

UNWANTED ALARM ANALYSIS OF RAPID CITY FIRE DEPARTMENT 2014

Rapid City Fire Department of Rapid City, South Dakota reviewed unwanted alarms for one year to determine the cause of the alarm and actions taken by fire fighters at the incident.

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Unwanted Alarm Analysis of Rapid City Fire Department 2014

Summary

Rapid City Fire Department studied the cause and property use of unwanted alarms in the city to determine if it would be appropriate to consider a change in system installations, education, and emergency response matrix warranted.

A one-year special study was conducted from January 1, 2014 to December 31, 2014 to gain a baseline of information and determine if there are any trends that would suggest a good place for change or more study.

The Rapid City Fire Department participates in the National Fire Incident Reporting System (NFIRS), the standard national reporting system used by U.S. fire departments to report fires and other incidents to which they respond in a uniform manner. The United States Fire Administration, under the Department of Homeland Security and the Federal Emergency Management Agency (FEMA), maintains these fire-response records. The NFIRS reporting format is based on the National Fire Protection Association Standard 901, Uniform Coding for Fire Protection. Local fire departments generally complete the report of each incident as it occurs and forward these to their state office for validation and consolidation into the national database.

All incidents are categorized by what occurred, called an incident type, such as fire, medical response, rescue, and false alarm. NFIRS incident type codes for False Alarms and False Calls (incident type numbers 700 – 751) and Confined Cooking Fires (incident type number 113), were evaluated and divided into different categories to look at property use, cause of alarm, and who needed to respond and in what timeframe. Confined cooking fires that required fire department involvement were not included as they are more like a structure fire than an unwanted alarm. Fire department involvement was required in confined cooking fires when there was an unconscious person in the building, when there were visible flames, or when the fire department suppressed the fire. In most confined cooking fires there was smoke but not flames; these were included. There were 1,013 incidents considered in the study.

The NFIRS false alarm incident type is a broad category, generally used to indicate that the fire department was not needed to respond to an emergency. It does not reflect situations where an occupant needed to take emergency action, such as a food burning and producing smoke but not flames, or when a system needed attention, such as when someone accidentally turns off water to a fire sprinkler system. The Rapid City Fire Department wanted to find where and why most false alarms happened and how often were these caused by human error versus a limit of detection technology.

Thirty-eight percent of the alarms occurred in residential property uses (NFIRS property use codes 400 - 464) and 41% of these occurred in multifamily dwellings (NFIRS property use code 429).

The cause of alarm was determined from incident narratives and categorized by an in-house list. One-quarter of the alarms were related to Monitoring, which was made up mostly of supervisory and trouble alarms and when life safety systems were serviced or altered without reporting this to the monitoring company, thereby generating a fire department response. After Monitoring, the most common were Confined Cooking Fires, eighteen percent, and Mistaken ID, eighteen percent, when the device could not tell the difference smoke from an uncontrolled fire and a non-fire event, such as dust from cleaning.

A detection device provided a warning that needed to be addressed but not necessarily in a ten-minute window, such as a supervisory signal, in fifteen percent of the 1,013 considered incidents. We will call these *Warning Alarms*. An occupant needed to take immediate action to intervene or evacuate, such as a pan of food on the stove that is smoking, in thirty-six percent of the incidents. We will call these *Emergency Action Needed Alarms*. *Unwanted Alarms*, when the device mistook something like steam or dust for an emergency, occurred in eighteen percent of the incidents. True *False Alarms*, incidents when someone pulled a manual pull station, a system was not in test mode during maintenance, or a monitoring company was not alerted before a fire drill, occurred in eighteen percent of the incidents. A cause could not be found or there was not enough documentation in the incident narrative report to determine the cause of alarm in thirteen percent of the incidents. There were no incidents where *Fire Department Emergency Alarms* occurred, when the fire department is needed immediately.

Reliability of alarms needs to be increased for the occupant; meaning, when an alarm sounds there is good reason to evacuate the structure. When an alarm sounds and, in hindsight, there was no threat to life or property, people begin to lose faith in the life safety system and sometimes ignore future alarms. In a study of mid-rise residential evacuation, less than twenty-five percent of the occupants felt the fire alarm indicated a potential real emergency. (Proulx, 1994) The study further suggested that the closer in time the non-emergency alarm activations occur, the less likely people will believe the alarm indicates an emergency.

While detection and alarm systems are improved to reduce nuisance alarms, we need to look at ways to reduce nuisance and unwanted alarms with existing technology and with the systems installed in existing buildings.

Concerns

One challenge is conflicting messages and criteria for desired response to a fire alarm. An alarm generally is a signal to evacuate, and yet human nature and fire service education often tells people to first assist others in evacuating or seek the source of the alarm and take action to reduce or eliminate the threat. As a fire service, we teach that there are times when it is more appropriate to suppress or mitigate the fire rather than evacuate. The fire service recommends the installation and use of fire extinguishers in many circumstances which delays that individual's evacuation while potentially eliminating the need for an evacuation. The fire service recommends all but one person evacuates and that single person suppresses the small fire using a lid (cooking) or a fire extinguisher.

This becomes a frustration when people seek more information about the cause of the fire and they are injured or killed while trying to suppress the fire or due to their delay in evacuation. If their actions

prevented further fire spread, they are praised. These teachings are neither wrong nor right; they are a barrier to a consistent message of what to do when a fire alarm sounds.

The occupant who recognized the fire alarm, found the source was smoke from food on the stove, and prevented the fire from becoming a hostile fire knows that there was an emergency and knows the emergency is over. Other occupants who were not near the cooking area do not know the reason for the alarm and after their evacuation may see this as an unwanted or nuisance alarm because they will not perceive any danger to themselves. The fire alarm was a call to action to evacuate and possibly to mitigate the threat of fire but also created a situation where occupants may have lost trust in the need to evacuate the next time the alarm sounds.

