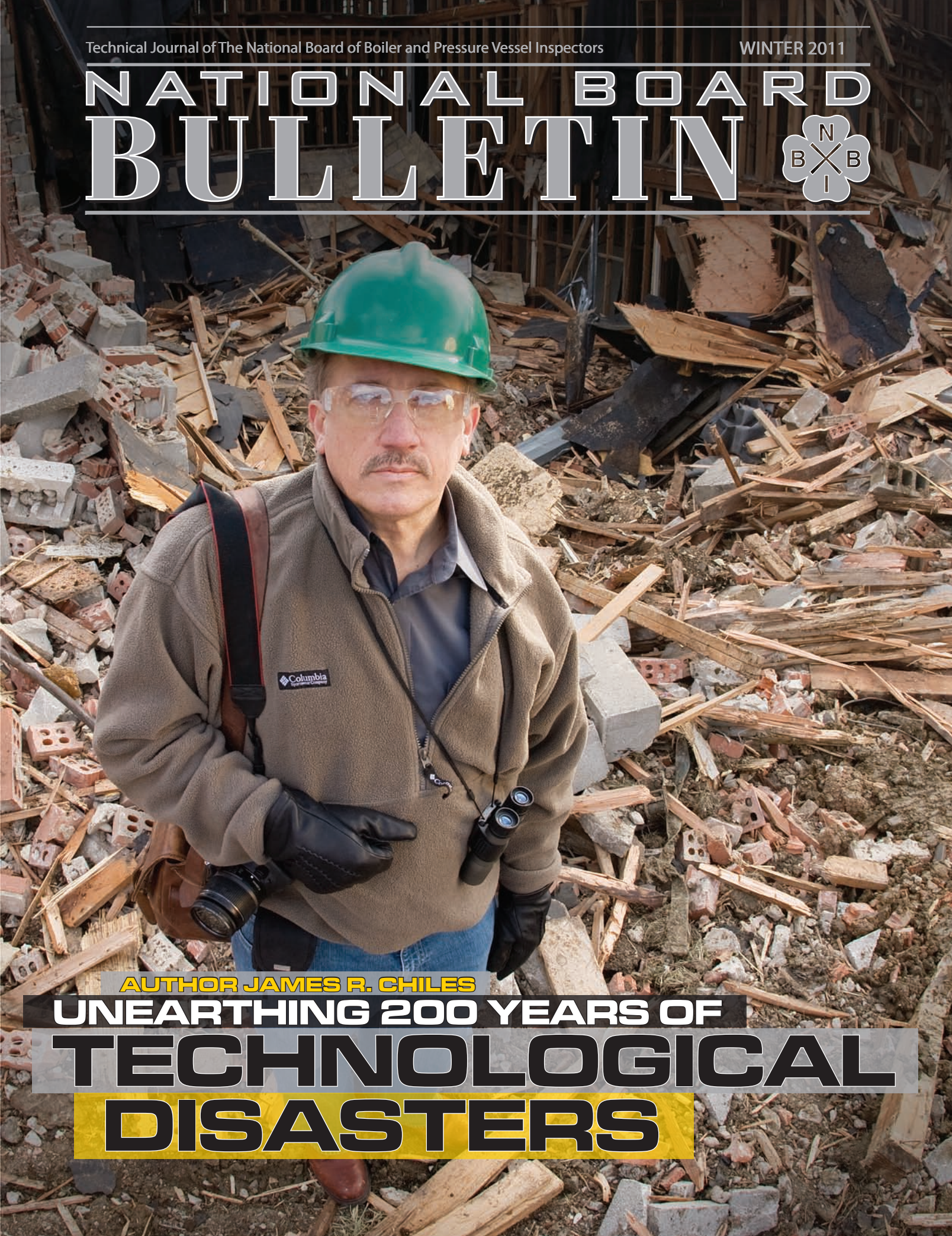
Technical Journal of The National Board of Boiler and Pressure Vessel Inspectors

WINTER 2011

NATIONAL BOARD BULLETIN



AUTHOR JAMES R. CHILES

UNEARTHING 200 YEARS OF TECHNOLOGICAL DISASTERS

TOP TEN REASONS

NBIC PART 2 ONLINE COURSE

WILL MAKE YOU SMARTER

#10
Developed by the very National Board professionals who bring you the NBIC

#9
Electronic bookmarks allow learning at your own pace

#8
An outstanding value at $150

#7
Learn at home or office, or both

#6
Continuing education credit for commission renewal

#5
Access the very latest NBIC developments

#4
No grading

#3
Open book quizzes

#2
Easily understood, comprehensively illustrated format

&

The #1 reason NBIC Part 2 Online Course will make you smarter:

YOU RECEIVE A CERTIFICATE OF COMPLETION THAT SAYS SO!!

