

# **THE BENEFITS OF USING GENTLER NOTIFICATION SYSTEMS IN THE FIRE STATION**

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## ABSTRACT

Many fire departments use a loud alarm or a Klaxon bell (school bell) to notify the fire fighter of an emergency call. This paper was done for the purpose to try and find information on the health dangers in using these loud bell or alarm system. There is not a lot of information on this topic, I had to research many different articles discussing other topics related to fire fighters. There would only be a paragraph or two in most articles if at all, that mention the concerns of dangers from loud bell in the fire stations. After spending quite a bit of time, I realized that there was definitely a need for further studies to try and educate every one to the possible dangers of using loud bell or alarms in fire stations. If the information on these studies do show a danger, then we can put pressure on the city managers to spend the money and replace all the loud alarms in fire stations. This would most likely reduce the number of fire fighter with on duty heart attacks and hearing loss.

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## INTRODUCTION

There has always been loud bells or some type of loud alarm system in fire stations to notify the fire fighters of an emergency call. In the last ten to twelve years it has come to the attention of health experts that these loud alarms are causing health problems with fire fighters. Data needs to be made available to all fire departments on the health problems contributed to loud alarms to help in convincing the city managers to change to a more friendly tone system. There is very little data on the total health problems cause by these loud alarms, the data that is available is by getting parts of paragraphs from several different article dedicated to all health hazard of fire fighting.

## BACKGROUND AND SIGNIFICANCE

Traditionally fire fighters do not complain about being injured at work, it was consider a weakness in a firefighters character to complain of being injured. This is one of the main reasons that it took so long for the medical researchers to realize there might be a connection to the stress and heart problems that fire fighters have and there work environment. It has always been a common joke among fire fighters of how high they can make a fire fighter jump when he is resting or sleeping by ringing the fire alarm.

One of the main concerns is when the fire fighter body jumps into high gear ready to go to work it closely resembles a psychophysiological alarm to the body which cause a reaction very similar with the fight or flight response. This is even worse there is no emergency because the body is making large amounts of adrenaline and when it is not used it can damage to the blood vessels and causing heart damage. But in the last ten to twelve years it has become more of a concern with fire fighters. With better medical technology to find out why and how these death of fire fighters are heart related, it has open the eyes of many to find out how to reduce the number of fire fighters line of duty deaths.

According to Law (2000) another possibility for the lack of interest in conducting studies into the health effects why fire fighters are dying from heart attacks could be the relatively small amount of affected population. In 1996 their was one million paid and on

call fire fighters in the United State Of America but only 715 duty related heart problems were reported (p. 78).

There is also a lot of research information how the loud alarms can cause hearing loss and cause a constant ringing noise in the ears known as Tinnitus. This is not only a health issue but it can also be a safety issue to other fire fighters if their partner was not able to hear their distress calls for help due to hearing loss. According to Winston (2001) Tinnitus in extreme cases have been known to be insidious and debilitating, infact it has been reported that it literally has driven some suffers to insanity and even to commit suicide. Many people have a misconception of this hearing problem as being a loss of hearing, but it is just the opposite of that. Tinnitus is a noise-induced deafness that results in an annoying, loud and constant noise inside the person's head that never stops.

It has always been consider part of the profession of being a fire fighter that you will suffer hearing loss and die earlier than the normal person from the stress on the heart. I believe this is not the normal way of thinking any more due to the large amount of people concern about their health. This is due to the education being offer to the fire fighters from the fire departments and the different fire representative groups like the International Association of Fire Fighters (IAFF).

There are studies that show the fire fighters that retired over the last 40 year were dying on average of 10 years younger than the life expectancy of the general

population. Hopefully with more information and the reduction in departments using loud alarms it will reduce the heart attacks and hearing loss.

## LITERATURE REVIEW

There are several reasons that using loud bells or alarms in fire stations to alert the firefighters of an emergency call can cause injury to the ears and the rest of the body. I will start with a problem that has very little information published on it. This problem is the effect that these alarms have on the heart of a firefighter when he is resting or sleeping at the fire station. According to (<http://www.usfa.fema.gov/pdf/usfapubs/fa-118.pdf>) they call this the “startle response” it starts when the firefighter reacts to the loud noise and the brain sends out nerve impulses to all parts of the body. These impulses cause various glands throughout the body that produce hormones such as adrenaline are stimulated. When this happens many experience a rise in their blood pressure and an increase of internal pressure of the skull along with an increase in sweating. This type of body reaction can be good when you are in danger it is known to have saved many lives, but when the body must remain in this kind of state of alertness for any extended period of time the adrenaline begins to fatigue and deteriorate the body.

