helmets, and four were not. It appears that the three firefighters who made entry to the building were wearing their helmets.

It appears that any helmets worn would have been immediately blown off by the force of the explosion and therefore would have afforded little or no protection to the wearer. It is unknown whether having the chin strap tightly secured would keep a fire helmet in place during an explosion of this force. One of the firefighters who stated he was wearing his helmet was outside the building. His helmet blew off during the explosion. He received serious facial injuries, which extended up to his skull. His injuries were consistent with those incurred in a severe blast and it is unknown whether wearing his helmet at the time of the explosion had any effect on the outcome of his injuries.

All eight firefighters were either concussed or stunned by the force of the explosion. Some received burn injuries extending into the area of the head that would be covered by a helmet if it had remained on. None appear to have received any serious injuries as a result of being struck on the head by objects subsequent to the explosion.

The inquiry team has been unable to conclude whether wearing a helmet at the time of explosion did provide, or would have provided, any protection to the wearer.

### **Breathing apparatus**

Five of the firefighters were donned in BA from the time they left their appliances to investigate the incident. The two drivers did not don BA and nor did the officer of 412.

From the available evidence it is not possible to be certain whether any of the BA sets were started up at the time of the explosion. Only two firefighters were inside the building when the explosion occurred, and a third (the driver of 412) was standing in the doorway. The SITREP transmitted at 16:29:47 said, “Entry gained, brigade investigating using BA”. However, it appears no BA entry control procedures had been instituted.

There were conflicting accounts about whether the officer of 411 started his BA. Two of the firefighters on 412 recalled the officer of 411 putting on his BA mask before entering the plant room, but one of the firefighters he accompanied into the building stated he did not have it started up inside the building, or at the time of the explosion. If the officer of 411 did have his facemask fitted at the time of the explosion, then it must have been immediately blown away, because he received extensive burn injuries to the face in areas that would have been covered and protected by the mask and flash hood if they were worn.

The five firefighters donned in BA were knocked over by the explosion and their BA shoulder straps were partially or fully dislodged. The force of the explosion was such that one mask was torn off its hose line. The firefighters, or their rescuers, removed the BA sets and left them on the ground.

The inquiry considered whether the firefighters should have been wearing BA and flash hoods in the circumstances. This was considered on the basis that they had no awareness of a flammable gas being present, or the potential for an explosion to occur, and they were operating in an investigation mode.

On this basis only the three firefighters who entered the building needed to consider starting up their BA. The National Commander’s Instructions (NCI 4: Breathing apparatus) require BA to be donned before entering a structure to investigate a fire or a suspected fire, including a private fire alarm call. In this sense, they complied with the instruction. However, the instruction requires firefighters to start up BA when involved in any operation that exposes them to toxic substances, dust, fumes, smoke, and other atmospheres that are not respirable.

The firefighters were unsure of the source of what they variously thought could be visible smoke, vapour, or leaking refrigerant and therefore could not confirm whether or not it was a safe atmosphere to breathe. Therefore, they should have started their BA.

However, although starting the BA would have afforded some additional protection to the two firefighters inside the building, it had no bearing on the explosion. Only two firefighters would have been started in BA at the time; six of the firefighters were outside the building, including the one who was killed and the one most seriously burnt.

### ***Flash hoods***

Apart from the two drivers, the other six firefighters appear to have been wearing flash hoods around their necks at the time of the explosion.

If the firefighters had been wearing their flash hoods with BA, and these had stayed in place during the explosion, it is likely they would have received less serious burn injuries to the face and head. However, only the two firefighters inside the building would have reason to be wearing a flash hood with their BA started at the time of the explosion.

### **Overall performance of PPE**

The inquiry team considered whether a different approach to the use of PPE at the incident could have prevented the death of the officer in charge of 412, or reduced the severity of injuries to the other firefighters.

The conclusion drawn is that no PPE measures for firefighters can be expected to handle an explosion of this type and severity. Fire Service operational instructions do not permit firefighters to knowingly enter an area where an explosion is a possibility.

PPE is designed to provide protection to firefighters for the situations they can reasonably expect to encounter. They are trained to recognise the signs of fire backdrafts and flashovers, because there is always a possibility they are exposed to these risks when undertaking internal fire attack. Therefore, operational instructions require firefighters to wear full protective clothing and BA before entering a building involved in fire. Modern protective clothing and BA are designed to provide a reasonable level of protection to firefighters in such situations.

The PPE worn by the firefighters did afford them a level of protection from the effects of the explosion. But the severity of the injuries had as much to do with the force of the blast and where each firefighter happened to be positioned at the time of the explosion. This is most evident with the different injuries incurred by the driver of 411 and the officer of 412. They were positioned just 2–5 m apart. The officer was wearing a higher level of protective clothing, but died of his injuries. The driver was the least injured of all the firefighters.

### **25.14 Appliances and equipment**

In addition to their personal protective equipment, firefighters use a range of appliances and equipment whose performance becomes part of the inquiry into an incident such as this one.

#### **Appliances**

All the fire appliances that responded to the incident appear to have functioned satisfactorily, except for some problems experienced with the Hamilton hazmat-command vehicle. This is a prototype of the Fire Service's new standard hazmat-command vehicle.

There were problems with some aspects of this vehicle's technology during the early stages of the incident. New incident management software, which was still being piloted on the vehicle at the time of the incident, was unstable, and the program needed to be restarted several times.

The two-person crew operating the vehicle was very busy during the early stages of the incident. After experiencing problems, they decided they did not have the time to persist with the computer-based incident management system and reverted to manual systems. This involved the use of whiteboards. If the incident management system had worked it would have provided the inquiry team with a detailed, timed record of incident decisions and the management structures put in place. However, the inquiry team obtained some paper records and photos of the whiteboards, which, along with interviews, enabled team members to gain an understanding of what occurred.

There were also problems associated with establishing and maintaining a data connection to the Fire Service computer system via the cellular network. The connectivity issue experienced may have been a combination of overloading and/or poor coverage. Not all cell sites are capable of operating at the T3G speeds used by the hazmat-command vehicles, and it may have been a slow connection that caused the connection issues.



Notwithstanding these technical difficulties, the hazmat-command vehicle still operated adequately as the incident control point. Representatives from several agencies commented on the value of the hazmat-command vehicle as a focal point at the incident. This factor was well utilised by the incident controller to maintain regular briefings to the other agencies and the media.

Since the incident, several improvements have been made to the computers and software on the Hamilton hazmat-command vehicle and these are expected to resolve the problems experienced at the incident. These improvements will also be included in the new hazmat-command vehicles under production.

The Type 4 combination pump/aerial appliance from Rotorua was used at the incident for several days. This is one of 16 such standard-design Type 4 appliances in use across New Zealand. The benefit of having a standardised design was demonstrated at the incident because the Type 4 appliance was readily used by relief crews from Auckland who already operate such appliances.

### **Equipment**

The wide range of hose, waterway, and other equipment used over the course of the incident appears to have functioned effectively and no significant problems were reported.

The only problem reported was a damaged fuel line on the portable pump from Pukete 431. The line was broken when it was removed from the appliance locker during the early stages of the incident. This made it inoperable, and it was replaced by another portable pump to draft water from a nearby house water tank. On this occasion, the delay in replacing the pump is not considered to have influenced the outcome of the fire.

A multi-gas detector was normally carried on 411, but at the time of the incident, it was away for its regular service and calibration. If a multi-gas detector had been used at the incident, it is probable that it would have detected the presence of flammable gas and alerted the firefighters to the risk of explosion and fire. However, there is no indication that the firefighters at the scene considered using a gas detector, even if one had been available at the scene. If they had had any knowledge or indication that a flammable gas was present, operational procedures would require them to stay at a safe distance and they could have called for a gas detector to be brought to the scene.

At the time of the incident the Fire Service owned 61 multi-gas detectors, strategically located on fire stations across the country. A programme to increase the number and availability of multi-gas detectors was under way before the incident, with an additional 200 detectors recently purchased. The purpose of the increase in numbers is to make gas detectors more readily available at incidents and to encourage their use at any time there is the slightest doubt about the state of the atmosphere where firefighters are working. The incident should serve as an enduring reminder of the dangers of unknown atmospheres and encourage firefighters to use gas detectors more readily than they may have in the past.

The portable radios carried by the firefighters on Hamilton 411 and 412 were not designed to be intrinsically safe. (Intrinsic safety is a protection technique for safe operation of electronic equipment in explosive atmospheres.) The Fire Service does not require its portable radios to be intrinsically safe because firefighters should never be operating in explosive atmospheres. There is no indication that the use of a portable radio was associated with the explosion.

## 26 Urban and rural fire issues

The Icepak fire was attended by Fire Service personnel and appliances from the Hamilton Fire District, but the site was located outside the district and in a rural area. This meant that it was, technically, a rural fire under the jurisdiction of the relevant rural fire authority, which is Waikato District Council. One of the first notifications of the explosion was to the rural fire authority, which was acknowledged by a call to the Comcen. However, the response to the incident itself was controlled and directed entirely by the Fire Service, without input from the rural fire authority.

The inquiry team examined whether the jurisdictional divide may have been a contributing factor in the fire crews' lack of knowledge about the Icepak facility.

### 26.1 The legislative framework

Neither the Fire Service Act nor the Forest and Rural Fires Act contemplates a rigid separation of roles between the Fire Service and rural fire authorities. Each provides a number of mechanisms that enable cooperation and sharing of resources. They include the National Commander's responsibility to operate coordination schemes for fire control, the provision for the New Zealand Fire Service Commission to enter agreements and arrangements for the sharing of services and apparatus, and the corresponding duties and responsibilities on fire services and rural fire officers when responding to fire alarms.

Fire safety is a separate issue that is dealt with exclusively in the Fire Service Act.

### 26.2 Preparedness and fire safety

Although the legislation creates a jurisdictional divide, it contains significant provision for coordination and cooperation in respect of preparedness.

#### *Responsibilities of rural fire authorities*

A rural fire authority has a duty to ensure that fire control measures are in place in its district relating to prevention, suppression, and extinction of fires.<sup>22</sup> That duty extends to fires in structures. However, the main focus of the Forest and Rural Fires Act is on fire control measures in respect of vegetation. In practice, this is likely to be the focus of a rural fire authority's fire plan. That is the case with Waikato District Council's fire plan, which the inquiry team examined.

