FIRE EMERGENCY NEW ZEALAND
WHAKARATONGA IWI

ECONOMIC COST OF UNWANTED FIRE ALARMS

Business and Economic Research June 2019

Fire and Emergency NZ attends more than 20,000 false alarm calls annually in which false alarm callouts can comprise up to 50%-70% of the total callouts at some fire stations.

This research will provide a greater understanding of:

- International approaches to reduce unwanted alarms and their applicability in the NZ context
- the cost to Fire and Emergency NZ of these unwanted alarms
- the wider costs to New Zealand (lost productivity etc.) of these unwanted alarms

The results of this research will be used to inform our work in influencing legislative and practice change of other agencies, as well as informing our own work programmes.

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Economic cost of unwanted fire alarms

Poutū-te-rangi 2019

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Making sense of the numbers

Fire and Emergency New Zealand (FENZ) attend between 23,000 and 26,500 unwanted alarms annually, which places a considerable strain on the available emergency response resource, especially as many unwanted alarms tend to be concentrated in certain areas. At individual fire stations between 30-90 percent of all calls turn out to be unwanted alarms with most occurring in built up urban areas.

Unwanted alarms cause a range of costs which must be paid by the emergency services, building owners, tenants and the general public. Business interruption can be significant especially if there are production lines to be shut down and restarted, stock spoiled, and deadlines missed. Additionally, there are a range of other costs such as congestion, traffic accidents, job satisfaction for professional firefighters, and negative effects on volunteer firefighters, their families and employers.

In addition, Fire Risk Management Officers can expend considerable time and effort to engage with property owners and managers throughout the period of high alarm activations. Intangible costs such as staff frustration and growing complacency will tend to be exacerbated when so many unwanted alarms occur at the same site over such an extended period.

It is projected that the quantity of unwanted alarms will be reasonably static over time. Calls due to defective alarm systems or malicious interference are expected to decrease as alarm systems are improved, even as they become more numerous. Calls to 111 (good intent) are expected to increase as the population increases, and as a result of public engagement efforts by FENZ (Datamine, 2018). These two effects could cancel each other out, leading to the conclusion that the overall level will remain roughly constant.

There is an alternative possibility where the numbers of alarm systems continue to rise, and that through poor commissioning and maintenance they produce even more frequent unwanted alarms. New and improved technology cannot reduce unwanted activations alone, it relies on proper system design, installation and ongoing maintenance.

Existing incentives for the various parties involved in procurement, maintenance and use of alarm systems mean that there is not a common desire to see that the systems achieve maximum reliability.

As the number of fire alarm systems continues to rise, there is currently no regulation or requirement which will ensure that their reliability will be improved. This would tend to imply that the number of unwanted alarms from alarm systems will rise over time, along with those from good intent. The combination would result in a steady increase in the number of unwanted alarms.

Our assessment suggests that the ultimate outcome in terms of number of unwanted alarms could lie somewhere along this spectrum. In this light, further work to mitigate the risk of a rising number of unwanted alarms (and the costs therein) would be prudent.

This study suggests a combination of legislation, management systems, technological improvements, and monitoring of analysis of data could assist in the reduction of the number of unwanted alarms.

Acknowledgement

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- Capital and Coast District Health Board
- Corrections Department New Zealand
- Housing New Zealand
- Ministry of Justice
- Pertronic Industries Ltd
- Select Realty Services

As well as numerous staff of Fire and Emergency New Zealand.

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Fire and Emergency New Zealand (FENZ) attend between 23,000 and 26,500 unwanted alarms every year, which places a considerable strain on the available emergency response resource, especially as many unwanted alarms tend to be concentrated in certain areas. At individual fire stations between 30-90 percent of all calls turn out to be unwanted alarms.

Fire and Emergency New Zealand perceive that they have very little control over the frequency of these alarms under the current regulatory regime.

This report investigates the economic costs of these unwanted alarms, which fall on FENZ and on New Zealand as a whole.

1.1 What is an unwanted alarm?

An unwanted alarm is defined as:

"A fire alarm system activation where the call may have occurred due to the detection of heat, smoke or airborne contaminants, occupancy activity or fire alarm system faults which did not result from an actual fire."

It is important to note that all alarms are treated as genuine until it is confirmed that there is no emergency, and therefore there is no such thing as a "false alarm".

1.1.1 Unwanted alarms are dangerous

- Limited resources - If fire crews are occupied attending to an unwanted alarm they are unavailable for other emergencies.
- Complacency - Frequent unwanted alarms in a building cause staff and residents to become complacent and less willing to act quickly when the alarm activates. Fire deaths have occurred when an occupant has silenced or ignored the alarm.
- Unnecessary risk – Fire crews travel at high speed to attend emergency calls and accidents do occur. Unwanted alarms put the public and the fire crews at unnecessary risk.

1.1.2 Unwanted alarms are expensive

Unwanted alarms cause a range of costs which must be paid by the emergency services, building owners, tenants and the general public. Business interruption can be significant especially if there are production lines to be shut down and restarted, stock spoiled, and deadlines missed. Additionally, there are a range of other costs such as congestion, traffic accidents, job satisfaction for professional firefighters, and negative effects on volunteer firefighters, their families and employers.

1.1.3 Common causes of unwanted alarms

The most common sources of unwanted alarm activations are:

- Lack of appropriate ventilation, particularly in bathrooms and kitchens
- Environmental factors such as dust or heat from the sun
- Alarm system faults such as contaminated sensors or wiring which are damaged or corroded
- Dust or smoke created by building work or welding
- Malicious activity.

While individual instances may be attributed to one of the above factors, in many cases there is an underlying issue of the alarm system being inappropriate for the situation, or poorly installed (Auckland Uniservices Ltd, 2006).

1.1.4 Benefits of reducing unwanted alarms

The benefit of reducing the number of unwanted alarms is to avoid some of the costs identified in this report. As will be shown, costs fall on FENZ, businesses, institutions such as hospitals and prisons, and the wider community. From the point of view of any fire service, a response to a condition that does not require fire fighter action is both a loss of resources and a needless risk of injury during the response. All of these costs would be reduced if the number of unwanted alarms was to fall.

In addition to reducing the incidence, it is also possible to reduce the effect of unwanted alarms, though intelligent alarm systems, filtering of calls, and modified response, the subsequent costs of unwanted alarms may be reduced.

1.2 Map of report

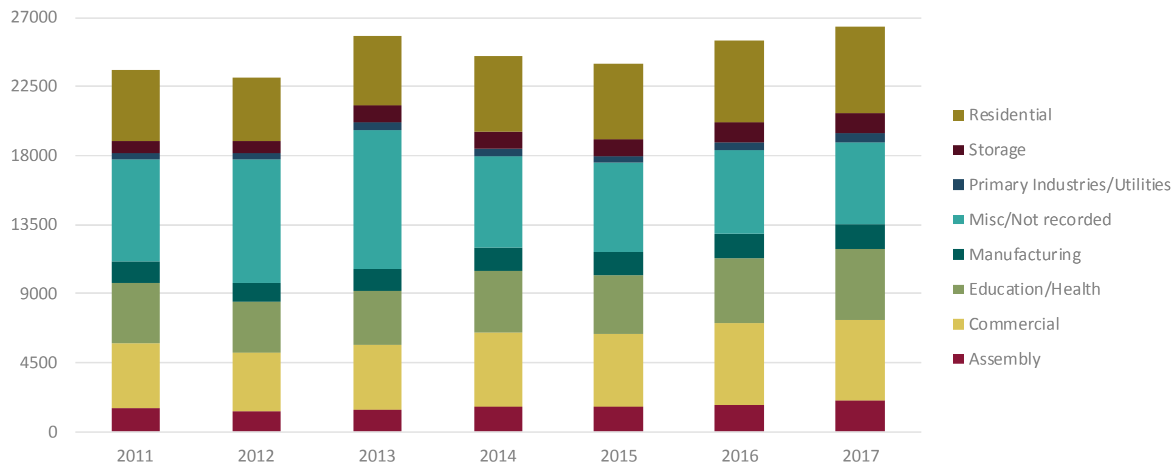
The following section introduces data on unwanted alarms in New Zealand. Section 3 surveys international approaches, while section 4 presents estimates of the costs of unwanted alarms. Section 5 summarises a selection of stakeholder interviews, along with a case study, and suggests opportunities for future changes to reduce or mitigate the costs of unwanted alarms.

2 Unwanted alarms in New Zealand

As depicted in Figure 2.1, the number of unwanted alarms has fluctuated in recent years. A low of 23,090 unwanted alarms was recorded in 2012, while there were more than 26,450 in the 2017 year. These calls places considerable strain on the available emergency response resource, especially as many unwanted alarms tend to be concentrated in certain areas. At individual fire stations between 30-90 percent of all calls turn out to be unwanted alarms with most occurring in built up urban areas.

FENZ perceive that they have little control over the frequency of these alarms. Prior to the passing of the Fire and Emergency New Zealand Act 2017 there existed a regulatory regime which enabled the then New Zealand Fire Service to issue a charge of $1,000 to building owners, usually after the third unwanted alarm within a 12 month period (New Zealand Fire Service, 2014). These fines could be waived if the building owner took remedial steps, such as alarm maintenance and upgrades, to avoid future unwanted alarms. This system was administered in each area separately, and implementation varied significantly between areas. This regime ceased on 1 July 2017 and it is intended to be replaced with a new system of offenses and penalties (Fire and Emergency New Zealand, 2017). The new regime is expected not to be in place for another 12 to 18 months.

Figure 2.1 Frequency of unwanted alarms by property use type



2.1 Fire alarm systems

FENZ provides a national automatic fire alarm system and service, managed through a national Code of Practice (New Zealand Fire Service, 2005). Some buildings are required to have a connected alarm as part of compliance with the New Zealand Building Code, and others are encouraged to connect to enable FENZ to respond more quickly in the event of a fire.

Alarms are monitored by one of three certified Automatic Fire Alarm Service Providers (AFASP) who transmit the alarm signal to the FENZ Communication Centres. Connected alarms are also able to relay fault signals to the Fire Alarm Service Agent (FASA) to enable timely maintenance.

2.1.1 New Zealand standard

In New Zealand allowable fire alarms are specified by New Zealand Standard NZS 4512:2010 Fire Detection and Alarm Systems in Buildings (Standards New Zealand, 2010). The latest update did not include any significant changes to equipment design requirements (Department of Building and Housing, 2011). Changes related to the installation, documentation, procedures, qualification of personnel, and inspection of alarm systems. The standard does not give specifications for what type of alarm system is required for a particular building. Rather, it is an integrated set of rules for the design, manufacture, and installation of alarm systems.

The standard specifies seven types of automatic fire alarm systems, these are:

1) Domestic smoke alarm system
2) Manual fire alarm system
3) Automatic fire alarm system activated by heat detectors and manual call points
4) Automatic fire alarm system activated by smoke detectors and manual call points
5) Automatic fire alarm system with modified smoke detectors and manual call points
6) Automatic fire sprinkler system with manual call points
7) Automatic fire sprinkler system with smoke detectors and manual call points.

