WINTER 2013

BULLETIN

TECHNICAL JOURNAL OF THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

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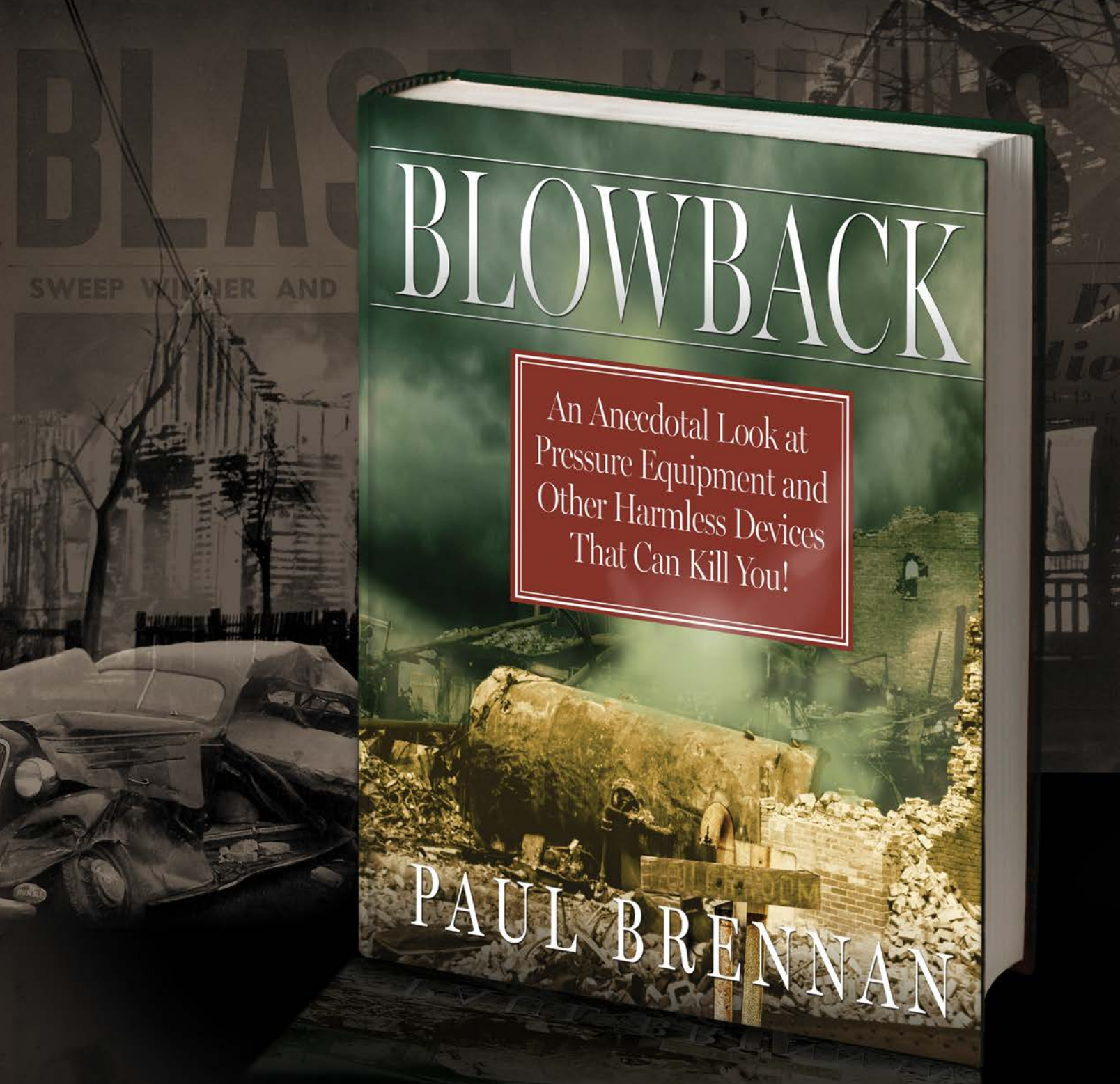

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Edward Tenner, Ph.D.

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BULLETIN
TECHNICAL JOURNAL OF THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

The National Board of Boiler and Pressure Vessel Inspectors was organized for the purpose of promoting greater safety by securing concerted action and maintaining uniformity in the construction, installation, inspection, and repair of boilers and other pressure vessels and their appurtenances, thereby ensuring acceptance and interchangeability among jurisdictional authorities empowered to ensure adherence to code construction and repair of boilers and pressure vessels.

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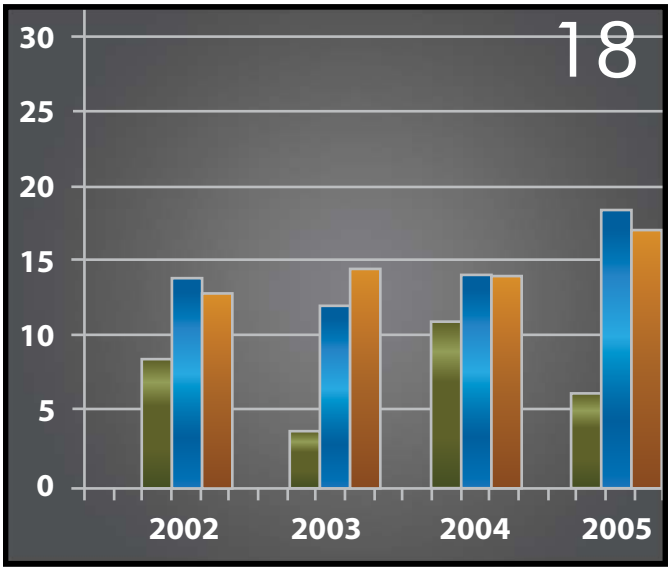

"The difference from what the National Board did in the past and what we are doing now lies in the thoroughness of the data gathered," National Board IT Director Bill Henningsen on the new reporting resources.

On the Cover:
The National Board presents two new reports, a modified Violation Findings Report and an all-new Incident Report, to better "gage" the state of safety within the boiler and pressure vessel industry.

COVER STORY

FEATURES

DEPARTMENTS

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Safety: First Choice, Last Chance

BY DAVID A. DOUIN, EXECUTIVE DIRECTOR

When the National Board discontinued its annual Incident Report in 2003, our industry was confounded. Why, they collectively inquired, would we eliminate an important study that helped call attention to pressure equipment accidents?

The simple answer: the National Board was uncomfortable with the distribution of information gathered from most yet not all of our jurisdictions. That made the data incomplete and somewhat misrepresentative of what we at the National Board sought to accomplish: a more comprehensive and accurate presentation of information that would prove analytically useful.

Beginning on page 18, the reader will see a reincarnated Incident Report that goes to significant and deliberate lengths to provide documented statistics. While perhaps not as timely as most would like, this approach should help readers gain a much better perspective on the successes and failures of pressure vessel safety efforts. To further improve the accuracy of our statistics, the National Board has also reformatted its violations tracking system to include additional incident data by eliminating generally nondescript classifications and replacing them with more-definitive violation categories.

While numbers give us a snapshot of our industry, they don't by themselves protect us from the unknown. That still requires initiative. And while I think all of us choose safety as our foremost priority, there remains a small yet significant group of individuals who still take shortcuts, sometimes resulting in accidents.

To call attention to being more attentive – particularly around pressure equipment – we are designating *SAFETY: FIRST CHOICE, LAST CHANCE* as the theme of this year's 82nd General Meeting in Miami. And to underscore the critical importance of safety preparation, we have invited four-time Pro Bowl Pittsburgh Steelers receiver and Super Bowl XL Most Valuable Player Hines Ward to provide keynote remarks during the General Meeting Opening Session on May 13.

During his remarkable 14-year career with the Steelers, Mr. Ward was the personification of preparation, having played 186 consecutive games (over 11 ½ football seasons) with at least one reception per game and four consecutive 1,000-yard seasons. The football analyst for NBC sports also demonstrated his durability when he and partner Kym Johnson were named champions of the popular TV dance competition, *Dancing with the Stars*, during the show's twelfth season.

As is tradition, this year's General Session will feature another great lineup of industry speakers including Ron Kent of KB Inspection Services, Robert " Buddy" Dobbins of Zurich North America Insurance, and David Peterson of The Cincinnati Insurance Companies. Also on the roster will be National Board's Paul Brennan, who will talk about his recently released book *BLOWBACK* and the importance of spreading the message of pressure equipment safety worldwide.

Our guests again this year will be treated to an outstanding selection of specially arranged outings (see page 30) starting with a tour of North America's only Art Deco Historic District on Monday afternoon. On Tuesday morning, guests will begin their day with a VIP visit to the state-of-the-art Marlins Ballpark, followed by lunch at the popular Spanish restaurant Casa Juancho, and finishing the afternoon touring Miami's renowned Little Havana district. The Wednesday all-day tour will consist of a leisurely cruise aboard the magnificent Floridian Princess yacht, featuring food, refreshments, music, and surprises too numerous to mention. For our Wednesday evening banquet, we promise everyone a smashing time experiencing the prop antics of comedic legend Gallagher.

Over the past several years, I have been noticing more new faces at the General Meeting. That is not only gratifying, but a healthy indication of increasing interest in what this important international event has to offer. And while there is much to be taken from the General Meeting each year, don't forget it is the participants who make this gathering of pressure industry professionals a valuable industry experience.

This year, cross the General Meeting off your wish list and make it reality. Between the meetings conducted by ASME and the National Board, technical presentations, exposure to other industry specialists and ideas, and the exchange of personal experiences, participants will add significantly to their professional knowledge base.

And while this particular General Meeting will not be your *last chance* to attend, make it the *first choice* for the person who will benefit most: you.

See you in Miami!

National Board *Synopsis* Update

The National Board has completed its annual jurisdictional authorities survey for the purpose of updating the 2012 *SYNOPSIS OF BOILER AND PRESSURE VESSEL LAWS, RULES, AND REGULATIONS*. Jurisdictions reporting amendments are individually listed below, followed by the *SYNOPSIS* sections in which the adjustment(s) occurred.

Please be reminded:

- *SYNOPSIS* data is subject to change without notice. Consequently, users should directly consult appropriate jurisdiction officials regarding any actions having significant financial, legal, or safety ramifications.
- All data on the National Board website is updated to reflect changes in the following categories:

STATES

Alabama – *State Department, Rules for Construction and Stamping, and State Fees;* **Arizona** – *Rules for Construction and Stamping;* **Colorado** – *Date of Law Passage, Rules for Construction and Stamping, and Insurance Inspection Requirements;* **Delaware** – *State Department and Date of Law Passage;* **Florida** – *Date of Law Passage;* **Hawaii** – *Rules for Construction and Stamping and State Fees;* **Illinois** – *State Department;* **Indiana** – *Rules for Construction and Stamping and Insurance Inspection Requirements;* **Kansas** – *State Department;* **Michigan** – *Rules for Construction and Stamping, Objects Subject to Rules for Construction and Stamping, Inspections Required, Insurance Inspection Requirements, Certificate of Inspection, State Fees, and Miscellaneous;* **Minnesota** – *Rules for Construction and Stamping and Miscellaneous;* **Nevada** – *State Department and Rules for Construction and Stamping;* **New Hampshire** – *State Department;* **New Jersey** – *Objects Subject to Rules for Construction and Stamping;* **North Dakota** – *State Department, Date of Law Passage, Rules for Construction and Stamping, Objects Subject to Rules for Construction and Stamping, State Fees, and Miscellaneous;* **Oklahoma** – *Objects Subject to Rules for Construction and Stamping;* **Pennsylvania** – *State Department and Rules for Construction and Stamping;* **Tennessee** – *State Department;* **Texas** – *State Department and Rules for Construction and Stamping;* **Utah** – *State Department, Date of Law Passage, Rules for Construction and Stamping, State Fees, and Miscellaneous;* **Vermont** – *State Department, Date of Law Passage, and Miscellaneous;* **Virginia** – *State Department;* **Washington** – *Rules for Construction and Stamping and State Fees;* **West Virginia** – *State Department;* **Wisconsin** – *Date of Law Passage, Rules for Construction and Stamping, Insurance Inspection Requirements, State Fees, and Miscellaneous.*

CITIES

Detroit – *Municipal Department, Date of Law Passage and Inspections Required;* **Milwaukee** – *Date of Law Passage and Rules for Construction and Stamping;* **Seattle** – *Objects Subject to Rules for Construction and Stamping;* **Spokane** – *Municipal Department.*

PROVINCES

Alberta – *Rules for Construction and Stamping;* **British Columbia** – *Date of Law Passage, Rules for Construction and Stamping, Inspections Required, and Provincial Fees;* **New Brunswick** – *Date of Law Passage;* **Newfoundland and Labrador** – *Inspections Required;* **Northwest Territories** – *Territory Department.*

NO CHANGES

STATES: Alaska, Arkansas, California, Connecticut, Georgia, Idaho, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Mississippi, Missouri, Montana, Nebraska, New Mexico, New York, North Carolina, Ohio, Oregon, Rhode Island, South Carolina, South Dakota, Wyoming.

CITIES: Albuquerque, Buffalo, Chicago, Los Angeles, Miami, Miami-Dade, New Orleans, New York, Omaha, Puerto Rico, St. Louis, Washington, DC.

PROVINCES/ TERRITORIES: Manitoba, Nova Scotia, Nunavut Territory, Ontario, Prince Edward Island, Quebec, Saskatchewan, Yukon Territory.

The National Board Owner-User Inspection Organization Program

How it Benefits Industry

By Chuck Withers, Assistant Executive Director - Technical

The degradation of pressure-retaining items such as boilers, vessels, piping, valves, or fittings of ferrous or non-ferrous material begins to occur once the equipment is placed in service. When organizations do not establish programs to minimize potential degradation processes and failure mechanisms that may occur during operation, chances of an event catastrophic to personnel or property can become a reality. At the very least, revenue loss due to reduction in operations will occur when equipment fails.

What can an owner of pressure equipment do to ensure safe operation? The National Board Owner-User Inspection Organization (OUIO) program, instituted in 1977, assists owners and users in maintaining safe operation of pressure equipment. Industries such as electric utilities, chemical, petroleum, and oil or gas refineries have benefited from having a National Board-accredited program in place. Three important aspects of this program serve to ensure quality and safety: owner-user involvement with organizations, use of qualified National Board commissioned inspectors, and understanding code requirements.

THE OUIO Program

Owner-users who understand they are ultimately responsible for the safe operation of their equipment will have quality programs in place with supporting procedures to ensure inspections and maintenance are regularly performed. The program must include a complete scheduled inventory listing of each pressure-retaining item to be inspected. Regular, detailed inspection helps detect and address potential problems before they become catastrophic. When potential problems are identified, maintenance and repair must be performed using qualified procedures and personnel. Following the guidelines of a quality program provides the basis to ensure safety. These guiding principles (and other specified requirements outlined within the National Board Owner-User Inspection Organization program) are why some owner-users elect to obtain National Board accreditation.

NB-371, Accreditation of Owner-User Inspection Organizations establishes the requirements for OUIOs performing inservice inspection activities of items owned and/or operated by the company. Each organization's quality program goes through an initial review and is then reviewed triennially thereafter to ensure program requirements are clearly defined, improved, and implemented. Additionally, this program must have the acceptance of the jurisdictional authority where the owner or user is located. Because safety laws and rules for each jurisdiction may vary (for specific frequency of performing inspections, scope of items to be inspected, types of inspections, and documentation needed for verification, for example), the OUIO program seeks to interact with each jurisdiction to establish rapport and work together to maintain safe pressure equipment.

Owner-users and jurisdictions who develop close working relationships through dialog and information exchange gain better understanding of jurisdictional laws, regulations, and limitations, thus contributing to the safety interests and objectives that benefit both parties.

Since most OUIO programs are similar (because they each address the same specific items outlined in NB-371), *how* each organization implements its program and *what* types of items will be inspected is unique to each organization; therefore, it is important for the jurisdiction to participate in or perform the reviews. When jurisdictions become involved with an OUIO program, they develop confidence in the capabilities of the OUIO and are aware of the equipment to be inspected and maintained. This supplements the need for jurisdictions to continually oversee or even perform required safety inspections. By accepting an accredited OUIO's program, jurisdictions can eliminate the need for additional jurisdictional inspectors while still meeting jurisdictional requirements for safety.

Along with developing a close working relationship with jurisdictions, owner-users interact with other inspection agencies, repair or maintenance organizations, and responsible insurance companies to combine knowledge and better understand repair, maintenance, and inspection methods to apply best practices for improved safety.

National Board Commissioned Inspectors

One requirement of the OUIO program is that owner-users must employ National Board commissioned inspectors. These inspectors meet

Industries such as refineries and chemical manufacturing plants benefit from the National Board OUIO program.

stringent requirements for education, experience, and training as detailed in *NB-263, Rules for National Board Inservice and New Construction Commissioned Inspectors*, and must pass a comprehensive examination before a commission is issued. The owner-user inspector must have the organizational freedom and authority to carry out the duties described in NB-263 and NB-371. This means that their oversight must be free of any organizational operation or production influences, and if there is a safety concern, the inspector has the authority to take necessary corrective action. In this respect, the commissioned inspector oversees the organization's safety and quality interests as defined within its quality program. This provides an advantage for owner-user organizations that may not be clearly defined within other quality programs.