To compensate for this, many rural fire authorities have entered cooperation agreements with the Commission under the Fire Service Act and/or the Forest and Rural Fires Act. For example, under section 38 of the Fire Service Act the Commission and the territorial authority of a rural area may enter an agreement for the protection of that area from fire, on agreed terms and conditions.

There appears to be no current agreement between the Commission and Waikato District Council. Bay-Waikato Fire Region management reported that it had offered to establish agreements with all the rural fire authorities in the region. Correspondence dating from 1999 indicates that a section 15 agreement with Waikato District Council was prepared at that time. However, neither the council nor the Fire Service has a copy of that agreement, and the council's fire plan (prepared under the Forest and Rural Fires Act) states that there is no such agreement in place.

Bay-Waikato Fire Region management reported that, some years later, it had offered to establish agreements with all the rural fire authorities in the region, but Waikato District Council did not

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<sup>22</sup> Forest and Rural Fires Act, section 12.

take up this opportunity. The inquiry team did not examine the reason for this, but that situation clearly needs to be reviewed in light of the Icepak incident.

It was outside the scope of the inquiry to examine the state of preparedness of the rural fire authority for the Icepak incident. However, as stated in section 24.3, the Hamilton district of the Fire Service had received no information from the rural fire authority about the facility. The authority told the inquiry team that it was not aware, until the incident itself, that flammable refrigerant was being used at the facility, and that it had received no notification from the Fire Service regarding a fire risk at the location. It also said that Waikato District Council had no information about the facility other than that the coolstores would be used for storing dairy products and horticultural and agricultural products.

### ***Role of the Fire Service***

Cooperation between the Commission, the Fire Service, and rural fire authorities is especially important in the environs surrounding urban fire districts, of the type where the Icepak facility was located.

As described in section 10.14, the Fire Service undertakes extensive risk assessments in the community. One object of that activity is to identify buildings that may pose a significant fire risk. This is done using street scanning, and by collating information received from other authorities and from within the Fire Service about resource consents, building uses, and fire evacuation plans.

It is important for this pre-incident planning to extend outside the strict boundaries of the urban fire district, and in practice it does. There are good reasons for this. The Commission is responsible for defining the boundaries of urban fire districts, but it is inevitable that some areas outside an urban boundary may have significantly more buildings (including large commercial or industrial premises) than the rural heartland. Because of their proximity to the urban district, the Fire Service can expect to be called out to alarms for those buildings. In any case, if the fire is in a significant structure the Fire Service may be better equipped to manage it.

In keeping with this practice, the inquiry team found that pre-incident planning in the Hamilton Fire District is not confined to the boundaries of the district. However, a number of assumptions appear to drive the activity, conditioned by the understanding within the Fire Service that there is a jurisdictional divide between a Fire Service district and the rural fire districts beyond it. In essence, the approach can be described as, “of course we will encompass buildings outside the district if they come to our attention, and of course we will respond to a fire outside the district if called upon, but in terms of operational planning and resource allocation the needs of the district have to come first”. Furthermore, it appears that the more remote a building is from the urban district, where Fire Service staff are based, then the more likely it is to be missed in the risk assessment process.

The inquiry team thinks this approach, which is understandable, is likely to be deeply engrained across the Fire Service, without necessarily featuring as a visible factor in the prioritising of risk. At a deeper level, it could result in confused thinking about the exact limits of the Fire Service’s responsibilities in respect of major buildings in rural fire districts.

It is not possible to say for certain whether this was a contributing factor in the failure of the Hamilton district’s risk assessment activities to identify the existence of the Icepak facility as a significant industrial building within reach of the city. However, the inquiry team thinks it is possible that it was, and that there may be lessons to be learned from this.

The lessons in respect of preparedness for the incident should be considered both at local and national level. The inquiry team has noted that the Icepak incident should prompt a review of the need for further cooperation between the Hamilton and Waikato fire authorities. More widely, there may be a need to review the application of the fire legislation in respect of cooperation schemes between rural and urban fire districts, especially in respect of fire control measures for buildings. If a large industrial facility poses a significant fire risk, the location of the facility in a rural or an urban district should not affect the taking of measures to prevent fires, or the level of preparedness of fire services to respond to any fire that does occur. If it is likely that the Fire Service will be called upon to respond to an alarm in such a building outside its district, then its level of preparedness should be the same as if the building were inside the district.

The need for a cooperation scheme should be considered with these standards in mind, to ensure the necessary supply of information for prevention and preparedness activities, and to enable effective decision making if an alarm does occur.

These are issues for the Commission, in exercising its overarching responsibilities in respect of fire prevention and fire safety, and for the National Commander, who has the responsibility to make provision for cooperation between all fire services, urban and rural, and for making provision for cooperation between the Fire Service and territorial authorities.<sup>23</sup>

There may be a need for enhanced staff training about the application of the jurisdictional issues in pre-incident familiarisation and risk assessment activities.

### ***Fire safety***

There may be added room for confusion when the Fire Service's role in respect of fire safety is brought into the picture. Under the Fire Service Act, the Commission has an overarching responsibility for fire safety throughout New Zealand. In practice, it is the Fire Service that gives effect to that responsibility. Here, the urban/rural boundaries are of less relevance.

For example, the requirements for building evacuation schemes under the Fire Service Act apply irrespective of whether the building is located in an urban or a rural fire district. If a building meets the necessary criteria under the Fire Service Act, the building owner must provide a scheme and have it approved by the National Commander. Fire districts play a part in the exercise of this responsibility.

Although these different responsibilities are reinforced in training, they come out of a complex legislative environment, and can be difficult for all personnel to understand.

## **26.3 Response**

When a fire occurs in a rural district, the primary duty to respond rests with the PRFO.<sup>24</sup> The PRFO has the control and direction of the firefighting activity, including of any Fire Service brigade attending the fire. However, if a Fire Service brigade has attended in connection with a building, the PRFO may direct the brigade to serve in connection with that fire. Once a direction has been given, the senior officer of the brigade has control and direction of the brigade and the extinction of the fire.

Under the Fire Service Act, the chief fire officer of an urban fire district is not obliged to respond to a fire or other emergency occurring outside the district, but may do so, taking whatever action is

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<sup>23</sup> Fire Service Act, sections 14, 17O, 20, 21.

<sup>24</sup> Forest and Rural Fires Act, section 36.

necessary to save lives and property in danger.<sup>25</sup> Typically, the factors bearing on such a decision will include the availability of resources, other commitments inside the urban district, and the distance needing to be travelled to a rural district fire.

In the case of the Icepak incident, the fact that the alarm related to a building outside the Hamilton Fire District did not appear to have any bearing on the Fire Service's response. The crews appear to have been dispatched to the incident without question, as if it had been in the district.

The rural fire authority was notified of the alarm, and responded by telephone call to the Comcen through the after hours call service. A number of other requests were made of the council as the incident progressed, for example to place water tankers on standby. The authority responded to those requests. The after hours rural fire officer responded to these requests as appropriate. The PRFO did not attend the incident because the Fire Service was in control of it, and no request was made for him to attend. As detailed elsewhere in this report, the Waikato District Council had a significant presence at the incident in other capacities.

The inquiry team has no concerns about the response in the context of the jurisdictional responsibilities. What happened was, in effect, that the control and direction of the incident was assumed by the CFO from the outset.

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<sup>25</sup> Fire Service Act 1975, section 28A(1).



## **PART 6: FINDINGS**

Part 5 provided analysis of the circumstances of the explosion and fire according to aspects specified in the terms of reference. This part of the report summarises the inquiry team's findings.

### **27 Findings on origin and cause of fire and related matters**

Specific numbered findings relating to the origin and cause of the fire are listed below.

#### ***Building performance***

1. Although the inquiry team is of the view that a building presenting the type of fire hazard of Icepak Coolstores should be sprinklered, particularly in an area without a reticulated water supply, the team was unable to determine whether or not sprinklers would have been effective in reducing the severity of the fire that followed the explosion.
2. After the explosion, the combination of stored foodstuffs and polystyrene building panels made a severe fire inevitable and virtually impossible for firefighters to contain in the early stages.

#### ***Refrigerants***

3. The Fire Service had no knowledge of propane-based refrigerants used in large-scale installations in New Zealand. This lack of awareness was shared by refrigeration experts contacted by the inquiry team.
4. Propane-based refrigerants are used in coolstores overseas, and there are a number of safety guidelines and standards for these facilities. The inquiry team has insufficient information to make comment on whether these guidelines had been followed at Icepak Coolstores.
5. The firefighters did not appear to smell anything that suggested flammable gas was present. If the firefighters had smelt the usual stenching agent associated with propane they would have been made aware of potential dangers.

#### ***Legislative matters***

6. The regulatory regime (HSNO) for managing large-scale flammable refrigerants appears to assume that a refrigeration system is sealed and therefore justifies a lesser level of regulation than for flammable gas stored in other ways. In this respect the regime appears to be deficient.
7. It appears that the building did not have hazardous substances signage, which is a requirement of the New Zealand Building Code. This would have contributed to the firefighters not being alerted to the presence of flammable gases.

8. The presence of hazardous substances in such quantities at the site would be expected to result in an evacuation scheme being prepared and submitted for approval to the Fire Service under the Fire Safety and Evacuation of Buildings Regulations. Had an application for approval of a fire evacuation scheme been made, the Fire Service should have been alerted to the presence of hazardous substances and this would have triggered the Fire Service pre-incident planning process.

## **28 Findings on preparedness**

Specific numbered findings relating to the preparedness of the Fire Service to manage an incident such as this one are listed below.

### ***Operational instructions***

9. Operational instructions were undergoing review prior to the incident to update them and improve alignment. However, despite any shortcomings, national operational instructions and local procedures provided adequate guidance for the safe and effective management of the incident.
10. The inquiry team has no information regarding initially attending officers' discussions and dynamic risk assessment on the scene. However, the actions of the firefighters in entering the building to investigate the fire alarm were consistent with operational instructions in the absence of any indication of obvious threat to their safety.
11. In light of what occurred at this incident, the following three amendments to the operational instructions would improve guidance to firefighters. Firstly, place more emphasis and give more direction on the use of gas detectors. Secondly, provide more detailed information and guidance on the range of refrigerants in use in New Zealand. Thirdly, include guidance on seeking advice before attempting to control leaks of unknown substances.