For some people with mobility concerns, the risk of evacuating the building without use of elevators is greater than the risk of a fire emergency. Even if there is an uncontrolled fire, as long as the smoke and heat are not threatening them personally, the risk of injury during evacuation appears to be too great. An honest look at the independent and assisted living apartments for older adults and adults with disabilities tells us that our fire department would have significant difficulty assisting with an evacuation of all occupants unable to evacuate on their own.

Few, if any, of these multi-family occupancies in Rapid City have an area of refuge as defined in International Fire Code Section 1002 or an elevator that will continue to function for occupant use after the fire alarm sounds. And yet, the risk of fire fighter and occupant injury during a full evacuation is significant. As a fire department, it may be best to suppress the fire rather than assist or carry all of the remaining occupants out of the building. It may be best for some occupants to shelter in their apartment, in a neighboring apartment, or on a lower floor, rather than attempt to evacuate to the outside of the building.

Inclement weather could increase the risks of injury during an evacuation and compound the concerns the fire department must solve upon their arrival.

These situations create a conflict that needs to be resolved. Are people to evacuate or mitigate? If they do mitigate to a point that there is no longer a threat, can they halt the evacuation? Will people who were evacuating know the alarm was a valid warning for a potential fire but the danger was mitigated, and will this retain a belief in evacuating when there is an alarm? Are there situations where it is less risky to remain in a building rather than evacuate, even without an area of refuge? How do we prevent unwanted alarms that train people to no longer trust an alarm is a warning of a potential threat to their safety? Have our building and fire codes created enough passive and active fire prevention and suppression levels of protection to negate the need for all occupants to immediately evacuate certain occupancies? Does the risk of injury and death in a rare and catastrophic uncontrolled fire outweigh the everyday situation of unwanted alarms?

While some older buildings have smoke alarms that only sound a notification at the same device that detected smoke, not alerting occupants in other parts of the building; there are also some where every alarm, even in an apartment, will sound an alarm to the entire building. Both can be problematic.

Smoke alarm and smoke detector placement is a concern that appears to result in unwanted alarms, especially confined cooking fires. The 2013 NFPA 72©, *National Fire Alarm and Signaling Code*© partially addresses this situation in residential occupancies. The Annex for NFPA 72 Chapter 29 encourages detection be at least 20 horizontal feet from a cooking appliance, never less than 10 feet away, and provides ways to reduce unwanted alarms when installing smoke detection between 10 and 20 feet from a cooking appliance. Alarms in this middle ground should be photoelectric and have a hush feature so the occupant can silence the alarm while they mitigate the source of smoke.

These guidelines did not exist when some of our residential occupancies were built, especially multi-family occupancies. We encourage changes when multiple unwanted alarms occur in a structure. There are situations where the apartment is too small to apply this solution, especially in studio apartments.

When commercial occupants install cooking devices in areas that were not originally designed as cooking areas, we generally encourage changes. Examples include when a hotel changes part of their lobby to provide a breakfast/snack area including a toaster and a microwave, or a car dealership installs a popcorn machine in their customer waiting area.

Some occupancies have monitored alarms, when an off-site company receives a signal from the alarm panel and calls the fire dispatch center to report the activation of a fire alarm. While these fire alarm systems have a “hush” feature to silence the alarm if they determine the cause of alarm is not a hostile fire, the fire department is already responding to the location. The responding fire fighters often turn off their lights and sirens when they know the nature of the alarm but generally feel an obligation to investigate the cause of the alarm and continue to respond. Silencing the alarm is helpful for the occupants but does not reduce the impact on the fire department.

We need more education for occupants and building owners as well as fire fighters. We need to consider changing our response to potential false alarms. Under consideration:

- Program fire alarm systems to require two smoke detectors or water flow before notifying a large area to evacuate.
- Eliminate smoke detection near cooking areas, including those with toasters and microwaves, in existing systems. In the case of fire alarm systems that do not have the single- or multiple-station smoke alarm hush feature, consider allowing a reliable occupant to silence or reset an alarm if the cause is cooking-related.
- Remove or reduce the additional smoke detection and notification local amendment for Business Group B occupancies as defined in the International Fire Code. These include most office buildings, banks, civic administration buildings, beauty shops, and outpatient clinics.
- Encourage zoned notification to evacuate only threatened areas in appropriate buildings – those with fire separations, smoke evacuation systems, fire sprinklers, trained staff, etc.
- Eliminate single station alarms in Americans with Disabilities Act (ADA)-compliant apartments from notifying the entire building; find an affordable way to relay the supervisory alarm.
- Reinforce the message to evacuate immediately and every time an alarm sounds as reliability increases.

- Educate the public and building owners on why there may be a small event without an alarm sounding or only a part of the building's alarms sounding requiring only a partial evacuation.
- Educate the public on the multiple sounds of alarm panels and stand-alone alarms that are not evacuation signals and steps to resolve the problem.
- Stage at the fire station for single smoke/heat detector alarms at specific buildings with trained staff and multiple safety features until a preliminary investigation is conducted on site; a second detector, water flow, or pull station activates; or someone on site calls 911.
- Regularly remind fire fighters of these changes in systems, education, and policy and the purpose for the changes.

Description of Rapid City and the Rapid City Fire Department

Demographics

Rapid City is the second most-populated city in South Dakota with an estimated 72,638 residents (US Census, 2014). Rapid City is the most-populated city in Pennington County with an estimated 108,242 residents (US Census, 2014). Most Rapid City residents are either White (80.8%) or American Indian (11.0%); 5.3% reported two or more races on the US Census. The US Census estimates 14% of Pennington County residents in 2013 were age 65 years and over, 59% between the ages 20-64 years, and 27% were age 19 years and under. The South Dakota State University Rural Life and Census Data Center estimates the age distribution for Pennington County in 2025 will be 21% age 65 years and over, 52% age 20 – 64 years, and 27% age 19 years and under.

Less than 5% of the population speaks a language other than English at home. Most adults age 25 and older have a high school diploma or equivalent, 91%; 30% have a Bachelor's degree or higher. 16% of the city's population is below the poverty level. (US Census, 2009-2013)

Rapid City is home to Rapid City Regional Hospital, a Level II Trauma Center; "Sioux San" Rapid City Service Unit, a hospital of the Indian Health Service; private surgery centers; and several small medical clinics.

