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Society of Fire Protection Engineers

New Jersey Chapter

FUSIBLE LINK

DECEMBER 2008

President's Message...

The topic of our November meeting was "10 Common Design Misunderstandings" which was extremely informative. My thanks to Ed Armm for serving as our guest speaker. Our next meeting in on Monday, December 1 so I look forward to seeing everyone at the Hanover Manor. I promise, turkey will not be on the menu!

Findings from the soon-to-be released report *Large-Loss Fires in the United States 2007* are featured in the latest issue of *NFPA Journal*, the official magazine of the National Fire Protection Association (NFPA). Each year, NFPA publishes details on large-loss fires and explosions in the United States that each resulted in property damage of at least $5 million. There were 25 more large-loss fires in 2007 than in the previous year, accounting for an increase of more than 54 percent.

In 2007, 71 fires occurred that resulted in losses of $5 million or more, compared to 46 in 2006. These fires accounted for less than one percent of the estimated number of fires in 2007, but accounted for 24 percent of the total estimated dollar loss from fires.

Other key findings from the report:

- Large-loss fires killed 19 civilians, injured 168 firefighters and 67 civilians.
- Large-loss fires resulted in $3.5 billion in direct property loss in 2007. (Total fire loss for 2007 was $14.6 billion.)
- Property loss from large-loss fires was up by almost $3 billion in 2007.
- Most of the increase in dollar loss in 2007 is attributed to the Southern California Firestorm.
- The Southern California Firestorm was one of 20 fires that caused more than $20 million in property damage. It was also one of five fires that resulted in a loss of more than $100 million.

Furthermore, now that the cold weather is upon us, we should pay special attention to space heaters and other home heating devices. Also, with the holidays rapidly approaching, the use of candles and other flame producing devices should be carefully monitored!

Finally, I would like to wish all members and their families a happy and safe holiday season.

David Gluckman
NJSFPE Chapter President

The minutes to the Chapter's Nov. 3rd meeting will be read at the Dec. 1st meeting

We sometimes take for granted combustion safety controls as well as pressure relief valves. 100 gallon gas fired water heaters are so often considered " small" pieces of equipment and depending on the state, may not require regular jurisdictional inspections. The attached article may raise a new awareness the next time you pass a gas fired piece of equipment whether it be at a plant, your place of business or your own home.

The following is an article that was published on the BNET Business Network (link http://findarticles.com/p/articles/mi_m0BPR/is_9_21/ai_n6209869/pg_1?tag=artBody;col1)

Boiler & Natural Gas Safeguards

When it comes to boiler safety in schools and beyond, the biggest risk factors can be human, not mechanical. Starting with a tragic water heater explosion at an Oklahoma school, the article looks at how people contributed to the cause and reacted to the telltale signs of danger. Clarification of what local laws do and don't require joins a look at interlock testing to lay the groundwork for steering clear of these largely avoidable accidents in the future.

Explosions, fires, natural gas leaks, and evacuations occur somewhere almost everyday. This includes all types and sizes of educational facilities from elementary schools to universities. Here is a list of incidents from recent years.

A boiler exploded in a Michigan junior high, evacuating over 800 students;

- The third gas leak in as many weeks caused school evacuations and concern in a Missouri community;
- A series of gas leaks were discovered on a college campus in Georgia resulting in evacuation of dorms and student centers;
- A gas leak in New Mexico hospitalized four students and one teacher during maintenance of the school's heater;
- A Houston school was evacuated after a gas leak was detected;
- A gas leak at an elementary school in Pittsburgh caused evacuation of over 400 students and fear in the community;
- A Washington, DC elementary school was evacuated due to a gas leak discovered in the school's basement; and
- An electrical fire in a boiler room at a high school in New Jersey caused evacuation of the school and injury to one person.

When disastrous events take place, human lives can be lost and property damaged. Even events that are not as devastating, such as gas leak evacuations, still result in a loss of confidence among the public, students, and parents. The entire community becomes concerned about the ongoing safety of the facility and about the capabilities of the facility's staff and administrators. In fact, a general negative perception is derived about the institution and this may take years to overcome.

In the case of property damage or injuries, some may feel betrayed since they depended on the school administrators to be fully aware of gas-fired equipment safety requirements and to check, service, and test the equipment as required by legal statutes.