Another reaction to this response is the blood vessels may constrict forcing the heart to work much harder to pump approximately the same amount of blood through the constricted blood vessels throughout the body. When this happens it can lead to hypertension also known as increased blood pressure levels (p. 25).

I found an article on the FEMA (<http://www.usfa.fema.gov/pdf/usfapubs/fa-118.pdf>) under " *The Extra Auditory Effects of Noise*" that talk about the effect noise has on the heart. This Article state

" Studies of fire fighters' reaction to the alarm signal indicate that the onset of both physiological and psychological stress induces measurable biological effects. Although the physical activity necessary to get into a truck following an alarm signal should not increase the heart rate to more than around 100 beats per minute; studies have found that heart beats, particularly among younger fire fighters, increase to as much as 130-150 beats per minute. Several studies have shown increase in pulse rate after the alarm signals from between 47-61 beats per minute. It has been theorized that such excited responses to the alarm signal could cause an excessive discharge of catecholamines, which have been shown to disrupt the integrity of the arteries' endothelial lining in animals. A disruption in the integrity of the endothelial lining is believed to cause premature atherosclerosis and could be a contributory factor in the higher incidence of cardiovascular disease among fire fighters"(p. 25).

According to Morohn (1999) in a study Performed in 1989 by National Fire Protection Association (NFPA) they found of all fire fighters deaths 54.3 percent resulted from heart attacks. In 1996 the National Fire Protection Agency (NFPA) did a similar study and found a decrease of 4.3 percent in these statistics. In 1989 the National Fire Protection Agency (NFPA) found that on duty deaths accounted for a 54.8 percent Mortality rate due to heart attacks and stress on the job. Again the National Fire Protection Agency (NFPA) redid a similar study in 1996 and it showed a decrease down



to 48.9 percent of all on duty fire fighters deaths are due to stress and heart attacks (p. 10)

According to Marohn (1999) the writer of *Cardiovascular Health In The Fire Service* stated in his article that a great precursor to the stress that a firefighter has comes from the inconsistency of calls and the uncertainty of what kind and what will happen on the next emergency call. Sean M. Marohn also states in his article that the heart rate jumps 60 to 70 beats per minute in less than 6 seconds when the fire alarm in the station sounds. He also said that depending on the type of call the heart could remain at a pace of 130 to 190 beats per minute. Additionally, the blood pressure will go up 30 to 40 points and will fluctuate up and down depending on the type of emergency call. The hardest type of call that the fire fighter has to respond to is at night. This is when most fire fighters are either sleeping or at a complete resting stage when the fire alarm sounds. That fire fighter must go from a total resting stage to a working stage giving a 110 percent of their ability and skills. The fire fighter barely has time to wake up much less warm up or stretch out to try and keep his heart rate down to a normal rate (p. 11).

Damage to the fire fighters hearing is the other main concern of loud fire alarms in the fire stations. Tinnitus is the most common ear injury from repeatedly hearing loud sounds. According to Winston (2001) Tinnitus is an annoying experience in which many people state it as a chronic ringing, hissing or any kind of constant noise in your head or your ears. Most people do not even realize just how annoying it can be to try to sleep or listen to soft music with a constant ringing in their ear (p. 3).

The Federal Emergency Management Agency (FEMA) and the United States Fire Administration (USFA) and the International Association of Fire Fighters (IAFF) together produce a report called *Fire and Emergency Service Hearing Conservation Program Manual*. This manual was the best source of information on loss of hearing related to on duty fire fighters. In this report it stated that there are several primary factors that are responsible in determining if the noise can cause hearing loss, they are due to the frequency, how long the noise last, intensity and the exposure pattern. The higher the frequencies the more dangerous it is, such as frequencies above 1000 Hz are more dangerous than below 1000Hz. The increase risks of damage the hearing increase tremendously with increase intensity and greater duration of exposure.