Buildings are required to have the appropriate type depending on the building size, normal use and other factors. Types two through seven can be connected to FENZ for immediate alarm notification.

Schools in New Zealand are required to have a minimum of a Type 4 fire alarm system installed with a direct connection to FENZ.

2.1.2 Systems in use

There are two types of alarm systems in use in New Zealand:

Conventional

Conventional alarms were the industry standard until about 15 years ago. The alarm indicator panel will show either fault or alarm, and a light indicates which sector has been activated.

For installation each sector must be on a separate circuit which has a pair of wires which run from the panel to the sensors in that sector and back to the panel. This incurs considerable wiring costs.

The panel includes a component called a Signal Generating Device (SGD) which is capable of sending four signal types:

- Fire – sent automatically to FENZ Communications Centres via the Automatic Fire Alarm Service Provider (AFASP)
- Defect – goes to the AFASP (fully automated) and, if set up, to the fire alarm service agent (FASA)
- Test – used during monthly tests, checks the transmission path to the AFASP
- Isolate – means the system is offline to enable building refit etc.

Conventional systems have a 45min timeout on the testing mode. The tester starts the test mode and has to walk around all of the sensors to test them. After 45mins the system reverts to normal active mode. If the tester has not completed their job and returned to the panel in time, then an alarm will be activated. There is a 15 second buzz to warn of the switch over, but the technician may be at the other end of the building. This situation causes many unwanted alarms.

Conventional alarm systems are appropriate for use in small buildings where the system is of low complexity.

Analogue addressable

Analogue addressable alarms are more effective for buildings larger than 4 or 5 rooms. Complex electronic processing allows the system to determine exactly which sensor has activated, and the type of sensor (heat or smoke).

Advantages are:

- Cheaper installation due to reduced wiring costs (all sectors can be on the same loop)
- Reduced maintenance cost – because the system is able to give pre-alarm alerts with information on which sensors are going out of calibration (becoming dirty) and they can be attended to before reaching an alarm state. Information can be sent directly to service agent
- System will produce a report on the health of all the sensors and results of testing for annual and monthly tests
- During an alarm the system can provide complex information on the location and type of any/all sensors activated
- Has a Super SGD protocol.

Super SGD protocol

- Rich information, can send data about the type, location and number of sensors which have activated. Service agents have software which includes building floor plans so they can see visually what is happening in the building.
- The amount of information is limited only by the amount of time it would take to transmit rather than by a limit on channels or processor capability.
- New Zealand has approximately 400 connections already established with this protocol – but the information is only going as far as the AFASP and is not transmitted to FENZ at the current time.
- The Ministry of Education have enabled it for all schools.
- Useful information can be sent at times other than during an alarm. For example intelligent sensors are able to detect when they are going out of calibration due to a dust build up or other environmental factor. The system can notify this as it happens so the appropriate maintenance can be carried out before the unwanted alarm activation takes place.

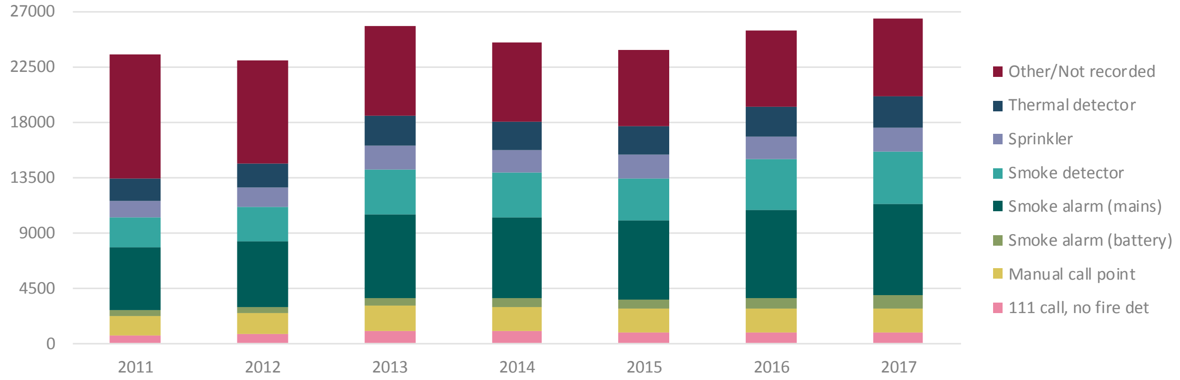
2.2 Causes of unwanted alarms

The causes of unwanted alarms in New Zealand have not been well studied, however it can be assumed that many of the causes will be the same or similar to other developed nations. Research from the US, UK, Europe and Australia is discussed in Section 3.

A New Zealand study from 2006 attempted to understand the local situation and undertook an analysis of a sample of free text fields in the FENZ database containing cause information (Auckland Uniservices Ltd, 2006). This study noted considerable difficulties with the type and quality of data collected about unwanted alarms.

Analysis of the method of alarm activations shows that "good intent" calls where a person notifies of a fire but is mistaken (as commonly occurs due to a fire-like event such as steam or dust which appears to be smoke) contribute only a small number of unwanted alarms. FENZ does not intend to discourage good intent calls, on the contrary they run public awareness and education programmes to encourage the public to phone 111 any time they believe there may be a fire or other emergency.

Figure 2.2 Frequency of unwanted alarms by activation type



The vast majority of calls are generated by automatic fire alarms. When the alarm is transmitted to FENZ it triggers a predetermined response which is based on a risk assessment. The risk assessment takes into account factors such as the type, size, location of the building, and water supply. For a central Wellington office building the predetermined response is typically four fire appliances.

Some sites such as manufacturers with dangerous chemicals, hospitals, or multi building complexes will have a modified response to take into account specific difficulties or hazards.

2.3 Previous studies

This section discusses major pieces of work which FENZ or, previous, the NZFS (the New Zealand Fire Service) have commissioned on unwanted fire alarms and related issues in recent years.

2.3.1 Uniservices 2006 report

A comprehensive report completed for the New Zealand Fire Service Commission identified a number of conclusions and recommendations for the future reduction in unwanted fire alarms (Auckland Uniservices Ltd, 2006). With a special focus on the Auckland CBD, the report takes a systems approach to evaluating the systemic causes of unwanted alarms. Case studies revealed numerous dangerous practices by the occupants of the buildings studied. These practices were employed to either reduce the accidental activation of the system, or to avoid the costs associated with evacuating such as business interruption or inconvenience. Some of the practices were:

- In a mall, tenants locked the door to their business pretending to have evacuated
- Apartment smoke detectors were covered with cling-film, plastic bags or rubber gloves so that they could not operate
- A forewarned scheduled inspection found four percent of detectors covered. The building manager estimated that up to 20 percent of detectors may be covered at other times.

Other observations of note from the report were that tenants in apartment buildings with frequent unwanted alarms began to ignore the alarm and refused to evacuate. The tenants had little understanding of how the alarm system worked, which contributed to behaviours which exacerbated the problem such as hanging items from sprinkler heads including laundry and pot plants. Education was not effective as tenants had a high turnover, were not interested, and due to language barriers.

Malicious activation of the alarm was a large problem, particularly near entrances of apartment buildings. Some building owners felt that installation of tamper resistant covers for manual call points should be mandatory in such situations.

The statements listed in the remarks column of the NZFS database for each case study was compared to the building owners understanding of the cause of unwanted alarms. This revealed that the recorded cause was often an immediate cause only and failed to capture the underlying factors which lead to repeated unwanted alarms. In many cases the alarm system installed in the building was not fit for purpose, for example it may have smoke detectors installed directly above the stove. The subsequent alarms activation might be recorded as "burnt cooking" whereas a properly designed system would not have been activated by what is an expected occurrence in the kitchen. At the time this report was written analogue addressable alarm systems were new to the market and the vast majority of those in use were the conventional type.

The report conclusions include:

- The preferred approach is to develop solutions through joint participation of all the parties affected
- Data collected and held by the then NZFS is not of a high quality. The report recommends changes to the way the NZFS collects and categorises data about unwanted alarms to enable future analysis of patterns and trends as well as information on underlying systemic causes
- Regulatory reform which saw a shift from regulations as being primarily prescriptive to one that relies on self-management according to regulations and codes has contributed to the current high rate of unwanted alarms
- There are numerous conflicts of interest between the parties involved in implementing fire safety. All parties involved must have a commitment to a best practice approach to achieve excellence in fire safety
- That a reduction in the incidence of unwanted alarms could lead to a more efficient and effective fire service, as well as benefits for confidence in alarm systems, and reductions in the economic and social costs of responding to unwanted alarms.

This report did not attempt to quantify the economic cost of unwanted alarms, however it is noted that the NZFS at that time considered the disruption to work of an unwanted alarm was equivalent to one hour per call.

2.3.2 BERL 2005 report

In 2005, BERL completed a project for the New Zealand Fire Commission to quantify the cost of managing the risk of fire within New Zealand. This report discusses unwanted alarms and identifies that the New Zealand Fire Service (NZFS), as it was then, carried the majority of the cost. Although businesses and the public sector suffered opportunity cost from employee downtime, this was found to be heavily outweighed by the cost of the actual response (BERL, 2005). In regard to unwanted alarms in commercial and public buildings, the cost of resources used, less the $1.5 million in revenue from charges, amounted to $43.8 million per annum[1].

[1] Figures have not been adjusted for inflation.

2.4 Projections

The general assumption within FENZ is that the quantity of unwanted alarms will be reasonably static over time. Calls due to defective alarm systems or malicious interference are expected to decrease as alarm systems are improved, even as they become more numerous. Calls to 111 (good intent) are expected to increase as the population increases, and as a result of public engagement efforts by FENZ (Datamine, 2018). These two effects could cancel each other out, leading to the conclusion that the overall level will remain roughly constant.

There is an alternative possibility where the number of alarm systems continue to rise, and that through poor commissioning and maintenance they produce even more frequent unwanted alarms. New and improved technology cannot reduce unwanted activations alone, it relies on proper system design, installation and ongoing maintenance.

Existing incentives for the various parties involved in procurement, maintenance and use of alarm systems mean that there is not a common desire to see that the systems achieve maximum reliability.

As the number of fire alarm systems continues to rise, there is currently no regulation or requirement which will ensure that their reliability will be improved. This would tend to imply that the number of unwanted alarms from alarm systems will rise over time, along with those from good intent. The combination would result in a steady increase in the number of unwanted alarms.

Our assessment suggests that the ultimate outcome in terms of number of unwanted alarms could lie somewhere along this spectrum. In this light, further work to mitigate the risk of a rising number of unwanted alarms (and the costs therein) would be prudent.

3 International approach to unwanted alarms

To gain information on international approaches to reduce unwanted alarms and their applicability in the New Zealand context several reports on the subject have been consulted. Literature reviewed described policy and research conducted in the United Kingdom, United States of America, and in Australia.