PRESENTED IN SIX MODULES, THE COURSE FAMILIARIZES STUDENTS WITH DIFFERENT SECTIONS OF NBIC PART 2, ENABLING THEM TO QUICKLY LOCATE APPROPRIATE CODE SECTIONS. EACH SECTION FOLLOWED BY UNGRADED KNOWLEDGE CHECK. STUDENT ACCOUNT AND COPY OF NBIC PART 2 REQUIRED.

NBIC PART 2

SINCE 1919

BULLETIN

WINTER 2011 • VOLUME 66 • NUMBER 1

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.

The National Board BULLETIN is published three times a year by The National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Avenue, Columbus, Ohio 43229-1183, 614.888.8320, www.nationalboard.org. Postage paid at Columbus, Ohio.

Points of view, ideas, products, or services featured in the National Board BULLETIN do not constitute endorsement by the National Board, which disclaims responsibility for authenticity or accuracy of information contained herein. Address all correspondence to the Public Affairs Department, The National Board of Boiler and Pressure Vessel Inspectors, at the above address.

On the Cover: James R. Chiles, author of the book Inviting Disaster: Lessons from the Edge of Technology
See story on Page 18. BULLETIN photograph by Greg Sailor.

Cover Story

Features

Departments

SAFETY: Consider the Alternative

BY DAVID A. DOUIN, EXECUTIVE DIRECTOR

EXECUTIVE DIRECTOR'S MESSAGE

A number of years ago, I read a book revealing some profound insight on how accidents occur.

Specifically, the author observed: "machine disasters nearly always require multiple failures and mistakes to reach fruition. A disaster occurs through a combination of poor maintenance, bad communication, and shortcuts."

He further explained: ". . . a failure begins when one weak point begins linking up with others. Even at this stage the failure will proceed no further if some force such as an alert employee intervenes to stop the chain of events . . ."

It is a well-known fact the main cause of boiler incidents in the US and Canada has always been and continues to be operator error. Hence the constant reminders of how human intervention plays a crucial role in accident curtailment.

Stopping to consider one's actions is critical to the safety process. If those of us in the pressure equipment industry would just take an extra second to evaluate every move of consequence and the impact that decision might have on one's own well being – as well as on the individuals in close proximity – we could probably reduce accidents by 80 percent.

That is why we are designating *SAFETY: Consider the Alternative* as the theme for our 80th General Meeting in Las Vegas. Translation: thoughtful consideration to safety *before* an incident takes place is more effective than an accelerated decision-making process *during* a crisis situation.

To amplify upon this General Meeting catchphrase, we have invited to our General Session the person who wrote the above-mentioned book to provide us his keen insight. That book, *Inviting Disaster: Lessons from the Edge of Technology*, is the work of James R. Chiles, a renowned technology and history author whose articles have appeared in *Smithsonian, Air & Space, Popular Science, Harvard, Aviation Week, Mechanical Engineering, and Invention & Technology*. (See Cover Feature, page 18.)

To launch our Opening Session, we have invited another expert who knows something about decision making under stress: the iconic NFL Hall of Fame quarterback Joe Montana.

Few athletes over the years have amassed a comparable reputation for the ability to remain cool under pressure than this four-time Super Bowl champion. Over a professional career spanning 15 years, Mr. Montana led his teams to 31 fourth-quarter come-from-behind victories. Rated by *Sports Illustrated* as the number one clutch quarterback of all time, he has been designated third on *The Sporting News*' list of Football's 100 Greatest Players and the 25th greatest athlete of the 20th century by ESPN.