Owner-user commissioned inspectors also coordinate (and may intercede) in inspection and repair activities performed by other organizations to ensure the work and documentation meets all proper requirements. They may even require additional examinations to verify the adequacy of the work performed. Additionally, commissioned inspectors have thorough knowledge of the *National Board Inspection Code* (NBIC) and can ensure NBIC requirements are followed. Their understanding of code requirements for design, materials, fabrication methods, examinations, testing, and documentation contribute to maintaining safe pressure equipment.

Commissioned inspectors benefit owner-user organizations because they have a vested interest in proper inspection and repair and they have the ability to identify and verify the many jurisdictional requirements that must be met to comply with manufacturing, construction, and post-construction codes and standards.

National Board R Stamp *Certificate of Authorization* Program

When an OUIO combines its inspection activities with an accredited National Board **R** Stamp *Certificate of Authorization* program, it can enjoy even greater benefits. This internationally recognized quality program is mandated by many US jurisdictions and business organizations. The owner-user National Board commissioned inspector may elect at any time to perform the required inspections during repairs or alterations. Repairs and alterations may be performed either by a subcontracted **R** Certificate Holder or by the owner-user when the organization has obtained **R** accreditation. Because an authorized inspection agency is not involved when the National Board owner-user commissioned inspector elects to perform inspections, time to perform the repairs is minimized and cost savings realized. This benefit is magnified when the owner-user obtains the **R** accreditation and performs the work in-house.

Safety Codes and Standards Committees

Finally, owner-user organizations can and do have a direct role in improving safety codes and standards. They gain valuable knowledge over time through the operation, inspection, and maintenance of their specific pressure equipment. They understand the causes that contribute to equipment failure and implement controls to minimize failures. When they participate on code and standard committees, committee members gain insight that ultimately contributes to the safety of pressure equipment. Organizations that implement an accredited quality program, such as the National Board OUIO, and employ qualified inspectors will realize the need to continually improve internal procedures and will want to take a special interest to assist in improving and revising the existing safety codes and standards that they specifically use. Organizations that get involved with code committees help to improve safety codes and standards for all organizations.

Safety Advantages

Although obtaining National Board OUIO accreditation involves meeting and maintaining specific requirements, OUIOs reap advantages that are well worth the effort and cost. Not only is personnel safety improved by having National Board OUIO accreditation, but over time, organizations realize potential cost savings for maintenance, inspection, and operation of their equipment.

Implementing a quality program and following code and jurisdictional requirements prevents confusion, improves communication, and promotes quality and safety. As more owner-user inspection organizations become accredited with the National Board, more people benefit by having a safe environment in which to live and work, and all people attain the most valuable benefit – SAFETY.

A Learning Tool - ASME Code Case 2695

By Robert Schueler, Senior Staff Engineer

ASME Code Case 2695 allows the *ASME Boiler and Pressure Vessel Code* (BPVC), Section VIII, Division 2, design-by-rule to be used for Section VIII, Division 1, Pressure Vessel Design.

Sometime in the not too distant future, subject to Code Committee approval, most ASME Code Section VIII, Division 1, pressure vessel construction rules will be moved into ASME Code Section VIII, Division 2. The current thinking seems to be that Division 1 will cover mass-produced vessels and other simple pressure vessel designs, while Division 2 will cover other designs.

However, such a move will involve changes in future code rules and for most vessel manufacturers' products. Code Case 2695 is part of BPVC-CC-BPV - Code Case Supplement 7 and has been issued to provide a learning tool for pressure vessel manufacturers and authorized inspectors.

The Code Case Inquiry reads:

Inquiry: Under what conditions may the design-by-rule requirements in Part 4 of Section VIII, Division 2, be used to design the components for a Section VIII, Division 1, pressure vessel?

To minimize the impact of this Code Case, many Section VIII, Division 1, rules are maintained, such as:

1) Allowable stress values for materials.
2) Impact testing rules.
3) Weld joint categories, types, and efficiencies.

At the same time, a number of Division 2 rules are either not required or prohibited:

1) Design by analysis rules in Part 5.
2) Fatigue analysis.
3) Design loads and load case combinations in Part 4, paragraph 4.1.5.3.
4) Primary stress check specified in Part 4, paragraph 4.1.6.

What is required by the Code Case is:

1) Use of the design-by-rule formula provided in Part 4 of Section VIII, Division 2.
2) Fabrication tolerances specified in Part 4, paragraphs 4.3 and 4.4, shall be satisfied.

Looking at the design-by-rule section in Part 4 of ASME Section VIII, Division 2, a first impression is that we will be solving for shells, heads, and nozzles in a new way.

If the formula provided is applied to verify a given set of conditions, as would be the case for inspector verification, the formula can be solved much as we do today. It will just take longer. If we try to use the formula to design for either thickness or pressure, this will require the ability to perform iterative solutions.

The simplest of the calculations is that of a cylindrical vessel shell. The formula can solve for internal pressure (P) or thickness (t) directly. The same formula appears in Section I, Appendix A-317, and in some other ASME codes.

Head calculations take the user in a different direction, which is to solve the buckling failure pressure of the knuckle and crown. Using the smaller of the two, the next step is to determine the maximum allowable internal pressure.

Radial nozzle calculations will require determination of the minimum nozzle wall, weld size attachments, and the maximum local primary membrane stress from which a maximum permitted internal pressure can be verified.

For the purposes of this article, we will look at a cylindrical shell, ellipsoidal head, and a radial shell mounted nozzle exposed to internal pressure using Section VIII, Division 1, and Code Case 2695 results for identical conditions. Shell and head results are shown in Table 1 for the following:

Test Case

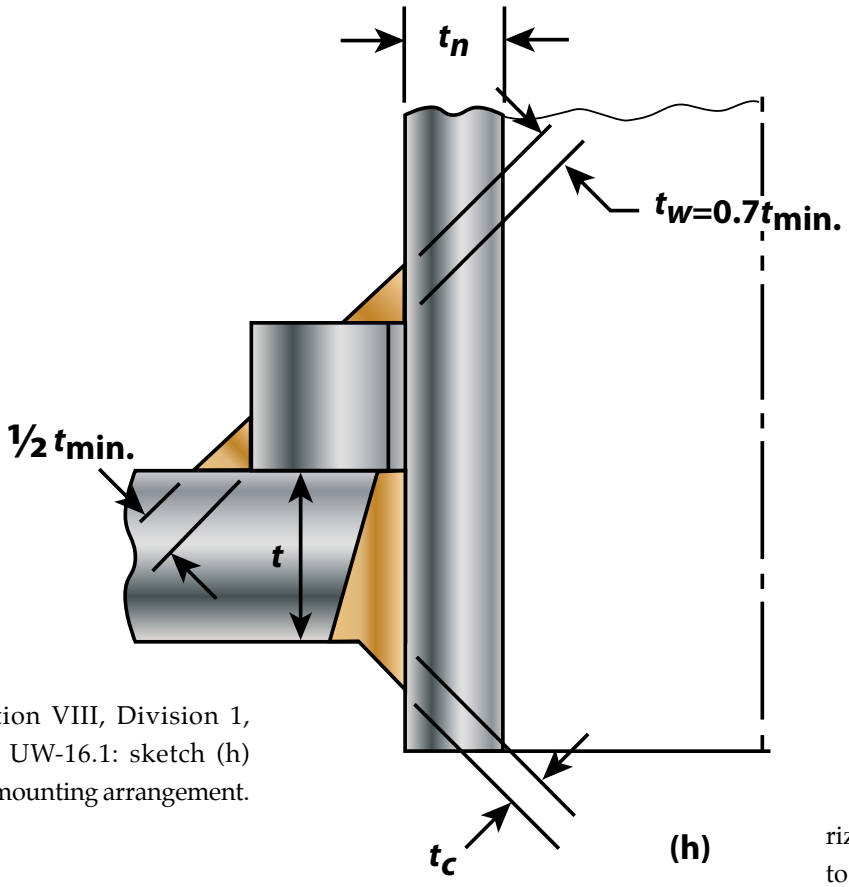
- MAWP = 500 psi (3.5 MPa) @ 100°F (38°C), weld E = 1, corrosion allowance = 0.0 and static head = 0.0.
- 48 inch (1220 mm) inside diameter of vessel shell and 2:1 ratio ellipsoidal heads.
- Material SA-516 Gr 70 shell plate.

Table 1.

	Section VIII, Div. 1	Code Case 2695
Cylindrical Shell	0.609 inch (15.47 mm)	0.608 inch (15.43 mm)
Ellipsoidal Head	0.602 inch (15.28 mm)	0.543 inch (13.80 mm)[1]

[1]Iterative solution used for the Division 2 head.

To evaluate the effect on nozzle requirements, a nominal pipe size (NPS) 10 standard weight pipe nozzle is installed radially into the vessel shell. The nozzle is SA-106 Gr. B and will have a reinforcing pad 20-inch (508 mm) outside diameter. The pad will be SA-516 Gr. 70.



Section VIII, Division 1, Fig. UW-16.1: sketch (h) for mounting arrangement.

For this comparison, the thicknesses of the pad and the pad fillet weld have been iteratively solved for each result. For Section VIII, Division 1, area removed was set equal to the sum of the replacement areas with P set at 500 psi (3.5 MPa). In Section VIII, Division 2, maximum internal pressure was set equal to P set at 500 psi (3.5 MPa). Results show in Table 2.

Table 2.

Radial Shell Mounted Nozzle	Section VIII, Div. 1	Code Case 2695[2]
Pad Thickness	0.506 inch (12.86 mm)	0.363 inch (9.21 mm)
Pad Fillet Weld Leg	0.359 inch (9.11 mm)	0.308 inch (7.82 mm)

[2]Iterative solution used for all nozzle calculations

Conclusions:

1) Code Case 2695 provides a slight advantage over Section VIII, Division 1, on the head thickness. A larger advantage resulted in the nozzle design, which in this case permitted the pad thickness to be reduced by approximately 28%.
2) As an overview of how Division 1 and Division 2 calculate things, please note the following:
   a. Division 1 solves for thickness and reinforcement somewhat directly.
   b. Code Case 2695 (for items other than cylinders) does not solve for thickness or reinforcement. Rather, for heads, buckling is solved; and for nozzles, maximum local membrane stress. These results are then used to determine a maximum design pressure. This means to solve for an exact answer, an iterative loop approach is required.
   c. The design-by-rule formula can be used in simple verification mode; however, the results are just a go or no-go on your assumed conditions and it seems well worth the effort to solve for each pressure part using iterative solutions even if this means producing or acquiring software to do the calculation.

Recommendation:

It is in the best interest of all current authorized manufacturers and authorized inspectors to acquire a copy of ASME Section VIII, Division 2, Alternative Rules for Construction of Pressure Vessels, and become familiar with the basis of the future pressure vessel code of construction. Reading the code and working a few sample problems is good preparation for some of the future changes ASME is planning.

Please note that not all jurisdictions permit the use of ASME code cases. Users are advised to contact the applicable jurisdiction before applying this or any other code case. ✽

What is the Best Welding Process?

BY JIM WORMAN, SENIOR STAFF ENGINEER

Quite often there is debate among welders as to what is the "best" welding process. In reality, the best welding process depends on a few factors: application, cost, and required quality level. The application involves considerations such as the material, welding position, and location.

The cost of welding is generally measured in pounds of deposited weld metal per hour. The cost of labor per hour is normally a fixed cost that is independent of a particular welding process. The required quality level is a function of the codes and standards to which the product is being built, as well as the customers' requirements.

There are basically five common arc welding processes used in boiler and pressure vessel fabrication:

- Shielded Metal Arc Welding (Stick)
- Submerged Arc Welding (Sub-Arc)
- Flux-Cored Arc Welding (Flux-Cored)
- Gas Metal Arc Welding (MIG)
- Gas Tungsten Arc Welding (TIG)

Each process has advantages and disadvantages that can help determine the most suitable welding process for a project. The following is an overview of each process for consideration.

Shielded Metal Arc Welding (Stick) is the most popular welding process. It is the most versatile and uses the simplest equipment. The small light electrode and holder can be used in very tight places or reach several hundred feet away from the welding power supply.

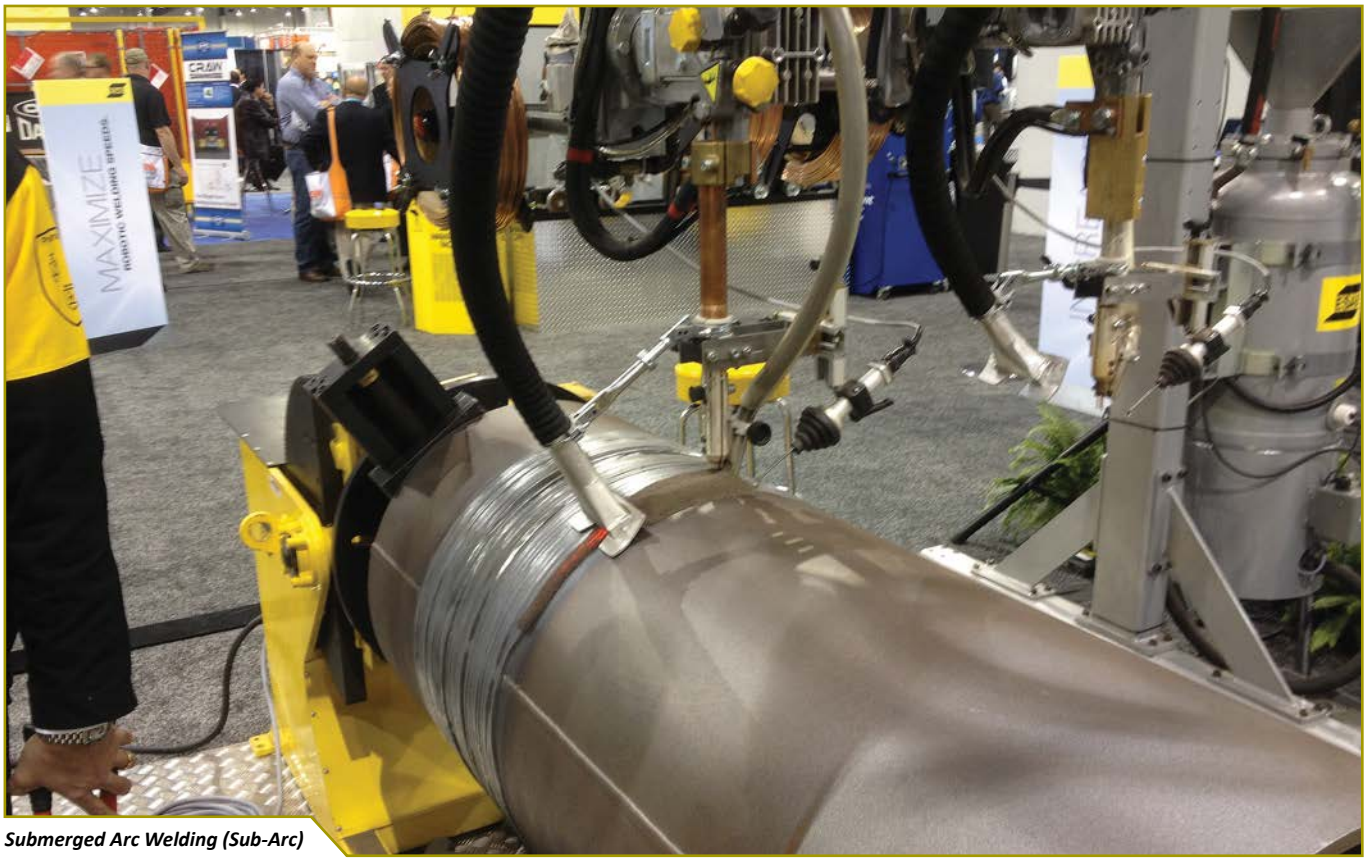
Even though the equipment is inexpensive (starting around $300), the overall cost of using this process can be high. This is because the deposition rate (pounds of deposited weld metal per hour) is rather low, typically around two to five pounds per hour. Since the typical consumable electrode is only 14 inches long, the arc is continuously stopped to put in a new electrode. This creates down time, stub loss, and overall inefficiency, which drives up the cost.

The quality of stick welding can be very good but requires skilled welders. The heat input is typically low, which gives a fine microstructure in the weld metal. This produces very good mechanical properties; however, the slag that protects the molten weld metal from the atmosphere can produce slag inclusions if not cleaned properly between passes and at the stop and start of each weld. There are many stops and starts in large welds, which quite often are where defects are found.