A common theme throughout the existing work done on this issue is the need to align the incentives of the fire services, building owners and occupiers, and the fire alarm industry to take steps to reduce the incidence and cost of unwanted alarms. A number of strategies and response regimes in use overseas are outlined. Noteworthy strategies discussed in the literature are summarised at the end of this section.

Across the jurisdictions it is agreed that measures to reduce unwanted alarms must not hinder or unduly delay response to fire. Early detection of fire saves lives, reduced property damage and reduces the risks to operational firefighters in extinguishing the fire.

3.1 Europe

A 2018 report from the European electronic fire and security industry body, Euralarm, examines the issue of unwanted alarms in fire alarm systems in several European countries (Euralarm, 2018). Analysis was made more difficult by the lack of standardised terms between countries and even between different parts of the same country. An unwanted alarm may be referred to as a false or unjustified alarm. Causes are also named and categorised in different ways. In Germany good intent and malicious are grouped together, presumably because in both cases a person deliberately triggered the alarm system. Many of the countries use between two and four high level categories for alarm cause, whereas Sweden uses 24. By comparison in New Zealand FENZ uses eight cause group categories which are then further refined into specific causes.

Fire alarm standards also vary between countries. Although the European Union (EU) 54 series standards are used in all countries these cover only the fire alarm components. Design and installation standards are country specific.

The method of connection between the alarm system and the Fire and Rescue Services (FRS) also varies. Many central European countries the alarm is connected directly to the FRS. In the United Kingdom (UK) connection is via an intermediary who can verify the alarm before passing it on to the FRS.

All of these variances make direct comparisons between countries difficult. The report compiles a raft of strategies for reducing unwanted alarms, most of which relate to the proper design and installation of the alarm system. Other reduction strategies listed relate to education of tenants, building operators, contractors, maintenance companies and the emergency services about the operation of fire alarms, and the setting of targets to encourage awareness and a proactive approach. Independent inspections, call filtering (pre-transmission confirmation of a fire), and cooperation between stakeholders are also identified as useful strategies.

3.2 United Kingdom

Fire and Rescue Services in the UK are adopting a range of innovative approaches to reducing the incidence and cost of unwanted alarms. Policy for managing unwanted fire alarms varies across the UK as each Fire Rescue Service sets the policies and procedures for their area.

Unwanted alarms are a serious problem in the UK. In Scotland 56 percent of all FRS activity is as a result of unwanted alarms from non-residential premises, each attended by up to three appliances generating 120,000 unnecessary journeys under lights and siren annually (Scottish Fire and Rescue Service, 2014).

3.2.1 Legislation change

The ability to innovate stems from a legislation change. The Fire and Rescue Services Act 2004, requires FRS to make provision for fire-fighting, but not to attend premises to ascertain if a fire exists. Prior to this FRS were required to attend every alarm activation as is customary in New Zealand. The change was required as the large numbers of unwanted alarms being generated made it increasingly costly to continue the historical cautious presumption that the call is genuine, until proved otherwise.

3.2.2 Changes in approach

As a consequence of the legislative change, many FRS are using alternative response strategies. These changes have resulted in attendance at unwanted alarms reducing by about a third over the 10 years following according to the Chief Fire Officer's Association (CFOA, 2014). England and Wales saw a 37 percent reduction, but still attended around 250,000 unwanted alarm calls annually.

One notable exception is the London Fire Brigade who continue to attend every fire alarm (London Fire Brigade, 2018). In 2017 they attended 38,000 unwanted alarms. London has decided to continue an education strategy and are currently considering introducing a charge, though it will not apply until a premises has experienced 8 unwanted alarms within a 12 month period.

Depending upon the type of premises involved, the new strategies range from non-attendance (unless fire situation is confirmed), reduced attendance, and call-challenging arrangements to gather information or confirm a fire before determining the response.

The predominant new strategy is onsite filtering to prevent unwanted alarms being transmitted to the FRS. This means that some agreed process is followed to confirm the cause of the alarm before calling the FRS (either manually or automatically).

For example, high reliability indicators of fire such as a sprinkler activation, multiple detector type activation, unoccupied premises or manual call point activation could justify an immediate and automatic transmission of the signal to the FRS. In premises with no on-site filtering, or which have a history of frequent unwanted alarms, it may be appropriate to establish a call back confirmation by the Fire Alarm Monitoring Organisation (FAMO) before a FRS response is dispatched. Call back confirmation means that on receipt of an alarm signal, a FAMO will phone the premises contact, waiting a maximum of 30 seconds. If the phone is not answered within 30 seconds the signal is relayed to the FRS.

For each premises a risk assessment should be completed to establish the correct level of onsite filtering. In high risk premises such as care homes it would be appropriate to automatically transmit all alarm signals without filtering. FRS would need to work with these premises to ensure effective alarm system maintenance and operation to reduce unwanted alarms.

In the majority of cases where on-site filtering is to be considered, the evacuation strategy will be one of immediate simultaneous evacuation to ensure life safety, unless the fire risk assessment can justify other arrangements. This would mean that business interruption costs will continue to occur due to an unwanted alarm, even if the FRS does not attend.

3.2.3 Address the causes

The Chief Fire Officer's Association (CFOA) continues to advocate a partnership approach where the FRS works together with building owners/operators and the fire alarm industry to further reduce the incidence and the cost of unwanted alarms (CFOA, 2014). For this to be effective incentives must be aligned to encourage change and investment in proper alarm maintenance.

Analysis conducted by Building Research Establishment (BRE) Trust attempted to collate information about the causes of unwanted alarms observed in buildings and identify approaches to reduce their occurrence (Chagger & Smith, 2014) (Chagger, 2015). Data was sourced from Kings College London and Buckinghamshire & Milton Keynes Fire Authority, providing a snapshot of the types of unwanted alarm incidents. The report identifies six solutions to reduce unwanted alarms, listed here in order of effectiveness:

1) Replace detector with multi sensor
2) Use of appropriate approved detectors located correctly
3) Use of protective covers over approved MCPs with adequate signage and CCTV where required
4) Use of EN 54-2 approved analogue addressable panel
5) Better control of contractors
6) More rigorous maintenance of the system.

The first intervention listed, the replacement of individual smoke or heat detectors with intelligent multi-sensor detectors, could reduce unwanted alarms by a substantial 69 percent. The report noted that the incident recording system used by the FRS lack sufficient detail to accurately classify alarm causes preventing the possibility of conducting a broad study into possible reduction strategies.

3.2.4 Enforcement

Under the law each building must nominate a "Responsible Person", usually the building owner or manager who is responsible for the fire protection measures, including proper operation of the fire alarm system and other duties relating to actions following an unwanted alarm (Fire industry Association, 2012)[2]. Failure to do so can result in a prosecution. Under UK fire safety legislation FRS can take enforcement action against repeat offenders, while in England, under the Localism Act 2011, FRS have powers to charge for attending unwanted fire alarms.

Although BRE Trust found that existing standards and codes of practice are adequate, all six of the identified interventions relate to the design, implementation, and maintenance of alarm systems. BRE Trust did note that to achieve change the incentives of building owners, "Responsible Persons" and the general public need to be aligned in order to increase the uptake of available new technologies, such as analogue addressable fire alarm systems. Education has a role to play as reductions in the frequency of unwanted alarms can be achieved through simple measures.

3.3 United States of America (USA)

In the USA work on unwanted alarms has been conducted at a federal level by the National Fire Protection Association (NFPA). According to the NFPA in 2014, U.S. fire departments responded to almost 2.2 million unwanted alarms, that is 45 for every 10 structure fires (Ahrens, 2016). This is part of a wider context where total emergency responses have more than doubled between 1980 and

[2] referred to as the "Duty Holder" in Scotland, or the "Appropriate Person" in Northern Ireland

2009, primarily driven by the more than tripling of medical aid calls (Hall, 2013). This rapid increase in genuine calls means that FRS resources are increasingly stretched, further reducing their capacity to absorb the burden created by unwanted alarms.

The NFPA identify the costs of unwanted alarms to include:

- Fuel costs
- Wear and tear on equipment and vehicles
- Risk of collision
- Injury
- Growing complacency when responding to automated alarms.

In response to the high rate of unwanted alarms, the NFPA produced a comprehensive report on the issue (National Fire Protection Association, 2011). The International Association of Fire Chiefs (IAFC) submitted 43 proposals for changes to commercial automatic fire alarms for changes to the 2013 edition of NFPA 72®, National Fire Alarm and Signalling Code (National Fire Protection Association, 2013). Just nine of the 43 proposals were accepted in principle, either entirely or in part.

Having had so many of their proposals rejected in 2011, the NFPA and fire chiefs decided to proactively build better communication between the fire service and the technical committee. This process then led to the Fire Alarm Response and Management Summit, which brought together the alarm industry and firefighters who respond when alarm systems are activated. One of the learnings from this event was that the FRS and the alarm industry had different understandings of what constituted a false or unwanted alarm.

Some practical tools were created as a result of what was learnt at the summit. The NFPA created the Fire Service Guide to Reducing Unwanted Fire Alarms, available free and intended to help all stakeholders work to a common purpose (National Fire Protection Association, 2012). The Fire Protection Research Foundation developed a risk-based decision support tool to assist fire departments in managing unwanted alarms (Hall, 2013).

As in other parts of the world a move to implement on-site filtering is seen as a key strategy to arrest the growth in the number of unwanted fire alarms (Sopp, 2015).

3.3.1 Research

When the Fire Analysis and Research Division was developing the tool in 2012, they encountered a lack of available national data on the percent of commercial fire alarm activations that were real emergencies, indicating that a national reporting system was required to facilitate effective research. A literature review was conducted which found that there was widespread inconsistency in the definitions of terms used between jurisdictions making analysis difficult (Ahrens, 2013). Further the literature study concluded US fire departments received almost 2.2 million unwanted alarms in 2010. Almost half of the unwanted alarm responses were due to unintentional activations while system malfunctions accounted for one-third. More than half of most types of unwanted alarms occurred in non-residential properties.

Having identified the lack of research based evidence, Seminole County decided to test two hypotheses that could potentially reduce the number of alarm responses (Apfelbeck, 2016). The interventions tested were:

- Earlier intervention by fire prevention bureaus and earlier notification of business owners in the expectation that more timely inspection, testing, and maintenance follow-up would reduce the number of unwanted alarms
- A fee schedule for repeat unwanted alarm responses by the fire department as a method to encourage a greater inspection, testing, and maintenance focus on unwanted-alarm-prone systems.

The data collected from these studies indicated that neither of these interventions proved successful in reducing the number of unwanted alarms. Apfelbeck concludes that the issue requires a more granular study than is possible with studies based on National Fire Incident Reporting System data and cause analysis conducted by fire departments (Apfelbeck, 2015).

National Fire Protection Association (NFPA) 2011 report

The NFPA's 2011 report Unwanted Fire Alarms summarises existing studies into the causes of unwanted alarms, policies to address them, and gives a detailed overview of responses to unwanted alarms in 2003, the most recent year for which data was available (National Fire Protection Association, 2011).