This year's General Session will once again provide valuable insight to current and recent industry issues, as well as a glimpse of future developments. In addition to hearing from Mr. Chiles and Mr. Montana, General Meeting attendees will receive an update from Common Arc's Jim Pillow on the welding certification program, and PVMA's take on mass-produced pressure vessel production. Chubb Group's Michael Zdinak will present his views on *Jurisdictional Inspection Integrity and Ethics*. We'll round out the program with additional perspective from our associates at ASME and the US Chemical Safety Board.

While there is much to be accomplished by the National Board during our week in Las Vegas, ASME – as always – will be conducting a full complement of committee meetings. Your attendance and participation are not only welcomed by ASME but encouraged. Those who have previously attended the General Meeting know these ASME sessions are an excellent opportunity to witness our industry's future direction. Additionally, they permit those who participate an outstanding chance to share critical code-making input.

As mentioned last year at this time, the General Meeting is an ideal occasion to personally interact and exchange ideas with other pressure equipment professionals. There is no better way to keep up with new technology, the code development process, and the most recent changes in jurisdictional rules and regulations. More important, General Meeting participants will leave Las Vegas with a renewed sense of duty and commitment, as well as the latest information on a wide selection of critical industry issues (so much for the notion *What happens in Vegas stays in Vegas. . .*).

Of course, you don't *have* to attend this extraordinary international event. It's your choice.

But consider the alternative . . .

NATIONAL BOARD SYNOPSIS UPDATE

The National Board has completed its annual jurisdictional authorities survey for the purpose of updating the 2010 *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 Web site is updated to reflect changes in the following categories:

STATES

Alabama – *Minor change to State Department;* **Alaska** – *Rules for Construction and Stamping and State Fees;* **Arizona** – *Minor changes to State Department, Rules for Construction and Stamping, and Miscellaneous;* **Arkansas** – *Minor changes to State Department;* **California** – *Rules for Construction and Stamping;* **Colorado** – *Minor changes to State Department, Rules for Construction and Stamping, and Inspections Required;* **Connecticut** – *Minor changes to Date of Law Passage, Objects Subject to Rules for Construction and Stamping, and Certificate of Operation;* **Florida** – *Minor change to Date of Law Passage;* **Illinois** – *Minor changes to State Department, Rules for Construction, and Stamping and Miscellaneous;* **Indiana** – *Rules for Construction and Stamping, Objects Subject to Rules for Construction and Stamping, minor changes to Objects Subject to Rules for Field Inspection, Insurance Inspection Requirements, Certificate of Inspection, and minor change to State Fees;* **Iowa** – *Date of Law Passage and Rules for Construction and Stamping;* **Kansas** – *Minor changes to State Department and Miscellaneous;* **Kentucky** – *Minor change to State Fees;* **Louisiana** – *Minor changes to State Department and Miscellaneous;* **Maine** – *Minor changes to State Department, Date of Law Passage, Rules for Construction and Stamping, Certificate of Inspection, and Miscellaneous;* **Michigan** – *Minor changes to State Department, Date of Law Passage, Rules for Construction and Stamping, Objects Subject to Rules for Field Inspection, and Miscellaneous;* **Minnesota** – *Minor changes to Empowerment, Date of Law Passage, and Miscellaneous. Major changes to Objects Subject to Rules for Construction and Stamping;* **Mississippi** - *Minor change to Date of Law Passage;* **Missouri** – *Minor change to Date of Law Passage, Rules for Construction and Stamping;* **Nebraska** – *Minor changes to State Department, Date of Law Passage, Rules for Construction and Stamping and Miscellaneous, and major changes to Inspections Required;* **New Jersey** – *Minor changes to State Department, Date of Law Passage, Rules for Construction and Stamping, Insurance Inspection Requirements, Certificate of Inspection, and Miscellaneous;* **New York** – *Minor change to State Department;* **North Dakota** – *Minor changes to Date of Law Passage, Rules for Construction and Stamping, and Miscellaneous;* **Oklahoma** – *Minor changes to Inspections Required and Miscellaneous;* **Oregon** – *Minor change to State Fees;* **Pennsylvania** – *State Department, Rules for Construction and Stamping, State Fees, and Miscellaneous;* **Puerto Rico** – *Minor change to Commonwealth Department;* **Tennessee** – *State Department, Date of Law Passage, Certificate of Inspection, State Fees, and Miscellaneous;* **Texas** – *Minor changes to State Department, Date of Law Passage, Certificate of Inspection, and Miscellaneous;* **Utah** – *Minor changes to Date of Law Passage, Rules for Construction and Stamping, and Miscellaneous;* **Vermont** – *State Department, Date of Law Passage, Rules for Construction and Stamping, Inspections Required, Insurance Inspection Requirements, and minor change to State Fees;* **Washington** – *Objects Subject to Rules for Construction and Stamping, and minor changes to State Fees and Miscellaneous;* **West Virginia** – *Minor changes to Objects Subject to Rules for Construction and Stamping and Miscellaneous;* **Wisconsin** – *Minor change to Certificate of Inspection.*

