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### **School Boiler Maintenance Programs: How Safe Are The Children**

The proliferation of boilers and pressure vessels in public places is something not often thought about by the general public or even those in the boiler and pressure vessel industry. Oftentimes the owner/user does not realize the impending danger of improperly operated, maintained, or repaired boilers and pressure vessels until the unimaginable happens: injury or death of unsuspecting people. Regrettably, such is the case in public and private schools alike, where children and adults spend most of their day. Numerous school incidents dot the landscape: Spencer, Oklahoma; Gallup, New Mexico; Baltimore, Maryland; and others. "School districts are likely to have several hundred pressure retaining items...each posing a potential explosion hazard," says Lee Doran, National Board field staff representative and training course instructor. "School administrators rarely make the connection between their tight budgets and the adverse effect on reliability, safety, and operation of the affected equipment. Consequently, maintenance of school boilers and related devices get a low priority in the budgeting process." Mr. Doran notes that better communication between the personnel involved in pressure equipment operation and the 'front office' could potentially increase awareness and promote an understanding of what support is really needed for safety. Small investments on boiler maintenance and operator training now can prevent larger costs and possible accidents from occurring later. Something as simple as better staff training could have a significant, positive impact on the threat of an accident or malfunction M. Doran adds.

Very few school districts (outside those states and provinces that require qualification, training, and licensing) provide the opportunity for adequate training of the staff who operate or perform seemingly small repairs to pressure equipment. As Mr. Doran observes, "It has been my experience while conducting National Board boiler safety seminars across the country that many boiler operation and maintenance personnel have never received any training on boilers or other fuel-burning apparatus for which they are responsible." It is ironic that in most school districts- where education and training is the goal the training of boiler maintenance personnel is not seen as a critical function.

However, even in districts where good maintenance programs and training are scheduled, problems can occur. In the Gallup-McKinley school district in New Mexico, Joe De La O. former director of maintenance for the district, recalls the boiler-furnace explosion that resulted from an unfortunate combination of events. Over a period of several months, an inexperienced and untrained electrician tried to keep a failing hot water heating boiler operating. On one cold winter afternoon in January 1984, the worker tampered with the burner programmers and relays repeatedly, until a (suspected) malfunction of the programmer led to the ignition of a large accumulation of natural gas. The result was a violent explosion. Although no one was killed, three workers were injured. The boiler and building sustained significant damage, according to Brad Hoover, one of the workers who still provides boiler maintenance for the district.

"The accident occurred at a critical time. It was around 3:00 p.m., about the time children were being sent home for the day," explains Mr. Hoover. "We were very thankful that students and teachers escaped injury. I believe because the boiler was located in the basement of the school building, in a room with concrete walls, many people were saved from possibly very serious injuries." The obvious conclusion from Mr. Doran, who viewed the accident scene after the fact, was clear: "...to prevent recurrence of an accident of this nature is to fully indoctrinate the boiler maintenance personnel on the operation of the burner flame safeguard control (FSG) and relays. If a malfunction of an FSG is suspected, it should be tested on a tester built for this purpose. Never bypass controls and limits; this almost always guarantees an accident."

Mr. Doran also concluded that damage was very extensive and required replacement of the entire boiler, controls, and stack. According to Mr. Doran, the incident was *not* a boiler explosion (failure of the boiler pressure parts due to overpressure), but a furnace explosion. The explosion consisted of the ignition of a large accumulation of natural gas fuel in the combustion chamber, which caused the pressure boundary to be broken.

Don Jenkins, Chief Boiler Inspector for Kansas, concurs, "The biggest problem is unqualified operators and maintenance personnel." Mr. Jenkins points out that "most educators don't think as much about mechanical systems as they do about topics directly linked to the educational process. Further, it's sometimes very difficult to

find qualified (maintenance) people for small districts. Traditionally, many boiler operators were former boiler technicians who had received training in the U.S. Navy. But now that the Navy has converted most of its ships' propulsion systems from steam to gas turbines or diesel electric, it is harder to find trained operators."

Several routes help ensure safety for all fuel and pressure items in school settings. First, it is important to purchase equipment built to the *ASME Boiler and Pressure Vessel Code* and registered with the National Board, and to see that the equipment is installed according to manufacturer's instructions and jurisdictional requirements.