### ***Personnel qualifications and training***

12. The eight firefighters on the initial response were appropriately qualified and trained to deal with the incident.

### ***Pre-incident planning***

13. The Fire Service held no information on the Icepak facility in its building or incident databases. The facility did not appear on the proprietary mapping dataset used in the joint fire/police communications centres.
14. There was no risk plan for this facility. As far as the inquiry team is aware, the first attending firefighters had little or no knowledge of the site.
15. Knowledge about the quantity of propane used at the site would have triggered the Hamilton Fire District's risk planning process.
16. The Fire Service's street scanning process to identify high-risk buildings appears to be less effective in rural areas, outside the urban fire district. The lack of a cooperation agreement between the Fire Service and the rural fire authority could have contributed to this.
17. The benefits of effective risk planning are clear, and the Fire Service needs to explore new ways to identify buildings such as Icepak Coolstores that slip through the net currently.



## 29 Findings on response and management

Specific numbered findings concerning the Fire Service's response to and its management of the incident are listed below.

### *Call receipt and mobilisation*

18. The monitoring company did not hold an accurate address for Icepak Coolstores. The facility did not appear on the proprietary mapping dataset used in the joint fire/police communications centres. Both contributed to over a two-minute delay in locating the building before dispatch. There is no evidence that this delay contributed to the outcome of the event in this instance.
19. Communication centres performed effectively through all stages from mobilisation to close of the incident.

### *Incident management*

20. After the explosion, the drivers of 411 and 412 acted in a highly commendable and quite extraordinary manner in the circumstances. In spite of having burn injuries, the driver of 411 quickly assessed the situation and started to send priority and assistance messages that followed best practice. He also operated the fire pump to cool the burns of the injured.  
The driver of 412 was stunned by the explosion and received very extensive and serious burns. Despite this, for over 20 minutes he instinctively acted to operate the pump, alert rescuers to the advancing fire, collect equipment, and even direct the second alarm appliances. After repeated requests from people administering first aid, he allowed himself to be treated and transported to hospital.
21. The other six firefighters also behaved stoically. They remained calm and composed while being treated for their injuries and were heard to express concern for their colleagues.
22. The officers responding to the second alarm made sound operational decisions in the face of an extremely challenging situation.
23. On arrival of appliances responding to the second alarm, the fire was established to the extent it was beyond the capacity of the Fire Service to control.
24. Resources were put into cooling what appeared to be a pressurised vessel in the vicinity of the treatment area for the injured firefighters. Though this later proved not to be a threat, it was a major distraction to second alarm crews in the early stages of the incident.
25. Senior officers arrived soon after the appliances responding to the second alarm and established effective command and control procedures.
26. The Co-ordinated Incident Management System (CIMS) was implemented at this incident and proved to be very effective. All agencies appeared to have a good awareness of CIMS.

### *Safety and welfare*

27. Fire service personnel and those from other agencies were well catered for in terms of food, drinks, and rest periods at the scene.

28. Good structures for critical incident stress management and peer support were provided to Fire Service personnel after the incident at the fire stations, at their homes, and at the communications centres.
29. CIMS principles were used to establish a welfare and communications structure centred on Hamilton station. This was effective and could be formalised for future use.
30. Bay-Waikato FRM drew on his training in crisis management to recognise the potential impact of the incident on the welfare of Fire Service staff and took action accordingly.

#### ***Scene security***

31. The scale of the site made it difficult to secure. This presented problems with some media representatives and others not involved with the management of the incident exposing themselves to risk. There was also the potential to disturb important evidence, especially as the scene began to be investigated.
32. There was no formal process for Fire Service personnel to relinquish the scene once firefighting operations had finished.

#### ***Firefighter injuries***

33. Outcomes for the firefighters were much improved because of the prompt help of medically qualified members of the public on scene.
34. The fatal injuries suffered by the officer in charge of 412 appear to have arisen as a result of the blast effects of the explosion. He received little or no burn injuries.
35. The burn injuries suffered by firefighters were as a result of the flame front of the explosion, not the subsequent fire.
36. Depending on the locations of the firefighters at the time of the explosion, their injuries were a combination of blast and/or burn injuries. Severity of injuries depended very greatly on where they were positioned. Those most severely injured were outside the building.

#### ***Water supplies***

37. There was no reticulated water supply at this incident. A large-scale tanker shuttle operation was effectively put in place to provide water to the incident. This relied on police to partially close State Highway 1 for a time.
38. The limited water supply and the intensity of the fire meant there was sufficient water only to protect exposures. The best that could be achieved in terms of protecting the exposures of 34 Devine Road and part of the coolstore was achieved.

#### ***Environmental protection***

39. Consideration was given to the environmental impact of the fire from the early stages. An informed decision was taken to allow the fire to burn; this represented a trade-off between airborne and water-borne contamination.
40. The impact of the incident on the environment was minimal. Considering the scale of the event, and the potential for serious water contamination, Environment Waikato reported that this was from their point of view a near-perfect event.

### ***Communications***

41. Communication with firefighters' families in the early stages of the incident was hampered because of the difficulty of locating next-of-kin contact details.
42. Communications in the weeks following the incident reportedly worked well on a number of levels, including local support by colleagues, practical help from the claims management unit, and continued interest by senior management.
43. An incident of this type has far-reaching effects on the local community. The Tamahere community took responsibility for supporting each other through meetings, services, and social events over the days that followed, involving Fire Service personnel.
44. Internal communications within the Fire Service were effective from the early stages of the incident, including communication to the Hamilton staff. Communication between the region and national headquarters was established immediately.
45. Assistance in management of the ongoing incident was offered from Auckland region and accepted, which released Hamilton staff to support each other, arrange the funeral, and deal with the media. Though this happened and worked well, it is not part of any defined procedure.
46. Even having been relieved of any ongoing involvement with the fire, local Fire Service management was under considerable stress with having to continue with normal management roles and coping with personal grief and that of colleagues, as well as dealing with funeral arrangements and the media.
47. Dealing with the media at the incident via an experienced media liaison person was beneficial in the early stages. This relieved the incident controller of continuous distractions.
48. Better support for local staff in handling media issues could have been provided in Hamilton if a national team had responded to the incident location at once.

### ***Liaison with other agencies***

49. Close working relationships established between agencies prior to the incident contributed to good communications and decision making during the incident.
50. The complexity of rural/urban legislation results in lack of clarity around responsibilities for fire risk management for buildings within rural fire districts. There is a need for the National Commander and the National Rural Fire Officer to put in place clear guidelines for urban and rural fire officers to address this gap.
51. The Waikato district rural fire authority was notified of the incident, and responded to that notification. The Principal Rural Fire Officer did not attend because the Fire Service was in attendance, and no request was made seeking his attendance. The after hours rural fire officer responded to a number of requests to the authority, mostly to place water tankers on standby.

### ***Personal protective equipment***

52. Fire Service personal protective equipment is not designed to protect against the blast effects of explosions. However, the high performance of structural firefighting protective clothing was significant in protecting firefighters from burn injuries. Burns were experienced only on skin not covered by structural firefighting clothing.

53. It appears that helmets that were worn were blown off by the blast.
54. Firefighters were not wearing structural firefighting gloves at the time of the explosion. The inquiry team finds this acceptable, as they were engaged in entry and investigation activities, with no obvious expectation of fire.
55. Because the firefighters inside the building were operating in an area where there was an unknown vapour, they should have started their breathing apparatus sets to protect themselves. However, the use of BA had no effect on the outcome of this incident.

### ***Appliances and equipment***

56. The multi-gas detector on the first arriving appliance was away for servicing. There is no indication, however, that the crews considered using a gas detector at the incident. If a gas detector had been used it is probable that it would have detected the presence of flammable gas and alerted the firefighters to the risk of explosion and fire. Operational instructions should be reviewed to place more emphasis and give more direction on the use of gas detectors, especially given the Fire Service's recent purchase of 200 additional gas detectors.
57. The Fire Service hazmat-command vehicle was established as the incident control point at the second alarm stage of the incident. It provided an effective focal point throughout the incident.
58. The hazmat-command vehicle was unable to maintain cellular data connection with the Fire Service computer network. Some of the local computer systems also failed on the day. Staff were required to fall back on tried and tested methods using manual systems. Despite these problems, the hazmat-command vehicle performed adequately over the duration of the incident.

## **30 Concluding statement**

Any one of nine factors could have averted the situation encountered at Icepak Coolstores, Tamahere:

- HSNO regulations applied fully to this installation
- prior notification to the Fire Service of hazardous substances at the premises
- receipt of an application for approval of an evacuation scheme
- pre-incident planning and familiarisation visit by local Fire Service staff
- Fire Service awareness of the large-scale use of flammable refrigerants in New Zealand
- warning signage at the premises
- stenching agent present in refrigerant gas
- flammable gas detection on the premises alerting crews
- crews using a portable gas detector.

This indicates that the fundamental cause of the incident may lie in part in systemic defects in the regulatory environment and the communication between the various regulatory agencies. This is an issue that may deserve wider investigation by the Government.

## **PART 7: RECOMMENDATIONS**

The inquiry team's recommendations concerning the Icepak fire are grouped according to their relationship to the following categories:

- the regulatory environment as a factor in the cause of the explosion and fire (3 recommendations)
- preparedness of the Fire Service (6 recommendations)
- Fire Service response and management (2 recommendations).

### **Regulatory environment as a factor in the cause of the explosion and fire**

1. The Hazardous Substances and New Organisms (HSNO) regulations and standards should be amended so that stationary refrigeration systems, and the refrigerant they contain, are subject to appropriate controls. The Fire Service Commission should take this issue up urgently with the Environmental Risk Management Authority and the Ministry for the Environment.
2. All large-scale flammable gas installations should by law require inclusion of stenching agents in the gas to promote safety of all persons affected by activities involving those substances, including users, firefighters, and the public. The Fire Service Commission should also take this issue up urgently with the Environmental Risk Management Authority.
3. The regulatory regime as a whole should be reviewed to promote the sharing of information about hazardous substances between regulatory and other interested agencies. The Fire Service Commission should take this issue up urgently with the Government.