There are an estimated 30,332 housing units; about 60% are single family residences. There are an estimated 4,000 commercial properties.

Rapid City Fire Department

The Rapid City Fire Department responds to more incidents than any other fire agency in South Dakota, providing primary fire protection for the 55.41 square miles of Rapid City and primary medical services for most of the 108,242 people (US Census, 2014) in the 2,776.55 square miles of Pennington County. In addition to general fire, BLS, and ALS services, the department's 119 fire fighters, EMTs, and Paramedics provide medical transport for emergency incidents throughout Pennington County and between

facilities, hazardous materials response, airport firefighting, and technical rescue. The Fire Prevention division has seven full-time employees and one quarter-time employee providing code enforcement, fire investigation, fire data maintenance, and community risk reduction education. The department has another 21 employees in billing, public information, command staff, and support staff.

Codes that May Impact Rapid City Fire Department's Results

The City of Rapid City is currently using the 2003 International Fire Code and NFPA 72 to determine which buildings require fire alarm systems and which must be monitored.

Rapid City made a local amendment to include fire alarm systems in all Group B and E occupancies with an occupant load of 50 or more persons. Smoke detection must be installed in corridors, lobbies, reception areas open to the corridor, and other similar common use spaces. This was put into place after the department responded to a fire in an office building where not all occupants knew there was a fire in their building and therefore had not evacuated. This amendment addressed the department's concern for the safety of those in our city.

Detection is required in multifamily occupancy (International Fire Code, IFC, R-2 occupancy group) corridors servicing resident and guest rooms unless the corridor is external or the resident or guest rooms have an egress door opening directly to an exterior exit access that leads directly to an exit. R-2 Occupancies are residential occupancies with multiple sleeping units where people are mostly permanent such as apartments and dormitories and are often called multi-family housing.

Our high-rise fire alarm requirement applies to buildings with floors used for human occupancy located more than 51 feet above the lowest level of fire department vehicle access.

Multi-family occupancies (IFC R-2) that are required by local planning rules to provide accessible apartment units meeting American Disabilities Act Accessibility Guidelines are encouraged to have these units' fire alarms monitored and trigger a response by the fire department. This has been done to aid in a swift evacuation of an occupant that may have a delayed ability to self-evacuate. Unfortunately, a common way to do this is to install fire alarm system detection and notification in these units. This meets the intents and requirements for federal and local intents but causes the entire building to be notified, and require evacuation, every time smoke (or substance mistaken for smoke) is detected in an ADA-compliant apartment.

Incidents

Rapid City Fire Department reported 15,424 incident responses in 2014. False Alarm & False Calls (all incident types in the 700 series) represented 5% of all incidents (832). All mutual aid, automatic aid, or other aid given to other fire agencies have been separated into one data element, Aid Given to Other Fire Departments, to ensure data evaluation that may lead to a change in policy is reflective only of Rapid City incidents.

Rapid City Fire Department Incidents by Group in 2014

Incident Type Group	Incidents	Percentage
Fire	361	2.34%
Overpressure Rupture, Explosion, Overheat	20	0.13%
Rescue & Emergency Medical Service Incident	11,562	74.96%
Hazardous Condition with No Fire	195	1.26%
Service Call	1,196	7.75%
Good Intent	762	4.94%
False Alarm & False Call	832	5.39%
Severe Weather & Natural Disaster	1	0.01%
Special Incident Type	19	0.12%
Aid Given to Other Fire Departments	476	3.09%
Total	15,424	100.00%

Table 1 Incident Types in Rapid City in 2014.

Unwanted Alarms

Rapid City False Alarms and False Call Responses in 2014

Total False Alarm & False Call	832
False alarm & false call, other (700)	42
Malicious (710 – 721)	42
Malfunction (730 – 736)	204
Unintentional (740 – 746)	544

Table 2 False Alarm breakdown 2014 Rapid City Fire Department.

Unwanted Alarm Types

In an attempt to understand the issue better, Rapid City began a special study creating a more descriptive list of NFIRS False Alarm Incident Types (700 series) with a focus on why the alarm sounded. These are called *Unwanted Alarm Types*; after one year, the list can be grouped into eight categories:

- Malfunction – alarm, sprinkler head, pipe, or other of the system was damaged or improperly installed
- Mistaken ID –something other than an uncontrolled fire detected
- Monitoring – supervisory, fire drills, systems that should have been in test mode
- Cleared – most likely a good cause for the alarm but it was clear when fire fighters arrived
- Pull Station – pull station or “fire” button of residential system activated
- Emergency Exit – activation of an alarmed exit
- Other
- Unknown – cause could not be determined by fire fighters on scene or there was not enough information in the narrative.

Unwanted Alarm Types were determined by one person, most often using incident narratives and occasionally discussion with responders.

In this data, an alarm had to be sounding for the incident to be categorized in the 700 series. It may or may not have been a monitored system – someone could have heard an alarm nearby and called 911. It could have been a non-fire alarm such as a trouble signal, or a burglar alarm that was reported as a fire alarm. If someone detected smoke, no alarm sounded, and it turned out that it was not an uncontrolled fire it was categorized as a Good Intent Incident.

The following is a chart of the *Unwanted Alarm Types* used. This is not a perfect list nor is it inclusive of every situation. The list was amended several times throughout the year.