Submerged Arc Welding (Sub-Arc) is generally the least expensive welding process, but the equipment can be expensive. Since sub-arc is normally an automatic or machine welding process and can only operate in the flat and horizontal positions, a good deal of money can be spent on carriages, turning rolls, manipulators, welding heads, and power supplies.

The high amperage (over 1,000 amps) of submerged arc welding can achieve good penetration and high deposition rates in carbon steel plates. Sub-arc can deposit over 100 pounds per hour, with as many as five wires going into the

Shielded Metal Arc Welding (Stick)



Submerged Arc Welding (Sub-Arc)

weld puddle at the same time. This is where big cost savings are achieved.

However, along with high productivity come several limitations. Sub-arc can only be done in the flat and horizontal positions because of the granular flux and fluid weld puddle. The high heat inputs associated with high amperage tend to make large grains in the finished weld metal. The large grains and some micro-inclusions from the slag system tend to create lower mechanical properties than can be found with some of the lower heat input processes, but they can still be quite good.

Flux-Cored Arc Welding (Flux-Cored) is probably the most diverse arc welding process. It is divided into two main categories: self-shielded and gas-shielded. Self-shielded is generally used outdoors and where high quality mechanical properties are not necessary. Gas-shielded is generally used in indoor manufacturing shops where higher-quality mechanical properties are required.

Gas-shielded is the most popular of the two processes and uses an external supply of shielding gas. Generally, CO_2 or a mixture of 75% argon/ 25% CO_2 is used to protect the arc. Typically, gas-shielded flux-cored arc welding has cleaner weld metal and better mechanical properties than self-shielded wires.

Large-diameter wires (3/32-inch) can produce a deposition rate of up to 21 pounds per hour and get good penetration. They can only be used in the flat and horizontal positions. Small-diameter wires (.035, .045, and 1/16-inch) are excellent for welding out-of-position. They produce the highest deposition rates and quality of any of the all-position processes. They can deliver 10 pounds per hour welding vertically and overhead.

Gas Metal Arc Welding (MIG) has four different operating modes (droplet transfers): short-circuiting, globular, spray, and pulsed. The current level, voltage, and the oxidizing potential of the shielding gas determine the operating mode.

Short-circuiting transfer is used in CO_2 shielding at relatively low current levels. Consequently, short-circuiting has very low heat input and penetration. This can be good to control distortion on thin sections, to fill gaps, and to weld over contamination. The fast-freezing puddle allows it to be used in all positions. Short-circuiting should not be used on thick sections or "lack of fusion" may occur.

Globular transfer is a higher-current version of short-circuiting. In globular transfer, the arc does not actually go out as it does in short-circuiting, so there is higher heat input and better penetration. It will operate in 100% CO_2 or a mixture of argon and CO_2.

Spray transfer commonly uses a gas mixture of 98% argon and 2% oxygen. A current level higher than the transition current is also required. Spray transfer uses a high

Flux-Cored Arc Welding (Flux-Cored)

Gas Metal Arc Welding (MIG)

current level and therefore has good penetration and high deposition rates. In the spray mode, 1/16-inch wire can deliver good penetration and a 14-pounds-per-hour deposition rate. Because of the higher heat input and more fluid puddle, spray transfer can only be used in the flat and horizontal positions.

Pulsed transfer is a combination of spray transfer and globular transfer. There is a low background current and a high pulse current. The high current produces a spray transfer and then the welding machine drops the current to the background level. Overall the heat input is lower than spray transfer, so it can be used to weld out-of-position. But the heat input is higher than short-circuit, so lack of penetration is not a problem. Since the arc is completely covered by shielding (as with minimal oxygen content) and there is no slag system, the mechanical properties of the weld metal are generally very good.

Gas Tungsten Arc Welding (TIG) is probably the highest quality and most expensive of the arc welding processes. It is generally performed manually; however, there are some automatic applications. A good welder can deposit ½ pound of weld metal per hour at about 1-to-3-inches-per-minute travel. Since the travel speed is slow, the heat input can be relatively high per inch of weld, giving good weld metal fusion. But this can also cause distortion in thin sections.

Since manual gas tungsten arc welding operates at relatively low amps and volts, and cold filler metal is added to the puddle, the heat input per deposited weld metal is low. This gives finer grain size and much better mechanical properties than other processes. Since there is no flux, there are no micro-inclusions to lower mechanical properties. Pure argon is generally used as the shielding gas on carbon and stainless steels, so the oxygen level in the weld metal is very low, which produces excellent mechanical properties.

Which is "The Best"?

There are pros and cons to each arc welding process. Each can produce high-quality welds; likewise, each can produce defective welds if not operated properly.

Generally, the processes with gas shielding have more pure weld metal and better mechanical properties. The processes with fluxes are easier to use, but can have micro-inclusions, higher oxygen levels, and lower mechanical properties.

And so, depending on the application, desired cost, and required quality level, any of the above processes may be "the best" as long as they are used properly.

Gas Tungsten Arc Welding (TIG)

Boiler External Piping (BEP)

Part 3 – Blowoff Piping

By Steve Kalmbach

This is the third and final article in a three-part series on boiler external piping (BEP). Previous articles in this series appeared in the winter (introduction), summer (part 1, steam piping), and fall (part 2, feedwater piping) 2012 issues.

Blowoff piping is probably one of the most misunderstood and improperly installed piping systems on a boiler. It is subject to some of the most extreme operating conditions, as compared to other systems, and has the potential for a serious accident if the installation does not meet code compliance. Blowoff piping is subject to different rules and requirements when compared to other piping systems. Rules for this piping are found in ASME B31.1, 122.1.4, 122.1.5 and in 122.1.7 (C), and ASME Section I, Paragraph PG-59.3.

Code Definitions

First, it's important to have an understanding of the code definitions:

Blowoff (also known as intermittent blowdown) is defined as piping and valves that are used intermittently to remove accumulated sediment in a boiler or to lower the boiler water level in a rapid manner. By definition, this valve should be (and usually is) located at the lowest connection to the pressure vessel.

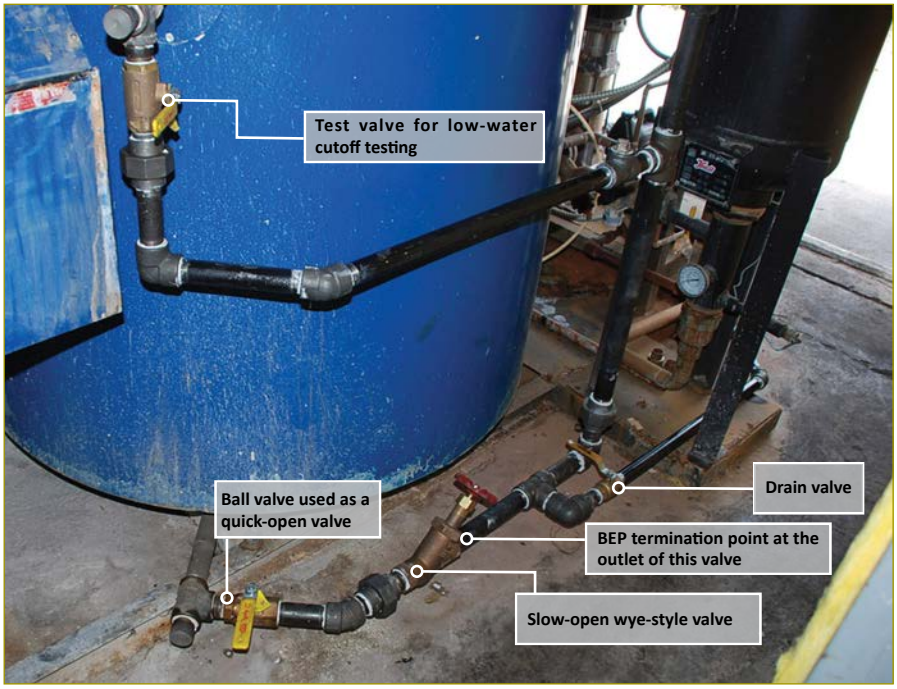
Blowdown (also known as surface blowdown or continuous blowoff) is defined as primarily operating continuously to control the concentration of dissolved solids in the boiler. This connection is normally located below the operating water level.

These definitions are not to be used for or applied to the following systems: drain piping, piping used on water columns, and other controls that are used to test the functionality or operating condition of these devices.

Drain piping is code-required piping for complete drainage of the boiler. By definition, this valve is located at the lowest part of the pressure vessel. It is operated when there is no pressure on the boiler. Blowoff piping may also serve as drain piping, but drain piping may not be used as blowoff piping unless it meets the requirements for blowoff piping.

Design Rules

The code requires that every boiler, except a forced-flow boiler or high-temperature hot water boiler, shall have a bottom blowoff outlet in direct connection with the lowest water space practicable (ASME Section I, PG-59.3.3). Valves used to test the operation of low-water cutoffs, secondary low-water cutoffs, or feedwater controls are subject to



Example of blowoff piping for vertical-style boiler.

Blowoff piping is subject to different rules and requirements when compared to other piping systems.

different design rules when compared to blowoff requirements.

There are additional design rules for blowoff piping when compared to steam and feedwater piping. The design pressure for fittings, pipe, and valves is MAWP + 25% or MAWP + 225 psi, whichever is lower. The effect of static head pressure must also be taken into account when applying these design rules.

Note that this is the MAWP and not operating pressure or safety valve setting. The design temperature shall be that for saturated steam at the MAWP of the boiler.

When the pressure used in the calculations does not exceed 100 psi, there are exceptions made for the acceptable materials that may be used in blowoff piping. Pipe and fittings are permitted to be nonferrous, such as bronze, cast iron, ductile, or black malleable. The code provides additional material restrictions for blowoff piping. When the pressure used in the design calculations is greater than 100 psi, the fittings and pipe shall be of **steel of at least schedule 80 construction**. This restriction does not allow the use of any class 150 or class 300 malleable fittings, or class 125 or class 250 cast iron fittings. Also, galvanized pipe and fittings are specifically listed and prohibited for use in blowoff service.

As noted, when the design pressure is 100 psi, exceptions are made for the material that is allowed for blowoff service. This rule also affects the number and style of valves used in blowoff service. When the design pressure exceeds 100 psi, two valves are required on the blowoff piping. This arrangement shall consist of one quick-open and one slow-open valve or two slow-open valves. The use of two quick-open valves is not permitted.

The following exemptions are made for electric boilers and forced-flow steam generators. If the normal water content does not exceed 100 gallons, a single slow-open valve is required. Electric boilers not exceeding normal water content of 100 gallons, and not exceeding 100 psi MAWP, may use a quick-open valve if it does not exceed 1" NPS. If the MAWP exceeds 100 psi, a slow-open valve (regardless of the size) shall be used. ASME Section I, parts PMB and PEB, also provide additional design requirements for this blowoff piping.

Valve and Fitting Design Requirements

The valves used in blowoff piping have additional design requirements and restrictions. Standard straight-run globe valves (or any valves designed with a pocket that may collect sediment) are prohibited. A wye-style blowoff valve has specific code requirements for the location of the seat in the body to prevent a pocket or dam, such as found in a standard-run globe valve.

A slow-open valve is defined as taking at least five full turns of the hand wheel to fully open. If the valve can be fully opened in less than five turns, it is classified as a quick-open valve. Most quick-open valves are either a quarter-turn design (such as a ball valve) or a knife-gate style with the handle moving through a fairly small arc to achieve full opening of the valve. Slow-open valves are typically of the wye-style or of the knife-gate style with a slow-opening mechanism for operation.

If the design pressure does not exceed 250 psi, valves constructed of bronze, cast iron, ductile iron, or steel are permitted. Exceeding this pressure requires the use of steel valves only, with a minimum rating of class 300.

When the design pressure is greater than 100 psi, **steel fittings and piping are required**. Threaded fittings require the use of forged steel fittings. Threaded fittings are available in three pressure classes: 2000#, 3000#, and 6000#. Care must be taken to use the correct schedule of pipe with each class to maintain its class rating. The forged steel standard lists the following combinations as being code compliant: class 2000# fittings are to be used with schedule 80 pipe. Class 3000# fittings are to be used with schedule 160 pipe. Class 6000# are to be used with XXS pipe. Using any other combination will be limited by either the pipe or fitting. Schedule XXS pipe with class 2000# fitting is limited by the fitting. Schedule 80 pipe used with a class 6000# fitting is limited by the pipe.

Piping and Installation

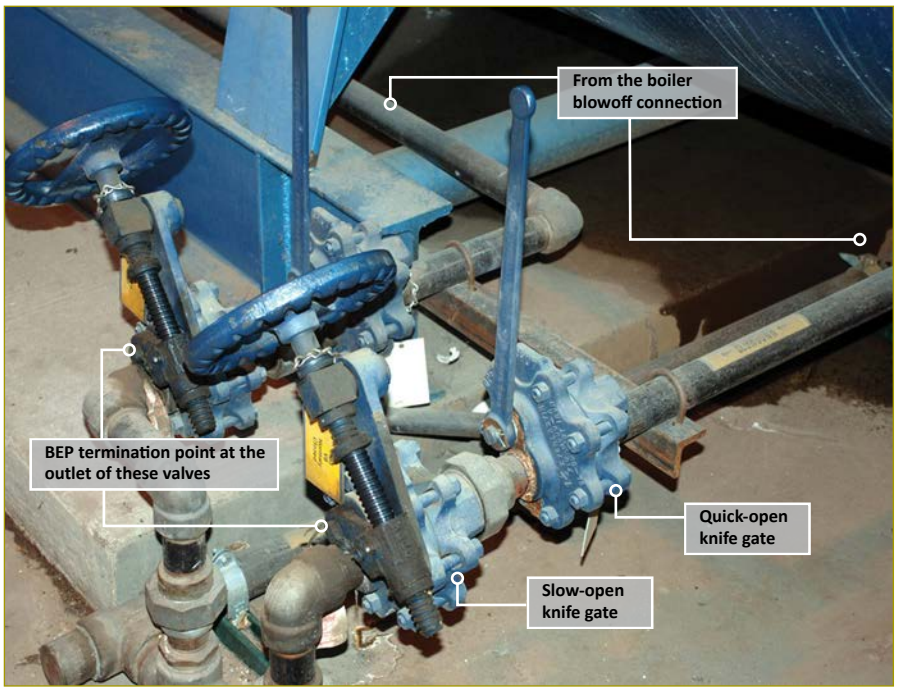
A question often asked is if piping used in blowoff service must be seamless. The code requirement says that the piping shall be of at least schedule 80 construction. There is no mention of the type of manufacturer of the pipe, seamless or electric resistance welded (ERW). By default the piping usually is seamless due to the fact that the standard for seamless pipe requires the heat number to be stamped on the pipe, whereas the standard for ERW pipe allows the heat number to be on the pipe by prior agreement with the manufacturer, and is not mandatory.

Not having traceability on the piping prevents it from being listed on a data report. The reason for the heat numbers is to provide traceability to show that the material is in compliance with the ASME code.

The code defines the installation sequence for blowoff valves installed with quick- and slow-open valves. The quick-open valve must be installed first and located closest to the connection on the boiler. This is then followed by the slow-open valve. This arrangement requires a specific operating sequence for proper operation and longevity of the valves. This operating sequence also applies when there are two slow-open valves installed instead of the quick- and slow-open valves.

First, the valve closest to the boiler is completely opened. Since there is no flow in the blowoff piping at this time – the valve disc or seat is simply moving through water – it is not starting or stopping flow. Theoretically, this should always be a tight shutoff valve and positive sealing. Next, the slow-open valve is opened to begin the blowoff process. Valves for this service are made with very hard seat construction. They are designed for the extreme conditions they are subjected to, such as temperature and cavitation. Thermal shock of the blowoff piping is reduced or eliminated by slow-opening this valve.

At the completion of the blowoff sequence, the slow-open valve is closed first and then the quick-open valve is closed last. At this time the quick-open valve is not stopping the flow and the valve disc or seat is simply moving through the water. This allows the first valve to be a positive-sealing valve, which allows the slow-open valve to be serviced or replaced with full boiler pressure on the upstream of the first valve.



Code-acceptable arrangement for multiple blowoff connections.

Remember: the valve closest to the boiler is opened first and closed last.