### **Preparedness of the Fire Service**

4. The National Commander and the National Rural Fire Officer need to undertake an analysis of current rural/urban fire legislation in relation to risk planning and control of fires in buildings throughout New Zealand. This analysis would be designed to clarify responsibilities and provide clear guidance to fire officers on the practical application of the legislation.
5. The National Commander should promote inter-agency sharing of information about buildings using nationally consistent formats. This information sharing should include fire alarm monitoring companies to ensure that they have the correct addresses for premises.
6. The National Commander should undertake a review of pre-incident planning processes to identify buildings that currently are not being captured in operational plans. This should include buildings outside the urban fire district.

7. The National Commander should review the current instruction on significant incident and post-incident support. Preparedness for supporting Fire Service staff emotionally affected by an incident such as this one should be formalised. Such preparedness would include:
  - capturing and documenting good practice put into place at Hamilton
  - investigating crisis management training for senior officers
  - trigger points for automatically relieving local management
  - deployment of a skilled media team to support local management.
8. The National Commander should review policy to ensure that privacy concerns over next-of-kin details are balanced against the need to contact families in the event of a serious incident.
9. The National Commander should review operational instructions to improve guidance to firefighters on the use of gas detectors, provide more detailed information and guidance on the range of refrigerants in use in New Zealand, and include guidance on seeking advice before attempting to control leaks of unknown substances.

#### **Fire Service response and management**

10. The National Commander should request the investigation of a more robust form of connection from the hazmat-command vehicle into Fire Service data systems.
11. The National Commander should establish formal security and scene handover procedures for major fires.

## **PART 8: APPENDICES**

- Appendix A: Terms of Reference
- Appendix B: Glossary
- Appendix C: Resource and building consents for Icepak Coolstores, Tamahere
- Appendix D: Guides and standards for coolstore design
- Appendix E: Standards and guidelines for use of hydrocarbon refrigerants
- Appendix F: Supporting data for the site investigation
- Appendix G: Comments by the Chief Executive on the inquiry team's draft report

## **Appendix A: Terms of Reference**

### **Inquiry into the Icepak Coolstore Explosion and Fire**

#### **Terms of Reference**

##### **Background**

On 5 April 2008 at approximately 1600hrs Hamilton fire station responded two four-person crews to a reported incident at Icepak Coolstore at Tamahere, some 12 kms from Hamilton. At approximately 1630hrs, whilst the crews were making entry to the facility, an explosion occurred and all eight responding firefighters sustained severe injuries. One officer subsequently died and at the time these terms of reference were issued one other remained in a critical condition in hospital with the others listed variously as in serious, stable or discharged condition. Following the explosion, fire engulfed the facility. The coolstore facility was extensively damaged and a new type 3 fire appliance was also lost in the incident.

##### **Comprehensive Inquiry**

The National Commander has responsibility under section 170(b) of the Fire Service Act 1975 to ensure that the NZ Fire Service is maintained in a state of operational efficiency. The Chief Executive also has responsibilities for workplace safety under the Health and Safety in Employment Act 1992.

The National Commander's Operational Instructions require the NZ Fire Service to undertake reviews and investigations into a range of serious incidents or near misses. These include:

- Formal Operational Reviews of all significant or major incidents;
- Fire Investigations into all fires involving significant loss or where the cause is suspicious; and
- Accident Investigations involving incidents where staff suffer serious harm or narrowly avoided serious harm.

The Icepak Coolstore incident requires investigation under all three categories. In order to minimise the potential for overlap and duplication, I have with the support of the NZ Fire Service Commission appointed a single group of expert persons to inquire into and produce a comprehensive report on:

1. The cause of the explosion and fire at the facility.
2. The general preparedness of the NZ Fire Service to manage such an incident.
3. The NZ Fire Service's response to, and subsequent management of, the incident.



## **Inquiry team**

I have exercised my powers as National Commander to initiate this inquiry but have decided it is appropriate for me to stand back from the inquiry and to appoint a suitably qualified team to undertake it without any involvement by me. The inquiry team will be:

Paula Beever, PhD CEng, BSc (Hons), FIPENZ, FIEAust, MSFPE, MIFireE (inquiry leader):

- National Director, Fire Risk Management for the NZ Fire Service.
- International standing in fire engineering discipline.
- Particular qualifications in combustion science.

Paul McGill, MA, MCGI, MIFireE:

- Director of Operations and Training, NZ Fire Service.

Paul Henderson, MBA, BA (Hons), MIFireE:

- Joined the NZ Fire Service in August 2007. Previously Chief Fire Officer of the Durham and Darlington Fire and Rescue Service, UK
- International experience in inquiries.

Steve Warner:

- President, New Zealand Professional Firefighters Union.

Given the nature of the incident and the high level of public interest I have invited an experienced and respected independent fire investigator from the New South Wales Fire Service in Australia to assist and advise the site investigation team. That team will report to the inquiry team. The inquiry team will also have access to such other independent specialist advice and assistance as may be required.

The team may take any reasonable steps to carry out the inquiry to the necessary standard and within the nominated timeframe.

## **Purpose of the Inquiry**

The purpose of the inquiry is to **understand** the cause of the incident, to **assess** the preparedness of the NZ Fire Service to respond to such an incident, and to **learn** from the operational response; all with a view to minimising the risk of such an incident being repeated in the future.

It is expressly not the purpose of this inquiry to attribute fault, blame or liability.

## **Specific Terms of Reference**

### (1) The Cause of the Explosion and Fire

The inquiry will include a detailed forensic examination of the incident, and the report will address:

- The location, design and use of the facility
- The provision of water for firefighting
- The construction materials including the insulation panels
- The passive and active safety features of the facility
- Building consent and warrant of fitness compliance history
- The origin of the explosive atmosphere within the building
- The ignition event
- The fire development

- The contribution of the coolstore contents to the explosion and fire
- Best practice on coolstore design and construction to (a) minimise the risk of fire and (b) provide a safe environment in which to fight a fire.

(2) The preparedness of the NZ Fire Service to manage such an incident

The inquiry and report will address:

- The National Commander's instructions and local instructions to manage this class of incident
- Personnel training and qualifications
- Pre-incident planning and familiarisation
- Personal Protective Equipment (PPE) and other equipment and resources
- Pre-determined responses

(3) The Fire Service response to, and management of, the incident

The inquiry and report will address:

- The notification of the incident
- Communications Centre response
- The information available to the crews on arrival at the facility
- Size-up and command and control procedures initiated at the facility
- Factors pertaining to the decisions made at the incident
- Escalation of alarm levels
- The proximate cause(s) of the injuries sustained by the 8 firefighters
- Management of ongoing incident
- Water supplies
- Communications to staff, families of injured employees
- Communications to the public, media
- Liaison with local government, health officials, and other agencies
- Use and performance of PPE and other equipment and resources
- Any other matters the inquiry team considers had a material bearing on the cause, progression or outcome of the incident, including, inter alia, the extent and adequacy of the National Commander's instructions.

**Inquiry Principles**

The inquiry will be carried out in accordance with the following principles:

- Honest communication with all concerned to maintain confidence in the integrity of the inquiry process.
- Objective and unbiased approach.
- Not blame-focused.
- Constructive evaluation for future improvement.

**Inquiry powers, procedures, and reporting**

The inquiry team will have full access to all NZ Fire Service personnel and records for the purposes of the inquiry. I have directed that all staff provide full assistance to the inquiry team.

The team may determine its own procedures including whom it will interview and what submissions (if any) it will call for, but the procedures it adopts must follow the principles of procedural fairness and best public sector practice.

The inquiry team will maintain confidentiality at all times, except to the extent necessary for the purposes of the inquiry and procedural fairness, and will keep all of its notes, interim conclusions and drafts confidential to itself. The inquiry team will report on the above terms of reference and make such recommendations as it considers appropriate. The team may also report on such other matters arising from the inquiry as the team, at its discretion, thinks fit. I expect the conclusions and findings of the report to be robust and defensible.

The inquiry team will submit a draft report to the Chief Executive within 90 days of these terms of reference coming into effect. The Chief Executive will provide comments on the report within ten days of receiving it. The inquiry team will then have regard to the comments of the Chief Executive, finalise its report and deliver it to the NZ Fire Service Commission.

### **Other inquiries**

There may be a Coroner's inquiry and/or inquest into the fatality. The Department of Labour may conduct its own investigation into the incident. Other inquiries and investigations are possible.

I expect the inquiry team to consult closely with the Coroner and the Department of Labour, and to liaise with other investigating agencies and persons, to help ensure that all necessary inquiries and investigations into the incident can proceed expeditiously; to address any potential overlaps with other agencies' jurisdictions; to promote co-operation and exchange of information and evidence where appropriate, possible and practicable; and to minimise the stress of repeated interviews on witnesses and other affected persons.

**Mike Hall AFSM, F.I. Fire E., FNZIM**

**Chief Executive and National Commander, NZ Fire Service**

**14.4.2008**

## Appendix B: Glossary

This glossary includes terms and abbreviations used in this report, especially those that relate mainly to Fire Service business.