Categories of Unwanted Alarms Used in the 2014 Special Study

Unwanted Alarm Type	Explanation
Cleared - CO alarm with probable cause but no problem upon arrival	When a CO detector alarmed, there probably was CO in the structure, but none was detected upon arrival - scene turned over to utilities
Cleared - other probable alarm but cleared upon arrival	We arrive and the panel is clear but an alarm did go off and probably for a good reason.
Emergency Exit - unintentional	When someone accidentally opens, or partially opens, an alarmed emergency exit
Emergency Exit - unknown	Unknown intent or cause of activation
Emergency Exit - malicious	Someone opens an alarmed emergency exit with the intent to disrupt and knowing there is not a problem
Emergency Exit - good intent	Someone believes they need to use the alarmed exit
Malfunction - Detector is damaged by contact or removed	Someone has struck or removed a detector and the system sends a full alarm rather than a trouble or supervisory
Malfunction - Detector is damaged by water	Water has leaked into the detector or wiring. Not set off by steam in the air but rather when water has caused damage to the system
Malfunction - Detector is dirty or oversensitive	Appears that the detector needs to be cleaned or reset. It should not have activated for the amount of particulate.
Malfunction - Detector due to ADA compliant setting/placement/full	When the ADA apartment alarm activates because an alarm is required too near the cooking area or when ADA unit alarms

alarm	are tied to the entire system but other units are independent loops
Malfunction - Detector malfunction/break, other (not monitoring)	Any other situation when the detector was damaged or not functioning properly
Malfunction - Sprinkler direct contact break (head, line, etc.)	When a sprinkler system is broken, generally due to someone running into it with machinery
Malfunction - Sprinkler pipe freeze	Sprinkler pipes froze and broke and are now leaking
Malfunction - Sprinkler/water line, other	When the sprinkler line has another problem that is not a freeze or direct contact break.
Malfunction - Domestic line freeze/domestic line, other	When domestic lines freeze and break or other problem with domestic water supplies
Malfunction, other	Whatever is unknown or not covered but suspected to be a problem with the hardware
Mistaken ID - Aerosol spray or smoke, other source	When a spray, aerosol, smoke or similar particulate sets off an alarm and is not covered by another data element
Mistaken ID - Bathroom - steam	When steam from a bathroom sets off the alarm
Mistaken ID - Cleaning - dust	Vacuum bags, school summer cleaning, and similar
Mistaken ID - Cleaning, other	Related to cleaning but not dust/dirt, aerosol, or smoke
Mistaken ID - Construction - dust or aerosol, paint	Spray painting, cutting concrete, and other dusts or aerosols during construction/remodeling
Mistaken ID - Construction - welding	When construction-related welding sets off the alarm
Mistaken ID - Construction other	Not listed otherwise but believed to be due to construction/remodeling
Mistaken ID - Cooking other (not fire 113)	Surprisingly there have been strange things blamed on cooking that did not produce smoke for a cooking-related alarm
Mistaken ID - Cooking steam	Steam from cooking (seen with rice)
Mistaken ID - Dryer/Laundry related steam, dust, smoke	When the dryer or other laundry type area appliance produces steam, dust or smoke that is not Carbon Monoxide, overheating motor, or potential fire
Mistaken ID - Heat from heating/cooling device malfunction	When a heating or cooling fan malfunctions and the ceiling temperature sets off the heat detector in the room or attic
Mistaken ID - Heat in attic on hot day setting off heat detector	Attic heat detectors activate due to ambient conditions rather than a fire
Mistaken ID - other	What's not covered
Mistaken ID - Range overheat (no smoke - 113)	When the restaurant cook turns the grill on without making sure the filters are back in place to diffuse the heat but there is no cooking-related fire/smoke
Mistaken ID - Toaster overheat (no smoke - 113)	When the toaster sets off the alarm due to cooking gases but does not produce smoke
Mistaken ID - Steam, other source	Steam not from cooking, bathroom, or laundry
Monitoring - Fire Drill not reported	When the occupants use their alarm for a fire drill but forgot to tell the monitoring company
Monitoring - Maintenance of system not reported	When someone is working on the life safety systems or related systems such as electricity but the system is not in test mode or

	the monitoring company is not contacted before work
Monitoring - Occupant called 911, supervisory or other alarm such as burglar	When a local alarm or trouble is sounding - something that is not supposed to trigger a dispatched response - and an occupant calls 911 to report a fire alarm
Monitoring - Related alarm, other	Other monitoring problems
Monitoring - Relay incorrect or misinterpreted	When someone on scene determines that the panel was misread, it was programmed incorrectly, or the monitoring company requested an inappropriate response
Monitoring - Supervisory - electrical	Supervisory signal that is related to an electrical concern
Monitoring - Supervisory - low air	Supervisory signal for low air in a dry system that is not due to an activation
Monitoring - Supervisory - tamper	Supervisory signal for Post Indicator Valve (PIV) tamper
Monitoring - Supervisory - freeze warning	Supervisory signal warning the internal temperature has reached a temperature where pipes may freeze.
Monitoring - Supervisory, other	Other supervisory signal
Monitoring - Trouble - low voltage	A trouble signal related to power supply
Monitoring - Trouble, other	Other trouble signals
Other including gas alarm false alarm	General other, I started tracking the rare things here such as an unwanted explosive gas alarm
Pull Station - good intent	They thought there was a problem (there was not) and the alarm had not sounded so they pulled an alarm or they were in need of attention/assistance and used the alarm to signal for help (violence)
Pull Station - malicious	Pulling an alarm to intentionally cause disruption with no need of assistance
Pull Station - unintentional	Most child pulls, did not mean for the alarm to sound from their actions
Pull Station - unknown	When we don't know why
Unknown after investigation	The narrative shows they ruled out many possibilities but don't know why
Unknown without investigation or lack of narrative	There isn't enough information or the narrative indicates they did not investigate

Table 3 List of Types of Alarms, the cause for the alarm sounding.

Confined Cooking Fires

Confined cooking fires with little or no fire are included in this report. Prior to 2012, Rapid City Fire Department categorized most cooking-related incidents that did not need fire department suppression as false alarms. Presently, all cooking-related incidents that were fires, or could have become fires (smoke was present), are categorized as Incident Types 111-Building Fire; 113-Cooking Fire, confined to object of origin; or 120 – 123, Fires in mobile property used as a fixed structure.

Categorizing all cooking-related fires as either false alarms or as structure fires does not reveal the full picture. To track differences, when a Confined Cooking Fire resulted in significant smoke damage, involved rescue, or fire fighters suppressed the fire, the “fire tab” on the incident report was completed and a dollar loss was entered. By searching for area of origin or by dollar loss, the confined cooking fires were separated into instances requiring fire department involvement and those that most likely did not require fire department involvement.