Blowoff Connections

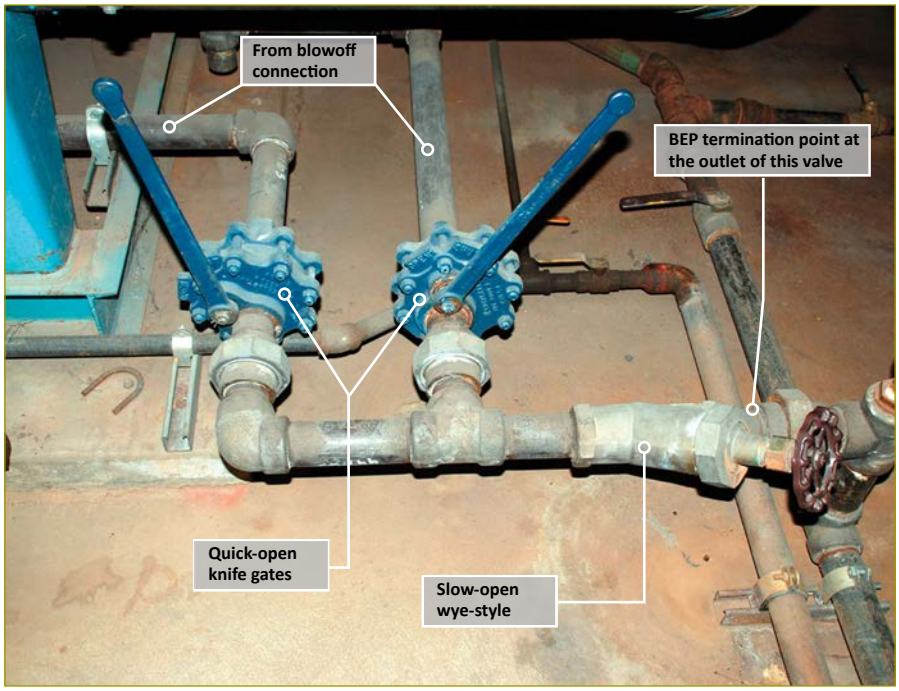
The code requires all blowoff connections be fitted with two valves: a quick and a slow, or two slow-open valves. There is an exception to this rule where the number of valves may be reduced by using one master blowoff valve in the common piping. In this case, the valve at the boiler or the master valve shall be a slow-opening valve. On a boiler with two blowoff connections, three valves would meet code requirements.

There are some blowoff valve arrangements that combine two valves into one body: a quick and a slow, or two slow-opening valves. This is code-permissible as long as the failure of one valve does not affect the remaining valve operation.

If an additional connection (other than the blowoff connection) is used to drain the boiler, there are specific rules that apply. A single valve is acceptable and does not need to meet the blowoff valve requirements; it only has to be rated for the MAWP of the boiler. However, this valve must be locked closed or have provisions for installing a blind between two flanges on the outlet. It may only be used to drain the boiler when there is no pressure on the boiler. If it is to be used as a blowoff, it is subject to all of the rules for blowoff piping.

Termination Points

The termination point for BEP blowoff piping extends from the boiler to the second blowoff valve. Piping



Code-acceptable arrangement for multiple blowoff connections.

from the boiler to this termination point shall be the same size as the boiler connection. Piping from this point to the blowdown tank (or point of safe discharge) is classified as non-boiler external piping (NBEP). Caution must be used when examining the blowoff piping from its termination point to the blowdown tank or point where the pressure is reduced to approximately atmospheric pressure. If this pressure cannot be increased by closing a valve, then provisions are made in the code for the design requirement of the piping. If a valve is installed in the piping, or there is choked flow, or an engineering assessment determines that the pressure is other than atmospheric, this part of the blowoff system must be designed to a specific set of rules given in the code and becomes part of the BEP system.

Here is a quick review of blowoff requirements when the design pressure exceeds 100 psi:

1. Class 125 and class 250 cast iron fittings are **not permitted**.
2. Class 150 and class 300 black malleable or galvanized malleable fittings are **not permitted**.
3. All piping and fittings **shall be of steel of at least schedule 80 construction**.
4. Two blowoff valves are required; one quick and one slow or two slow-open valves.
5. Straight-run standard globe valves are **not permitted**.
6. Blowoffs may be used as drains, but drains may not be used as blowoffs.
7. When using a quick- and a slow-open blowoff valve, the quick-open valve is the first valve from the boiler.

Blowoff Valves and Pipe

There are other valves installed and used as blowoffs, such as on low-water, secondary low-water, and feedwater regulator controls. Although these valves are referred to as blowdown or blowoff valves, they do not meet the definition of blowoff piping in the code. To be a blowoff valve it must remove accumulated sediment from the boiler and be capable of rapidly lowering the water in the boiler. Valves such as those on the low-water cutoff are generally smaller than blowoff valves and are not located at the lowest part of the boiler to allow for removing sediment or lowering the boiler water level in a rapid manner. Good engineering practice dictates using two valves that operate in sequence allowing the first valve to be a positive shutoff valve that allows servicing the second valve with full boiler pressure. These valves are only required to be equal to or exceed the MAWP of the boiler. Good engineering practice would also dictate that these valves be of a style other than a straight-run globe valve.

When doing a first-time inspection or reinspection, pay particular attention to the blowoff piping system. This system is subject to misinstallation and improper repairs. Sometimes during the first inspection there will be deficiencies in the new blowoff piping from the factory.

Some manufacturers send out the slow-open blowoff valve with the new boiler. This valve is usually not found on a normal pipe supplier's shelf. It is an expensive specialty valve. The manufacturer usually ships this valve with the boiler so

that it is code compliant. Because they do not ship this valve loose (as it could become lost or used for another service), they install the valve on the boiler. If the installer is not familiar with BEP requirements for blowoff service, a second quick-open valve may be added onto the existing slow-open valve. This arrangement does not comply with the code requirement that the quick-open valve be installed as the first valve and located closest to the boiler.

When the contractor adds the quick-open valve, such as a ball valve, the chance of the correct valve having a rating per code requirements is slim. Most standard ball valves are not rated high enough and with the proper temperature rating. The pressure and temperature requirements for blowoff service usually exceed the ratings for a standard off-the-shelf ball valve. In some cases, the contractor installs a valve of the proper pressure and temperature rating, but it is a globe-style valve, which is prohibited by the code.

New Installations

Another area of concern is if the organization installing the boiler does not hold an ASME Certificate of Authorization (which results in non-compliance), and modifications or additions to the blowoff piping are required to install the boiler. If they are not aware of the code rules, there is the possibility of black or galvanized malleable fittings being installed, in violation of code requirements. There is also the possibility of schedule 40 pipe being installed, which is also a violation of the code requirements.

If during the first inspection it is noticed that some piping was added or modified that is within the code boundaries, a simple request to the authorized organization for the proper paperwork, such as a P-4A for welded piping or P-4B for threaded piping, should answer any questions. This document will list the material used and installed, as well as the material's traceability. It will be easy to verify if the material installed is in code compliance.

Inservice

If there is evidence that piping or fittings have been replaced during a reinspection of the boiler, verify that the material used is code compliant. The fittings and piping are required to be of at least schedule 80 construction, which are generally not available at a local hardware or big box store. This material is usually only available at a large pipe supplier. Be sure that any replacement valves are of the correct pressure and temperature rating. Many regular valves have only a 125 psi rating, and that is probably not even a steam rating. If there is evidence of black or galvanized fittings on the blowoff piping, it is not in compliance. Most hardware and big box stores will carry only galvanized pipe and fittings. These are specifically prohibited in the code for use in blowoff service.

In Conclusion

The installation and inspection of boiler external piping requires a good understanding of the different code requirements as they apply to the different piping systems found on boilers. Steam, feedwater, and blowoff piping each have very specific requirements, and the failure to follow these specific requirements will put the systems out of compliance with the code and possibly make them unsafe.

The ASME code has recognized that systems such as blowoff are subject to extreme operating conditions and have instituted additional code requirements for this service, such as the use of steel fittings and schedule 80 pipe. Blowoff piping is found to be out of compliance in many field installations by the use of improper valves, installing valves in the improper sequence, and the use of schedule 40 pipe and malleable black or malleable galvanized fittings.

The bottom line is that we all want to install and inspect systems that are in compliance with the well-established rules that have been proven effective and safe over many years of service.

Steve Kalmbach has been involved in the boiler repair, maintenance, and service industry for 40 years. His company, Kasco, has been in operation for 30 years and has a National Board R Certificate of Authorization for repairs and alterations and an ASME Certificate of Authorization with S and U designators controlled by the office in Golden, Colorado. He can be reached at skalmb4427@aol.com. ✱

Forgotten, but not Gone

Investigation of an Inservice Incident

By John Hoh, Senior Staff Engineer

An ASME Section IV watertube steam heating boiler was located at a multiple-building facility which also had several ASME Section I power boilers. The Section I boilers were considered critical to the operation of the facility and were tended by full-time operators. The heating boiler was used to heat the offices in one of the adjoining buildings. Like so many heating boilers, it was installed in a large closet where it was forgotten. That is, until a morning when the offices were cold – and employees noticed a burning smell coming from that closet.

One of the power boiler operators was called to check the situation. He found the burner on the heating boiler firing at a high rate and the closet dangerously hot. The operator shut off the gas valve to the burner and turned off the electrical power. The city fire department arrived within a few minutes and they monitored the scene until the boiler and closet cooled to a safe level. So far, this sounds like a disaster averted – but the story gets better.

After the boiler was cool enough, the operator began his search for the problem. The boiler was equipped with a float-type mechanical water feeder, but curiously, the gage glass was dry. He opened a bypass valve to feed water directly into the boiler. Within seconds, water was pouring from the boiler casing and onto the floor. The operator told his manager this was obviously far beyond anything he could repair and returned to his well-tended power boilers.

The boiler was not insured and the facility had never notified the jurisdiction of the heating boiler's existence. The end result: no inspection had been performed. In dire need of finding the cause of the problem, the facility risk manager contacted the jurisdiction's chief boiler inspector for advice.

When the inspector arrived the next morning, he asked for part of the boiler casing to be removed. It was immediately clear why the water poured onto the floor – the tubes had melted. The next step was to determine why the boiler overheated. The float chamber of the mechanical water feeder was opened and found to be completely filled with dried sediment ("packed" may be a better description), rendering the float inoperable. So why didn't the separate float-type low-water fuel cutoff prevent the boiler from operating in a low-water condition? You guessed it – its float chamber was also filled with dried sediment. Two separate controls had the same condition. The chief boiler inspector asked the obvious question concerning flushing of the float chambers. Nobody could remember when or if it had ever been done!

More questions and discussion finally led to the root cause of this incident. Remember the full-time operators the facility had for the power boilers? Part of their assigned responsibilities was to maintain this heating boiler, but those duties were completely ignored.

This is what happened. The operators' rationale was, "it's only a low-pressure heating boiler, there's no reason to worry about it." Tending to it also required them to leave their control room and walk to another building.

Unfortunately, their neglect cost the facility several thousand dollars to replace the boiler. Fortunately, there was no explosion, fire, or other property damage.

Recovering from this somewhat embarrassing episode, they learned that even the simplest things, when neglected, can cause tremendous problems. Even with the lack of maintenance, an inspection could have been the best investment ever made.

Finally, they learned that while the heating boiler could be stashed away in a closet and forgotten, it was never gone.

Stronger Evidence:
Two New National Board Reports Reveal Prevention, Report Accidents

Consistent with its objectives to gather and make available information and statistics useful to the pressure equipment industry, the National Board is offering two new reporting resources: the recently modified Violation Findings Report and a brand new Incident Report.

The success of the Violation Findings Report has always been contingent on the participation of National Board members. In 2011, an average of 37 jurisdictions (out of 65) voluntarily participated in the report, but Executive Director David Douin hopes to see this number increase.

The Violation Findings Report provides insight into the inspection process *before* an incident happens and serves as a measure for accident prevention. The Incident Report reveals what happened *after the fact*. Data and analysis collected from both reports alert the pressure equipment industry to problem areas and trends and underscore the importance of industry safety efforts.

The New Violation Findings Report

The Violation Findings Report has been modified for more complete and specific identification of violations found during routine inspections.

In 1990, the National Board took measures to format its growing collection of industry-related accident records by forming the Task Group on Incident Data Collection. Through its work, the Task Group recognized a need to also investigate accidents *prevented* through regular inspection. This resulted in the Violation Tracking Pilot Program, known today as the Violation Findings Report.

Fine-Tuning the Report

This year, Executive Director David Douin took new measures to reformat the report. "There was too much general or miscellaneous information in the former report, and we want to achieve a detailed account of violations," he explains. "The new report is more meaningful due to the changes we've made."

A team of National Board staff engineers worked together and made significant modifications to the report's original selection criteria, resulting in data that now reflects a set of specific

violations commonly found during jurisdiction-required inspections.

Notable changes include: new main category topics (equipment components); all "undefined" subcategory listings have been eliminated and replaced with definitive violation selections; and a new category has been added, Device Type / ASME Certification Designators, to indicate a specific device with a specific violation.

"This is the most important aspect of the new form," Douin says in regards to the new category. He explains that the original report did not designate a device with the violation, so it was not known, for instance, if an inoperable safety relief device was found on a pressure vessel, a low-pressure steam boiler, or other type of equipment. Now, five subsets of devices have been added to the form so that each violation can be clearly identified to a specific device. Chiefs can look at the potable water heaters category, for example, and see the types of violations found on that specific piece of equipment. The five devices are: high-pressure / high-temperature boilers, low-pressure steam boilers, hot water heating / supply boilers, pressure vessels, and potable water heaters.

The success of the Violation Findings Report has always been contingent on the participation of National Board members. In 2011, an average of 37 jurisdictions (out of 65) voluntarily participated in the report, but Douin hopes to see this number increase. "The overall goal is to get 100% participation from our chiefs so we can have a viable account of violations across all of North America," he says. Why? "This data exposes the need for boiler inspection programs. Pressure equipment still needs both inspection and oversight performed by trained inspectors. It's vital to public safety."

Accordingly, the revised statistics will be used in future presentations to industry, government, and technical groups to reinforce the important role of National Board Commissioned Inspectors in both inservice and new construction boiler and pressure vessel safety inspections. The data will also be used to define the body of knowledge objectives for the National Board training courses.

The new Violation Findings program was launched in July 2012 for the third quarter report. Initial results follow. The annual Violation Findings Report will continue to be published in the summer *BULLETIN* and online.

The Incident Report: A New Effort

The National Board has launched a new effort to report the occurrence of pressure equipment accidents to provide the industry with an annual benchmark evaluation.

The last Incident Report issued by the National Board was for the year 2003, published in the summer 2004 *BULLETIN*. "The National Board faced challenges authenticating the information," says Douin. "It was often incomplete or redundant, and rather than provide inconsistent data, it was in the organization's best interest to set aside the program."

In 2012 as technology improved, the National Board revisited the report and began to look for a new, credible approach to gathering and sharing accident data. The organization's information technology (IT) team researched various public data sources, such as mortality tables and hospital admissions records, but all had limitations in reporting conclusive information about accidents or deaths directly related to boilers or pressure vessel equipment.

Violation Findings Third Quarter Report

Object	Total number of Inspections	Total number of Violations	Percent of Violations
High-Pressure / Temperature Boilers (SME)	21,784	1,297	6%
Low-Pressure Steam Boilers (H)	16,644	1,561	9%
Hot Water Heating / Supply Boilers (H)	67,553	5,924	9%
Pressure Vessels (U UM)	58,260	1,253	2%
Potable Water Heaters (HLW)	16,244	1,054	6%

Statistics were derived from tracking period 7/1/2012 - 9/30/2012. Number of jurisdictional reports: 31.

"We began looking at existing data sources national in scale and seeing if we could organize those resources in a way that is relevant to us," says IT Director Bill Henningsen. They found a promising resource when they came across a public database on the Occupational Safety and Health Administration (OSHA) website.

A decades-long program (the Occupational Safety and Health Act was enacted in 1970), OSHA provides fact-based, detailed reports relating to on-the-job accidents. "OSHA has a wonderful amount of public data to work with on its website," says Henningsen. "Their data is vetted – every accident reported to OSHA goes through a thorough investigation and review process before the results are published. And the criteria are the same across the country, which ensures accuracy and consistency from state to state."

How it Works

In calibrating a new reporting and verification system, Henningsen says that he and his team learned from past processes. "The difference from what the National Board did in the past and what we are doing now lies in the thoroughness of the data gathered from OSHA and the ability to look at specific details provided in their accident reports."

Statistics collected for the new Incident Report come directly from a database on OSHA's website called the "Fatality and Catastrophe Investigation Summaries" (also known as "Accident Investigation Summaries").

According to the website, accident summaries "are developed after OSHA conducts an inspection in response to a fatality or catastrophe. The summaries provide a complete description of the incident, including events leading to the incident and causal factors." Summaries also include the fines incurred with each incident.

To establish an initial baseline, National Board searched summaries from 2002 through 2010 using industry-specific keywords to customize the results. OSHA's database generated over 5,000 summary reports and a team of National Board staff reviewed each one. All accidents that the staff agreed were relevant to the boiler and pressure vessel industry were classified as an 'incident' and included in the Incident Report statistics. The failure of individuals and businesses to follow safety procedures was a common theme.

When reviewing the customized results, the team observed a considerable drop-off in the total reported incidents from 2008 to 2010. This was confirmed in discussions with OSHA and is due to OSHA's three-to-five-year lag in time to clear an investigation and post the results. Therefore, National Board's initial Incident Report will show trends from 2002-2007, and future results will be included as newer data is available from OSHA.