Second, care must be taken when ordering replacement parts. Many jurisdiction regulations enforce codes such as Controls and Safety Devices for Automatically Fired Boilers (ASME CSD-1) which require controls and safety devices to be accepted and listed by a nationally recognized testing agency such as Underwriters Laboratory (UL), Factory Mutual (FM), or the American Gas Association (AGA). This code also does not allow the use of rebuilt or altered controls.

Third, ensure that adequate training is provided for all personnel who might operate or repair a boiler or other fuel burning device. The chief boiler inspector for each jurisdiction can assist in identifying available training. The National Board also offers seminars developed specifically for boiler operators.

Fourth, establish routine safety inspection and testing (i.e., in accordance with manufacturers recommendations and jurisdictional requirements) for all boilers, pressure vessels, fuel burning equipment, and other devices that pose potential danger. Such inspections must be accomplished by qualified personnel in accordance with jurisdictional, National Board and ASIDE standards. Mr. Doran says, "The start of the heating season is accident season. Equipment brought on line without proper safety checks of control and safety devices promotes a dangerous situation. Prior to automatic operation, all controls and safety devices must be checked for proper operation. The operator must observe at least three normal cycles prior to independent operation to ensure the boiler is running properly."

Finally, if repairs are needed, use a competent repair organization. Welding, if needed, should be performed by a repair organization that possesses a National Board "R" Certificate of Authorization for Repairs and Alterations.

Preventive maintenance is probably the most important strategy. This includes reporting all accidents, even small ones that seem insignificant, to the local chief boiler inspector. Says Mr. Doran, "a small accident is annoying, but usually it is a signal of bigger things to come."

Take the example of a 300 horsepower boiler valued at about \$100,000. After a maintenance worker noticed water dripping from the steam valve, the boiler was shut down for inspection. During the inspection, insulation was removed. The boiler inspector concluded that water had been leaking into the insulation for so long that corrosion had developed completely around the boiler. The inspector could actually penetrate the boiler with a pocket knife. The boiler was a total loss; yet less than \$5 worth of packing, applied at the right time, would have saved the boiler. "Good preventive maintenance is a cost savings. It's much less expensive than corrective maintenance, where the entire piece of equipment may need to be replaced," Mr. Doran says.

In most jurisdictions, the chief boiler inspector or his or her colleague will give informational talks on safety at school board meetings. By communicating the need for proper maintenance and safety procedures, information can be directed to those who can impact the operation and safety of boilers, pressure vessels, and other fuel-burning equipment.

Remember, training is the key to safety. Most accidents involving this equipment can be directly attributed to untrained and unqualified boiler operators and maintenance personnel. Proper training and good maintenance programs cannot be overemphasized - don't let another careless incident happen before these issues go unresolved.

**Recommendations  
for a  
Safe Boiler Room**

(1)	(6)
Keep the boiler room clean and clear of all unnecessary items. The boiler room should <i>not</i> be considered an all-purpose storage area. The burner requires proper air circulation in order to prevent incomplete fuel combustion and the production of carbon monoxide <i>The boiler room is for the boiler!</i>	Monitor all new equipment closely until safety and efficiency are demonstrated.
(2)	(7)
Ensure that all personnel who operate or maintain the boiler room are properly trained on all equipment, controls, safety devices, and up-to-date operating procedures.	Use boiler operating log sheets, maintenance records, and manufacturer's recommendations to establish a preventive maintenance schedule based on operating conditions, past maintenance, repair and replacement that were performed on the equipment.
(3)	(8)
Before start-up, ensure that the boiler room is free of all potentially dangerous situations, like flammable materials, mechanical or physical damage to the boiler or related equipment. Clear intakes and exhaust vents; check for deterioration and possible leaks.	Establish a checklist for proper startup and shutdown of boilers and all related equipment according to manufacturer's recommendations.
(4)	(9)
Ensure a thorough inspection by a properly qualified inspector, such as one who holds a National Board commission.	Observe equipment extensively before allowing an automating operation system to be used with minimal supervision.
(5)	(10)
After any extensive repair or new installation of equipment, make sure a qualified boiler inspector re-inspects the entire system.	Establish a periodic preventive maintenance and safety program that follows CSD-1-1995 Part CM and the manufacturer's recommendations.

**Source:** NATIONAL BOARD BULLETIN / FALL 1997