CITIES

Albuquerque – *Minor changes to Municipal Department, Empowerment, Date of Law Passage, Rules for Construction and Stamping, Inspections Required, and Miscellaneous;* **Los Angeles** – *Municipal Department and minor changes to Municipal Fees;* **Milwaukee** – *Municipal Fees;* **Omaha** – *Minor change to Municipal Department, Rules for Construction and Stamping;* **St. Louis** – *Minor change to Municipal Department;* **Spokane** – *Minor changes to Date of Law Passage and Rules for Construction and Stamping.*

PROVINCES

Alberta – *Minor changes to Date of Law Passage and Rules for Construction and Stamping;* **New Brunswick** – *Provincial Department;* **Newfoundland and Labrador** – *Rules for Construction and Stamping and Inspections Required;* **Nova Scotia** – *Provincial Department;* **Prince Edward Island** – *Minor changes to Provincial Department and Date of Law Passage;* **Quebec** – *Provincial Fees;* **Saskatchewan** – *Minor changes to Provincial Department, Empowerment, Rules for Construction and Stamping; Insurance Inspection Requirements, Certificate of Inspection, Provincial Fees, and Miscellaneous.*

NO CHANGES

STATES: Delaware, Georgia, Hawaii, Massachusetts, Montana, New Mexico, North Carolina, Ohio, South Dakota, Wyoming.

CITIES: Buffalo, Chicago, Detroit, Miami, Miami-Dade County, Seattle.

PROVINCES: British Columbia.

TERRITORIES: Northwest Territories.

282 POWER Vol. 53, No. 7

JOSEPH F. SCOTT
Chairman

National Board of Boiler and Pressure Vessel Inspectors Organizes

Detroit Meeting Fills Long-Felt Need for Permanent National Body of Boiler Inspectors

C. O. MEYERS
Secretary-Treasurer

On February 2, 1921, nearly 60 people assembled in Detroit, Michigan, with a single purpose – uniformity in boiler and pressure vessel safety standards. National Board's first General Meeting established a longstanding tradition of industry professionals gathering to review important issues pertaining to boiler and pressure vessel equipment.

Attendees discussed organization, plan, and scope of the newly formed National Board, and laid out the Board's constitution and bylaws. The three-day event included addresses from industry leaders, discussion of future plans, and an evening banquet. The ASME Boiler Code Committee met at the same time; the two organizations held their first joint meeting.

This May National Board celebrates its 80th General Meeting in Las Vegas (see registration information on page 13). Through the years, memorable speakers, industry experts, and opening session presenters have marked the occasion, but the underlying theme has remained the same: safety. Upwards of 400 people from various countries and disciplines now attend the annual meeting to make new contacts, exchange ideas and information with other professionals, and learn the latest industry developments.

The following excerpt looks back at the historic first gathering and outlines the intentions of those working to establish a national safety organization. It was published in Power *magazine on February 15, 1921 (Volume 53, Number 7), and written by* Power *editor Fred R. Low, who participated in the meetings. Low's concluding words reflect the spirit of the inaugural meeting that set the pace for generations to come:* "The meeting throughout displayed a depth of interest and earnestness of purpose which warrant the belief that the Board will rise to the opportunities before it."

The first annual meeting of the National Board of Boiler and Pressure Vessel Inspectors brought together at the Hotel Statler in Detroit on Feb. 2, 3 and 4 about sixty people, including members of the Board itself, of the Boiler Code Committee of the A.S.M.E. and others interested.