Limitations

While there are clearly positive aspects to using OSHA data, there are limitations. First, the data is limited to the US. Also, OSHA's reporting and investigation process can take years for an incident to clear, which means a delay of years in reporting. And there are other limitations. "Obviously, OSHA's data is not collected with the National Board or the pressure industry in mind. It is strictly related to the workplace, and there are certain requirements for reporting an incident," explains Henningsen. According to an OSHA fact sheet, an accident must be reported "when a worker is killed on the job and/or three or more workers are hospitalized." When these criteria are met, an employer covered by OSHA must report the incident within eight hours.

But what if a piece of pressure equipment malfunctions and causes severe property damage but no injuries or loss of life? It would not be reported to OSHA, but it would be of interest to the National Board.

While OSHA doesn't provide a complete picture of pressure equipment accidents across the US, it's a worthwhile beginning for gathering industry-related incidents. "We've got a great foundation for collecting data and looking at trends. Over time we'll have an even clearer snapshot of events that have occurred over the years," says Henningsen.

Looking Ahead

Another promising data source the National Board is evaluating comes from the National Fire Incident Reporting System (NFIRS). Across the country, fire departments use a uniform set of codes to record the causes of fires and injuries. As first responders, fire fighters are called to the scene of many different types of accidents, resulting in data that encompasses a wide range of incidents, including those that do not result in injury. This differentiates NFIRS data from OSHA's, which is strictly workplace-related based on

certain criteria. The National Board hopes to use NFIRS data to identify pressure equipment incidents outside OSHA's scope.

Currently, data available through NFIRS is incomplete for National Board purposes, but NFIRS is working on upgrading and expanding its system. Once finished, the new database will provide thorough data regarding boiler and pressure equipment incidents. The NFIRS report will be a separate, stand-alone source and will provide additional insight into the overall occurrence of pressure equipment accidents across the US.

"We are taking a new and different pathway rather than trying to achieve an ideal system for reporting on industry accidents," concludes Henningsen. "We recognize it is not the end-all-be-all, but once we get our OSHA and NFIRS processes established and underway, we can begin to look at other sources – domestic, international, or industry-specific resources – for inclusion into our process."

Initial Findings

The initial findings are presented in the following chart. Included are: total available OSHA incidents for years 2002-2007; total customized reports (using industry-specific keywords); total incidents identified by National Board as boiler and pressure vessel-related; of those incidents, total fatalities and total injuries. For example, in 2002, OSHA reported 4,554 incidents. Of those, National Board reviewed 798 customized reports and flagged 13 as industry-related. Of those 13 incidents, there were 8 fatalities and 14 injuries. (One incident could involve two deaths and five injuries, so the total injuries and total fatalities could be higher than the total number of incidents flagged by National Board). The graphs on pages 22 and 23 break down each category by year.

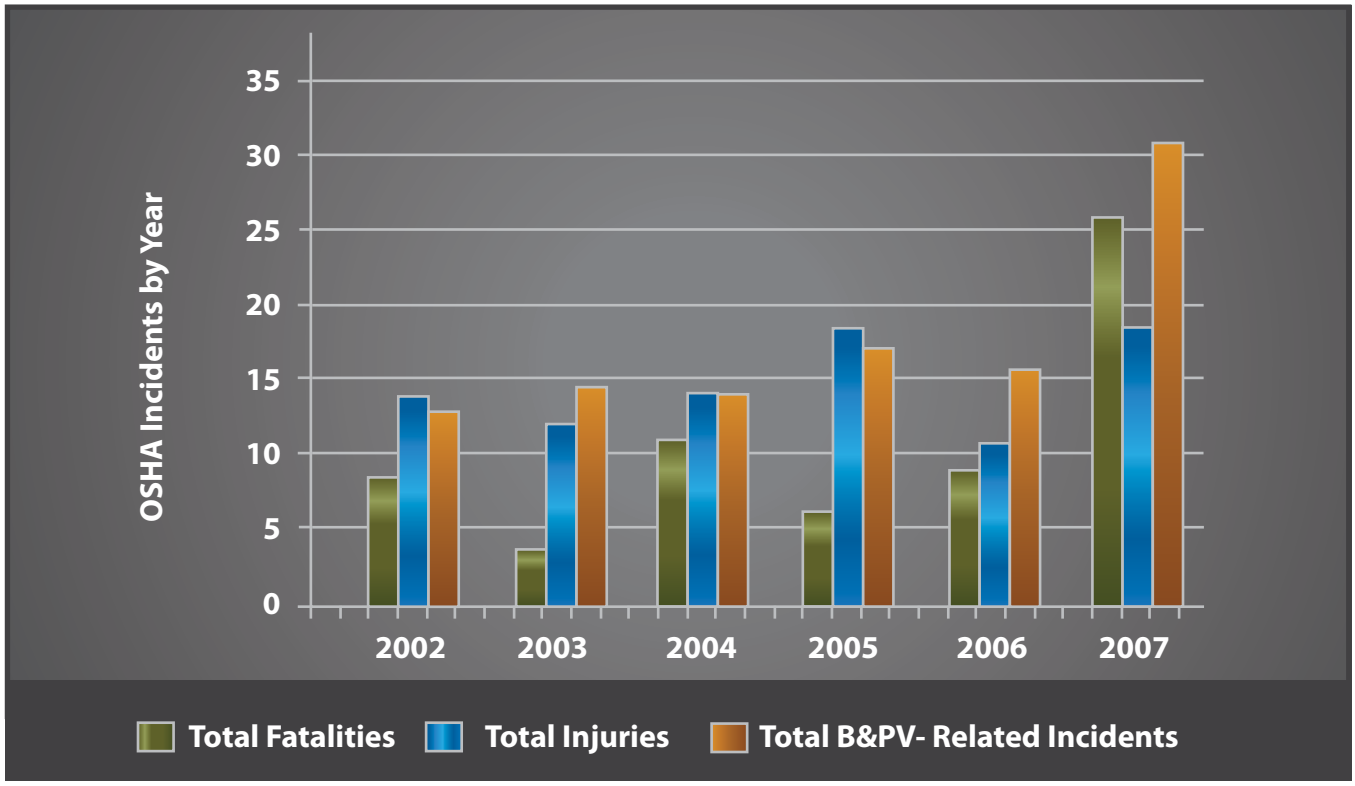
Updates to the Incident Report will be published annually in the winter *BULLETIN* and made available on the National Board website.

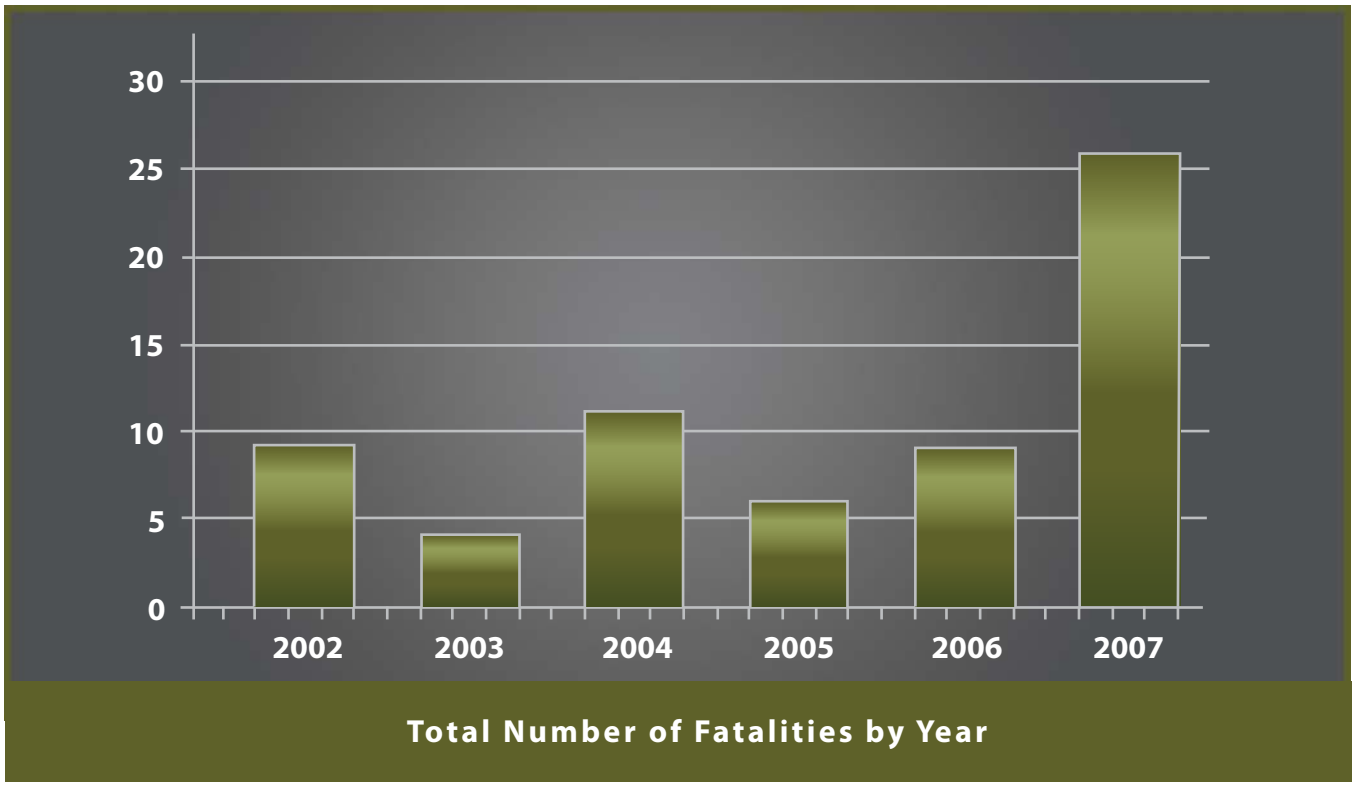
> *"We've got a great foundation for collecting data and looking at trends. Over time we'll have an even clearer snapshot of events that have occurred over the years."*

YEAR	Total OSHA Incidents	Total Incidents Reviewed (Filtered by keywords)	Total B&PV-Related Incidents	Total Fatalities	Total Injuries
2002	4,554	798	13	8	14
2003	4,667	895	14	4	12
2004	4,651	849	14	11	14
2005	4,599	838	17	6	18
2006	4,632	775	16	9	11
2007	4,589	861	31	26	18
TOTAL	27,692	5,016	105	64	87

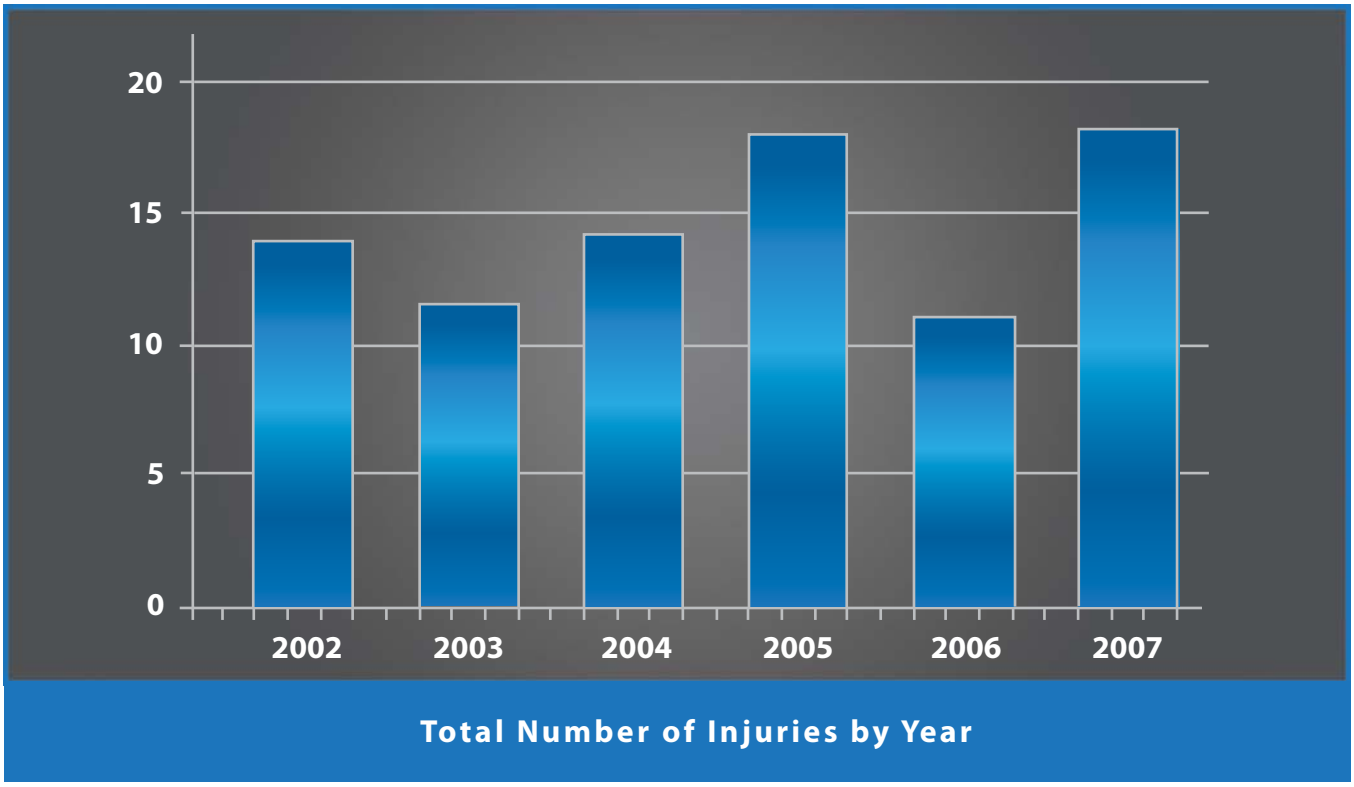
Statistics were derived from data files available for download from OSHA for incidents closed between 12/31/2001 and 12/31/2007.

Benchmark Incident Findings Based

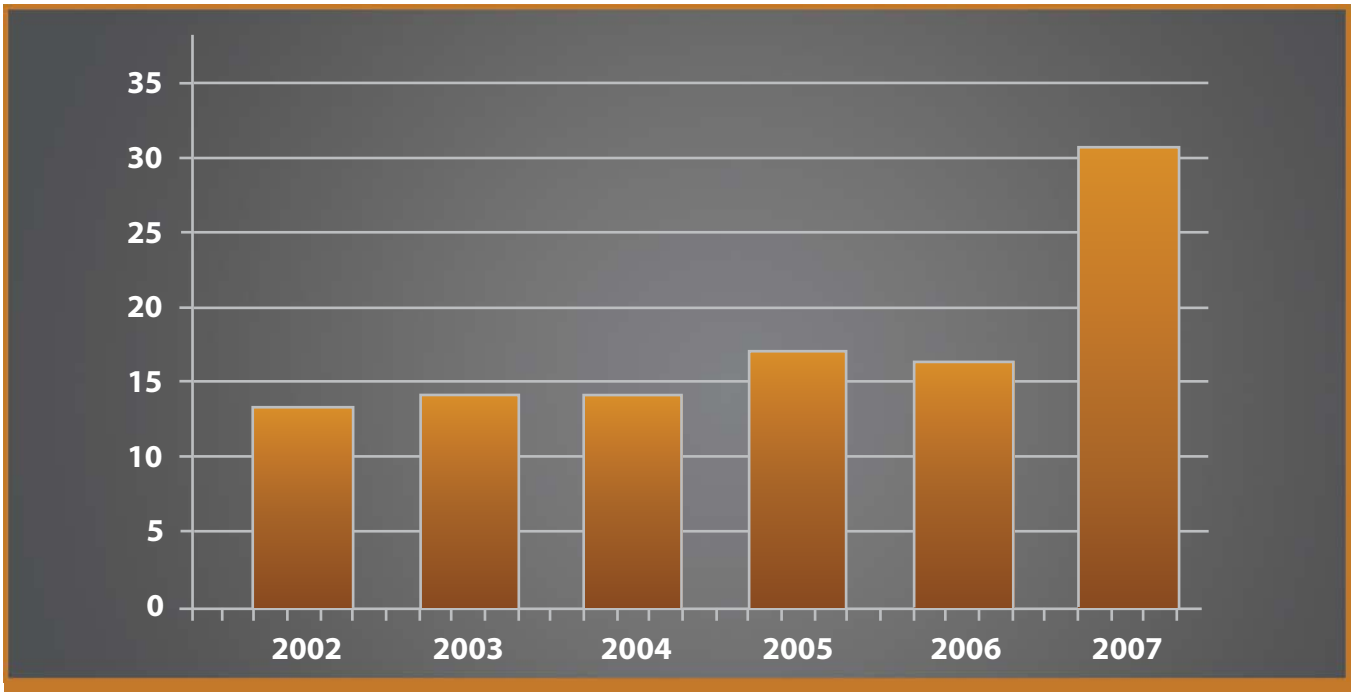




on OSHA Data from 2002-2007



Total Number of Injuries by Year



Total Number of B&PV Incidents by Year

Pressure Relief Device Shipping and Handling

Proper Packaging Matters

BY JOSEPH F. BALL, P.E., DIRECTOR, PRESSURE RELIEF DEPARTMENT

In the *ASME Boiler and Pressure Vessel Code*, much attention is given to the design, testing, and certification of pressure relief devices. These devices are recognized as the "last line" of safety and are expected to provide protection for equipment and personnel when other controls fail or a process upset occurs. There are numerous requirements for the design and materials of pressure relief devices, and a detailed test program is outlined to prove their function and capacity. Similarly, the *National Board Inspection Code* (NBIC) includes details on important installation requirements, outlines periodic inspection procedures, and includes a program to certify organizations that repair pressure relief valves so that the user can continue to rely on them.