Conclusions of note

- The ratio of genuine to unwanted calls is useful for understanding the problem and communicating the magnitude of the issue to stakeholders including the general public.
- In defining unwanted alarms, there is a grey area in which no fire occurred, but would have without the early warning from the alarm. For example: an iron is left on and falls onto the floor scorching the carpet. If the alarm activates an occupant is alerted to the danger and picks up the iron, avoiding ignition.
- Complacency is a risk if the alarm has a reputation for frequently giving unwanted alarms. Both building occupants and FRS responders can become complacent and this can lead to real life risk. This 'cry wolf' effect is difficult to quantify.
- If a FRS adopts a reduced response procedure approach, this may result in insurance issues. Risk of unintended consequences.
- Some interventions are successful. For example South Metro reduced repeated alarms through increased inspections.
- Valuable observations regarding the expertise at design and installation stages, and the ongoing training of maintenance people as being important to preventing unwanted alarms.

Model based tool

The report includes a detailed description of a modelling tool which can be used with local data to decide among courses of action to deal with unwanted alarms. The model outputs are estimates of costs, fire losses and other impacts of strategies. Constructed in the format of a decision tree, this tool includes calculating the probability of a call being an unwanted alarm by building use type, which would provide valuable information on where education and other interventions would be more usefully targeted.

Possible points of intervention

The following table is reproduced from page 15 of Unwanted Fire Alarms (National Fire Protection Association, 2011). This table identifies the contributing factors and the possible interventions to reduce the incidence of unwanted alarms.

Table 3.1 Minimizing the Toll of False Automatic Fire Alarms: Possible Points of Intervention

Aspect				
Plan design	Qualifications of designer			
Plan review	Qualifications of reviewer			
System installation	Qualifications of installers			
System inspection and maintenance	Communication with FD and property owner	Qualifications of inspectors		
In apartments or hostels, dwelling unit or suite detection sounds only in unit (NFPA 101, 9.6.2.10.4)				
Possible pre-alert in occupant space before external signal transmitted	Would probably require changes in technology and code			
Educate about hot work and alarms				
Alarm verification	Occupied vs. unoccupied premises	Motivation and competence of verifier	Risk from unchecked fire	Is the property sprinklered?
Discretion to downgrade response				
Investigate and communicate the false alarm cause	Help property owners and managers prevent the alarms			
Target frequent properties				
Penalties for repeat false calls				

In New Zealand the technology to enable pre-alerts in occupant space now exists, and is in use where appropriate. Known as an Alarm Acknowledgement Facility (AAF), these are commonly referred to as a hush button. AAF are most commonly used in apartments, but may be appropriate for kitchens or other places where smoke like effects can be common.

Life safety

The NFPA notes that despite the aforementioned efforts unwanted alarms remain a problem in the United States. Action on the issue needs to be balanced against findings that fire spreads more quickly in modern homes and that occupants have less time to escape (Ahrens, 2016).

3.4 Australia

Fire services and regulation are administered separately in each state/territory of Australia. Across Australia FRS report high numbers of unwanted alarms and identify this as an issue requiring further efforts to reduce the incidence and costs resulting.

In Australia alarms fall into two categories: Direct brigade alarms have a direct link to the FRS Communications Centre, privately monitored alarms are monitored by a monitoring company, the chosen private monitoring company must manually phone the emergency line to request a response by the FRS.

3.4.1 The human factor

Design guidelines from Queensland acknowledge that even a well designed and installed fire alarm system will suffer from occasional unwanted alarms "A fire alarm system design should address the 'human factor' by including a reactive element to minimise the UAs signalled to the QFES. (For example: Alarm Acknowledgement Facility, Alarm Delay Facility) " (Queensland Fire and Emergency Services, 2016).

A technical advisory note issued in 2018 by Fire Protection Australia reinforces that the installation is critical to the proper performance of the fire alarm system (FPA Australia, 2018). The note describes specific wiring issues which may prevent the alarm from sending system status signals correctly, most likely occurring subsequent to commissioning of the system, possibly as an attempt to prevent unwanted alarms. If an isolate or fault system status is not transmitted this could result in life safety systems failing to operate.

3.4.2 Strategies to reduce unwanted alarms

Charges

FRS in every state and territory of Australia charge for attendances to unwanted fire alarms. They have the authority to do so under the Fire and Emergency Services Act 1998. The amount of the charge and circumstances which trigger the charges vary across the states/territories.

Pragmatic Cooking and Shower Test

The Queensland Fire and Emergency Services (QFES) have established a Pragmatic Cooking and Shower Test (Queensland Fire and Emergency Services, 2016). This test is applicable to any Class Two or Three building served by an Automatic Fire Detection and Alarm System required to comply with Australian Standard AS1670.13. This test was developed in response to changing facilities

[3] A Class Two Building is a building containing two or more sole-occupancy units each being a separate dwelling. A Class Three building is a residential building, other than a Class One or Two building, which is a common place

installed in these types of buildings. For example the majority of Class Three buildings now have cooking facilities installed without a fire alarm designed to allow the system to discriminate between normal activities and a fire. Minimum ventilation requirements under the National Construction Code result in high numbers of unwanted alarms occurring in these buildings. Therefore in addition to other alarm testing, and prior to the issuing of a final approval, QFES must be satisfied that the system will achieve the specified performance.

Improved data collection

Researchers from the Worcester Polytechnic Institute attempted to conduct a cost-benefit analysis on installing kitchen exhaust systems in Class Two and Three buildings to reduce unwanted fire alarms. This analysis involved acquiring unwanted alarm data from each state, including: the number of unwanted alarms in any given year, causes of unwanted alarms (cooking fumes, steam, etc.), type of detectors that were set off, and the building type in which these unwanted alarms occurred. However, many states were unable to provide this information, which restricted the research findings. In order to address this problem, the paper recommends that Australian fire authorities look to create a central database for unwanted alarm statistics, and a standardised coding system for fire brigades when recording responses to unwanted alarms.

3.5 Conclusions

The problem of unwanted alarms is widespread and there are no easy solutions. Many FRS around the world recognise the problem and have invested in research and developed strategies to try and mitigate the issue. There is no established best practice example to follow, rather a range of strategies which are appropriate in some situations and not others.

All of the jurisdictions looked at agree that specific alarm system design, installation, and ongoing maintenance are vital to keeping unwanted alarms to a minimum. Even if this is done well, there will continue to be some amount of unwanted alarms due to human behaviour be it malicious, accidental or ‘good intent’.

3.5.1 Strategies of note

- Upgrade to analogue addressable fire alarm systems.
- Use of appropriate approved detectors located correctly. Replace single type detectors (usually smoke) with multi sensor which detects more than one fire sign.
- Prevent malicious alarm activations - use of protective covers over approved Manual Control Points and sensors with adequate signage and CCTV where required.
- Use localised alarm sounding and Alarm Acknowledgement Facility (hush buttons) in apartment type situations.
- More rigorous maintenance of the system, better control of contractors, rigorous inspections to confirm maintenance has been performed correctly and the system has not been tampered with (both to prevent unwanted alarms and to ensure life safety).
- Better data collection and national databases to enable proper analysis of the causes and patterns of unwanted alarms.

of long term or transient living for a number of unrelated persons. Example: boarding-house, hostel, backpackers’ accommodation or residential part of a hotel, motel, school or detention centre (Queensland Building and Construction Comission, 2014).

- Call back procedures and altered response to mitigate impact of unwanted alarms while maintaining life safety.
- Communication and cooperation between the FRS and alarm industry.
- Measures to align the incentives of building owners/managers and the alarm industry with those of the FRS. Successful strategies include networking events, cooperating on policy creation, information sharing.

4 Costs of unwanted fire alarms

In this section we aim to capture the range of costs both tangible and intangible which FENZ bears as a result of receiving unwanted alarms. We draw on information supplied by FENZ, previous analysis conducted on this subject, and other data sources relating to volunteering and the risks associated with responding to emergency situations.

Until the legislation change in 2017, the costs of attending unwanted alarms was offset to a small degree by the ability to levy a charge. These charges of $1,000 were issued when a building or site experienced a third or subsequent unwanted alarm, within a 12 month period. The charges could be forgiven if the building owner took remedial work to address the cause of the unwanted alarms, hopefully preventing further events. Unwanted alarms remain a cost to individual firms, property owners, FENZ administration and operational procedures and staff, and the economy.

Should the number of unwanted alarms increase as a proportion of genuine emergency calls, the burden is likely to become increasingly problematic, particularly as unwanted calls are not spread evenly across the fire stations.

These costs are outlined in this section.

4.1 Methodology

To capture a broad sweep of the costs to both FENZ and to New Zealand a combination of data sources and approaches have been used.

4.1.1 Quantitative analysis

Call data

FENZ supplied a database export of all calls classified as unwanted alarms spanning the time period of 3 August 1998 to 18 September 2018. This data gives rich information on the timing, location, duration, type of building and where possible the immediate cause of each unwanted alarm.

GDP lost through business interruption

Using the exported data from the FENZ database, information on building use for each unwanted alarm was mapped to the relevant industry at the most detailed level possible (506 level) and a value for GDP per minute for each industry was calculated based on the BERL database. Using the assumption that a business was unable to operate from the time the fire alarm was activated until the site was declared safe to re-enter, call duration multiplied by Gross Domestic Product (GDP) per minute then gives the cost of the business interruption in terms of lost GDP.

Financial analysis FENZ costing model

In 2018 FENZ developed a modular costing model. We had hoped to access data from this model to assess overall costs to FENZ of unwanted fire alarms. However, time and resource constraints meant this effort was deferred to a later project.

4.1.2 Qualitative analysis

In addition to the cost calculations, a range of other tangible and intangible costs arise from unwanted alarms. To further identify and gauge the magnitude of these, a qualitative analysis has been undertaken.

Stakeholder interviews

Many businesses will experience interruption and associated costs well beyond the duration of an unwanted alarm as recorded in the FENZ database. It is not possible to capture this in the above calculations. To address this shortcoming, stakeholder interviews have been conducted to gather information on these expenses, and other intangible costs. The stakeholders selected have included both public and private organisations as well as representatives from the fire alarm industry.

Case study

In Section 5.2 a case study illustrates the experience of a business which suffered multiple unwanted alarms causing serious interruption to their business. The hotel in question ultimately undertook a largescale upgrade of the alarm system. The hotel management's viewpoint and considerations made are discussed along with the issues the case presented to FENZ in responding to the many calls.

4.1.3 Data challenges and limitations

A number of data challenges and limitations were encountered during this research project. The specific issues and measures to manage them are outlined below. Data provided spanned the period from 3 August 1998 to 18 September 2018. Where appropriate the incomplete years of 1998 and 2018 have been omitted from analysis. A change to the way information was recorded and categorised occurred in 2005, therefore some analysis begins from 2006.

Industrial action

During periods of industrial action recording of information in the FENZ database may be incomplete. This appears to have happened during Sep – Dec 2009, and August – April 2011. Data collected during these periods cannot be assumed to be entirely reliable.

