Combustion Safety, Inc.

LESSONS LEARNED THE HARD WAY

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Hot Water Heater Explodes In Elementary School

seven dead, 36 injured

Explosions from even simple, relatively obscure, equipment like hot water heaters can be destructive and/or deadly. The aftermath with its tragic consequences, however can serve as warning to all of us involved in operating and maintaining equipment. Shedding light on the underlying causes behind the explosion at Star Elementary School provides an opportunity to review our own testing, repair and preventative maintenance schedules.

It was shortly after noon, in a busy school cafeteria, in the small town of Spencer, Oklahoma. Children were seated at tables, enjoying lunch when their secure little world was torn from them. A concrete wall, which separated the lunchroom from the kitchen, blew in, as an 80-gallon water heater 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.

Preventative Highlights

1. Safety relief valves need lift tested at least annually.
2. It's important to test safety operating limits at least annually.
3. Proper eqipment light offs must be verified on a regular basis.

How the day started.

The first employees arrived at the school at 7:00 AM. 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 were not so satisfied. They soon noticed that the water temperature was again much too hot, and getting hotter. They placed another call for service, which tragically went unanswered. At 12:13 PM the explosion ripped through the school.

How did this happen?

The Chief Boiler Inspector for Oklahoma dug deeply into the accident. He noted the 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 covers high-pressure steam boilers but not smaller equipment such as water heaters.

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QUICK FACTS

Location: **Star** *Elementary School, Spencer, Oklahoma*
Date: *January 1982*
Event: *While students were eating lunch the school's water heater exploded.*
Results: Seven *dead, 36 Injured*

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This meant that the school system itself was responsible to determine what would constitute adequate inspection, maintenance and repair of the water heater.

When the technician replaced the faulty gas valve, a used valve was installed. This valve was also faulty. It may have been faulty when stored, or it may have deteriorated in storage. The valve may or may not have been a suitable replacement part for the particular water heater, even if it had been functioning correctly. When the valve failed, it apparently did so by hanging open allowing the burner to stay on continously, superheating the water and over-pressurizing the water heater's tank. Once this occurred a relief valve should have opened to allow fresh cold water to flow into the tank while removing pressure and temperature from the vessel. Only then could the tank's contents have reached a safer condition. The relief valve never worked. Temperature and pressure continued to rise. Ultimately the water flashed to steam as the tank ruptured. The tank landed 135 feet from where it sat seconds before.

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. There was either no preventative maintenance schedule, or if there was one, 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.

Combustion Safety, Inc. has implemented programs for clients that maintain buildings and facilities so that their own staff can better understand how to operate and maintain all types of gas-fired equipment. Their programs identify a number of important regular checks for water heaters including:

1. Lift testing safety relief valves.
2. Testing safety operating limits.
3. Verifing proper equipment light offs.
4. Conducting gap analysis to review safety controls installed vs. current code requirements.

Information about services available to help ensure your gas fired equipment's safe operation can be obtained at ***www.combustionsafety.com.***

The state boiler inspector listed four main causes:

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