The meeting was called to order at 10 o'clock Wednesday morning by Chairman Joseph F. Scott, of New Jersey, who announced its purposes in a brief introductory address. In the absence of the mayor, Police Commissioner Dr. James W. Inches welcomed the visitors to the city.

The entire first day was devoted to the hearing of addresses. Dr. D. S. Jacobus, acting chairman of the A.S.M.E. Boiler Code Committee, told of the genesis and development of the Code, emphasizing the fact that no action had been taken without consideration of all the interests involved, and nothing had been adopted in either the Code or the interpretations from which any member of the committee dissented. The methods of the Boiler Code Committee were described and its interest in the new organization expressed.

Charles E. Gorton, chairman of the American Uniform Boiler Law Society, told of the appointment by Col. E. D. Meiers, when president of the American Society of Mechanical Engineers, of the first Boiler Code Committee, how the society had reached the limit of its functions in the formulation and interpretation of the Code, and the Uniform Boiler Law Society had been organized to promulgate it, and how the National Board of Boiler and Pressure Vessel Inspectors had been organized at the instigation of the American Uniform Boiler Law Society. He told of seeing on his recent trip to the Coast, a boiler with the stamps of 22 different states on it, which absurd practice, now not uncommon, would be

avoided by the facilities and simple procedure offered by the organization of the National Board.

C. W. Bissell, dean of the Michigan Agricultural College and chairman of the Michigan Board of Boiler Rules, spoke of the advantages of interchange of opinions between members of boiler boards and the necessity for the rigid enforcement of rules adopted by such boards.

J. C. McCabe, commissioner of the City of Detroit, and Chief Inspector of Boilers for the State of Michigan, treated of the qualifications and duties of boiler inspectors.

E. R. Fish, vice president of the Heine Safety Boiler Co., explained still further the advantage of having a single stamp for boilers constructed in accordance with the Code. S. F. Jeter, chief engineer of the Hartford Steam Boiler Inspection and Insurance Co., spoke on the advantages of uniform qualifications for boiler inspectors. F. W. Herendeen, secretary of the National Boiler and Radiator Manufacturers Association, stated the attitude of that industry toward the new Board and the Code to be sympathetic so long as they did not demand inspection for low-pressure heating boilers, and Fred R. Low, editor of Power, outlined some of the possibilities, opportunities and responsibilities before the National Board. Wednesday evening was devoted to an informal discussion of the plan and scope of the Board.

All day Thursday the members of the Board attended the meeting and took part in the deliberations of the Boiler Code Committee of the American Society of Mechanical Engineers.

This meeting was held at Detroit instead of, as usual, at the headquarters of the society in New York, to give the committee the advantage of meeting and counseling with these men from all over the country who are enforcing the Code. The range of application and the wide field from which the experience in the administration of the Code placed at the service of the committee was drawn, may be appreciated from the following list of the inspectors present:

Joseph F. Scott, New Jersey; James Neil, Pennsylvania; C. O. Meyers, Ohio; R. L. Hemingway, California; J. C. McCabe, Michigan; Eugene Webb, Missouri; Geo. A. O'Rourke, New York; L. R. Land, Oklahoma; C. D. Thomas, Oregon; E. W. Farmer, Rhode Island; Gerald Gearon, Chicago; James Speed, Erie; W. H. Brooks, Kansas City, Mo.; W. D. Johnston, Nashville; Robt. D. Ridley, St. Louis; Wm. E. Murray, Seattle; A. J. Bell, Allegheny Co., Pa; D. M. Medcalf, Ontario, Canada; W. G. Matthewson, New Glasgow, N.S.

Thursday evening the Board members entertained their guests at a banquet.

Friday the speeches and discussions of the preceding days crystallized into a definite plan of action adopted by the Board in the following constitution and by-laws:

MEMBERS OF THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS
Excepting the Delaware member, not yet appointed, and the St. Joseph member, who did not send a photograph.

PREAMBLE

The National Board of Boiler and Pressure Vessel Inspectors is organized for the purpose of promoting greater safety to life and property by securing concerted action and maintaining uniformity in the construction, installation and inspection of steam boilers and other pressure vessels and their appurtenances, and to secure interchangeability between political subdivisions of the United States.