The recent examples listed above are only a handful of the dangerous gas leaks and boiler-related fires and explosions throughout the United States. Boilers and hot water heaters deserve more attention and respect than they typically get. Most people do not realize that even a 100-gal residential hot water heater has the explosive force of 10 sticks of dynamite.

Every, building or facility manager somewhere is storing explosives like this at his site. The problem is that many ignore, or do not understand, the responsibility that goes with this destructive power. Sometimes the problem is a lack of knowledge, and sometimes it is a lack of emphasis. This article hopes to move you up the learning crave and not fail the people whose lives depend on you daily.

CAFETERIA TRAGEDY

We can learn a lot from a terrible elementary school hot water heater explosion that left six children and one teacher dead 20 years ago in Spencer, OK. Shedding light on the underlying causes behind the explosion at Star Elementary School provides an opportunity to review your own combustion equipment testing, repair, and PM schedules.

It was shortly after noon in the busy cafeteria. Children were seated at tables, enjoying lunch when a concrete wall, which separated the lunchroom from the kitchen, blew in. An 80-gallon water heater had exploded and launched itself skyward. The children seated nearest the wall were crushed and killed as concrete and steel were propelled from the epicenter of the blast. It was a horrific scene. In all, seven were killed and 36 lay injured.

Tragic warning signs at Star Elementary screamed out loudly to those trained to listen. Sadly, most building managers and facilities staff would never have heard them. For example, would you understand that when people complain that the water is too hot in the sinks, it could be a sign that you are about to have an explosion in your building? What about that safety relief valve that keeps dripping, or the little gas leak? It was a combination of issues as subtle as these that contributed to the death of those children and that teacher.

WHAT HAPPENED?

The first employees had arrived at the school at 7 a.m. as usual. They included the cafeteria workers, who noticed that the domestic hot water was much hotter than normal. The custodian was called and the gas water heater was shut down to await the arrival of a technician. The technician's fix was to replace the gas valve and relight the water heater. The technician returned within the hour and noted that the water heater seemed to be working normally. The cafeteria workers soon noticed that the water temperature was again much too hot, and getting hotter. They placed another call for service, which went unanswered. At 12:13 p.m. the explosion ripped through the school.

Jim Greenawalt was the State of Oklahoma's chief boiler inspector at the time; he was on the scene 15 minutes after the catastrophe. The events leading up to the explosion and some of the reasons for it were recounted by him and through a video describing the tragic day 20 years later in 2002, at a gathering of institutional facility managers in Columbus, OH.

HOW DID THIS HAPPEN?

Greenawalt indicated that the problem water heater sat in disrepair for three or four years. The controls had been tampered with, the safety valve was in the wrong place, and the temperature probe had been removed. Oklahoma's boiler inspection law at the time covered high pressure steam boilers but not smaller equipment such as water heaters. This was not a situation unique to Oklahoma. Most states do not provide much in the way of inspections for certain classes of combustion equipment, even in places of public assembly.

This meant that the school system itself was responsible to determine what would constitute adequate inspection, maintenance, and repair of the water heater. This is an often-overlooked responsibility. Many facility managers do not understand that they are responsible for proper inspections and maintenance when it comes to combustion equipment.

COULD THIS HAVE BEEN PREVENTED?

This was an accident that could have been prevented if the proper procedures and inspections had been put in place. If there was a PM schedule, it was ineffective. Critical safety items were installed incorrectly, disabled, and/or never tested. Controls were tampered with and sensing probes removed. New repair parts were not used, and the condition of the used replacement gas valve was not known. After installation, the functioning of the gas valve may not have been adequately confirmed to ensure it was cycling properly. The technician doing the work may not have inspected the entire unit to make sure that the safety relief valve was installed correctly, let alone verify its operation.

The full investigation identified additional causes, including a safety relief valve that had been altered. The safety relief valve was a pressure-temperature model. The temperature probe had been cut down to fit an elbow that was installed at the unit. This disabled the temperature relief capability of the unit.

The hot water heater's burner would not shut off. The safety relief valve, now altered, could not relieve the pressure. When this happens, the water in the tank starts storing a lot of energy. As the temperature increases, the tank itself can start to tear. At failure, all of this water expands 1,700 times its volume in an instant. This creates a pressure pulse that blows out walls and moves anything in its path. One hundred gallons of water instantly flashing into steam is like setting off 10 sticks of dynamite.