Comparison of Fires, Fires in the Kitchen, Confined Cooking Fires, and Confined Cooking Fires with No Damage or Injury in 2014

All Fires	361
“Cooking area, kitchen” area of origin for fire incident types 111, 112, and 114 – 123	6
Cooking Fires, confined to container (113)	195
Confined cooking fire – unwanted alarms (no suppression, no rescue, and no smoke damage) [Ten incidents from the 113 incident type required a fire department response for extinguishment or rescue]	181

Table 4 Breakdown of cooking-related fires in 2014.

The 181 confined cooking fires that resulted in unwanted alarm activation, the fire department wasn’t needed, are included as unwanted alarms along with those in the 700 incident type series unless otherwise specified.

Most Common Unwanted Alarm Types

Unwanted Alarm Types, or the causes of the unwanted alarm, fall into four major categories. Almost 25% of the unwanted alarms in Rapid City were Monitoring (251). Monitoring included 102 supervisory signals; our philosophy on supervisory signals has been that they are imminent alarms where intervention is needed and good customer service can be provided. Other common categories were Mistaken ID, 18%; Confined Cooking Fire, 18%; and Malfunction, 17%.

Unwanted Alarm Types by Group in 2014

Unwanted Alarm Types	Incidents	% of incidents
Cleared	8	0.79%
Confined Cooking Fire	181	17.87%

Emergency Exit	3	0.30%
Malfunction	177	17.47%
Mistaken ID	183	18.06%
Monitoring	251	24.78%
Other	2	0.20%
Pull Station	77	7.60%
Unknown	131	12.93%
Grand Total	1013	100.00%

Figure 1 Percentage Distribution of Unwanted Alarm Types in 2014.

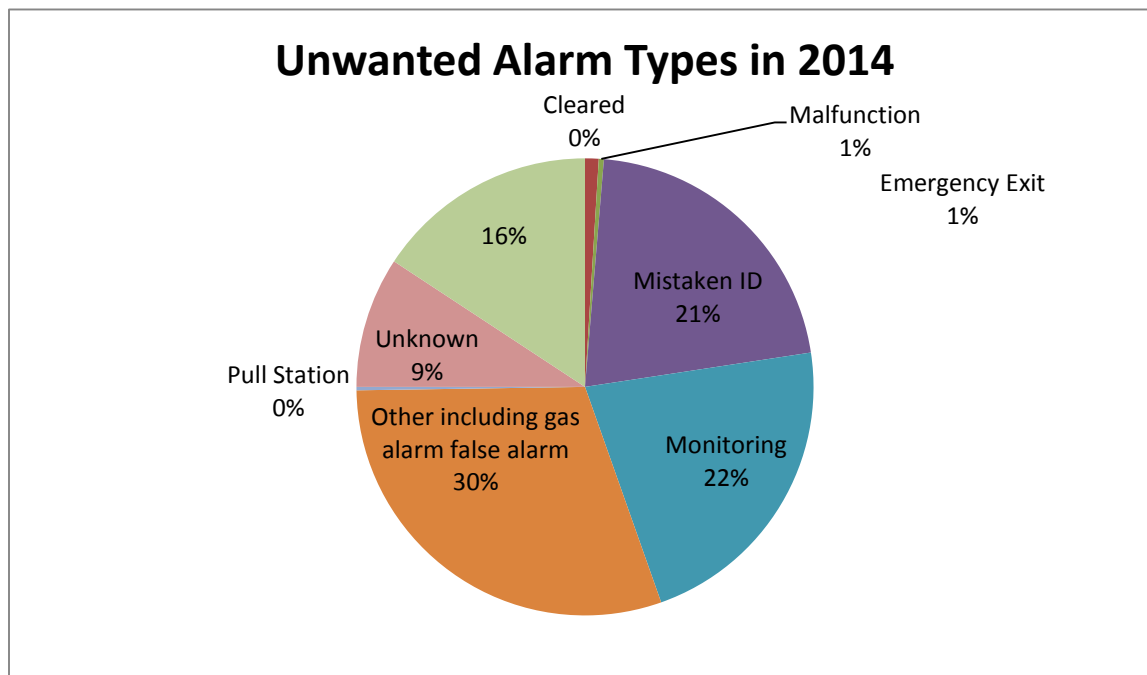


Table 5 Frequency of Unwanted Alarm Types in 2014.

Unwanted Alarm Types Compared to Incident Types

Incident type code 113 – confined cooking fire incidents were all categorized as *Cooking smoke* or *Cooking smoke with damage* Unwanted Alarm Types. *Cooking fire with damage* are cooking fires that were confined to the object of origin but had significant smoke damage or a person was rescued from the building. These fires are best described as starting in a cooking utensil and the fire never left the object of origin, an incident type 113. With resulting damage or a need for rescue, the fire is more like a structure fire than an unwanted alarm. When the occupant was able to mitigate the fire in the cooking utensil or there was only light smoke and no flames, the fire was more like an unwanted alarm.

When entered into NFIRS, the most common incident type selected were the NFIRS Incident Type categories of *Unintentional Activation* (544), Incident Type codes 740 – 746. These *Unintentional*

Activation incidents were mostly sorted into *Malfunction, Mistaken ID, and Monitoring* Unwanted Alarm Types.

The following chart shows a cross tabulation of the Unwanted Alarm Types by groups and the NFIRS Incident Type groups.

Unwanted Alarm Types by Incident Types Selected by Fire Fighters in the NFIRS Report

Unwanted Alarm Types	113 - Cooking fire, confined to container	700 - False alarm or false call, Other	710 - 715 - Malicious Alarms	721 – Bomb scare, no bomb	730 - 736 – Malfunction	740 - 746 - Unintentional Activation	Total
Cleared					1	7	8
Cooking smoke	181						181
Emergency Exit			1			2	3
Malfunction			1		75	101	177
Mistaken ID		11	1	1	5	165	183
Monitoring		14			93	144	251
Other including gas alarm false alarm		1		1			2
Pull Station		8	37		1	31	77
Unknown		8			29	94	131
Grand Total	181	42	40	2	204	544	1,013

Table 6 Comparison of Unwanted Alarm Types and the Incident Type selected on the incident report.