The *BULLETIN* thanks *Power* magazine for sharing this historical document with *BULLETIN* readers. To see entire article, go to nationalboard.org

Liquid Penetrant Examination

BY JIM WORMAN, SENIOR STAFF ENGINEER

Liquid penetrant examination is one of the most popular Nondestructive Examination (NDE) methods in industry. It is economical, versatile, and requires minimal training when compared to other NDE methods. Liquid penetrant exams check for material flaws open to the surface by flowing very thin liquid into the flaw and then drawing the liquid out with a chalk-like developer. Welds are the most common item inspected, but plates, bars, pipes, castings, and forgings are also inspected using liquid penetrant examination.

Over the years, liquid penetrant examination has been called many names: penetrant testing (PT), liquid penetrant testing (LP), and dye penetrant testing (DP). The American Society for Nondestructive Testing (ASNT) uses the name liquid penetrant testing (PT). The *American Society of Mechanical Engineers Boiler and Pressure Vessel Code* (ASME B & PVC) and the *National Board Inspection Code* (NBIC) use the name liquid penetrant examination (PT).

The first documented use of PT was in the railroad industry. Cast railroad wheels were dipped in used oil, dried off, and then coated with powder chalk or suspension of chalk in alcohol. Once the wheels were dry, any oil stored in the flaw would bleed out into the chalk and be detected. This was called the oil and whiting method.

The *ASME Boiler & Pressure Vessel Code* recognizes six different techniques of PT. They vary by type of penetrant and method of cleaning before applying a developer. The two penetrant types are either fluorescent or color contrast (dye) penetrant. They can then be used with any of the three methods of cleaning: water washable, post-emulsifying, and solvent removable. The most popular is dye penetrant that is solvent removable. This method is referenced throughout this article.

The dye penetrant solvent removable method is most popular because it is low cost and very versatile. It typically comes in three aerosol cans – cleaner, penetrant, and developer. The cans can be purchased from welding supply distributors for typically $5 to $15 a can. For less than $50 you can have all the equipment you need to conduct liquid penetrant examinations. The aerosol cans are very versatile, which allows them to be taken up ladders, inside boilers, down into pits, and into very tight places. Most nonporous materials (steel, stainless steel, cast iron, aluminum, brass, bronze, titanium, rubber, plastics, and glass) can be examined using PT. Porous materials (concrete, wood, paper, cloth, and some types of fiberglass if the fibers are exposed to the surface) should not be examined using PT.

For less than $50 you can have all the equipment you need to conduct liquid penetrant examinations.

Dye penetrant solvent removable aerosol cans.

It is important to remember penetrant is a very thin liquid designed to seep into the smallest crack. Consequently, if an assembly has stitch welds or material not sealed by a weld, the penetrant will travel behind the welds and between layers of unfused material. Penetrant can be nearly impossible to remove from these areas. Trapped penetrant will cause defects in welds if further welding is done, or will bleed out over time and contaminate paint and process fluids.

For PT to be used on ASME Code construction or NBIC repairs or alterations, a written procedure must be followed. This must comply with *ASME Boiler and Pressure Vessel Code,* Section V, Article 6, and address all essential and nonessential variables. Many liquid penetrant examinations are done for informational purposes only, and do not follow a written procedure. For instance, a written procedure does not need to be followed if a welder grinding out a weld crack for repair is using PT to ensure removal of the entire crack. However, if the PT is being done to comply with Code, the written procedure needs to be followed by qualified NDE personnel.

There are six basic steps to follow when using the dye penetrant solvent removable method.

1. Pre-clean part.

This can range from grinding and wire brushing to merely wiping the part with a rag moistened with the cleaner/remover. The surface needs to be free of dirt, rust, scale, paint, oil, and grease, and be smooth enough to wipe off the penetrant without leaving residue.

2. Apply penetrant.

This is generally done by spraying penetrant from the aerosol can or applying it with a brush. A dwell (soak) time needs to be observed to allow the penetrant to permeate into cracks and voids. This is typically 5 to 30 minutes but should never be long enough for the penetrant to dry. The penetrant manufacturer's recommendations and written procedure should be followed.