The unit had also not been maintained properly, and the staff had not been properly trained in maintenance techniques. Most facilities do not have personnel properly trained in combustion equipment maintenance. Most

sites also do not follow proper interlock and safety testing guidelines even though laws mandate them. Boiler safety laws passed by a number of states hoped to help this. Boiler inspections that call for combustion interlock testing to be carried out only exist in 26 states and in some additional specific municipalities. In these states, jurisdictional inspectors ask to see evidence of this gas train and safety interlock testing. However, it is beyond their work scope to do any of this testing.

In most other states, boiler inspection laws call for inspecting only the pressure vessel part of each boiler system and not at all looking at combustion issues. In many cases, facilities and maintenance managers think that a boiler inspection is a lull and complete look at everything, when in fact it usually is not.

Boiler inspectors (often hired by insurance companies or employees of the state) have their hands tied when it comes to what they can ask someone to do. What they are inspecting for is often limited by exactly the letter of the law. For example, in many cases they can only evaluate equipment for its code compliance when it was installed.

There's typically no screening for how far away from the most recent codes the old "grandfathered" technology is. This kind of inspection sometimes means that you could be "technically" in compliance with archaic and antiquated equipment that is 50 or more years old and has little in the way of modern new safeties.

WHAT IS INTERLOCK TESTING? WHY DOES IT MATTER?

Burning fuels can be useful so long as it is a controlled process. Control means that combustion takes place where we want it, when we want it, and at the rate we want it. The complicated looking series of valves, wires, and switches that comprise the gas train installed on gas-fired equipment is what attempts to do this.

Gas trains help us to keep gas out of the combustion chamber when no combustion is taking place through a series of tight, specially designed shut-off valves that are spring-loaded to close. These are the safety shut-off and blocking valves. Larger gas trains require dual valves and some also have a vent between these for added safety. The specific configuration that you have depends on your insurance and local code requirements. Gas trains also have a number of components that try and make sure that safe light-offs take place and that shutdowns occur immediately if anything goes wrong during the operation of the equipment. They do this with a series of pressure switches that look for exceptionally high or low gas pressure being sent to the burner. They typically also have switches to make sure that air flows are correct lot purging residual combustibles prior to light-off and that airflow is correct during operation.

Flame-sensing components also usually exist to make sure that flames are present when they are supposed to be present and not present at a wrong time.

Other components for sensing that the fuel valve is at low fire position prior to light-off may be present along with furnace pressure switches, high temperature limits, and/or water level cut-outs (depending on the type of equipment.)

All of these components are logically linked or interlocked to a burner management system controller. The burner management system is the brain that supervises and sequences all of the light-off efforts and sits and watches as the combustion processes take place. Burner management system manages the timing and adequacy of the purge prior to light off and the time intervals allowed for getting pilots and main flames lit.

All of this equipment is supposed to be checked on a regular basis by law, but with maintenance budgets among the first to be cut, proper checkouts and testing may go unperformed. Codes and manufacturers define what these frequencies are for different types of equipment. Frequencies of required testing range from daily for some items like observing flames (assuming you know what to look for), to annually for some block and bleed valve tightness testing requirements. It is in this frequency area that we find many problems in facilities today.

Auditors at Combustion Safety, Inc. have evaluated thousands of pieces of combustion equipment. They usually find that few sites are aware of regular testing requirements specified by codes. In most cases, they find that sites do some level of testing semi-annually or annually. The level of comprehensiveness varies depending on who is in charge and that person's knowledge of the equipment or systems. It is rarely what is required by law.

Operations and the human element are the biggest safety issue. The National Board of Pressure Vessel Inspectors statistics for boiler incidents from 1992 through 1998 show that 40% of all deaths, 37% of all injuries, and 31% of all accidents are caused by human error or poor maintenance.

GAS EXPLOSIONS CAN BE AVOIDED

Natural gas and combustion equipment satiety continues to be a black art to most maintenance staffs and even engineers. Many sites have personnel who are not adequately trained in either the safe start up/shutdown of equipment, daily operations, or its proper testing and maintenance. A recent survey of users found that less than 10% actually perform manufacturer- or code-recommended preventive maintenance, including testing of critically important safety interlocks. The combination of these two circumstances can spell disaster, and it has in numerous facilities.