Miscategorised calls

On occasion the fire crew may arrive to find that the alarm was triggered by a small fire, since extinguished by persons present. This may then be recorded in the database as an unwanted alarm, though it does not meet the definition as there was an actual fire. Unfortunately it is not possible to identify in the data where this has occurred, so it can be assumed that the number of unwanted alarms is inflated to some small extent by this effect.

Cause information

There exists significant disagreement within the data on the cause of unwanted alarms. Each call is broadly categorised by cause. The data for the same incident varies between what is recorded by FENZ, and by the attending FASA as is shown in Figure 4.1 and Figure 4.2 below.

Figure 4.1 Cause group as recorded by FENZ and FASA 2006 - 2017

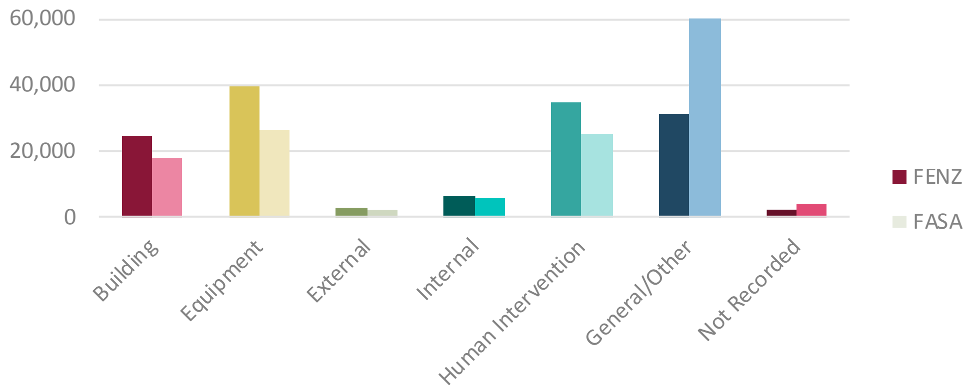
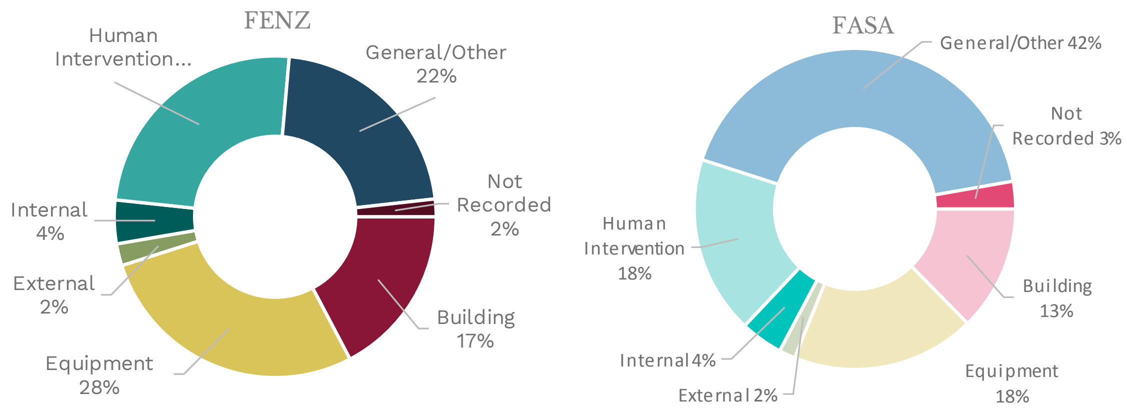


Figure 4.2 Recording of cause group FENZ, FASA 2006 - 2017



FENZ personnel tend to record against more specific categories, whereas the FASA personnel lists 42 percent of all unwanted alarms from automatic fire alarms as "Other". When the high level cause was recorded as "Other" by the FASA, the more specific call details were recorded as "No apparent cause" 24 percent of the time, and "Unable to classify" the remaining 75 percent of the time.

Part of the role of the FASA is to investigate the cause of the alarm activation so that appropriate measures can be employed to avoid future similar activations. Either this is not being done for a significant portion of calls, or the information is not being relayed and correctly recorded in the FENZ database.

There exists no category for errors on the part of the FASA, despite maintenance work and monthly and annual checks being understood as a major cause of alarm activations.

The database also contains free text fields which may hold additional information specific to many calls, however an analysis of this data was outside the scope of this project.

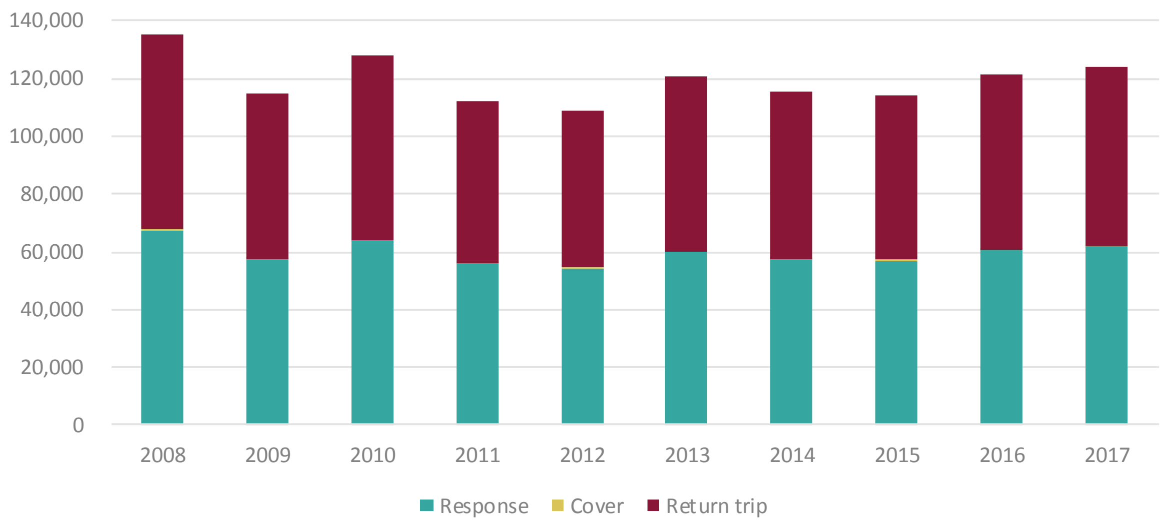
4.2 Risks associated with emergency response

Travelling in vehicles always carries risk, but this is amplified in emergency situations. In the USA 2017 had a record low number of firefighter deaths, yet the total of 60 fatalities included 8 firefighters (13 percent) who died on the way to or from an incident (Fahy, et al., 2018). In addition 4,555 injuries occurred to firefighters while they were responding to or returning from incidents (Evarts & Molis, 2017).

Those injuries and fatalities which resulted from a vehicle collision will have also caused injuries and fatalities of members of the public. There will be significant damage to the fire appliance. Even a minor collision can remove the resource from being available for firefighting.

Because an alarm can only be ruled as unwanted once it is established that there is no fire, journeys to these types of incidents are no different to those initiated by a genuine fire or other type of emergency. After attending the incident the appliances must return to the station, although they can do this as normal traffic as opposed to the emergency response which is under lights and siren.

Figure 4.3 Number of vehicle movements resulting from unwanted alarms



4.3 Costs on staff

FENZ has nearly 13,000 frontline personnel, of which 1,740 are in paid professional roles. The remaining 11,260 are volunteers, either as firefighters or as operational support who provide traffic management and other non-firefighting duties at incidents. Unwanted alarms affect all frontline personnel, though the type of effect does vary somewhat between paid and unpaid personnel.

4.3.1 Professional firefighters

Firefighters are committed to an at times dangerous job which plays a vital role in our society. Training is centred on the skills and physical capacity to tackle emergency situations, and job satisfaction comes from intervening in those situations to rescue people and property.

In the current situation where upwards of half of all calls turn out not to be an actual emergency, it is expected that job satisfaction will fall due to the sense that their time is being wasted. This is particularly true where crews must return to the same location time after time.

Staff may look for alternative employment if they feel their job is largely a waste of time. This leaves FENZ with a higher staff turnover and the associated costs.

4.3.2 Volunteer personnel

The effects on volunteers are very similar as for professional firefighters, except that they are able to resign more readily without financial penalty, indeed they may save money or increase earnings by ceasing to volunteer. In addition, recruiting and training volunteers is expensive and requires significant effort. Retaining volunteers is essential to ongoing capability, and high degree of training and competence of units staffed by volunteer firefighters.

Volunteer goodwill is extremely valuable to FENZ. The erosion of such goodwill would be costly to FENZ, in both financial and operational terms. It is clear that this goodwill is at risk of being expended by repeated responses to unwanted alarms.

Families and employers

A study conducted into the experiences of families of volunteers found that although the families benefitted from having a volunteer member, the unpredictable nature of volunteering did have a negative impact (Litmus, 2017). When the calls turn out to be unwanted alarms although they tend to be resolved relatively quickly, the disruption to family life can still be considerable. Repeated unwanted alarms will tend to erode the support the family gives to their loved one continuing as a volunteer, as these calls are perceived to have no worth which would otherwise outweigh the negative effects of being suddenly called away.

Many employers allow their staff time away from work in order to serve their communities as volunteer firefighters. In the situation where are large proportion of the calls are unwanted alarms, this can create significant costs which are carried by the employer due to the interruption of work. If these costs become too great the employer may become less generous in allowing their staff the time to attend callouts, and may develop a negative perception of FENZ and firefighting.

4.4 Business interruption costs

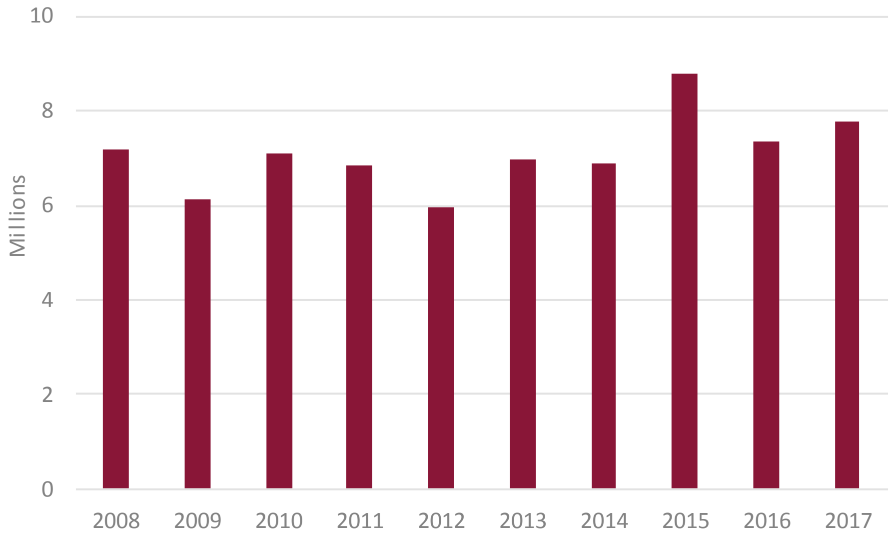
Each time the fire alarm sounds at a place of business, the employees must stop work and evacuate. Business operation ceases to operate from the time the fire alarm was activated, until the site is declared safe to re-enter. The amount of disruption this causes varies widely, and depends on many factors including:

- Type of operation
- Time required to evacuate
- Number of employees and customers on site
- Time taken for the emergency response to arrive
- Time taken to establish if it safe to re-enter
- Machinery which may require shut down and restarting procedures
- Effect on the business's ability to meet deadlines
- Any stock which is spoilt
- Time needed for employees to return to productivity
- Seasonal effects
- Time of day, or day of the week.