The following examples are common source of noise that we are expose to on an every day occurrence. This list is from the hearing Conservation Manual above.

<u>Source</u>	<u>dba</u>	<u>Source</u>	<u>dba</u>
Saturn Rocket	194	Passing Truck	100
Ram jet	160	Subway, Machine Shop	90
Turbo Jet	150	Noisy Restaurant	80
Threshold of pain	140	Inside Car w/Closed Windows	70
Pipe organ	130	Office	60
Propeller Plane, air horn	120	Average Home	50
Pneumatic drills	110	Quiet Office	40
Siren	105	Whisper	20

Many of the fire stations use the school bell type of fire alarm to alert the fire fighters of an emergency. These bell are very loud and according to (<http://www.lhh.org/hrq/25-1/stn.htm>) Guiney et al., (2000) the bell it the school they check were at least 20dba above the dangerous levels. The dangerous level of noise starts at 85dba, that would make the bell at these fire station at lest 105dba.

## **PROCEDURES**

The only way that I could gather information on this topic was by using the internet to research any articles that addressed the use of loud alarms in fire stations for notification of emergency calls. The second method I tried was by going to the library to find any books that address the health problems fire fighter have that are related to loud noises. The main problem that I ran into was that there are very few studies or articles written on these health issues. I had to read through many articles that talk about fire fighters health and try to find what little they wrote about dangers of loud bells in the fire stations. This made it very difficult to find a lot of information due to most of the articles mainly had the same information just present a little different.

## **RESULTS**

There is definitely a need to have some professional studies and research on the health dangers to using loud alarm systems in fire stations. According to most of the opinions and what data was available there is a definite danger with using these loud bells. I fell it

is the responsibility of all fire departments and the associations that represent these fire fighters to take action as soon as possible. By acting as soon as possible it may reduce many of the health problems that are caused by loud noises at the fire station.

The cost of using a gentler notification system in the fire station is very difficult to set a price. There are many kinds of alarms from just replacing the bell with a quieter buzzer to a complete alarm system from a company like Westnet or Zetron. A complete system can cost as little as \$6,000.00 or as much as \$100,000.00 it depends on how big the fire station is and what extras you want. There are tones for each individual sleeping area as well as you can have tone systems in all rooms and areas of the station. Some systems will even shut the stove off, open and close the apparatus doors, turn the lights on, and activate a traffic light in front of the fire station.

## **DISCUSSION**

I was very surprised to find that many different researchers and studies all came to similar conclusions in their research. There seems to me, that no one has shown an urgency into doing studies directed towards the dangers from using loud fire alerting systems in the fire station. A problem that I had researching this topic is the lack of research information available as shown in the statements below;

Law (2000) Two studies questioned what effect the type of alarm system had on firefighters' conditioned response. The Helsinki study suggested the Klaxon (school bell type) should "not strive for a physiological alarm reaction, but should be more

informative". Barnard and Duncan also questioned the alarm system, asking whether there was a difference between the old fashion bell and the modern tone system.

Both studies concluded that we know little about the impact of Klaxons, and that we could gain much by studying alarm systems further (p. 82).

I have look for any further studies done by these researchers since these studies were published that applied to them doing any follow up studies and found none.

## **RECOMMENDATIONS**

It is my opinion that he fire fighters need to make the different fire department management personnel aware of this concern and put more pressure on the medical society to do more research and studies. If we can do this it should make it easier to convince the city administrators to spend the money on fire fighters health by replaying the loud bells with gentler notification systems. I was able to convince our administration in Taylor to try a new system at our fire station 2 with a limited cost to see if the system makes a difference to the fire fighters. We are trying a system made by Westnet Fire Alerting System.

## REFERENCES

Law, G. (2000). Hearts Afire; Fire Rescue Magazine April, 2000

Winston, R. (2001). Tinnitus – A little Known Malady Can Have Big Consequences For Fire Fighters; ICHIEFS On Scene, June 15,2001

FEMA, USFA, IAFF. Fire and Emergency Service Hearing Conservation Program Manual; <http://www.usfa.fema.gov/pdf/usfapubs/fa-118.pdf>

Marohn,S. (1999). Cardiovascular Health In The Fire Service: The Silent Killer; The California Fire Service, January 1999

Blum, Lawrence. Stress And Survival In The Fire Service: How They Live And Die