Term	Definition/explanation
AFRC	assistant fire region commander
BA	See breathing apparatus
BOD	See biological oxygen demand
biological oxygen demand	A measure of the amount of oxygen needed by aquatic organisms to break down solids and other readily degradable organic matter present in waste water. The BOD of drinking water is less than 1 mg/litre. BOD is not an accurate quantitative test; rather, it is an indication of the quality of a water source.
breathing apparatus	Breathing apparatus is self-contained equipment worn by firefighters to provide breathable air in a hostile or irrespirable environment. BA consists of a high-pressure tank, a pressure regulator, and an inhalation connection. It is mounted on a carrying frame.
building code	The New Zealand Building Code is a schedule to the Building Regulations 1992. It is a performance-based code that provides requirements for compliance with the Building Act in construction of a new building or alteration of an existing one. The building code sets out performance standards that building work must meet, and covers aspects such as structural stability, fire safety, access, moisture control, durability, services, and facilities. The code is divided into clauses each with specific performance criteria.
CIMS	See Co-ordinated Incident Management System
CISM	See critical incident stress management
CFO	chief fire officer
Comcen	See communication centres
communication centres	There are three joint Fire Service/police communication centres located in Auckland, Wellington, and Christchurch. The prime role of these communication centres is to receive emergency calls, to dispatch the appropriate resources, and to maintain communications during incidents.
compliance documents	Compliance documents are published by the Department of Building and Housing and contain building methods known as “acceptable solutions”, which are intended to assist people to comply with the building code. (See building code.) They are not mandatory, and “alternative solutions” may be used provided performance standards are met.
Co-ordinated Incident Management System	The Co-ordinated Incident Management System has been used by emergency services in New Zealand since 1998. CIMS is now used widely across Government agencies. It involves teamwork, common terminology and operating structures, the integration of communications, and other management requirements to deliver emergency management. Different agencies can work together stabilising an incident and protecting life, property, and the environment. CIMS can be scaled up or down to deal with varying types of incident.

<b>Term</b>	<b>Definition/explanation</b>
critical incident stress management	Critical incident stress management is designed to help people deal with traumatic or stressful events in their role. The Fire Service's structured CISM programme involves health professionals and selected firefighters who are trained as peer supporters.
deflagration	An explosion with a propagation front travelling at subsonic speeds (as compared with supersonic detonation).
DCFO	deputy chief fire officer
EECA	Energy Efficiency and Conservation Authority
EPS	expanded polystyrene
ERMA	Environmental Risk Management Authority
exposure	Property near fire that may become involved by transfer of heat or burning material from main fire, typically by convection or radiation. May range from 13 m to several kilometres, depending on size and type of fire or explosion.
fire appliances	The following fire appliances feature in this report.
- hazmat-command vehicle	The hazmat-command vehicle is Fire Service vehicle that combines the features of a specialist hazardous materials vehicle and an incident command vehicle.
- hydraulic platform	The hydraulic platform is a hydraulically powered extension boom mounted on a fire appliance, with a caged platform on the end in which firefighters can stand. Such platforms are used for rescue purposes and for directing water onto a fire from an elevated position.
- Type 4	The Type 4 is Fire Service vehicle combining the features of a standard fire engine and an aerial appliance. It has a 17 m hydraulically powered extension ladder with a large nozzle mounted at the top through which water and foam can be supplied.
FHC	fire hazard category
firecell	A firecell is a space within a building that is enclosed by a combination of fire separations, external walls, roofs, and floors. It may be on a single level or on different levels within a building. The floor area of a firecell may be unrestricted if it is protected by an automatic fire sprinkler system (designed and installed to the appropriate New Zealand Standard). A building with only one floor may be one firecell if 15 percent of the roof area is designed to provide effective fire venting.
FireNet	The intranet of the New Zealand Fire Service. Operational instructions are published and updated on FireNet.
FRM	fire region manager/commander
hazmat	hazardous materials
hazmat-command vehicle	See fire appliances
HSE Act	Health and Safety in Employment Act 1992
HSNO	Hazardous substances and new organisms, in particular relating to the Hazardous Substances and New Organisms Act 1996 and associated regulations.
hydraulic platform	See fire appliances
ICAD	See Intergraph Computer Aided Dispatch system
Intergraph Computer Aided Dispatch system	The Intergraph Corporation supplies the computer aided dispatch system used in the joint Fire Service/police communication centres.
LPG	liquefied petroleum gas
MIE	See minimum ignition energy

<b>Term</b>	<b>Definition/explanation</b>
minimum ignition energy	The minimum energy that can ignite a mixture of a specified flammable material with air or oxygen, measured by a standard procedure. There are several standard procedures for determining MIE of dust clouds, solvent vapours, and gases. The common element in all procedures is that the energy is generated by an electrostatic spark discharge released from a capacitive electrical circuit.
monitor	A large ground-based or apparatus-mounted nozzle through which large amounts of water can be flowed. This device can often be operated remotely.
National Commander	Day-to-day management of the Fire Service is in the hands of the Chief Executive and National Commander. As the administrative head, the Chief Executive is responsible to the Fire Service Commission for the general conduct of the Fire Service and its efficient, effective, and economical management. The National Commander is the operational head of the Fire Service responsible for the prevention, suppression, and extinction of fires and the safety of persons and property endangered by fire. The current Chief Executive and National Commander is Mike Hall.
National Rural Fire Authority	The National Rural Fire Authority is responsible for coordinating the rural fire management activities of New Zealand. Activities include rural fire control nationally, and promotion of training, research, and cooperation between the rural fire authorities. The New Zealand Fire Service Commission is also the National Rural Fire Authority for the purposes of the Forest and Rural Fires Act 1977. (See also New Zealand Fire Service Commission, rural fire authority.)
New Zealand Fire Service Commission	The New Zealand Fire Service Commission is a Crown entity constituted under the Fire Service Act 1975. The Commission exercises general control over the New Zealand Fire Service and is responsible to the Minister of Internal Affairs for the efficient administration of the Fire Service Act 1975. The Commission is also the National Rural Fire Authority for the purposes of the Forest and Rural Fires Act 1977. Both Acts are administered by the Department of Internal Affairs.
NZQA	New Zealand Qualifications Authority
OSM	operational skills maintenance
overpressure	A transient air pressure, such as the shock wave from an explosion, that is greater than the surrounding atmospheric pressure.
PDA	See predetermined attendance
personal protective equipment	Personal protective equipment refers to clothing, helmets, goggles, footwear, breathing apparatus, and other equipment designed to protect the wearer from harm.
PFA	See private fire alarm
PPE	See personal protective equipment
predetermined attendance	The predetermined attendance determines which fire appliances from which fire stations attend an incident. The PDA will differ depending on the seriousness of the incident, where the incident is located, and whether it is a fire in a structure, or a car accident, a hazardous substance spillage, a rescue, etc. PDA planning work is carried out to determine where the nearest and most appropriate appliances are located to attend any type of incident.
PRFO	principal rural fire officer
private fire alarm	A private fire alarm is a system installed in a building to alert occupants to an outbreak of fire. Many PFA systems are connected to the Fire Service or a monitoring company that will be automatically notified if a fire is detected.

<b>Term</b>	<b>Definition/explanation</b>
recognition of prior learning	Assessment that makes use of indirect evidence of achievement and/or evidence from activities that are undertaken without first requiring additional learning. The term “recognition” is meant to imply that skills and knowledge will be recognised by some form of assessment against established criteria.
RME	Resource Management Act 1991
RPL	See recognition of prior learning
rural fire authority	Rural fire authorities manage fire control for fire districts that lie outside areas under the control of the New Zealand Fire Service. They include the Department of Conservation for State areas, the Defence Force for most of its own lands, Rural Fire District Committees for specially gazetted areas, and territorial authorities for all areas that fall outside the above. (See also National Rural Fire Authority.)
SITREP	A situation report is a brief report transmitted to relevant persons and agencies to keep them informed on the status of an emergency incident.
SMS	See station management system
station management system	The station management system is a computer program developed for Fire Service use. It provides a single integrated application for most of the tasks and data that are used by operational personnel. It includes task and target planning and tracking, incident reporting, building information, risk plans, staff rostering, and training records.
stenching agent	Any substance that, when added to a hazardous substance, imparts to the hazardous substance an offensive stench that makes the product readily detectable.
Type 4	See fire appliances
watch	The New Zealand Fire Service uses a standardised watch system to maintain 24/7 staffing on fire stations with paid firefighters. There are four rotating watches, called Red, Green, Brown, and Blue Watches. Red Watch was on duty when the Icepak fire started.
waterway equipment	Waterway equipment is all equipment associated with the movement of water from its source to the fire.
WH	working high (This purpose group category of the building code refers to spaces used for working, business, or storage, with high fire load and slow, medium, or fast fire growth rates.)
WL	working light (This purpose group category of the building code refers to spaces used for working, business, or storage, with low fire load.)
VSO	volunteer support officer

## **Appendix C: Resource and building consents for Icepak Coolstores, Tamahere**

This appendix provides further detail relating to sections 9.3 and 9.4 of the report: the resource consents for the Icepak facility at Tamahere, as well as fire engineering designs and building consents.

### **Resource consents**

Table C1 summarises the resource consent history for the site.

The resource consent applications highlighted in Table C2 are those where Waikato District Council holds associated documentation; these files were reviewed in the course of the Fire Service inquiry. Relevant details from submissions and hearings on these three applications are summarised below, as well as the nature of a recent application for resource consent lodged in 2007.

#### *Resource consent 69/00/020 (2000)*

This consent consisted of an additional 531 m<sup>2</sup> coolstore area and a 153 m<sup>2</sup> canopy extension to be used for the storage of dairy produce as well as horticultural and agricultural products. It was an extension of the existing activities on the site and this addition increased the existing cool storage capacity from 7,800 m<sup>3</sup> to 11,800 m<sup>3</sup>.

Submissions opposing the development centred around the potential increases in traffic and heavy vehicle movement within the local area, poor aesthetics and visual outlook created by the new building additions, and an increase in noise production.

Further concerns highlighted the use of anhydrous ammonia as a refrigerant within the facility and the potential for refrigerant to leak, with toxic gases being released into the environment. This was viewed in the consent hearings by the applicant as unrealistic; he said that the refrigeration system was built to the best standards and was regularly and well maintained. It was also stated that annual inspections were made by appropriate authorities and that all fire safety requirements had been met.

Fourteen consent conditions were stipulated by Waikato District Council in granting this resource consent application. No consent conditions related to hazardous substances or to Fire Service-related matters.

#### *Resource consent 69/02/004 (2002)*

This application sought consent to erect an additional coolstore building consisting of a 540 m<sup>2</sup> coolstore and a 305 m<sup>2</sup> canopy.

Submissions opposing the development centred around the potential increases in traffic and heavy vehicle movement within the local area, poor aesthetics and visual outlook created by the new building additions, a perceived increase in noise production, use rights and zoning, and fire risk.