Calculating an exact cost of this business interruption is therefore prohibitively difficult. Despite this challenge, it is important to gain a sense of the magnitude of the cost of the lost productivity from the New Zealand economy.

Using the data from the FENZ database, information recorded on the building use for each call was mapped to the relevant industry at the most detailed level possible (506 level). A value for GDP per minute for each industry was then calculated based on the BERL database[4]. Using the assumption that a business was unable to operate for the length of time recorded in the FENZ database, call duration multiplied by GDP per minute gives the cost of the business interruption in terms of lost GDP.

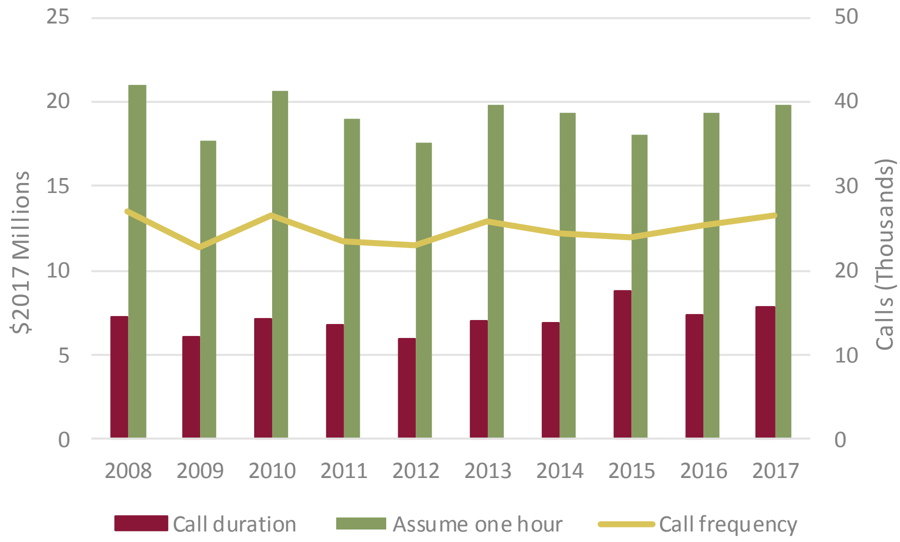
Figure 4.4 Magnitude of GDP lost due to unwanted fire alarms in New Zealand (2017$M)



Previous work by the New Zealand Fire Service has suggested that the actual interruption from an unwanted alarm is one hour. The same calculation as above can be repeated using the one hour duration. A comparison of the results is presented below. This cost varies by year depending according to the number and duration of unwanted alarms, and by the average productivity of the industries affected.

[4] Annual GDP was assumed to be spread across 12 hours each day, 365 days per year to average between different operating hours.

Figure 4.5 Magnitude of GDP lost by call duration and assumed one hour interruption and call frequency



The following table gives figures for the five years from 2013 until 2017. In 2015 the estimated cost was the highest of this period, yet the number of calls was the lowest. This was no longer true if the assumption of a one hour interruption period was applied to the calls.

Table 4.1 Cost of business interruption due to unwanted alarms 2013 - 2017

Year	2013	2014	2015	2016	2017
Business interruption cost $2017	6,983,067	6,892,347	8,782,894	7,365,233	7,787,097
Assume one hour duration $2017	19,757,060	19,354,967	18,038,440	19,334,367	19,838,091
Number of calls	25,806	24,498	23,948	25,461	26,458

In actuality the business which experiences the greatest opportunity cost won't necessarily be that with the highest productivity (as measured by GDP). Those businesses which are located close to fire stations, and can cease and restart production quickly and easily, will suffer the least from an unwanted alarm. This suggests that manufacturers, large retail outfits and other businesses with significant shutdown costs should invest in measures to prevent unwanted alarms.

4.4.1 Interpretation

While every effort has been taken to create a result which is as accurate as possible this calculation should not be viewed as an exact accounting of actual business interruption cost due to the challenges discussed above. It serves to give an indication of the magnitude of business interruption cost, and is useful in weighing up the relative benefits of investment to reduce unwanted alarms. Actual business interruption will exceed this figure as it does not account for costs such as restarting production lines, stress or panic caused by the alarm, or instances where workers may be away from their jobs for a longer period of time.

This analysis does show that over the last 10 years business interruption from unwanted alarms has cost the economy in the vicinity of $70 million.

4.5 Marginal costs

Marginal costs are those which are additional to the primary cost. Individually they are insignificant, therefore it is difficult to quantify their effect. Collectively over the thousands of unwanted alarms which occur each year, these costs become significant so must be included in the analysis of total economic cost.

4.5.1 Congestion

The over 110,000 vehicle movements which occur as a result of unwanted alarms frequently cause congestion issues, particularly in busy central business areas. Half of these occur as emergency response to the alarm meaning they are under lights and siren. On reaching the location of the call significant congestion occurs around the area due to several large vehicles parked near the alarm site.

It may be possible to quantify this congestion issue by cross matching the FENZ unwanted alarm data with information from Google maps, however this is beyond the scope of this report. It is safe to assume that at least half of all unwanted alarms result in localised congestion.

4.5.2 Traffic accidents

FENZ records approximately two vehicle accidents each year, however it is likely there are other minor mishaps which go unreported. There is no record kept of near misses.

4.5.3 Reputational damage

For some types of businesses an unwanted alarm can cause significant reputational damage. Businesses in retail and hospitality industries, or those which host large numbers of people such as stadiums or conference centres are especially vulnerable.

Manufacturers often have significant costs around the need to shut down and then restart production lines. Depending on the duration of the interruption there may be spoilage of stock, or flow on effects which mean that a contracted deadline is exceeded. In addition to the direct costs this affects that business's reputation or ability to deliver on time.

4.5.4 FENZ procedures and operations

Wear and tear on equipment

With half or more of all calls being unwanted alarms, and an additional 110,000 vehicle movements each year as a result there is the associated degree of additional wear and tear on vehicles and other equipment including personal protective clothing.

Interruption of other activities

In the time between callouts, firefighters complete other worthwhile activities including public outreach and education, training, recommissioning of vehicles, and administrative duties. When a call comes in these activities are immediately interrupted in order to provide the emergency response.

Complacency

At the extreme end, some stations are experiencing 90 percent of all calls as unwanted alarms. In these conditions even professional firefighters can become complacent. They may not prepare the correct equipment, or follow strict procedures in the expectation that a given call is more than likely not a real emergency. This effect can compromise safety for both the firefighters and for the communities they protect.

5 The case for change

5.1 Stakeholder engagement

For this report representatives from the alarm industry and a wide range of commercial and public institutions were consulted. Non-industry stakeholders were asked about the affects they suffered from unwanted alarms, their efforts to prevent them occurring and the costs they experienced.

5.1.1 Alarm manufacturer/wholesaler

The New Zealand standard for fire alarms systems is specific to New Zealand. This creates significant barriers to entry for new manufacturers, and difficulty for overseas companies coming into the New Zealand market with existing products. A new entrant would have to develop a product specifically for New Zealand. Country specific standards also mean local installers cannot directly import products to on sell.

The Fire Protection Association run a register of approved equipment and its members are encouraged to only use the products listed. Local manufacturer Pertronic have new products tested by an independent lab so that customers can have confidence that they will perform as per the specifications. Pertronic also manufacture a separate Australian product line to comply with the Australian standard.

There are industry specific qualifications, but no requirement that installers must be qualified. Wholesale suppliers consulted for this report are intentionally discerning about who they will supply to, as high quality installation is important for the proper functioning of the product. Frequent unwanted alarms can reflect poorly on the product even if the fault is with system design or installation.

Difficulty in accessing a wholesale supply limits the ability of “cowboy operations” to enter the market. Installers who attempt to cut costs by doing substandard installation work will incur significant aftersales costs. Instances where electricians have attempted to move into alarm installation without adequate training and experience has shown that it is not profitable due to the resulting issues needing to be resolved at their cost.

5.1.2 Hospital

In the hospital environment unwanted alarms are extremely costly. The costs incurred can include disruption to procedures, stress, and even threat to life safety for vulnerable patients. Because of this all available steps are taken to reduce or avoid unwanted alarms.

In older hospital buildings unwanted alarms are usually due to malicious activations via a manual call point or tampering with the sprinklers. Where there is a history of unwanted alarms the staff can be tempted to try to establish whether or not there is a fire, rather than beginning the evacuation procedure.

New buildings have more sophisticated alarm systems which has reduced the number of activations. In addition the hospital is organised into zones, when the alarm is activated only the zone affected must evacuate which has significantly reduced the costs to staff and patients.

Financial costs for installing and maintaining fire alarms comes under the general maintenance budget, and is not significant among the other maintenance items required in the hospital.

The FENZ predetermined response for a hospital is understandably large. Every instance of an unwanted alarm at the Wellington Regional Hospital is usually attended by a number of appliances.

This represents a significant deployment of resources which are not available for genuine emergencies.

Hospitals are reducing their unwanted alarms by using the newest available technology. Tamperproof fittings, smart sensors and where appropriate Alarm Acknowledgement Facilities have all contributed. Despite these efforts hospitals still feature as sites with high numbers of unwanted alarms and more is required to further reduce the impact these have on the hospital operation, on FENZ and on those who may suffer an emergency at a coinciding time.

5.1.3 Prison

Prison fire alarms have an arrangement unlike most other sites. The prisons operate a "double knock" system where an alarm signal generated from within the areas occupied by the inmates is sent to the monitoring company but is not automatically forwarded to FENZ. If FENZ were to attend the staff would take up to 30 minutes to pass through security and enter the prison. For this reason prison staff are trained in firefighting, and FENZ are not requested to visit except in the event of a large fire.

Unwanted alarms occur frequently in a prison environment. Rimutaka Prison experienced 300 unwanted alarms in the last ten years. The vast majority of alarm activations are due to the inmates tampering with the sensors or sprinklers. Fire events are extremely rare.

When the alarm system is activated a strict policy is followed. The person who has set the sprinkler off has to be shifted out of their cell while the water is cleaned up, and the maintenance contractor replaces the sensor and/or sprinkler head. If the sprinklers have been activated the water is off in the prison cells during this period, so the maintenance contractor must respond within three hours to enable the cell to be cleaned up, the prisoner put back in their cell and the water back on.