Property Use

Most false alarms occurred in residential properties, most often in apartments and hotels. Apartments and hotels were also more likely to have monitored alarms than 1- or 2-family dwellings. Occasionally someone in an apartment called 911 to report a non-monitored alarm sounding in their neighbor's unit. We did not see neighbors reporting alarms sounding for non-emergencies in 1- or 2-family dwellings. Other frequent property uses were nursing homes, hospitals, and office buildings.

The following chart is a cross tabulation of Unwanted Alarm Types and Property Use groups.

Unwanted Alarm Types by NFIRS Property Use Groups

Unwanted Alarm Type	Assembly	Educational	Health Care, Detention, and Correction	Residential	Mercantile, Business	Other	Grand Total
Cleared				8			8
Cooking Fire	5	21	28	118	8	1	181
Emergency Exit		1		1	1		3
Malfunction	16	15	29	45	45	27	177
Mistaken ID	16	32	36	76	19	4	183
Monitoring	39	19	42	59	41	51	251
Other		1			1		2
Pull Station	12	8	15	28	12	2	77
Unknown	14	9	18	54	16	20	131
Grand Total	99	106	168	389	143	108	1,013

Table 7 Unwanted Alarm Types grouped by Property Use.

This chart is a breakdown of Unwanted Alarm Types of residential occupancies by Property Use.

Residential Occupancy Breakdown by Unwanted Alarm Type Groups

	400	419	429	449	459	439, 460, 462, 464	
Unwanted Alarm Types	Residential, Other	1 or 2 family dwelling	Multifamily dwelling	Hotel/motel, commercial	Residential board and care	Dormitory-type residence, other	Grand Total
Cleared	1	4		3			8
Cooking Fire	2	40	49	15	1	11	118
Emergency Exit				1			1
Malfunction	1	7	23	11		3	45
Mistaken ID	1	9	20	36		10	76
Monitoring	1	4	36	12		6	59
Other							0
Pull Station		1	9	16		2	28
Unknown	2	8	23	11	1	9	54
Grand Total	8	73	160	105	2	41	389

Table 8 Breakdown of individual residential Property Use and Unwanted Alarm Types

To Intervene or Not to Intervene

Determining if a trained fire fighter was necessary at a given incident can only be based upon evaluation after the incident. Before the incident there are many unknown factors and therefore fire resources are sent to investigate with a “better safe than sorry” approach. Looking back on the incident, there was not a need for evacuation due to a false alarm though there is often a need for some other action. Using the hindsight approach we can get a better idea of the risk we would take if we changed how often and when alarms sounded, how much of the building should be evacuated if at all, and how many firefighting resources should be used for monitored alarm activations.

To better define the incident based on the actions that were taken, the incidents have been grouped as follows:

- FD Emergency Alarm – the fire department was definitely needed in a timely manner. A false alarm would not be in this data element, it would be a different incident type. The confined cooking fire that required suppression or rescue would be in this data element.
- Emergency Action Needed – someone probably needed to take action right away, such as in the case of a cooking fire or a carbon monoxide alarm, though the potential problem may or may not have developed into an emergency warranting an emergent fire department response. The fire department may have been helpful in responding to these incidents (such as providing ventilation or helping to reset the alarm) but they were not necessary.
- Warning Alarm – supervisory or trouble signals, freeze alarms, broken or dirty detectors, etc. An occupant, facility manager, or owner needs to take action; a fire fighter or fire prevention officer may need to provide guidance or ensure action is taken.
- Unknown – the fire fighter could not find a cause for the alarm or there wasn’t enough information. As there was no identifiable problem, and thus no life-threatening emergency, a fire fighter may have been needed to investigate but it is more likely that no response was needed.
- Unwanted Alarm – the detector couldn’t differentiate between an emergency and benign causes such as dust or steam. There was no threat of fire even if the situation was allowed to continue.
- True False Alarm – human error, intentional or unintentional, caused the alarm. This includes when the alarm is being serviced but is not put in test mode, when someone activates the alarm for a fire drill but doesn’t tell their monitoring company, or someone activates a pull station with no suspicion of a fire.

Intervention Needed Compared to How the Incident Was Reported

Row Labels	911 Call	Call to Fire Station	Monitored Alarm	Monitored and 911	Radio to Dispatch	Grand Total	
Emergency Action Needed	61		213	93	1	368	36.33%
Warning	7		116	26		149	14.71%
Unknown	7	1	102	21		131	12.93%
Unwanted Alarm	11		117	56		184	18.16%
False Alarm	10		100	71		181	17.87%
Total	96	1	648	267	1	1,013	100.00%

Table 9 Comparison of the level of action needed for the incident and the manner the incident was reported to 911 Dispatch.

When the alarm sounded and there wasn't a fire emergency, it sounded for a purpose that required someone's attention almost two-thirds of the time, though a trained fire fighter was not required within 10 minutes of the alarm activation. The cause of the alarm was unknown and therefore required investigation before nothing was found 13% of the time, the alarm was a specific warning signal such as a supervisory alarm 15% of the time and the alarm warned of a possible uncontrolled fire or carbon monoxide leak 36% of the time.

While false alarms are by definition non-emergencies in hindsight, it is initially a possible fire. It is wise to compare actions taken for all incidents that at first could have been fires, regardless of the outcome. At dispatch, most *Structure Fires* (111 – 123), *Explosions without Fire* (200 series), *Hazardous Conditions* (400 series), and *False Alarms* (700 series) were or could have been fires. All incidents in these Incident Types (1,298) were used in the following evaluations.