**Table C1: Application history for resource consents at the Tamahere site**

Consent No	Description
RMA 22/13/66	Erection of additional facilities for the sale of market garden produce, as a change of use in 1973.
RMA 22/13/317	To erect a new shop to replace the existing one and a coolstore and general storage area. Granted in 1979. Subsequently withdrawn.
RMA 22/13/439	To sell dairy and grocery lines from the property. Lodged with council but subsequently withdrawn.
RMA 22/13/455	To subdivide the area with buildings for transfer to Turners and Growers. Approved in 1982.
RMA 144/1/521	In 1984 a decision to decline an application to extend a depot was appealed.
RMA 144/1/700	To erect a building to enable the existing produce to be carried out fully under cover on part of Lot 1 DPS 10710 (area zoned for horticultural servicing). Approved in 1987.
RMA 69/96/011	An application for freezer storage and packing was lodged with council.
RMA 70/90/110	A subdivision consent of Part Lot 1 DPS 10710, Blk III into two lots – Lot 1 for a specific intensive use lot, and the balance of the area for horticultural services and preliminary processing of horticultural produce. Issued in 1990.
RMA 69/00/020	In September 2000, a land use consent for a non-complying activity to add a 531 m <sup>2</sup> addition to the existing coolstore and a 153 m <sup>2</sup> associated canopy was approved. This consent was completed, but was later cancelled and superseded with RMA 691353.
RMA 691353	Certificate of compliance issued on 7 November 2000, confirming existing use rights for the proposal to construct and operate a new coolstore building as well as provide five additional on-site car parking spaces.
RMA 69/02/004	In 2002 a non-complying land use consent was approved for an extension to the existing coolstore operation consisting of a 540 m <sup>2</sup> coolstore area and a 305 m <sup>2</sup> canopy.
RMA 69/03/020	In July 2003, consent was granted for two additional coolstore buildings and an associated canopy area. The two new buildings were each 590 m <sup>2</sup> ; the canopy was 230 m <sup>2</sup> .

Source: Waikato District Council.

**Table C2: Three resource consents reviewed by the inquiry**

Consent No	Date granted	Consent for
RMA 69/00/020	18 September 2000	Additional 531 m <sup>2</sup> coolstore area and a 153 m <sup>2</sup> canopy extension.
RMA 69/02/004	14 May 2002	Additional 540 m <sup>2</sup> coolstore area and a 305 m <sup>2</sup> canopy extension.
RMA 69/03/020	22 July 2003	Two additional coolstore buildings and an associated canopy area.

Source: Waikato District Council.

In relation to fire risk, one submission objecting to the resource consent application expressed concern at the potential for fire given the presence of a polystyrene-clad building structure, the presence of freon and ammonia, and the historical use of nitrogen. In addition, concern was expressed at the lack of provisions for firefighting; there were submissions that the council decide upon the appropriate water storage for a plant the size of Icepak, that all refrigeration plant have appropriate firewalls around them, and that gas leak monitoring equipment be installed that would automatically alert accredited repair companies.

In response to those concerns it was stated at hearings committee meetings that all possible precautions were taken to ensure that the design and operation of the facilities minimised the potential for fire. As to the safety of the plant on site, plant was tested annually and the company had an evacuation plan. With respect to whether the presence of ammonia gas presented any issue, it was said that there was insufficient ammonia gas on site to create any problem.

Thirteen consent conditions were stipulated by Waikato District Council in granting this resource consent application. No consent conditions related to hazardous substances or to Fire Service-related matters.

*Resource consent 69/03/020 (2003)*

This application sought to gain consent for the construction of two new cool storage buildings and an associated canopy. The two new buildings, each 590 m<sup>2</sup>, were intended to provide four additional storage spaces, two per building, to expand the existing adjacent coolstore operation. The canopy of 230 m<sup>2</sup> was intended to provide cover between the two new buildings for all-weather loading and unloading of vehicles.

Submissions opposing the development centred around existing zoning conditions, safety issues for Tamahere School, increased sound and traffic concerns, further future planning applications, increased hours of operation, fire risk, and a dangerous goods risk. Concerns were also raised regarding the lack of an extra water supply to mitigate the perceived fire risk for firefighters and potential risk to nearby residential properties. Council's resource consent documentation highlighted that a fire design philosophy statement would be required at the time of building consent application and that the buildings would have to comply with the relevant requirements for fire safety. It was viewed that this statement would address the fire risk arising from the development and how such risk would be mitigated.

Nineteen conditions were stipulated by Waikato District Council in granting this resource consent application. Of note in the resource consent conditions was a condition pertaining to hazardous substances. This stipulated that no hazardous substances that exceeded the quantities for permitted activities shall be stored or used on site without prior approval of council's district hazardous substance officer. This guidance is given in section 47 – Hazardous Substances, of the Waikato District Plan 1995.

*Resource consent LUCO361/07*

Waikato District Council also received a fourth resource consent application (LUCO361/07) in 2007. The proposal included the establishment and operation of a four-cell cold store and associated plant room adjacent to the existing cold store to the north-west of the site. It was proposed that this new cold store facility would be used in conjunction with the existing site storing produce and products as bulk storage with a capacity of an additional 7,520 pallets. The proposed gross floor area of the cold store was 3,542 m<sup>2</sup>, with the plant room being 50 m<sup>2</sup>.

## **Fire engineering designs and building consent history**

The documentation held by Waikato District Council shows that three fire engineering designs were completed for buildings on the site since 2002 (in 2002, 2004, and 2005).

In 2002, fire report reference number O3202 (8 February 2002) was for a new 510 m<sup>2</sup> single-level building to be used as a coolstore for storing fruit. A new 302 m<sup>2</sup> canopy was also proposed for the front of the coolstore. The fire report said that the purpose of the coolstore was to store fruit, and therefore it was designed as an FHC 1 facility, with a design occupancy stated as five people.

The primary method of construction was James Hardie Bondor insulation panel.

The design of fire report reference number 27404 (30 November 2005, issue 4) was for the construction of two new coolstores attached to each other and divided into five rooms. The buildings were also designed with the intention to have racking systems in excess of 3 m in height. The coolstores were stated to be FHC 4 facilities.

The construction of this building as described in the fire report was steel portal framing supporting Bondor or Equibond EPS panels. The fire report specified that each coolstore room was designed for fewer than 10 people. The fire report made no mention of the plant room, the blast freezer, or any activities associated with these spaces. Nor did it refer to the use of coolants, LPG, or any other hazardous substance. Although refrigeration is a process integral to the site, the report is generic in its approach to the building and its features. Waikato District Council commented to the inquiry team that, as the new coolstores were not part of the existing building, the plant room, blast freezer, and associated activities in the existing building did not have to be reviewed in conjunction with the construction of the new building.

The fire report assesses the length of escape routes. It goes on to say that the building has been designed as a WH-purpose group (these are spaces used for working, business, or storage, with high fire load and slow, medium, or fast fire growth rates), but that the means of escape had been assessed as an IA-purpose group. An IA-purpose group is defined in C/AS1 as “Spaces for intermittent occupation or providing intermittently used support functions – *low fire load*”. If the building is designed as a WH-purpose group, then it follows that that group should be used as the basis for designing the means of escape.

All of the fire reports said that the designs were carried out in line with the compliance documents to the New Zealand Building Code, clauses C1–C4 Fire Safety as prepared by the Department of Building and Housing. They all appeared to have been designed as single firecells.

The 2004 and 2005 fire reports referred to bulk storage of goods to a height in excess of 3 m and referred to the building being FHC 4. C/AS1 requires specific fire engineering design in this regard. However, the fire reports did not assess this requirement. Waikato District Council issued building consents for the buildings as being compliant, even though the designs did not comply with the specific fire engineering design requirements. The council commented to the inquiry team that specific fire engineering may have been necessary for the S rating and for the firecell floor area size (if effective fire venting was not to be provided). It should be noted, however, that the fire did not originate from this building.

The fire reports specified that signs complying with clause F8 of the building code were to be fitted to specific areas within the buildings. Of note is the reference in the reports to the fitting of signs to “Potential Hazards such as dangerous goods and electrical hazards”. Nevertheless, no further assessment was made of such hazards and the presence of hazardous substances that were intended to support the processes of the Icepak site. The council commented to the inquiry

**Table C3: Building consent application history at the Tamahere site**

Building consent/permit number	Description of works	Date issued	Code compliance certificate issued/ permit completed
BCo182/04	Coolstore building	28 July 2004	13 June 2007
95740	Office additions	18 July 2002	17 January 2003
94986	Coolstore building	12 August 2002	16 January 2003
93353	Replacement septic tank	8 November 2000	27 November 2000
93017	Coolstore addition	1 December 2000	25 July 2001
85963	Partition existing building and office addition	1 December 2000	31 January 2001
74916	Freezer/coolstore	23 June 1994	21 May 1999
Do15750	Pump and power house	21 March 1986	4 April 1986
Co73404	Boiler house	10 October 1985	20 November 1985
57/7762A and 57/7763A	Plumbing and drainage to new alterations	17 December 1984	
B114395	Packing shed	19 September 1984	25 April 1985
Bo18886	Sign – freestanding	14 October 1983	19 October 1983
Bo18663	Alterations to store (internal)	8 June 1983	Completed (no date)
A25936	Storage shed	30 June 1982	14 April 1983
B114360	Freezer room	5 September 1984	No inspections carried out – unauthorised building notice sent
Jo60863	O'Neill building – coolroom	19 August 1980	15 September 1981
Jo72839	Shop packhouse	19 October 1979	January 1980
H50622	O'Neill building – storage shed	15 September 1976	September 1976
Gl08049	O'Neill building – storage shed	13 August 1975	October 1975
E62806	Extension to shop	19 October 1972	10 January 1973
E72362	Haybarn-type store/implement shed	27 February 1973	No date entered
A074785	Implement shed	Rec'd 14 Jan 1969	No date entered
A048464	Dwelling and garage	Rec'd 8 April 1968	No date entered
A018145	Roadside stall toilet (shop)	Rec'd 18 Sept 1967	No date entered
Bo81197	Greenhouse	Rec'd 26 April 1967	No date entered

Source: Waikato District Council.

team that it relied on statements by Icepak, at the resource consent stage, that there were no health and safety issues arising from the presence of dangerous goods.<sup>26</sup>

<sup>26</sup> Note: LPG substances were transferred from the previous “dangerous goods” regime to the HSNO regime in 2004; see the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004. The “hazardous substances” terminology, and the HSNO requirements, applied from that time.