Previous articles in the Pressure Relief Report column have reviewed some of the detailed technical requirements for device testing and application. However, this article focuses on an often overlooked but vital accessory – the box that a device is shipped in. Improper shipping and handling can often affect how devices will operate inservice and may lead to an unhappy pressure relief valve customer.

The general philosophy is that a pressure relief valve should be treated as an instrument, not as a pipe fitting (this also applies to non-reclosing devices). If you received a high-accuracy pressure gage, it would be carefully packaged and protected. Pressure relief valves, which have close internal tolerances and have been carefully calibrated, should be treated in the same way. Since valves appear to be quite rugged and sturdy, they do not always receive the care and attention appropriate to their importance.

The NBIC recognizes the importance of properly handling pressure relief valves and has included recommendations for packing and shipping these devices.

NBIC Part 2, 2.5.6: PACKAGING, SHIPPING AND TRANSPORTATION

The improper packaging, shipment, and transport of pressure relief devices can have detrimental effects on device operation. Pressure relief devices should be treated with the same precautions as instrumentation, with care taken to avoid rough handling or contamination prior to installation.

b) The following practices are recommended:

1) Valves should be securely fastened to pallets in the vertical position to avoid side loads on guiding surfaces except threaded and socket-weld valves up to 2 in. (50mm) may be securely packaged and cushioned during transport;

2) Valve inlet and outlet connection, drain connections, and bonnet vents should be protected during shipment and storage to avoid internal contamination of the valve. Ensure all covers and/or plugs are removed prior to installation;

3) The valve should not be picked up or carried using the lifting lever. Lifting levers should be wired or secured so they cannot be moved while the valve is being shipped or stored. These wires shall be removed before the valve is placed inservice;

4) Pilot valve tubing should be protected during shipment and storage to avoid damage and/or breakage.

Similar requirements are included in NBIC Part 3, Supplement 7.14.2, which is a repair procedure for spring-loaded valves, and Supplement 7.14.3 for repair of pilot-operated pressure relief valves. One additional recommendation is added here relating to valves that have been cleaned for special applications:

"Valves for special services, including but not limited to oxygen, chlorine, and hydrogen peroxide, should be packaged in accordance with appropriate standards and/or owner procurement requirements." [NBIC Part 3, S7.14.2, m), 5)]

These requirements seem somewhat obvious; however, we will look at several of them to understand why they are written as shown.

*"Valves should be securely fastened to pallets in the **vertical** position to avoid side loads on guiding surfaces." [NBIC Part 3, S7.14.2, m), 1). Emphasis added.]*

During testing, the force exerted by the spring of a direct spring-loaded valve is balanced by the pressure forces in the inlet. However, when the inlet pressure is released after testing, the entire spring force is now pressing the valve seats together. Valve seats are often very narrow to promote seat tightness during valve operation. This large spring load is concentrated on the very small area of the valve seat, and can exert forces that approach the yield strength of the seat material. Vibrational forces, particularly those acting parallel with the valve seat, can cause the seating surfaces to move very slightly in relation to one another, and the seating surface can be easily damaged. The symptom experienced by users is that the valve leaks when it is installed in their system, even though it was leak-tight when it left the manufacturer or repairer.

Even though users rely on the valve for overpressure protection, most of the time their expectations are that the valve will sit in their system – and do nothing at all. If the valve is leaking in service, it represents increased maintenance costs and the loss of product, which may be costly or hazardous. Even if it does not pose a safety problem, a leaking valve can also be considered an environmental issue for which fines may be levied, and the plant will be considered a poor neighbor to those around it.

Clearances can be very small between valve internal parts that serve a guiding function. When a valve is on its side, those parts can rub against each other due to vibration, resulting in wear between the guiding surfaces; therefore, best shipping practice for larger valves is to transport them in an upright position. Put it on a sturdy pallet large enough that the shipper cannot tip it over. Protect the inlet and outlet connections, as well as the drain and vent holes, and the valves should arrive in good condition. Many shippers using this method do not put a box around the valve and still do not have problems.

"Lifting levers should be wired or secured so they cannot be moved while the valve is being shipped or stored." [NBIC Part 3, S7.14.2, m), 4)]

Every manufacturer cautions against using the lifting lever as a device to pick up the valve. Its purpose is to lift the valve disk off the seat to test that the valve is not stuck shut while in service. However, to the uninformed, a lifting lever certainly looks like a handy way to carry a valve. One problem encountered is that if the valve disk lifts a bit due to being carried by the lift lever, contamination can get between the seat and disk of the valve. In service, the pressure differential would quickly sweep the contamination away; however, with no pressure on the valve, the dirt will now cause a leak or damage to the seats. A second issue is that the lift lever is typically designed to work with some pressure assisting it. Without pressure, the valve stem or the threads on top of the stem may be damaged. Again, maintenance costs are increased and the lift lever might malfunction when it is needed for a test.

The NBIC recommendation is to wire the lifting lever down so it cannot open the valve if used as a carrying handle during transport. Once the valve is installed, the wire must be removed so the lever becomes functional.

Finally, common sense should be used when selecting shipping containers. Valves sent to the National Board Test Lab represent a significant investment that will allow a company to become certified on a particular product or for repair certification. We are continually surprised when we receive a valve that may weigh 50 or 60 pounds, and find it has been thrown into a cardboard box with a bunch of "peanuts" as packing material. These valves rarely make it through the shipping process without the box being damaged and a portion of the valve sticking through the box.

Careful attention to the shipping and handling of pressure relief devices, treating them as a precision instrument, and using a bit of common sense in packaging will result in more reliable service from a device that is dedicated for safety.

Data Mining

By James R. Chiles

The National Board is taking new steps to get on top of safety data so that previously unknown patterns can shine through. As you'll read in this issue, the pressure equipment industry has much to learn, or re-learn, from past years of inspection reports and investigations by OSHA and state OSHA agencies.

If anyone doubts the importance of inspectors and investigations in catching problems early, consider the following news items, all clipped from a single year, 2009:

- After a major investigation, *The Chicago Tribune* pointed out that despite legal requirements to annually inspect elevators, the city hadn't bothered to check 70% of them the previous year. Some units hadn't been checked once since 2001.
- Hundreds of Southern homeowners first reported sickening smells inside their houses along with blackened, corroded metal. Chemical sleuthing tracked the problem to sulfur compounds emitted by particular batches of drywall, most (but not all) of which were imported from China. Drywall imports spiked after widespread hurricane damage along the Gulf Coast in 2005.
- Following a huge water main break that required helicopters to rescue motorists from the ensuing flood, the Washington Suburban Sanitary Commission in Maryland admitted that it had backed off on pipe inspections and repairs for the previous decade – not spending $15 million in repair funds collected over four years.

In all these cases, earlier detection would have reduced or eliminated risks. The exploding 66-inch main in Maryland hadn't been inspected for 10 years, despite its crucial role in the system. Cutbacks in inspections are never far from the news feeds, particularly after a fatal and avoidable mishap. After Suzanne Hart's 2011 death in a Manhattan elevator, a New York newspaper pointed out that the city assigns much more effort, on a proportional basis, to inspecting restaurants and delicatessens than to verifying safety in buildings and at construction sites, though equipment mishaps at the latter cause more deaths.

Data mining means "selecting, exploring, and modeling large amounts of data to uncover previously unknown patterns for business advantage."

Won't looking through closets of old data just turn up new skeletons? At first blush, it might seem that a detailed look through past years of compliance information will send chills down the collective spine of people on the other side of the inspector's clipboard: boiler and pressure vessel owners, manufacturers, installers, and maintainers.

But more than a decade of airline experience with data analysis in the Global Aviation Information Network (GAIN), points to benefits on the bottom line, not just to safety. Here's one example. For years, airlines operating in congested airports suffered from abnormally high rates of aircraft downtime due to signs of possible overstress in wing flaps. Because lowering the flaps is critical to safe landings, any sign of flap overstress required taking the plane out of service for inspection and sometimes for repairs as well. That's always expensive, even when no repairs are needed. Fortunately, a close look at automatically gathered aircraft data (from air traffic control logs and in-flight records) showed that much of the overspeed problem was avoidable: instructions from harried air traffic controllers were forcing pilots to cut airspeeds and altitudes too abruptly. That discovery, which crossed multiple flights by multiple airlines, led to practices benefiting safety and operating expenses too.

The modern term for such work is "data mining." It's more than analysis. Here's a definition from the SAS Institute, which specializes in the analysis of large information stores: data mining means "selecting, exploring, and modeling large amounts of data to uncover previously unknown patterns for business advantage."

Hard-rock mining – if not data mining – has long been a part of American lore. Movie buffs may remember this line from the 1939 film *Destry Rides Again*: "Thar's gold in them thar hills!" Today, gold prices are much higher than in frontier days, so many new gold mines have

opened. But whatever the posted price of gold, there's more value in what we might call "them thar data hills," meaning, the giant heaps of data compiled but never inspected. And there's much to dig through, because companies and government agencies have done better at stacking away information than using it.

To stretch the analogy a little further, gold rush miners watched for nuggets and rich veins as they chipped away. But a well-run data mine can turn up entirely new material. Imagine a gold mine so productive that it produced not only gold but a brand new and very useful mineral. That's what data mines can do: go beyond the expected to the unexpected.

"Operational research" is an early name for data mining, and it was a major factor in winning the Battle of the North Atlantic during World War II. It was grounded on this principle: if you have enough reliable numbers to crunch, and if you know the context of those numbers, you can improve practices beyond anything that anecdotes and old wisdom will tell you.

Here's an example of operational research in action. During the Blitz of 1940-41, British civil defense authorities needed urgently to know how much danger German bombs posed to London's subway stations, because citizens were starting to seek shelter there by night. But subway stations lie at different depths, and a time-delayed bomb breaking into a fully occupied station would kill hundreds of people. How to know the safe depth? The answer was found in data already gathered – the after-action reports filed by bomb disposal units, who had been jotting details of each dud bomb's weight, size, and ground-penetration track. Wrote a veteran of the statistical effort, all the key information was stored in the War Office, "though apparently no one had had time to look at them." Once analyzed for meaning and reliability, the dud-bomb data helped identify every station deep enough to be safe.

Moving from the subject of data mining and its value, I'd add two points about the definition – points sometimes missed in the current buzz. First, data mining is a continuous improvement process, not something that is likely to bring miracles of insight from quick snapshots of data.

Second, the best data mining comes from combining user expertise with computing power. While some trade publications tend to emphasize what the latest software can do, data mining is not just dumping spreadsheets and databases into a supercomputer. The process needs people at the front end to plan the approach and at the back end to judge what the results mean for improved models and for subsequent runs. And experienced people are also needed in the field, because they bring a larger context probably missing from the warehouse of data being mined, however voluminous.

User groups that mingle regulators, operators, and industry are an excellent source of the expertise that world-class data mining needs. One familiar to some readers of the *BULLETIN* is the Heat Recovery Steam Generator (HRSG) Users Group. These engineers, designers, and operators watch over the giant heat exchangers commonly employed at high-efficiency power plants, such as those where HRSGs convert gas turbine exhaust into usable steam. Changes in the generation market and the need for fuel efficiency have increased the importance of HRSGs but also posed new challenges in safety and reliability. That's why the user group combines the latest field observations and data to pick out problems and work on solutions.

Here's a typical warning from the HRSG user group's guidebook, as publicized in *POWER* magazine, concerning the risk of failures in certain equipment at the pressure boundaries: "These failures are potentially very serious to personnel in the vicinity because steam/water mixtures at high temperature and very high pressures (1,500-2,000 psi) are released at an uncontrolled rate." Among other details that the group has recently flagged for members' attention: drain lines improperly joined together and the fact that condensate liquid probably needs chemical treatment as much as raw feedwater does.

What can readers of the *BULLETIN* do to contribute to better data mining? The National Board's effort needs consistent and thorough reports from inspectors. (Note to those inclined to cut some slack: verbal warnings can't build a database like written reports do.) Installers, manufacturers, and technicians: read the new reports and give your feedback. What's missing? What extra context is needed? What fixes are affordable and safe? Your boots are on the ground, so what you see is very important. The sooner a problem is detected, the quicker preventive steps can be taken.

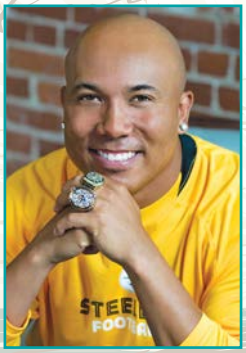
James R. Chiles, author of Inviting Disaster *and* The God Machine *has been writing about technology and history for over 30 years. His work has appeared in* Smithsonian, Air & Space, Popular Science, Harvard, Aviation Weekly, Mechanical Engineering, *and* Invention & Technology. *He maintains a blog called* Disaster-Wise *and can be reached at* j.chiles2050@gmail.com.

The 82nd General Meeting MIAMI, FLORIDA, 2013

Hyatt Regency Miami

Connected to the Miami Convention Center and minutes from the bustling Art Deco District of South Beach, the Hyatt Regency Miami overlooks the Miami River and Biscayne Bay. The hotel is easily accessible to everything from Mary Brickell Village and Coral Gables to the Latin flavor of Little Havana. A complimentary trolley service with a hotel terminal allows hotel guests easy access to points of interest in the downtown Miami vicinity.

National Football League Great & Dancing With the Stars Champion Hines Ward to Keynote Opening Session



Through 14 seasons with the Pittsburgh Steelers, future National Football League (NFL) Hall of Fame wide receiver Hines Ward was named to the NFL Pro Bowl four times and was elected Super Bowl XL Most Valuable Player. Before his retirement from the Steelers in 2012, he became a household name when he and partner Kym Johnson were declared the 12th-season champions of the popular TV dance competition, *Dancing with the Stars*.

Ward achieved 186 consecutive games with at least one reception per game and recorded a remarkable streak of four consecutive 1,000-yard seasons. In retirement, he assumed the role of football analyst for NBC's *Sunday Night Football*. He made his movie debut as a member of the fictional Gotham Rogues football team in the 2012 Batman film *The Dark Knight Rises*. Opening Session special guests are the Miami Dolphins Cheerleaders.

Comedic Legend Gallagher to Headline Wednesday Evening Banquet

Producing 14 *Showtime* classic comedy programs over 25 years, he literally invented one-man comedy specials on cable television. Then in May of last year, following several heart attacks, he retired. Sort of.

After cancelling tour dates from May to the end of last year, Gallagher's back. And performing what may be his farewell shows before *really* retiring after 32 years on the road.

Gallagher will take the stage during the evening banquet at 8:30 p.m. on Wednesday, May 15. And yes, this comedic legend will be accompanied by his patented Sledge-O-Matic. So be on hand for drinks, dining, and especially dessert, featuring ample and abrupt servings of watermelon.

82nd GENERAL MEETING

PRELIMINARY PROGRAM

The National Board of Boiler and Pressure Vessel Inspectors
&
ASME Boiler and Pressure Vessel Committee

Monday, May 13

Opening Session

10:15 a.m. REMARKS
Hines Ward*

General Session

1:00 p.m. Invited - TBA

1:30 p.m. **MANUAL WELD EXAMINATION USING PHASED ARRAY ULTRASONIC TESTING (PAUT)**
Ron Kent, ASNT Level III
KB INSPECTION SERVICES

2:00 p.m. ***B L O W B A C K:* Between the Lines**
Paul Brennan, Director of Public Affairs
THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

2:30 p.m. BREAK

2:45 p.m. **BIOGAS: THE HIDDEN COSTS OF GOING GREEN**
Robert "Buddy" Dobbins, Technical Director – Machinery Breakdown
ZURICH NORTH AMERICA INSURANCE

3:15 p.m. **ANATOMY OF A CATASTROPHIC BOILER ACCIDENT**
David Peterson, Machinery and Equipment Specialist
THE CINCINNATI INSURANCE COMPANIES

3:45 p.m. TBA

* PHOTO SESSION WITH HINES WARD FOLLOWS OPENING SESSION

(No autograph requests, please)

General Meeting Notices

- Participants and guests are encouraged to dress in a business-casual style for all hotel events except the Wednesday banquet (where ties and jackets will be the evening attire).
- Distribution of any and all literature other than informational materials published by the National Board and ASME is strictly prohibited at the General Meeting.
- To obtain a preregistration discount of $50, all forms and fees must be received by May 1.
- On-Site Registration Desk Hours:

  Sunday, May 12 . . . . 9:00 a.m. - 2:00 p.m.
  Monday, May 13 . . . 8:00 a.m. - 10:00 a.m.
  Tuesday, May 14 . . . 8:00 a.m. - 10:00 a.m.