When assessing your site's circumstances, consider the following:

- By far, most of the explosions and fire incidents are due to human error. All of the safeties and interlock equipment in the world will not help if you attempt to short-circuit or jumper-out safely controls. There is no possible substitute for proper training.
- Start-up and shutdown are your biggest risks. You need well written and clear procedures so that everything is very simple and straightforward.
- Make sure that you do regular and complete interlock testing. Jurisdictional inspectors cannot be at your facility every day. Combustion safety and testing needs to be part of your organization's culture.

It may take a lot of effort and changes in your site's culture to start testing and maintaining this equipment properly. The bottom line is that implementing comprehensive combustion equipment safety programs will save lives.

Remember, if you have combustion equipment, it is like you are storing explosives every day. You have an awesome responsibility to all who come into or near your facility. Please do not let them down. This equipment only gives you one chance. Tragedy in Oklahoma

QUICK FACTS

Location: Star Elementary School, Spencer, OK

Date: January 1982

Event: While students were eating lunch, the school's water heater exploded.

Results: Seven dead, 36 injured

The state boiler inspector listed four main causes:

- Lack of proper controls and safety devices;
- Lack of proper maintenance;
- Improperly trained maintenance personnel; and
- Failure to inspect on a regular basis.

Puskar is principal of CEC/ Combustion Safety, Inc. (Cleveland). His experience has been in designing and retrofitting mechanical systems related to boilers, steam, natural gas, water, and ventilation. In 1999, Puskar directed the creation of a corporate combustion safety program for over 150 Ford Motor Company plants. He is a member of ASHRAE, AEE, ASME, NFPA, and the American Society of Safety Engineers and has been directly involved in training over 1,000 people worldwide.

For more information on combustion safety, please visit www.combustionsafety.com or contact us at 1-888-826-3473.

Dec 1, 2008 Chapter Meeting Technical Session - The 25 Principles of Alarm Science and Case Studies of Alarm Liability

Our December meeting will feature nationally recognized forensic alarm expert Jeffrey D. Zwirn, CPP, CFE, CFPS, DABFET, CHS-III, SET, President of IDS Research & Development, Inc. He will provide us with the 25 Principles of Alarm Science, explore actual case studies where alarm systems failed, the reasons why, and will scientifically focus on how Alarm Science would have dramatically changed the outcome. With over 35 years of experience, Mr. Zwirn has been involved in the design, programming, installation, service, maintenance and monitoring of more than 3000 security and life safety systems. He is a NICET Level IV, (SET) Senior Engineering Technician in Fire Protection Engineering Technology Fire Alarm Systems, is a Certified Fire Protection Specialist, is Certified in three states as an alarm contractor, is a Certified Protection Professional, Board Certified in Security Management, and has been appointed to serve on the committee on Fundamentals of Fire Alarm Systems for NFPA 72, in the special expert category. Mr. Zwirn also serves on eighteen (18) UL (STP) Standard Technical Panel Committees.

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MEETING NOTICE

Date: December 1, 2008

Place: Hanover Manor
16 Eagle Rock Avenue
East Hanover, NJ

Price: $26.00

Dinner: 5:00-6:00 (Cash bar for mixed drinks)
Dinner at 6 PM

Speaker(s): Jeff Zwirn, President IDS Research & Development

Topic: 25 Principles of Alarm Science

Please note for this meeting:
All officers, directors and committee chairman are requested to attend a meeting at 4:00 p.m. at the Hanover
Manor.

PLEASE COMPLETE AND RETURN WITH YOUR CHECK PAYABLE TO "SFPE NJ CHAPTER" TO:

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OR PAY AT THE DOOR

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Meeting Dates/Programs 2008-2009

DATE	TOPIC
December 1	25 Principles of Alarm Science—Jeff Zwirn, IDS Research & Development
January 5	Introduction to the Internal Fire Code—Robert Davidson, Davidson Code Concepts
February 2	Case Study: Saw Mill Dust Explosion—John Cholin
March 2	MIC—Microbiological Corrosion—Prevention & Inspection Requirement—Pete Carey, Potter Signal
April 24	Seminar
May 4	Installation Issues with CPVC Piping
June 1	Green Impact on Fire Protection Technology—Vinnie Fichera

2008-2009 Chapter Committees

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Consulting - Peter Rullo

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John Cholin, Chairman

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Chuck Gandy
Glenn Buser

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John Warnet

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Nicole Smith

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Jim Tolos

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Ana Crisostomo—Coordinator
Mailing/Automation/e-mail—Vicki Serafin, Chairperson

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