Part 8 of C/AS1 refers to provisions for firefighting. Although the 2002 fire report referred to this for Fire Service access arrangements, the reports did not address firefighting in any other way. (Although not required by the building code or the council's own requirements, no reference to firefighting water supplies or dialogue with the Fire Service was evident in the documentation.)

Building consents relating to the incident site are summarised in Table C3.

## Appendix D: Guides and standards for coolstore design

A brief description of useful publications on the topic of coolstore design is tabulated below.

Reference sources for coolstore design	Description and comment
<p><i>Guide on Design, Construction, Specification and Fire Management of Insulated Envelopes for Temperature Controlled Environments.</i> International Association for Cold Storage Construction (European Division).</p>	<p>This guide was introduced in 1999 by the International Association for Cold Storage Construction (European Division) (IACSC), the international representative organisation for the cold storage industry.</p> <p>The guidelines present recommendations for insulated envelope structures including their design, maintenance, construction, and fire safety management. The guidelines relate mainly to the use of large insulated sandwich panels forming the insulated envelope.</p>
<p><i>FPA Design Guide for the Fire Protection of Buildings, Stand-Alone Cold Stores 1: Design Principles.</i> Fire Protection Association, UK.<sup>1</sup></p>	<p>The aim of the FPA Design Guide is to provide loss prevention guidance for those who design and construct industrial and commercial buildings.</p> <p>This design guide was published in 2004 and includes guidance relating to arson prevention, maintenance programmes, smoke control, fire resistance and compartmentation, refrigeration defrost systems, and management of fire safety. The guidelines highlight the surveying of risks associated with such structures through quantitative assessment methods.</p> <p>This document is one of a number that go to make up the <i>FPA Design Guide for the Fire Protection of Buildings</i>, a development from the <i>LPC Design Guide for the Fire Protection of Buildings 2000</i>.</p>
<p>The Food Storage and Distribution Federation (FSDF) in the UK has several guidelines of note.<sup>2</sup> Three are listed here:</p>	
<p><i>Guidance on the assessment of fire risk.</i></p>	<p>Guidance on how to undertake fire risk assessments, what to look for, and how to identify problem areas.</p>
<p><i>Guide to the Management and Control of Fire Risks in Temperature Controlled Structures of the Refrigerated Food Industry.</i></p>	<p>This guide is published by FSDF. The publication gives guidance on how to manage and control fire risks, preserving life, property, and business.</p>
<p><i>Fire risk minimisation guide for the food industry.</i></p>	<p>This guide is published by the Food Industry Panels Group (FIPG), a broad consortium of trade associations in the food manufacturing, storage, and distribution sectors. The guidance provides information on controls relating to people, processes, and the premises involved.</p>

Reference sources for coolstore design	Description and comment
<p><i>The RFIC Guide to the Management and Control of Fire Risks in Temperature Controlled Structures of the Refrigerated Food Industry.</i> Refrigerated Food Industry Confederation.</p>	<p>The aim of this document is to provide guidance to managers operating insulated buildings in the cold storage and food processing industry. The recommendations given in this guide apply to fire safety in</p> <ul style="list-style-type: none"> <li>• buildings used for the preparation of food including cooking</li> <li>• factories for the processing and packaging of food</li> <li>• cold stores used for the storage of loose or packaged frozen or chilled foods</li> <li>• regional distribution centres (RDCs) of the retail food industry</li> <li>• large retail outlet cold rooms (in excess of 250 m<sup>3</sup> volume).</li> </ul>
<p>BS 5502-72:1992, Buildings and structures for agriculture. Code of practice for design and construction of controlled environment stores for vegetables, fruits and flowers.</p>	<p>This British standard was published in April 1992. The standard provides recommendations for buildings for the storage of produce under controlled temperature, humidity, and atmosphere conditions.</p>

<sup>1</sup> <http://www.thefpa.co.uk/Shop/Product+Categories/Design+Guide+-+Premises-specific/Stand+alone+Cold+Stores+Design+Principles.htm>. <sup>2</sup> <http://www.fsd.org.uk/index.php?p=5/8/o>

## **Appendix E: Standards and guidelines for use of hydrocarbon refrigerants**

Numerous international standards and guidelines cover the use of hydrocarbon refrigerants. They provide guidance on safe design of systems containing hydrocarbon refrigerants, as well as considerations on key factors such as building occupancy (for example industrial or domestic), room size, and refrigerant charge. Choice of suitable electrical equipment is covered as an essential difference between systems that use flammable and non-flammable refrigerants.

The following list includes those standards and guidelines most commonly applied or consulted in New Zealand.

AS/NZS 1677.1:1998 Refrigerating systems – Refrigerant classification.

AS/NZS 1677.2:1998 Refrigerating systems – Safety requirements for fixed applications.

BS EN 378-1:2000 Specification for refrigerating systems and heat pumps. Safety and environmental requirements. Basic requirements, definitions, classification and selection criteria.

BS EN 378-2:2008 Refrigerating systems and heat pumps. Safety and environmental requirements. Design, construction, testing, marking and documentation.

BS EN 378-3:2008 Refrigerating systems and heat pumps. Safety and environmental requirements. Installation site and personal protection.

BS EN 378-4:2008 Refrigerating systems and heat pumps. Safety and environmental requirements. Operation, maintenance, repair and recovery.

American Society of Heating, Refrigeration, and Air-Conditioning Engineers, Inc. (ASHRAE) publications:

*ASHRAE Handbook – Refrigeration, 2006*

ANSI/ASHRAE Standard 15-2007, Safety Standard for Refrigeration Systems

ANSI/ASHRAE Standard 34-2007, Designation and Safety Classification of Refrigerants.

*Guidelines for the use of Hydrocarbon Refrigerants in Static Refrigeration and Air Conditioning Systems*, Air Conditioning and Refrigeration Industry Board (ACRIB), UK, 2001.

*Safety code for compression refrigerating systems – utilizing group A3 refrigerants*, 2001, Institute of Refrigeration, Carshalton, Surrey, UK, 2002.



## Appendix F: Supporting data for the site investigation

This appendix includes calculations concerning the explosion and fire on 5 April. The information is supplementary to the full account in Part 4 of the report.

Table F1 shows idealised pressure calculations for the blast freezer door (see section 20.5) and other exhibits listed in Table 4 (section 21.1).

**Table F1: Idealised pressure calculations for explosive force relating to items of evidence on site**

Physical details of exhibits		
Surface area of 50 mm panels	6 m × 1.2 m	7.2 m <sup>2</sup>
Mass of each panel	7.2 × mass per m <sup>2</sup>	
Mass per m <sup>2</sup>	50 mm panels	10.15 kg
Mass per m <sup>2</sup>	200 mm panels	13.88 kg
Displacement force = mass × distance projected (ignoring separation moment and aerodynamic configuration)		
For Exb 1		
Mass	10.15 kg/m × 7.2 m <sup>2</sup>	73.08 kg
Distance		53 m
Force required	73.08 kg × 7.2 m <sup>2</sup> × 53 m	27887 Nm <sup>2</sup> m
		<b>27.887 kPa</b>
For Exb 2		
Mass	10.15 kg/m × 7.2 m <sup>2</sup>	73.08 kg
Distance		50 m
Force required	73.08 kg × 7.2 m <sup>2</sup> × 50 m	26309 Nm <sup>2</sup> m
		<b>26.309 kPa</b>
For Exb 3		
Mass	10.15 kg/m × 7.2 m <sup>2</sup>	73.08 kg
Distance		78 m
Force required	73.08 kg × 7.2 m <sup>2</sup> × 78 m	41041 Nm <sup>2</sup> m
		<b>41.041 kPa</b>
For Exb Blast freezer door		
Area	2.4 m × 3.0 m	7.2 m <sup>2</sup>
Mass	13.88 kg/m × 7.2 m <sup>2</sup>	100.0 kg
Distance		27 m
Force required	100.0 kg × 7.2 m <sup>2</sup> × 27 m	19440 Nm <sup>2</sup> m
		<b>19.440 kPa</b>

See text of Part 4, sections 20.5 and 21.1.

Figures F1 and F2 present the calculations for possible scenarios in the build up of an explosive atmosphere in Plant Room 1 as a result of refrigerant leaking from a pipe as discussed in section 21.3. They allow for a range of pipe diameter and lower and upper flammable limits for the atmosphere.