At Rimutaka the disruption to prison life is minimal. The disruption lasts while the sprinkler is being reinstated as noted above. Because the water is off the staff do more fire watches involving security patrols and visual checks. Extra staff are not required but prison activities may need to be restricted during this period. Most of the unwanted alarms occur at night or early in the morning when the prisoners are bored or annoyed so activities are not usually interrupted.

At Arohata Prison which is a much smaller facility it used to be required that all prisoners be evacuated and water would be shut off from the entire building. This was extremely disruptive and raised significant safety issues. The local fire brigade is a volunteer staffed station and prison management are aware of the impact on the volunteers and their employers and families.

A preventative approach has reduced the number of unwanted alarms. The Department of Corrections worked with a fire engineer to develop a solution. This was approved by prison management and FENZ was then consulted. The new approach has seen the number of unwanted alarms at Arohata Prison halve over the last five years.

New buildings in the prison have tamper proof alarm sensors installed. Prisoners who are at higher risk of activating the alarm system are housed in these newer areas. Old sprinklers in the cells are being gradually replaced with a tamper proof type which is recessed into the celling, at a cost of approximately $2,000 per sprinkler head. The entire system will be upgraded within five to six years.

5.1.4 Building owner/manager

Discussions with the owners and managers of commercial buildings revealed a wide variance in the knowledge they hold regarding fire alarm systems, their maintenance, and the standards and regulations as they apply to their building(s). There appeared to be a strong correlation between this knowledge and the incidence of unwanted alarms. Both activations as a result of issues with the alarm system, and from the actions of contractors, were lower in the buildings with knowledgeable and proactive management.

Inevitably, alarm systems will reach the end of their useful life at some point. Components appear to last between 10 and 25 years depending on the installation and local environmental conditions. As the system suffers from corrosion, or otherwise degrades, unwanted alarms will become more frequent. From this point the actions and decision making of the building manager can determine if the unwanted alarms continue, often with increasing frequency, or if the underlying issue is resolved.

For the purposes of usual maintenance it is appropriate to replace individual fault components as they fail. If the system is old, multiple components are failing, or the panel is producing faults this would tend to suggest that greater intervention is required. Attempting to continue to maintain a system beyond its serviceable lifetime may be less expensive for the building owner as they can delay the need for more extensive work. Costs of ongoing unwanted alarms fall on tenants and the FRS which must attend.

Alarm system upgrades may be required for other reasons such as changes to the building use or when a building consent is required, for example for seismic strengthening work. The building must then comply with the standards of the day.

Building managers acknowledge the cost on tenants as they are aware of the disruption caused by trial evacuations. Sensitive tenants such as doctors or dentists may have patients under sedation or procedures in progress. Trial evacuations can be arranged to mitigate this problem, which is not true of unwanted alarms.

Where fines have been issued from unwanted alarms caused by the action of tenants it has proven difficult to pass these fines on. More often than not the building owner has either applied to NZFS to have them waived or borne the cost.

Tradespeople frequently cause unwanted alarms due to dust or welding. Proactive building managers induct tradespeople to the building, explain the types of activities which can trigger the alarm. Use of the ability to isolate parts of the building undergoing construction or alarm maintenance was common.

In some circumstances the tenant is responsible for the fit out including the fire alarm. The building owner has no influence over the design or installation of the alarm system in this case. Once a problem occurs from poor installation, especially if a fine is issued, the building owner can often use this to insist that the problem be remediated.

It was generally agreed that the period of interruption resulting from an unwanted alarms was approximately one hour.

5.1.5 Varying incentives of stakeholders

Alarm system manufacturer

Pertronic are enthusiastic about tackling the problem of unwanted alarms, and continue to develop their products to improve the reliability and accuracy. Much of their new development is focussed on the human interaction with the system, including software to better enable timely maintenance and the correct operation of the system both on-site and remotely. A reduction in the incidence of unwanted alarms would benefit Pertronic as it would tend to bolster their reputation of reliable intelligent products. If their systems could be shown to have a low rate of unwanted alarms this would provide them with a strategic advantage over their competitors.

Complex and country specific standards benefit existing industry players. Bringing the New Zealand standard closer to that of other countries or adoption of a common standard with Australia would enable new entrants to the New Zealand market increasing competition. This may lead to improvements in the technology available, reliability and reductions in cost of alarm systems. Care would be required to ensure quality of systems is maintained following any change in the standard.

Alarm system installer/maintenance

Maintenance contracts with building owners typically include the monthly and annual checks, and attendance at unwanted alarms for a fixed fee. This gives the maintenance company an incentive to minimise the numbers of unwanted alarms.

System installation and commissioning would typically lead to a maintenance contract, so again the incentive is to ensure that unwanted alarms are minimised.

Potentially overriding these incentives are the need to keep operating costs as low as possible. High staff turnover appears to be common among these companies. Qualifications exist for alarm installers/maintenance but are not mandatory except for inspectors certifying alarm systems.

Public institutions

For Corrections and DHBs the problem of unwanted alarms is one of safety and disruption rather than cost. The financial costs of installing and maintaining the alarm systems are a relatively small and necessary part of their total capital and operational budgets. Both institutions have taken a proactive investment approach to use new alarm system technology, tamper resistant sensors and sprinkler heads to reduce the incidence of unwanted alarms. This has been largely successful.

The need to evacuate patients, in the case of a hospital, and inmates, in the case of a prison, as well as the practicalities of getting service workers in to replace damaged sensors causes a range of difficulties and safety issues. Their incentive is to prevent unwanted alarms as far as is possible, closely aligned to that of FENZ.

Building owner/manager

Incentives of building managers tend to differ depending if they are also the owner of the building. Non-owners will be motivated to reduce costs in the current year. By avoiding large upgrades which are costly, disruptive to tenants, and require considerable input from management they reduce their own costs and workload. The incentive is to do the minimum required to remain compliant.

The owner/manager may be more motivated by efficiency over the longer term. An alarm system upgrade can avoid many small future costs and improve the alarm performance which both avoids unwanted alarms and improves actual fire detection.

5.2 Case study – a hotel experience

To illustrate the problems and costs which are faced by businesses with repeated unwanted alarms, this case study explores the example of a hotel with alarm system reliability issues. The hotel is run in a building built in the 1960s, and has 136 guest rooms as well as function rooms and a restaurant.

5.2.1 Outline of events

Initially the alarm system was a pneumatic type. Due to the age and effects of corrosion the pipes had many leaks and this was responsible for unwanted alarms beginning in the early 2000s. In about 2005 an electronic system was installed. There were 14 unwanted alarms in that year.

Subsequently, numbers of calls reduced but within a couple of years the problem reappeared. This is attributed to the local atmospheric conditions causing faster than usual corrosion of the components, and the electronic system installed was not encapsulated in a protective coating. Despite maintenance work to replace defective alarm system parts, the volume of unwanted alarms became very high with the cumulative 12 month count of calls reaching 20 in both 2010 and 2011.

Total unwanted alarm charges issued by the NZFS since 2005[5] amounted to $89,000 although approximately $70,000 of these were waived as they were incurred by the alarm maintenance workers as part of attempts to repair or upgrade the alarm system. From 1 July 2017 the legislation changed meaning that FENZ could no longer issue unwanted alarm charges.

The region's Fire Risk Management Officer facilitated a meeting with the hotel management and local council representatives to enable a period of six months during which the hotel would be disconnected from the automatic fire alarm monitoring system to enable work to be undertaken to bring the alarm system up to an acceptable standard. This was necessary due to the high number of calls which were triggered by the maintenance activities. A protocol was agreed in which the alarm would sound in the building, staff would investigate the cause of the activation and in the event of a fire phone 111. The initial 6 month period continued on until after 18 months the hotel was reconnected to ensure life safety. A further meeting was held with property management staff and the alarm maintenance provider and the Fire Risk Management Officer. At this point $70,000 of unwanted alarm charges had been waived, but the hotel was informed that no further charges would be waived.

In mid-2018 the Fire Risk Management Officer began to attend all calls to this site. This enabled him to discuss the situation with the hotel management and with the attending service agent at the time of the problem. Local council again became involved as there were safety concerns about areas of the hotel including guest rooms being isolated from the alarm system.

The system was so unreliable that on 14 occasions the alarm activated twice in one day, or on consecutive days within a 12 hour period (e.g. overnight). There was many other occasions when the system activated during consecutive daytimes.

By October 2018 the 12 month count reached 23 alarms. The FENZ National Risk Reduction Manager wrote to hotel management to advise them they intend to instruct the automatic fire alarm system monitoring agent to disconnect the hotel's fire alarms system from the FENZ automatic fire alarm monitoring system. This would have wide implications for the hotel, as well as FENZ no longer being notified of a fire alarm, the system would no longer conform to the New Zealand standard, the building would no longer be able to obtain a building warrant of fitness and the hotel will likely be in breach of council permits.

Following this letter the remedial work was completed and the hotel management notified FENZ, narrowly avoiding the disconnection. The conventional alarm panel has been replaced with the newer and more sophisticated and reliable analogue addressable type. Total cost of the alarm system upgrade was $240,000.

[5] Charges prior to June 2005 are not recorded in the database.

Table 5.1 Unwanted alarms at case study hotel site 2000 - 2018[6]

Year	Qty alarms	Charges	Vehicle trips
2000	1		4
2001	2		8
2002	1		4
2003	0		0
2004	3		12
2005	14	8,000	56
2006	5	2,000	20
2007	1		6
2008	7	1,000	30
2009	11		44
2010	20	3,000	98
2011	14	14,000	66
2012	8	8,000	38
2013	10	9,000	42
2014	12	12,000	50
2015	13	13,000	56
2016	14	13,000	60
2017	8	6,000	34
2018	21	N/A	84
Total	**165**	**89,000**	**712**

The repeated fire alarm activations have caused considerable interruption to the hotel business over the 20 years of unreliable service. The nature of the business meant that work to improve the system was constrained by the room occupancy. During the high season maintenance could only be conducted between 10am and 2pm while the room was between occupancies. According to the hotel the upgrade was conducted in three stages, and was already well advanced at the time of the letter from the National Risk Reduction Manager.

The hotel has suffered three real fire events and on each occasion the alarm system performed as expected.

5.2.2 Costs to the hotel

The major costs of the alarms to the hotel have been incurred as a result of waking the guests in the night. This resulted in some groups insisting on moving to another hotel late at night, while many others received a refund for their accommodation. Typical occupancy of the hotel is 120 rooms occupied by up to 280 people. At an average room rate of $180 this could amount to lost revenue of $21,600 per night, not allowing for any functions which may have been interrupted. The hotel is frequently full over the peak season and hosts several large functions such as weddings each year.

Hotels trade on their reputation and online reviews are increasingly important to the industry. Hotel management keep a close eye on reviews both positive and negative and have not noticed frequent mentions of problems with the alarm system. This means they have largely avoided suffering from reputational damage as a result of the fire alarm. Guests tend to stay for short periods and are therefore unlikely to have experienced repeated alarm activations.