Actions Taken is a data element required in all incident reports and provides some insight to the extent of the emergency. While scene investigation and good customer service is always provided at the incident, evaluating Actions Taken provides a way to interpret the need for an immediate, or emergency, response by the fire department. Actions Taken indicating the need for an emergency response are *advanced life support* medical care and *transport patient* (someone was injured or very ill); *establish a safe area* and *evacuate area* (a fire fighter was needed to evaluate the scene and protect people); *extricate, disentangle* (someone was rescued from the building); and *extinguished by fire service personnel* (fire fighters put out the fire). Some Hazardous Materials responses are emergencies and some are low risk and could wait or could be handled by a non-fire fighter. These will all be considered emergencies in this evaluation though further investigation could be beneficial.

Good service is provided in many instances, though it was likely not needed in an emergency fashion or may have safely been provided by someone else. These Actions Taken include: *assistance, manpower; fill in, standby* (we were there just in case but were not needed); and *ventilate* (clear smoke from the structure).

Using these standards, there were 109 incidents, 8.4%, that required, or probably required, a quick response by trained fire fighters. These are labeled as “*FD Emergency Alarm” in the chart below.

Most Important Actions Taken by Fire Fighters at Possible Fires

First Action Taken	Count of Incident Number
Assistance/Other	19
Action taken, Other	3
Assistance, Other	11
Provide apparatus or manpower	5
Safety & Fire Ground Activities	20
Fires, rescues & hazardous conditions, other	1
Ventilate	13
Evacuate area *FD Emergency Alarm	2
Establish safe area *FD Emergency Alarm	3
Operate apparatus or vehicle	1
Fire Suppression	45
Extinguishment by fire service personnel *FD Emergency Alarm	35
Salvage & overhaul	3
Fire control or extinguishment, other	7
Investigate	1039
Information, investigation & enforcement, Other	24
Investigate	980
Investigate fire out on arrival	34
Refer to proper authority	1
Systems	97
Shut down system & Systems and services, other	17
Restore sprinkler or fire protection system	5
Restore fire alarm system	75
Hazardous Materials *FD Emergency Alarm (all)	60
Hazardous condition, Other	5
Hazardous materials leak control & containment	8
Hazardous materials spill control and confinement	9
Hazardous materials detection, monitoring, sampling, & analysis	2
Identify, analyze hazardous materials	1
Remove hazard	30
Remove hazardous materials	5
Standby	9
Rescue/EMS (at non-EMS-based incident) *FD Emergency Alarm (all)	9
Provide advanced life support (ALS)	2
Transport person	3
Rescue, remove from harm	4
Grand Total	1,298

Table 10 Actions Taken in Incident Types 111 - 123, 200 series, 400 series, & 700 series.

Actions Taken in identified structure fires (Incident Types 100 – 123) resulted in 40 incidents (15.9%) that required quick response by trained fire fighters.

Most Important Action Taken on Structure Fires

First Action Taken	Count of Incident Number
Assistance/Other	2
Assistance, Other	2
Safety & Fire Ground Activities	12
Fires, rescues & hazardous conditions, other	1
Ventilate	11
Fire Suppression	43
Extinguishment by fire service personnel *FD Emergency Alarm	35
Salvage & overhaul	2
Fire control or extinguishment, other	6
Investigate	168
Information, investigation & enforcement, Other	4
Investigate	134
Investigate fire out on arrival	30
Systems	21
Restore fire alarm system	21
Hazardous Materials *FD Emergency Alarm (all)	1
Hazardous condition, Other	1
Standby	0
Rescue/EMS (at non-EMS-based incident) *FD Emergency Alarm (all)	4
Rescue, remove from harm	4
Grand Total	251

Table 11 Actions Taken in structure fires (111 - 121 Incident Types)

In 2014, 14 of the above fires required a full response; determined locally as one Battalion Chief, one Medic Unit, one Truck or Quint Unit, and a combination of three Engines or Quints. There was one civilian death and one fire fighter injury during these 14 fires. These were 11 residential properties and three commercial properties resulting in \$5,094,100 loss in structures valuing \$9,094,638.

The spread of the fire is one way of determining the fire department's overall effectiveness as it takes into account occupant behavior, suppression systems, building design, and fire fighter suppression. The following chart breaks down the spread of these full response fires.

Spread of Fire at Structure Fires Requiring a Full Response

Confined to Room & Contents	28.57%
Confined to Floor of Building	21.43%
Confined to Building (included are one outbuilding and one lightning-caused heat damage in the walls and attic)	35.71%
Spread beyond the building or started on the outside of building	14.29%
Total	100.00%

Table 12 Fire spread in 2014 of Full Response fires.

Actions Taken in identified unwanted and false alarms, confined cooking fire with no damage or need of rescue, and incidents in the 700 series Incident Types, resulted in no incidents needing fire department emergency response.

Most Important Action Taken at Unwanted Alarms

First Action Taken	Count of Incident Number
Assistance/Other	7
Action taken, Other	7
Safety & Fire Ground Activities	9
Fires, rescues & hazardous conditions, other	1
Ventilate	8
Fire Suppression	1
Fire control or extinguishment, other	1
Investigate	901
Information, investigation & enforcement, Other	22
Investigate	863
Investigate fire out on arrival	16
Systems	95
Shut down system & Systems and services, other	15
Restore sprinkler or fire protection system	5
Restore fire alarm system	75
Hazardous Materials *FD Emergency Alarm (all)	0
Standby	0
Rescue/EMS (at non-EMS-based incident) *FD Emergency Alarm (all)	0
Grand Total	1,013

The Impact of Monitored Alarms

A common assumption is there are more false alarms because there are more monitored alarms. Another belief is that with the prevalence of mobile phones, most “real” fires are reported by an occupant or passerby calling 911 and monitored alarm are no longer a necessity.

Using narrative information, the way the incident was reported to 911 Dispatch was recorded. Options were a phone call to 911, a phone call directly to a fire station who then radioed to Dispatch, a radio call to Dispatch from an on-duty emergency responder, a monitored system alarm – both private monitoring companies and those that Dispatch monitors directly, and when Dispatch receives information from both a monitored alarm and someone on scene before the fire department personnel arrive.