- General Meeting Registration is required in order to receive the special $169 room rate at the Hyatt Regency Miami.

Reminder

General Meeting details can also be found on *InfoLink!* located on the National Board website at *nationalboard.org*.

National Board and ASME Meetings

- The following meetings are scheduled for Tuesday, May 14: National Board Members' General Discussion Session, National Board Members' Meeting, and the ASME Conference Committee.
- ASME Code meetings are scheduled all week. Meetings are open to the public.
- Check hotel information board for National Board and ASME meeting locations and times.

GENERAL MEETING GUEST TOURS

NOTE: Registrants are not permitted to attend the Monday or Tuesday tours intended for designated guests. This policy is strictly enforced.

Monday, May 13

Art Deco Tour, 1:00 p.m. – 4:00 p.m.

This tour captures the glitz and glamour of the roaring '20s and '30s in North America's only Art Deco Historic District. Don't miss this rare chance to experience the thrill of a city that defiantly danced 'til dawn through Prohibition, the Great Depression, major hurricanes, and two World Wars. In addition to learning about the larger-than-life personalities and world-famous events that reshaped a society and its architecture, guests will walk the halls of the first hotel ever built on Miami Beach and delight at the imaginative and playful Art Deco lifeguard stands lining the beach like pastel-colored toy soldiers. Guests will also witness the evolution of architectural styles while viewing unique and evocative Art Deco landmarks serving as signposts to an era that looked forward to a future of celebrated progress, innovation, adventure, and freedom. By afternoon's end, guests will understand why millionaires, movie stars, thousands of soldiers, and countless others have fallen under the magical spell of Miami Beach.

NOTE: This tour requires a minimal amount of walking. Sunscreen and light, comfortable clothes and shoes are recommended.

Tuesday, May 14

VIP Marlins Ballpark and Little Havana Tour, 10:00 a.m. – 4:00 p.m.

This full-day Miami activity provides not only something for everyone, but a one-of-a-kind chance to experience the best Miami has to offer. First up: a VIP tour of the new state-of-the-art Marlins Ballpark. Considered the jewel of Miami, Marlins Ballpark has been thoughtfully designed for a completely new experience, with special features that include a retractable roof (constructed to eliminate weather complications). This exceptional sports venue was meticulously planned to seamlessly integrate a unique ballpark with Miami's eclectic traditions and heritage. It even has an authentic South Beach experience: a swimming pool! The VIP behind-the-scenes tour will include visits to the Suite Level, Press Level, Service Level, Home Plate Fish Tanks, and Promenade.

Following the Marlins Ballpark tour, guests will dine at Casa Juancho, considered among Miami's most popular Spanish dining locations. Then it's off to Little Havana.

From the food, to the accents on the street, to the fashion scene and artist's studio, Miami's Little Havana pulses with original blended culture. Journey through the streets of Miami's Cuban community and experience firsthand the passion and vision that brought these motivated exiles to their new home. Stops include Miami's own version of the Statue of Liberty, a well-loved marketplace, great Cuban food spots, moving monuments, lively street scenes, and a place of spiritual reflection and longing. Be prepared for a day of discovery and fun as guests take in the smells, sights, sounds, and colors of a street that launched the dramatic transformation of Miami over four decades ago.

NOTE: This tour requires a minimal amount of walking. Sunscreen and light, comfortable clothes and shoes are recommended.

Wednesday, May 15

Miami Mansion Tour aboard the Floridian Princess, 9:00 a.m. – 2:00 p.m.

It doesn't get more leisurely than this.

At the Hyatt Regency Miami, climb aboard the magnificent 125-foot, five-deck mega Floridian Princess yacht for a day that will not be soon forgotten. Accommodating up to 400 passengers and 20 crew members, the Floridian Princess was custom built to include every possible amenity to ensure its status as one of the finest cruising and dining vessels in the world! Guests will begin the day with a continental breakfast along with a selection of light adult refreshments. A fully-narrated sightseeing cruise will feature Miami's famous mansions along scenic Biscayne Bay as well as spectacular coastal sites that include the beautiful downtown Miami skyline, the Port of Miami, Fisher Island, Miami Beach, and "Millionaire's Row" – the homes of the rich and famous. At noon, guests will be treated to a specially prepared buffet luncheon along with full open bars. Throughout the journey, everyone will have an opportunity to experience a bit of Latin influence featuring a variety of activities. Promptly returning to the hotel at 2:00 p.m., guests will disembark the Floridian Princess with both great memories and a newfound appreciation of South Miami culture.

NOTE: This tour requires an exceptional amount of leisurely sightseeing and relaxation. Sunscreen and light, comfortable clothes and shoes are recommended. The Floridian Princess is ADA compliant.

Please see *InfoLink!* on the National Board website for tour guidelines and restrictions.

Online Registration Form

Online registrations are accepted using a secure website form accessible via *InfoLink!* at nationalboard.org. This allows General Meeting attendees to process payment and receive a receipt and email confirmation at time of online registration.

General Meeting Hotel Information

Hotel reservations are the responsibility of attendees and can be made through Hyatt Regency Miami. The Hyatt prefers attendees make their reservations online at the following web address:

https://resweb.passkey.com/Resweb.do?mode=welcome_gi_new&groupID=10597159

This link can also be accessed on the National Board web-site under *Infolink*! For assistance with reservations, call 888.421.1442

To receive the $169 nightly group room rate,* reference Group Name:

National Board

Group rate reservations must be received by April 19.

Room refunds available only with 72-hour prior notification.

** Group rate for General Meeting registrants only*

IMPORTANT NOTICE

While the National Board and the host hotel will do everything possible to accommodate all General Meeting visitors, registered participants will be given first priority for all discounted sleeping rooms. In the event of a sold-out hotel, the National Board reserves the right to cancel the reservations of anyone in its room block not preregistered for the General Meeting. It is therefore strongly recommended participants register for the General Meeting before securing room reservations. Additionally, it is suggested participants make their hotel arrangements early to ensure availability. Those seeking special room rates but failing to register for the National Board General Meeting are not guaranteed the discounted nightly rate.

Mail or Fax Registration Form

Name _____

First Name for Badge _____

Company/Affiliation _____

Telephone _____ Fax _____

Address _____

_____

Email _____

Guest Name _____

Guest Address (city/state only) _____

_____

Additional Guest* Name _____

Additional Guest Address (city/state only) _____

_____

*Additional guests (16 years of age or older) may register for a fee of $225.00 each.

Those requesting special or handicapped facilities are asked to contact the Public Affairs Department at 614.431.3204.

FEES

Only one registration fee will be charged for each attendee and one guest (guest program participant).

General Meeting Preregistration Fee ..... $ _____
(includes ONE banquet ticket)

Registration fee is $425.00 if received *on or before* May 1.
Registration fee is $475.00 if received *after* May 1.

Additional Guest Fee(s)
_____ Additional guests at $225.00 each ..... $ _____
(each includes ONE banquet ticket)

Additional Banquet Ticket(s)
_____ Additional tickets at $85.00 each..... $ _____

AMOUNT ENCLOSED..... $ _____

To preregister by telephone or fax using your VISA, MasterCard, or American Express, contact the National Board at 614.431.3203, or fax 614.888.0750.

❑ VISA ❑ MasterCard ❑ American Express

Card # _____ Exp. Date _____

Cardholder's Name _____

Signature _____

All checks and money orders must be made payable in US dollars to:
The National Board of Boiler and Pressure Vessel Inspectors

Preference for registration confirmation: ❑ Email ❑ Fax ❑ Mail

REGISTRATION DEADLINE: May 1

Accounting Department Only: AMOUNT $ _____ DATE _____

The National Board of Boiler & Pressure Vessel Inspectors
1055 Crupper Ave.
Columbus, Ohio 43229

CHRIS FULTON

Chief Boiler Inspector, State of Alaska

BULLETIN Photograph by Photo Arts by Janna

Chris Fulton is perplexed.

Fellow National Board members are retiring in multitudes. Yet he isn't even thinking of retirement.

Last winter, the Alaska chief boiler inspector endured 144 inches of snowfall, including 10 feet in one day in Cordova. He still has to make many of his state inspection rounds in a floatplane or hovercraft. And then there are those confounding moose and bears he will, on occasion, personally encounter on city streets and parking lots.

Welcome to Anchorage, and the world of aurora borealis and nights of unyielding daylight. Mr. Fulton's world. And he loves every minute of it.

As he reflects on his good fortune, Chris can't help but be astounded by the circuitous and sometimes serendipitous route that brought him to Alaska from his hometown of Bellevue, Washington.

"My dad worked at Boeing for 44 years. He always said it was a temporary job until he found something better," Chris smiles. But the elder Fulton wasn't the only one working in the family.

"I remember working a lot as a kid," the Alaskan official explains. In addition to a morning paper route, Chris earned money chopping wood and selling cords "at $15 back then" to area residents. "When not working, I was involved in Cub Scouts and Boy Scouts. It was through these groups I developed a love for the outdoors, particularly fishing."

Following high school graduation in 1966, the Washington native went to work at Boeing performing machining and tooling work. Even though he knew at the time being employed by Boeing was not his career choice, Chris spent three years at the airline manufacturer before being drafted.

"I took the Army aptitude test and was told I was mechanically inclined," he

recalls. "Because of my work at Boeing, I was sent to school in Eustis, Virginia, to become a helicopter mechanic specializing in props and rotaries."

Chris found the school to be "pretty interesting." After being shipped in a support role to Ansbach, Germany (where he would serve one-and-a-half years), the state official discovered he was accumulating a number of skills that would be helpful once he departed the service. "As with airplanes, helicopters require a lot of non-destructive testing," he adds.

Chris' Army experience would lead him to a number of jobs within the aviation industry. But a slow economy when he was discharged in February 1971 precluded going back to Boeing. Instead, Chris took a position in Kent, Washington, building electric boilers. "I was there for a year-and-a-half and the one thing that I vividly recall were visits from the boiler inspectors. They commanded such respect," he notes with a grin. "I said to myself THAT is what I want to do."

Chris' next job in 1973 took him to Palmdale, California, where he worked for Lockheed as a plant electrician. "I lasted in the desert about two years before deciding I liked the Seattle weather better."

In 1974, the future National Board member accepted a federal job at the Puget Sound Shipyard as a boilermaker. "My experience building those electric boilers in Kent was instrumental in allowing me to secure a boilermaker position. It was tough work," he explains without reservation, "because it was all manual. I knew I wouldn't last in that capacity for too long!"

Five years later, Chris made a significant career decision. "I took a correspondence course to become a boiler inspector. Without much encouragement from my supervisor, I was continually told I wouldn't be able to pass the course because I lacked math skills."

The supervisor's remarks left Chris more determined than dejected. "I completed the course then proceeded to pass all of the course tests," he smiles proudly. "To become an inspector I just needed two years' operating experience."

In 1979, the Bellevue native took a job in Silverdale, Washington, at the Bangor submarine base, location of the Trident submarines. Having secured his required experience, the state official applied in 1981 to become an inspector for Royal Insurance. The only thing he didn't have for the position was a National Board Commission.

"What the company didn't know at the time was that I had been studying for years to pass that exam," Chris says with a laugh. "In May of 1981 I traveled to the World Trade Center in New York City. There, I sat for and passed the commission examination on my very first try!"

In 1984, the newly minted commissioned inspector left Royal to work for Kemper in Salt Lake City. "It was a great city to live and work in," he explains. But after 11 years, the lure of family brought Chris back to Seattle. The Alaska official left Salt Lake City in 1995 to join Factory Mutual in Seattle.

"My work at Kemper required regular inspection trips to Anchorage," he explains. "My trips continued when I joined Factory Mutual." Those visits took on more significance when Chris met his future wife Pat on an inspection trip in 1997.

Chris' fondness for the area and Pat's connection to her native Anchorage prompted the couple to move north in 2000, where the Army veteran accepted a position as an Alaska state inspector.

In 2005, Chris left Alaska for a state inspector's position in Nevada. "After about a year, we decided we liked a cooler climate as opposed to the Nevada heat," he explains. "With my old job still open, Pat and I returned to Anchorage."

In February 2008, Chris Fulton assumed the title of chief inspector for the state of Alaska. His department now includes seven inspectors who work with 30 insurance company inspectors and 20 owner-users. "Right now, our jurisdiction oversees more than 50,000 pressure equipment items, 30,000 of which are active pressure vessels," he is quick to add.

With retirement far from his mind, the Alaska state official says he is living in the moment. Sidetracked by some nagging health issues, he is determined to enjoy his family, the wonderful Alaskan people, and a job he finds extraordinarily satisfying.

Recently, the Fultons took on the responsibility of raising a family member's three-year-old son. "Zachery has brought so much joy into the lives of Pat and me," Chris professes with pride. "He has certainly given us much hope for the future with both his high level of energy and talent."

With family still living in the Seattle area, Chris tries to visit several times during the summer "while not having to worry about the challenges of air travel during an Anchorage winter."

And while still having fondness for his old hometown of Seattle, Chris has only one regret.

"I should have invested in Microsoft and Starbucks . . ." ♣

NBIC Ventilation and Combustion Air Requirements for Boilers

By Robert Ferrell, Senior Staff Engineer - Training

When it comes to combustion boilers, air plays an important part in safety. It does this in two ways. It provides oxygen for the safe combustion of carbon-based fuels and it provides oxygen and cooling for the health and safety of personnel in the boiler room. We refer to the air provided for the combustion boilers as "combustion air" and the air provided for human safety and comfort as "ventilation air."

Ventilation Air

The 2011 *National Board Inspection Code* (NBIC), Part 1, Paragraphs 2.5.4(a) and 3.5.4(a), require a minimum of 19.5% oxygen in boiler room ventilation air. The United States Occupational Safety and Health Administration's (OSHA) Respiratory Protection Standard, 29 CFR 1910.134, considers any atmosphere with an oxygen level below 19.5% to be oxygen-deficient and immediately dangerous to life or health [from paragraph (d)(2)(iii)].The following excerpt is taken from the preamble of the Respiratory Protection Standard and explains the basis for this requirement:

> Human beings must breathe oxygen in order to survive, and begin to suffer adverse health effects when the oxygen level of their breathing air drops below the normal atmospheric level [19.5% oxygen]. Below 19.5% oxygen by volume, air is considered oxygen-deficient. At concentrations of 16 to 19.5%, workers engaged in any form of exertion can rapidly become symptomatic as their tissues fail to obtain the oxygen necessary to function properly (Rom, W., *Environmental and Occupational Medicine*, 2nd ed.; Little, Brown; Boston, 1992). Increased breathing rates, accelerated heartbeat, and impaired thinking or coordination occur more quickly in an oxygen-deficient environment. Even a momentary loss of coordination may be devastating to a worker if it occurs while the worker is performing a potentially dangerous activity, such as climbing a ladder. Concentrations of 12 to 16% oxygen cause tachypnea (increased breathing rates), tachycardia (accelerated heartbeat), and impaired attention, thinking, and coordination (e.g., Ex. 25-4), even in people who are resting.
>
> At oxygen levels of 10 to 14%, faulty judgment, intermittent respiration, and exhaustion can be expected even with minimal exertion (Exs. 25-4 and 150). Breathing air containing 6 to 10% oxygen results in nausea, vomiting, lethargic movements, and perhaps unconsciousness. Breathing air containing less than 6% oxygen produces convulsions, then apnea (cessation of breathing), followed by cardiac standstill. These symptoms occur immediately. Even if a worker survives the hypoxic insult, organs may show evidence of hypoxic damage, which may be irreversible (Exs. 25-4 and 150; also reported in Rom, W. *Environmental and Occupational Medicine*, 2nd ed.; Little, Brown; Boston, 1992).

The NBIC further requires that ventilation air be supplied by either an unobstructed air opening or by power ventilation fans.

Combustion Air

The *National Fuel Gas Code* (NFPA-54) defines *combustion* as: the rapid oxidation of fuel gases accompanied by the production of heat or heat and light. Complete combustion of fuel is possible only in the presence of an adequate supply of oxygen.

The most common fuels are hydrocarbon fuels, which contain carbon and hydrogen. Oxygen comes from the surrounding air and is at a concentration of almost 21%. Complete combustion combines all of the available oxygen with the available fuel with no unburned fuel in the exhaust. The chemical-compound byproducts created by combustion of hydrocarbons are:

- Carbon dioxide (CO_2) – Complete combustion of carbon in the fuel.
  - Complete combustion is achieved when CO_2 gas concentration is maximized for a particular fuel in the exhaust or flue.
- Carbon monoxide (CO) – Incomplete combustion of carbon in the fuel.
  - Carbon monoxide is toxic and still combustible. CO is absorbed in the blood and is cumulative. It takes the place of oxygen in blood cells, which leads to hypoxia. Once it is in the blood, it takes days for it to be removed. Although pure CO is odorless and colorless, the creation of CO in combustion has the smell and look of soot and unburned fuel. The US Environmental Protection

Agency (EPA) allows 400 ppm (parts per million) in the exhaust of combustion equipment. Exposure to concentrations of 100 ppm or more can be dangerous to human health.