Staff have experienced stress in relation to encouraging guests to evacuate. Guests from overseas may be inclined to try and pack their belongings before evacuating. Domestic guests sometimes fail to accept that evacuation is necessary. These issues can result in some unpleasant interactions.

[6] Data extends only to August of 2018.

Unwanted alarm charges represent a large potential cost, however $70,000 of the $89,000 of charges issued between 1998 and 2017 were waived to encourage the hotel to redirect that money to alarm system upgrades.

None of the reoccurring tour group clients have cancelled their contracts, though management did note that the guests themselves are different each time so most do not experience repeated alarms. Some tour companies have criteria around the type and location of hotels they can use which restricts their ability to take their business elsewhere.

5.2.3 Costs to FENZ

In addition to the costs of unwanted alarms identified elsewhere in this report, the Fire Risk Management Officer has expended considerable time and effort to engage with the hotel management throughout the period of high alarm activations.

Intangible costs such as staff frustration and growing complacency will tend to be exacerbated when so many unwanted alarms occur at the same site over such an extended period.

5.3 Opportunities for practice change

This study suggests a combination of legislation, management systems, technological improvements, and monitoring of analysis of data could assist in the reduction of the number of unwanted alarms.

Advantages from new technology can be exploited further, for example through improvements and automation of call-back procedures, along with access and transmission of rich information from existing analogue addressable fire alarm systems to FENZ communications centre.

Information held about buildings and their alarm systems can be used in conjunction with rich information from analogue addressable fire alarm systems to develop onsite filtering where appropriate, and modifications to the predetermined response. For example a reduced response, or the first responding appliance may be sent under lights and siren, with the remaining appliances traveling at normal road speed.

Improve data collection and storage to enable more complete analysis of unwanted alarm causes, and trends by building use. Current FENZ data is incomplete and may include many instances of fires already extinguished on arrival. Measures should be put in place to ensure proper data collection continues during inevitable periods of industrial action.

Independent auditing of the software settings and wiring of alarm systems post commissioning. This could occur randomly, at regular intervals (two or five yearly), or following repeated unwanted alarms. Overseas experience has shown that alarms may be altered to reduce unwanted alarms, and that these changes can have consequence for life safety (FPA Australia, 2018). Audits should be conducted by an agent other than the commissioning or maintenance contractor.

Current standards require commissioning and acceptance testing of fire detection and alarm systems must be performed by appropriately qualified third party certifiers (IPENZ, 2011) (Standards New Zealand, 2010). There is no requirement for independent inspection or auditing after commissioning.

The alarm industry, building owners/managers, the insurance industry, and local government all have an interest in fire safety and delivering quality service for their customers. FENZ should engage with these groups to ensure all have the same understanding of the definition and problem with unwanted alarms, as well as the cost burden each faces as a result. It may be possible to encourage the adoption of alarm systems with new technologies through better understanding of the issue and through incentives through such mechanisms as reduced insurance costs, rates rebates and the like.

Further studies may also contribute to better information. For example, testing interventions to reduce unwanted alarms in a localised area with a high rate of unwanted alarms such as the Wellington CBD. Such a study may comprise the following scope and stages:

- Baseline period 12 months where additional data is collected for each site which experiences an unwanted alarm including
  - Alarm model and age, types of sensors used, other system specifics
  - Verify building use information held in the FENZ database is correct
  - Any building use change or refit since alarm installed – verify if alarm adjusted or reconfigured to account for refit
  - Has system been installed according to industry best practice (given it's age and for current best practice)
  - Which company is contracted for maintenance
- Review data for patterns, correlations and likely causations
- Design interventions
- Consider nudges where alarm is very old, or there is poor technology
- Test interventions over a period – 12 months
- Compare test period to baseline period to evaluate which interventions are effective.

6 References

Ahrens, M., 2013. *Development of a Risk-Based Decision Support Tool to Assist Fire Departments in Managing Unwanted Alarms, Task 2 Deliverable – Literature Review,* Quincy: The Fire protection Research Foundation.

Anon., n.d. *Fire and Emergency New Zealand Act 2017.* [Online] Available at: www.legislation.govt.nz/act/public/2017/0017/43.0/DLM6712701.html [Accessed September 2018].

Apfelbeck, A., 2015. Two Hypotheses to Reduce Unwanted Automatic Alarms. *Florida Fire Service Magazine,* Issue May.

Apfelbeck, A., 2016. The AHJ's perspective. *NFPA Journal,* Issue May June 2016.

Auckland Uniservices Ltd, 2006. *The cost factors and profile of false and unwated alarm activations in New Zealand,* Wellington, NZ: New Zealand Fire Service Commission.

BERL, 2005. *The cost of managing the risk of fire in New Zealand,* Wellington: The New Zealand Fire Service Commission.

BERL, 2012. *The economic costs of fire in non-residential buildings,* Wellington, NZ: The New Zealand Fire Service Contestable Research Fund.

CFOA, 2014. *CFOA Guidance for the reduction of false alarms & unwanted fire signals,* Tamworth, UK: Chief Fire Officers' Association.

Chagger, R., 2015. *Live investigations of false fire alarms,* Watford, UK: BRE Global Ltd.

Chagger, R. & Smith, D., 2014. *The causes of false fire alarms in buildings,* Watford, UK: BRE Global Ltd.

Datamine, 2018. *Incident projections,* Wellington, NZ: Fire Emergency New Zealand.

Department of Building and Housing, 2011. *Compliance document for New Zealand Building Code, Clause F7 Warning Systems, 3rd Edition,* Wellington: New Zealand Government.

Euralarm, 2018. *False Alarm Study,* Berlin, Germany: Erich Schmidt Verlag.

Evarts, B. & Molis, J., 2017. *United States Firefighter Injuries,* Quincey: National Fire Protection Association.

Fahy, R., LeBlanc, P. & Molis, J., 2018. *Firefighter Fatalities in the United States - 2017,* Quincey: NFPA Research.

Fire and Emergency New Zealand, 2017. *Proposals for Fire and Emergency New Zealand regulations (fire safety and evacuation of buildings, and offenses and penalties) discussion document,* Wellington, NZ: Fire and Emergency New Zealand.

Fire and Emergency New Zealand, 2018. *Research into Private Fire alarm Unwanted False Alarms (National Perspective),* Wellington, NZ: Fire and Emergency New Zealand.

Fire industry Association, 2012. *Guidance for Responsible Persons on False Alarm Management of Fire Detection and Alarm Systems,* Hampton, UK: Fire industry Association.

FPA Australia, 2018. *Alarm Signalling Equipment: Connection Requirements (Victoria).* Blackburn North, Australia: Fire Protection Association Australia.

Hall, J., 2013. *Development of a Risk-Based Decision Support Tool to Assist Fire Departments in Managing Unwanted Alarms, Task 5 Deliverable – Model and Tool for Assessing Policies,* Quincey: The Fire Protection Research Foundation.

Hammerberg, T., 2016. The industry perspective. *NFPA Journal,* Issue May June 2016.

IPENZ, 2011. *Practice Note 22 - Guidelines for Documenting Fire Safety Designs,* Wellington: The Institution of Professional Engineers New Zealand Inc.

Litmus, 2017. *The voice of the family, research with families of volunteers,* Wellington, NZ: New Zealand Fire Service.

London Fire Brigade, 2018. *Responing to fire alarms.* [Online] Available at: https://www.london-fire.gov.uk/about-us/services-and-facilities/responding-to-fire-alarms/
[Accessed january 2019].

National Fire Protection Association, 2011. *Unwanted Fire Alams,* Quincey, MA: National Fire Protection Association.

National Fire Protection Association, 2012. *Fire Service Guide to Reducing Unwanted Alarms,* Quincey: National Fire Protection Association.

National Fire Protection Association, 2013. *NFPA 72 National Fire Alarm and Signaling Code,* Quincey: National Fire Protection Association.

National Fire protection Association, 2016. The Unwanted Conundrum. *NFPA Journal,* Issue May June 2016.

New Zealand Fire Service, 2005. *Code of practice for the automatic fire alarm system,* Wellington: New Zealand Fire Service.

New Zealand Fire Service, 2014. *Process Map: Unwanted False Alarm Management Plan,* Wellington: New Zealand Fire Service.

Queensland Building and Construction Comission, 2014. *Building Codes of Australia (BCA) Classes of buildings.* [Online]
Available at: www.qbcc.qld.gov.au/building-codes-australia-bca-classes-buildings
[Accessed January 2019].

Queensland Fire and Emergency Services, 2016. *Fire Alarm and Building Design Guidelines for the Reduction of Unwanted Alarms,* Brisbane, Australia: State of Queensland.

Queensland Fire and Emergency Services, 2016. *Pragmatic Cooking & Shower Test.* [Online] Available at: www.qfes.qld.gov.au/buildingsafety/unwanted/Pages/cookandshowertest.aspx
[Accessed January 2019].

Scottish Fire and Rescue Service, 2014. *Prevention and Protection Fire Safety Enforcement: Unwanted Fire Alarm Signals (UFAS) incident Policy,* Edinburgh, UK: Scottish Fire and Rescue Service.

Sopp, M., 2015. *The on-site filtering of fire alarm signals.* [Online] Available at: app.croneri.co.uk/feature-articles/site-filtering-fire-alarm-signals
[Accessed December 2018].

Standards New Zealand, 2010. *Fire Detection and Alarm Systems in Buildings,* Wellington, NZ: Standards New Zealand.

7 Glossary

AFA – Automatic Fire Alarm

AFASP - Automatic Fire Alarm Service Provider. Manages the connection of fire alarms to Fire and Emergency New Zealand Communications Centres.

AAF - Alarm Acknowledgement Facility. Commonly known as a 'hush button' allows the occupant to silence the alarm in the event of an unwanted activation. AAF are available with both conventional and analogue addressable fire alarm systems.

Analogue addressable fire alarm system – Electronic system for larger and more complex buildings

Conventional fire alarm system – Electronic system suitable for smaller buildings

FAMO – Fire Alarm Monitoring Organisation. From the United Kingdom, a third party which monitors the alarm system and transmits alarm signals to the FRS either automatically via a direct connection or manually by making a phone call to the emergency line. May perform call filtering to confirm the presence of a fire. Usually receives fault and isolate signals from the alarm system. Similar in operation to the AFASP in New Zealand.

FENZ – Fire and Emergency New Zealand

Fire Alarm Service Agent – contracted by a building owner/manager for alarm system installation and maintenance

FRS - Fire Rescue Service(s) which refers to the relevant local authority tasked with fire and emergency response for that area.

NZFS – New Zealand Fire Service, became Fire and Emergency New Zealand on 1 July 2017

PFA – Private Fire Alarm

Signal Generating Device (SGD) – Component in a conventional fire alarm. Capable of transmitting four signal types: fire, defect, test and isolate.

Super Signal Generating Device protocol (Super SDG) – Component in an analogue addressable fire alarm. An intelligent system which can transmit complex information from the fire alarm panel.