Looking at all potential fires (Incident Types 111 – 123, 200's, 400's, and 700 series), the means of reporting the incident were not documented, leaving 1,144 incidents to review. Of the remaining 1,144 incidents, 82% were from monitored alarms. Of those monitored alarms, 29% also had someone on scene either calling 911 or information was relayed through the monitoring alarm company.

Information Received From Someone On-Scene at Potential Fires Prior to Fire Department Arrival

Phone call to 911 dispatch center	195	15.02%
Phone call to fire station or responder radio traffic to dispatch	12	0.93%
Monitored systems – panel info only prior to arrival	664	51.16%
Monitored system with on-scene information prior to arrival, either through the monitoring company or a 911 call.	273	21.03%
Unknown	154	11.86%
Total	1,298	100%

Table 13 How the incidents were reported to 911 Dispatch for Incident Types 111 - 121, and all incidents in the 200 series, 400 series, and 700 series.

Reviewing only structure fire incidents, Incident Type 111 – 123, (all incidents had a recorded means of contacting 911) 61%, came in from monitored systems. Of those monitored alarms, 29% had on scene information prior to arrival.

Information Received From Someone On-Scene at Structure Fires Prior to Fire Department Arrival

Phone call to 911 dispatch center	94	37.45%
Phone call to fire station or responder radio traffic to dispatch	3	1.20%
Monitored systems – panel info only prior to arrival	109	43.43%
Monitored system with on-scene information prior to arrival, either through the monitoring company or a 911 call.	45	17.92%
Total	251	100.00%

Table 14 Structure fire incidents and how they were reported to 911 Dispatch.

Of the 1,144 potential structure fires, 22% (251) were structure fires and of those structure fires, 6% (14) required a full response. Those 14 full response fires are 1.2% of the potential fires.

In all of the 14 fires requiring a full response, Dispatch received information from someone on-scene prior to fire department arrival. One of the incidents was reported via radio from nearby law enforcement officers, one was initially reported by a monitored alarm and an employee called 911, and the remaining 12 incidents were reported only by calls to 911.

Of the 154 structure fire incidents with a monitored alarm, only 1 resulted in a fire requiring a full response. In this fire, there was an ANSUL suppression system that activated properly but the fire was able to spread behind the cooking area and duct work.

More information would be needed before assuming that monitored systems are not needed since so few alarms result in significant fires. Monitored systems are only in place in structures with fire detection and in many cases automatic sprinkler suppression. It is possible that the alarms provided warning to occupants to intervene before the potential fire was large enough to warrant a full response from the fire department or the fire department was able to arrive before the fire grew so large.

Below are charts dissecting the actions taken with the ways the incidents were reported to 911 Dispatch and when someone was on scene prior to fire department arrival.

Of the structure fire incidents (111 – 123 Incident Types), 34 of the 40 incidents that were absolute emergencies were reported by a 911 call and 38 of the 40 involved information prior to arrival.

Most Important Action Taken at Structure Fires Compared to How the Incident Was Reported

	911 Call	Call to Station	Radio to Dispatch	Monitor Only	Monitor and On-scene	Grand Total
Assistance, manpower	1			1		2
Extinguished by fire service personnel *FD Emergency Alarm	30	1	1	1	2	35
Fire control or extinguishment, other	5			1		6
Fire, rescue, hazard, other	1					1
Remove from harm *FD Emergency Alarm	3			1		4
Hazardous Condition *FD Emergency Alarm	1					1
Information, investigation & enforcement	41		1	92	34	168
Restore system, secure property, remove water	4			9	8	21
Salvage and overhaul	2					2
Ventilate	6			4	1	11
Grand Total	94	1	2	109	45	251

Table 15 Actions Taken at structure fires (110 – 121 Incident Type) and the way incidents were reported to 911 Dispatch.

If we remove confined cooking fire where there was no damage, there are 70 incidents remaining 35 were extinguished by fire personnel. Thirty of those those were reported by a 911 call and another 2

were a combination of a monitored system and someone on scene. Two incidents requiring emergency response were reported only by a monitored system without any on scene information.

Most Important Action Taken at Structure Fires Compared to How the Incident Was Reported

	911 Call	Call to Station	Radio to Dispatch	Monitor Only	Monitor and On-scene	Grand Total
Extinguished by fire service personnel *FD Emergency Alarm	30	1	1	1	2	35
Fire control or extinguishment, other	4			1		5
Remove from harm *FD Emergency Alarm	3			1		4
Hazardous Condition *FD Emergency Alarm	1					1
Information, investigation & enforcement	14		1	3	2	20
Salvage and overhaul	2					2
Ventilate	2				1	3
Grand Total	56	1	2	6	5	70

Table 16 Actions Taken at structure fires (111 - 123 Incident Types) without cooking fires (113) that resulted in no damage or need for extinguishment, and the way the incidents were reported to 911 Dispatch.

Reviewing False Alarms and unwanted cooking-related alarms, Incident Types in the 700 series and Incident Type 113 with no rescue or damage, there were 1,013 incidents. One required Fire Department Emergency Alarm responses and 36% required some emergency action (368). When the incident was reported only by the monitored alarm, the fire fighters confirmed there was no emergency and took no action except investigation and restoring systems at 99% of the incidents.

Most Important Action Taken of Unwanted Alarms Compared to How Incident Was Reported

Action Taken	911 Call	Call to Fire Station	Monitored Alarm	Monitored and 911	Radio to Dispatch	Grand Total
Fire control or extinguishment, other	1					1
Hazardous Condition *FD Emergency Alarm	1					1
Ventilate	4		4			8
Systems and services, other			9	1		10
Restore sprinkler or fire protection system			4	1		5
Restore fire alarm system	6		40	28	1	75
Shut down system	1		2	2		5
Assistance, other	1		4	2		7
Information, investigation, & enforcement	74	1	580	230		885

Investigate fire out on arrival	8		5	3		16
Total	96	1	648	267	1	1,013

Table 17 False Alarms (700 series) by Action Taken and means alarm was reported to 911 Dispatch.

Works Cited

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