- Water vapor (H_2O) – Combustion of hydrogen in the fuel.
  - Water vapor created when hydrogen and oxygen combine absorbs heat and takes it up the stack. If the exhaust gas is less than 150°F, condensation of this water vapor may occur in the boiler and cause corrosion.
- Nitrogen oxides ($NO_{2,\ 3,\ 4}$) – When nitrogen (78% of air) combines with oxygen at 2,800°F.
  - The term NO_x refers to the various combinations of nitrogen and oxygen. When NO_x is released to the atmosphere it contributes to acid rain. Therefore, a number of jurisdictions have mandated maximum limits for NO_x in the exhaust gas of combustion equipment. Maintaining the flame temperature less than 2,800°F by reducing the combining rate of oxygen to fuel will reduce the creation of NO_x. This action may increase the production of CO.

In order to obtain complete combustion, boilers are provided with "excess air" to ensure all of the fuel comes into contact with oxygen. Knowing the amount of excess air and the type of fuel, we can determine the minimum air requirements and the resultant CO_2 percentage in the exhaust gas of a properly fired burner.

For example:

WITH EXCESS AIR OF 10%

FUEL TYPE	% CO_2	AIR REQUIRED
Natural gas	10.5	11.0 cu ft./cu ft. of gas
Propane	12.6	25.5 cu ft./cu ft. of gas
#2 Oil (distillate oil)	13.8	1,483 cu ft./gal of oil

The 2011 NBIC Part 1, Paragraphs 2.5.4(b-e) and 3.5.4(b-e), require minimum sizes for unobstructed openings and minimum flow rates for power ventilators for combustion air.

Sizing requirements of the *National Fuel Gas Code* (NFPA 54), Section 9.3, *Air for Combustion and Ventilation*, and the *Standard for the Installation of Oil-Burning Equipment* (NFPA 31) are also allowed. These standards permit the use of indoor combustion air when the air infiltration or fenestration (outdoor air leakage into the building) rate is known.

When sizing free area openings for these air requirements, all fuel-burning devices in the boiler room must be considered.

Both combustion air requirements and ventilation air requirements must be treated separately to ensure adequate air is supplied to the boiler room for the health and safety of personnel.

FREE AREA OPENING REQUIREMENTS

Fuel-burning equipment with air from the outside	NFPA 54 (gas) and NFPA 31 (oil)	NBIC Part 1 Sizes may be reduced when you have an engineered system w/jurisdictional approval
Minimum number of openings required	2	1
Direct outdoor opening	1 sq. in./4,000 BTUH	1 sq. in./2,000 BTUH
Vertical ducts	1 sq. in./4,000 BTUH	1 sq. in./2,000 BTUH
Horizontal ducts	1 sq. in./2,000 BTUH	1 sq. in./2,000 BTUH
Free area allowance for wood louvers	20-25%	*use information provided or NFPA Standard
Free area allowance for metal louvers	60-75%	*use information provided or NFPA Standard
Damper or ventilators / fans interlocked with burner fuel	Yes	Yes
*Use manufacturer's free area rating when it is fewer BTUs /square inch		

References:
North American Combustion Handbook, First Edition, Copyright 1952
OSHA.gov; Standards - 29 CFR
The National Board Inspection Code, NB 23, Part 1 - Installation
National Fuel Gas Code, NFPA 54
Encyclopedia Britannica, definition of carbon monoxide

New National Board Members

Detroit

Gary Baumgardner has been elected to National Board membership representing the city of Detroit, Michigan. From 1980 to present, Mr. Baumgardner has been a self-employed mechanical contractor in the state of Michigan. From 1986-1992 he worked for the city of Detroit as a mechanical inspector. He served as the chief mechanical inspector and plan reviewer for the city of Royal Oak, Michigan, from 1992-1998. Registered with the state of Michigan as a mechanical inspector, plan reviewer, and building official, Mr. Baumgardner has served in those capacities since 1998 before assuming the post of supervising boiler inspector for Detroit. He is a member of the Southeastern Michigan Mechanical Inspectors Association.

Gary Baumgardner

Georgia

Benjamin J. Crawford has been elected a National Board member representing the state of Georgia. Mr. Crawford studied welding technology at George T. Baker Aviation School. In 1985 he joined Consolidated Engineering in Kennesaw, Georgia, where he worked as a welder fitter, foreman, and certified welding inspector (CWI). In 1996 he joined the Georgia Department of Labor/Safety Engineering Division and served as a boiler inspector, elevator inspector, and carnival amusement inspector. In 2005 Mr. Crawford was promoted to supervisor over inspections. He remained in that position until he assumed the role of chief engineer in 2012.

Benjamin J. Crawford

Massachusetts

Brian E. Logan has been elected a National Board member representing the Commonwealth of Massachusetts. Mr. Logan was a first class engineer instructor for the Steam Engineering Institute in Braintree, Massachusetts, from 1997 to 2010. Simultaneously, he worked as a shift supervisor at Mirant Canal Generating Station in Sandwich, Massachusetts, from 1979 to 2010. In June of 2010 he assumed the role of manager, district engineering, with the Massachusetts Department of Public Safety. Mr. Logan is a member of the American Society of Mechanical Engineers (ASME), ASTM International (formerly known as the American Society for Testing and Materials), and the National Association of Amusement Ride Safety Officials.

Brian E. Logan

Northwest Territories

Matthias Mailman has been elected to National Board membership representing the Northwest Territories in Canada. Mr. Mailman studied power engineering at Holland College. He was chief engineer for Gulf Shrimp Processing from April 2001–January 2006. He then served as a hospital tech 2 at Stanton Territorial Hospital from January 2006 until he assumed the position of chief inspector in 2012.

Matthias Mailman

New Hampshire

Darrell E. Mallory has been elected a member representing New Hampshire. Mr. Mallory has 25 years' experience working for **R** Stamp Holders repairing high pressure boilers, and nine years' experience performing welded repairs in the nuclear industry. He was a welding inspector and performed non-destructive testing from 2005-2011. In 2011 he joined the New Hampshire Department of Labor as a boiler inspector before becoming chief in 2012.

Darrell E. Mallory

Member Retirements

Milwaukee National Board Member Randy Pucek Retires

National Board member Randy Pucek, representing the city of Milwaukee, Wisconsin, retired effective November 15, 2012. Mr. Pucek served the industry for over 30 years. From 1974-1978 he served in the US Navy and was trained as a boiler technician.

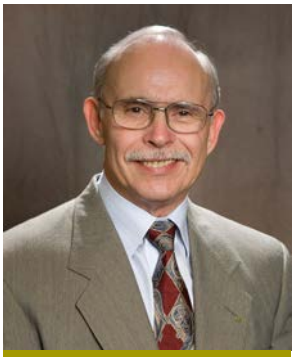
In 1979 he began his career with the city of Milwaukee as a part-time boiler inspector. He then became lead boiler inspector and served as the city representative on the Wisconsin Boiler Code Committee. In 1986 he assumed the duties of Milwaukee chief boiler inspector and was officially named to the position in 1989. Mr. Pucek became a National Board member that same year.

Randy Pucek

Illinois National Board Member Bennie F. Bailey Retires

Bennie F. Bailey, former superintendent of Boiler and Pressure Vessel Safety for Illinois, has retired. Mr. Bailey announced his retirement with the state effective December 31, 2011, but agreed to a request by the state fire marshal to continue in the superintendent's position until a replacement could be found. Clayton C. Novak was named to succeed Mr. Bailey and was elected a National Board member in May 2012.

A veteran of the US Army (1969-1971), Mr. Bailey earned his bachelor of science in construction management from Southern Illinois University. From 1966 to 1990, he served as a journeyman with Boilermakers Local 363. He joined the Illinois Boiler and Pressure Vessel Safety Division in 1990. In January 2009, he replaced David Douin as superintendent and was elected to National Board membership in February 2009. Mr. Bailey held National Board Commission number 11123 with **A** and **B** endorsements.



Bennie F. Bailey

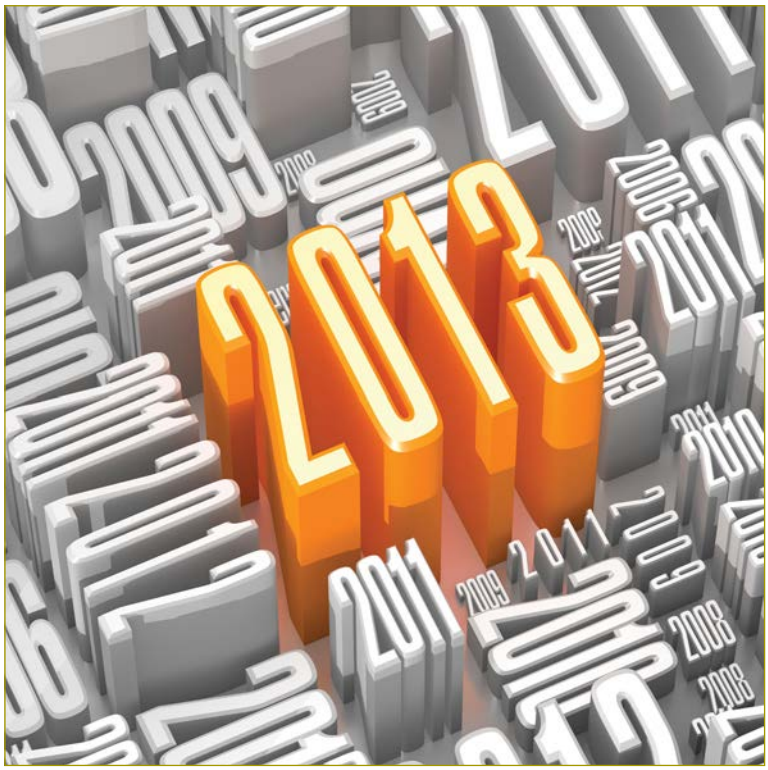
Mr. Bailey is credited with photographing an explosion site that served as a backdrop to a damaged wood sign identifying the rubble as once being the "Boiler Room." The iconic photo has been published numerous times by the National Board symbolizing boiler room dangers of pressure equipment.

The 2013 Training Calendar Doesn't Disappoint

BY KIMBERLY MILLER, MANAGER OF TRAINING

The demand for training of boiler and pressure vessel inspectors is higher than ever. This need for training is not only within the United States or even North America, but it is worldwide.

In order to accommodate the industry, we have expanded the training calendar for 2013 to include a higher number of commission training classes than in years past. At a minimum, we will conduct four Inservice Commission and six New Construction Commission / **A** Endorsement classes in 2013. Since the opportunity to train inspectors off-site is also on the rise, this schedule will allow National Board training to accept requests for contract training throughout the year for organizations wishing to hold National Board training at their facilities.



Also on the calendar is an extended schedule of endorsement training – several more offerings than in the previous year: three Authorized Inspector Supervisor **(B/O)** classes, three Authorized Nuclear Inspector **(N)** classes, and one class date each for the Authorized Nuclear Inservice **(I)**, Authorized Nuclear Supervisor **(NS)**, and Authorized Nuclear Concrete **(C)** courses. And since the **C** endorsement course is only conducted once every two years, 2013 provides the opportunity for students currently holding an **A** and **N** to obtain the necessary training toward their nuclear concrete endorsement.

Our always-popular repair seminars are back in full force in 2013, including a return trip to Houston, Texas, in the autumn. Two versions of repair seminars are offered: boiler and pressure vessel repairs (a three-day session) and pressure relief device repairs (a five-day session). Each includes information on the National Board accreditation program associated with the training, as well as valuable information on performing repairs and alterations in accordance with the *National Board Inspection Code* (NBIC).

Enrollment for all 2013 class dates is now open under the TRAINING menu at nationalboard.org. Keep in mind, commission classes tend to close quickly so early enrollment is recommended.

That covers classroom, but how about online?

The menu of online training will continue to grow with the addition of several new offerings. A series of continuing education modules will be rolled out in 2013. These online courses will meet the continuing education requirements for commissioned and endorsed inspectors described in NB-263, *Rules for Commissioned Inspectors*, which will be enforced with the 2015 renewal cycle. Yes, that is 2015, so individuals needing to take continuing education will have a two-year window to do so.

Whether in the classroom or online, National Board is prepared to meet the diverse requirements of tomorrow's inspectors.

Will we see you in 2013?

2013 Classroom Training Courses and Seminars

The 2013 training calendar is currently released through December 2013. Class size is limited and availability subject to change. Check the National Board website for up-to-date availability. All training is held at the National Board Training Center in Columbus, Ohio, unless otherwise noted.

COMMISSION/ENDORSEMENT COURSES

(B/O) Authorized Inspector Supervisor Course
TUITION: $1,495
2.6 CEUs Issued
August 5-9, 2013
November 4-8, 2013

(N) Authorized Nuclear Inspector Course
TUITION: $1,495
2.8 CEUs Issued
March 4-8, 2013
June 24-28, 2013
September 9-13, 2013

(I) Authorized Nuclear Inservice Inspector Course
TUITION: $1,495
2.5 CEUs Issued
September 16-20, 2013

(IC) Inservice Commission Course
TUITION: $2,995
9.6 CEUs Issued
April 29-May 10, 2013
July 22-August 2, 2013
September 23-October 4, 2013

(A) New Construction Commission and Authorized Inspector Course
TUITION: $2,995
8.1 CEUs Issued
April 8-19, 2013
June 3-14, 2013
August 19-30, 2013
October 14-25, 2013
December 2-13, 2013

(C) Authorized Nuclear Inspector (Concrete) Course
TUITION: $1,495
2.5 CEUs Issued
November 11-15, 2013

(NS) Authorized Nuclear Inspector Supervisor Course
TUITION: $1,495
2.5 CEUs Issued
November 18-22, 2013

CONTINUING EDUCATION SEMINARS

(VR) Pressure Relief Valve Repair Seminar
TUITION: $1,495
OFF-SITE TUITION: $1,595
March 11-15, 2013
June 17-21, 2013
September 23-27, 2013, Houston, TX

(RO) Boiler and Pressure Vessel Repair Seminar
TUITION: $795
OFF-SITE TUITION: $895
March 19-21, 2013
May 21-23, 2013
October 15-17, 2013, Houston, TX

DID YOU KNOW?

The U.S. military considered use of steam-powered warplanes in the early 1930s as a way to avoid detection by sound.

H.J. Fitzgerald wrote in the July 1933 *Popular Science Monthly*: "Because above 1000 feet, steam-driven planes would be as silent as soaring birds, they would have particular value in military work. Noiseless warplanes have long been sought. But muffling gasoline engines reduces their power to such an extent that the plan is impractical. The new power plant, silent by nature, would permit long-distance raids above the clouds by ghost ships giving off no telltale drone of motors to warn the enemy or to aid in directing anti-aircraft fire."

In the ten years between 1895 and 1905, it was estimated over 7,600 individuals – an average of two per day – were killed by boiler explosions in the United States.

Between 1885 and 1895, over 200 boiler explosions were reported per year. The following decade saw more than 3,600 such explosions, or approximately one each day.

A renowned American Inventor in 1911 predicted the imminent death of the steam engine.

Thomas Edison told the *Miami Metropolis* on June 23: "… the steam engine is emitting its last gasps. A century hence it will be as remote as antiquity as the lumbering coach of Tudor days." Among the incandescent icon's other visions: "Gold has even now but a few years to live. The day is near when bars of it will be as common and as cheap as bars of iron or blocks of steel."

The first recorded locomotive boiler explosion occurred in 1815.

The experimental railway locomotive *Brunton's Mechanical Traveller* exploded on July 31, 1815, in County Durham, England. The incident resulted in the deaths of 16 people, a majority of whom were curious onlookers. Also called the *Steam Horse*, the newfangled engine moved on four wheels pushed by mechanical feet. Because the locomotive ran on an industrial wagon way as opposed a railway, the accident is seldom recognized as the earliest boiler accident.

This account is an excerpt from National Board Public Affairs Director Paul Brennan's forthcoming book, *B L O W B A C K*. It is a noteworthy collection of stories detailing the dangers that exist when pressure equipment is misused, neglected, or defective. Anecdotal accounts span several centuries beginning with the first usages of steam to common pressure-retaining items employed every day.

NO OTHER MARK SAYS MORE ABOUT YOUR COMPANY

Owners, users, insurers, and regulatory authorities trust the integrity of the National Board R Certificate Program. The mark of the National Board R Certificate Program stamped on pressure-retaining items signifies strict repair and/or alteration requirements have been met and verified by a National Board Commissioned Inspector.

Knowledgeable owners and users demand it – even when not required – because of its established safety record. There is no better way to promote the quality of your company's work than by proudly displaying this trusted and enduring mark.

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