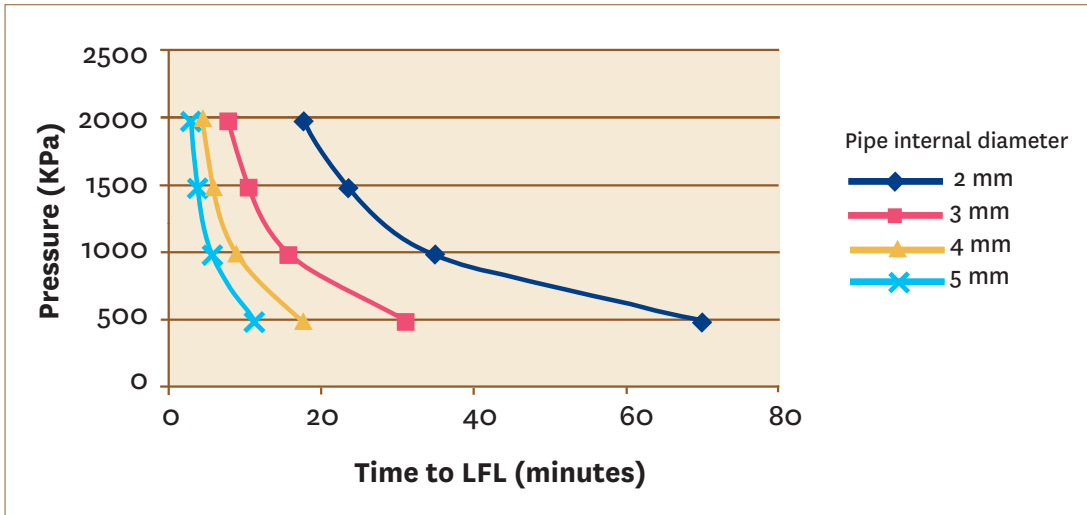


Figure F1: Times for build up of an explosive atmosphere in the plant room (lower flammable limit)

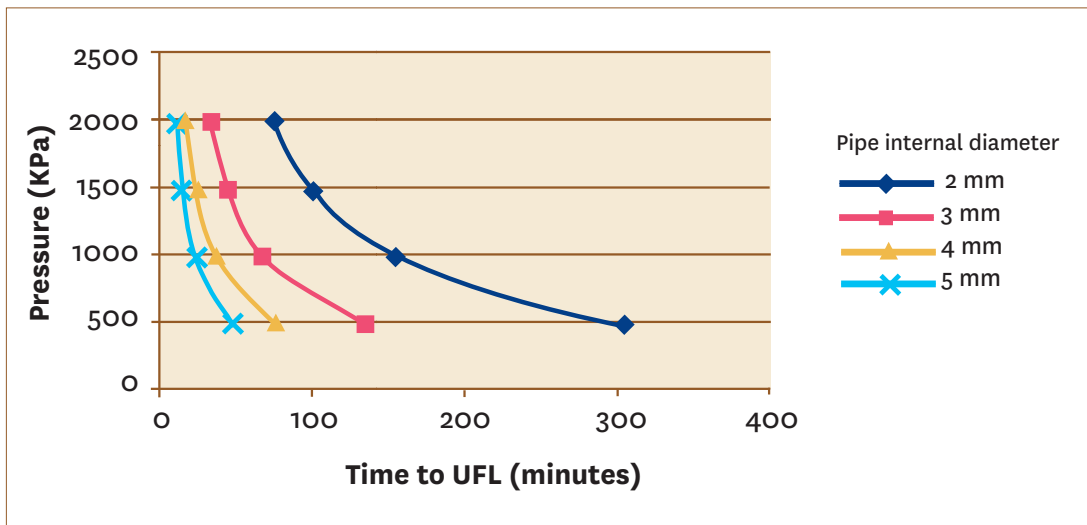


Figure F2: Times for build up of an explosive atmosphere in the plant room (upper flammable limit)

## **Appendix G: Comments by the Chief Executive on the inquiry team's draft report**

Appended below (pages 151–155) is a document with the comments of the Chief Executive of the New Zealand Fire Service on the draft report submitted to him by the inquiry team on 12 August 2008 in accordance with the terms of reference.

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### **CHIEF EXECUTIVE'S RESPONSE TO THE DRAFT REPORT ENTITLED "INQUIRY INTO THE EXPLOSION AND FIRE AT ICEPACK COOLSTORES, TAMAHERE, ON 5 APRIL 2008"**

On Saturday 5<sup>th</sup> April 2008 a serious explosion and subsequent fire occurred at the Icepack Cool Store facility in Tamahere near Hamilton. This resulted in the death of one firefighter, and serious injury to seven others, along with the total destruction by fire of approximately 90% of the facility.

As a result of the incident, the Chief Executive (CE) of the New Zealand Fire Service (NZFS) appointed a four person team to look into the circumstances of the incident and provide a draft report (the report) within 90 days. This period was later extended by a further 30 days to allow for a number of complexities surrounding the report's compilation.

The report is based on the terms of reference (TOR) provided by the CE to the team. Given that the roles of CE and National Commander (NC) of the NZFS reside within the same person, it was determined at the outset that the correct course of action was to preserve the separation of responsibilities by presenting the CE with the report for comment, prior to the inquiry leader, Dr. Beever, presenting the report to the Fire Service Commission (the Commission).

This document represents the CE's comments on the report as outlined in the above process.

## **The Report and the Terms of Reference**

The TOR for the report were compiled under legal guidance to ensure that they encompassed the scope that would be expected by the Commission and the public, and under the following four key principles:

- Honest communication with all concerned to maintain confidence in the integrity of the inquiry process
- Objective and unbiased approach
- Not blame-focussed
- Constructive evaluation for further improvement

The CE is satisfied that the report has complied with these principles and has properly addressed the broader requirements of the TOR.

The CE recognises that the report, as produced, is the end product of a considerable effort by a number of people, especially the inquiry team members, who have worked tirelessly to produce such a comprehensive report in a compressed time scale.

## **General comments**

When reading the report, it is necessary to recognise that the inquiry team did not have any legal powers to require information from parties relevant to the inquiry. This means that information may yet come to light that is relevant to the inquiry and the report. Nevertheless, in the broader sense, there is enough clarity and breadth of evidence to support the recommendations of the report, and to proceed to act thereon.

## **Chief Executive's response to recommendations**

As is the case in most tragedies, the causes are complex and lie in a chain of interlocking failures, each of which, in itself, would not have resulted in the Tamahere incident. This is revealed in the "Concluding Statement" of the report. Had any one of these nine factors been complied with, the tragedy would not have occurred.

For the purposes of responding to the report at large, responses will be made below in report order to each of the recommendations in PART 7.

### "The regulatory environment as a factor in the cause of the explosion and fire"

1. **Agreed.** The report comments on the vagaries around "sealed systems" which by implication are safe, and then notes that these systems might lose as much as 15% of their contents annually. Such systems are obviously not "sealed" and could quite easily become unsafe under some circumstances.
2. **Agreed.** Smelling a flammable gas stenching agent would be a key determinant in deciding on relevant operational procedures.
3. **Agreed.** The relevant information should move automatically between affected agencies or at least trigger an action requirement to notify affected agencies of circumstances which might concern them.

### "Preparedness of the Fire Service"

4. **Agreed in principle.** However, this is a complex matter that requires more consideration. On the face of it the recommendation is sound. However, there is little point in the NC and the National Rural Fire Officer (NRFO) coming to an agreement that confirms the responsibilities of the local Principal Rural Fire Officer (PRFO) for structural fire planning when that PRFO may have little experience or expertise in that area and limited resources available anyway. A whole range of agencies has spent the last 4 years at Government direction on just this subject, without resolution. As an interim practical measure, it should be possible to emphasise roles and responsibilities as outlined in current legislation and encourage appropriate agreements between the parties, to clearly delineate who will give effect to those accountabilities. But care will need to be taken to ensure that there is no loss of service to the community by overemphasising rural legislative accountability in areas ill-equipped to accept it, whilst encouraging those that are able to do the job (NZFS) to step away from their implied response role.

The CE's view is that, whilst the NC and the NRFO can deal with the short term details of the above, they cannot change legislation. It would seem to be a strategic task for the Commission to continue to press for the reform and integration of both Acts, the shortcomings of which have been further revealed by this incident.

5. **Agreed.** This is a recommendation of two dimensions. Interagency sharing of relevant information is a massive task, with a number of complex dimensions such as technology compatibility, information sensitisation (i.e. defining what needs to be shared in the first place), privacy issues etc. As we move into the

broader e-government arena these issues should be incorporated into such thinking. The NZFS should attempt to influence this process via involvement with the State Services Commission.

The second dimension, that of liaison with alarm companies, is easier to undertake and can commence immediately under NZFS direction.

6. **Agreed.** Commenced.
7. **Agreed.** Commenced.
8. **Agreed.** Commenced.
9. **Agreed.** Note that, as indicated in the report, a program to improve NZFS gas detection capacity was underway prior to this incident.
10. **Agreed.** In hand. It should be noted that the Hazmat/ICU used at Tamahere was a prototype vehicle for the Hazmat/ICU nationwide enhancement project. The limitations of commercial cell phone systems under emergency circumstances are well known. The new generation of vehicles about to go into service (the first to Christchurch within the month) have satellite phones and satcom dishes to ensure that they can operate independently anywhere in the country.
11. **Agreed.** Noted for action.

### **General comments**

A central issue in respect of the obligations of the NZFS is that pertaining to the matter of inspecting premises regarded as "special risks" and preparing a "tactical action plan" for same, when such premises lie outside the urban fire district. In this case, the legal obligation to ensure that such a plan existed appears to lie with the Waikato District Council. The most efficient way to give effect to these responsibilities would have been for the PRFO to contact the Chief Fire Officer of the Hamilton Fire District as the response agency to ensure that such planning took place. However, that this planning did not occur is unsurprising.

A feature of recent discussions regarding the development of "unitary" Fire and Rescue legislation for New Zealand was the failure to understand that fire issues in NZ cannot be simply confined to matters "urban" and "rural". In fact, matters strictly urban or strictly rural cause few problems. The issues arise in the "interface" areas between urban and rural. Council PRFO's may or may not have rural fire backgrounds or any fire background at all. Very few have any urban fire history. It is

not surprising, therefore, that they are conditioned to look after primarily rural interests. At the same time, the NZFS is legislatively responsible for structural fires only within urban fire districts, although it MAY respond outside the urban district. This factor will clearly impact on the prioritisation of inspection requirements for premises outside of urban districts. Two other factors will also impact on this. Firstly the distance of the premises outside of the urban district, and secondly whether the NZFS even knows the premises exists.

To avoid further confusion, the simple maxim "**If we are going to go, we need to know**" will be formally adopted to drive further NZFS operational and planning doctrine in these areas.

### **The good things in the report**

It is always tempting to concentrate on the room for improvement in any report such as this, and rightly so. However, it's worth noting some of the positive highlights of the report as an affirmation in general of the health of the NZFS. These include:

- The excellent performance of the level 2 protective clothing;
- The excellence of the incident command structures;
- The embedded use of CIMS in such a large scale multi agency incident;
- The sound performance of all agencies in environmental protection.

It would be remiss of me not to also mention the fortuitous proximity of very capable medical staff to the incident and the very positive effect this had on casualty outcomes, and the exemplary performance of the drivers of fire appliances Hamilton 411 and 412, who both performed to the highest traditions of the NZFS under extremely adverse conditions.

Mike Hall 

Chief Executive and National Commander

New Zealand Fire Service

Wellington

19.08.2008.