3. Remove penetrant.

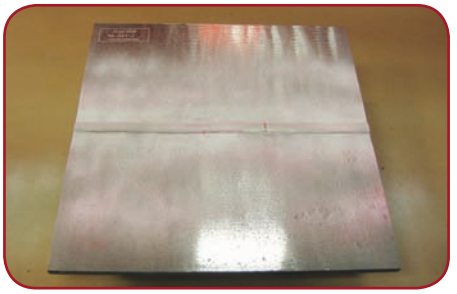
All penetrant should be removed with clean, dry, lint-free rags until thoroughly clean. The part or material should be rubbed vigorously until the penetrant is not visible on the dry rags. Next, cleaner/remover should be sprayed on another clean, dry, lint-free rag and used to vigorously rub the part again until there is no penetrant visible on the rag.

4. Apply developer.

A thin, light coating of developer should be sprayed on the part being examined. A dwell time needs to be observed to allow time for the dye to exit the flaws and create an indication (flaw) in the developer. The dwell time for developer is typically 10 to 60 minutes. The developer manufacturer's recommendations and written procedure should be followed closely.

5. Evaluate indications.

It is critical to examine the part within the time frame designated in the written procedure. Length of an indication can grow over time as penetrant bleeds out, causing an acceptable indication to be a rejectable defect. Length of indication is measured for evaluation, not length of the flaw. Here, the two linear indications are rejectable defects. The round indication is nonrelevant.



6. Post-clean part.

The part needs to be cleaned to remove all developer after it has been evaluated.

Light meter showing 109.9 footcandles of light.

ASME Section V also requires the dye penetrant solvent removable method be evaluated with a minimum light intensity of 100 foot candles on the part surface. Proper quantity of light must be verified using some type of light meter.

In the ASME B & PV Codes of Construction, magnetic particle examination or liquid penetrant examination is called out many times to detect the possibility of surface defects. If material is nonmagnetic, the only choice is PT. Some typical examples of ASME Code required examinations include:

- castings for surface defects,
- plates for laminations in corner joints when one plate's edge is exposed and not fused into the weld joint,
- head spin hole plug welds,
- weld metal build-up on plates,
- removal of defects before welding repair.

Advantages and disadvantages of using liquid penetrant examination

Advantages:

- High sensitivity to small surface discontinuities;
- Easy inspection of parts with complex shapes;
- Quick and inexpensive inspection of large areas and large volumes of parts/materials;
- Few material limitations (metallic and nonmetallic, magnetic and nonmagnetic, and conductive and nonconductive can all be inspected);
- A visual representation of the flaw is indicated directly on the part surface;
- Aerosol spray cans make the process portable, convenient, and inexpensive;
- Indications can reveal relative size, shape, and depth of the flaw;
- It is easy and requires minimal training.

Disadvantages:

- Detects flaws only open to the surface;
- Materials with porous surfaces cannot be examined using this process;
- Only clean, smooth surfaces can be inspected (rust, dirt, paint, oil and grease must be removed);
- Metal smearing from power wire brushing, shot blasting, or grit blasting must be removed prior to liquid penetrant examination;
- Examiner must have direct access to surface being examined;
- Surface finish and roughness can affect examination sensitivity (it may be necessary to grind surfaces before PT);
- Multiple process steps must be performed and controlled;
- Post cleaning of parts and material is required, especially if welding is performed;
- Proper handling and disposal of chemicals is required;
- Fumes can be hazardous and flammable without proper ventilation.

Figure 1.
The inside of a pressure vessel nozzle that has been in service.

Figure 2.
The tubesheet of a boiler that has been in service.

Figure 3.
The knuckle of a stainless steel pressure vessel head that has been in service.

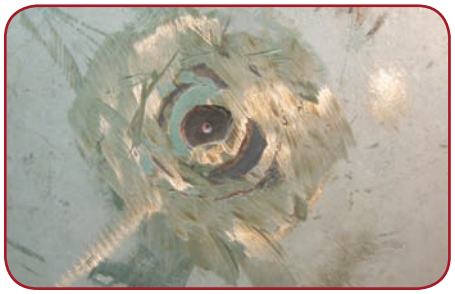


Figure 4.
Head spin hole plug weld after cleaning.

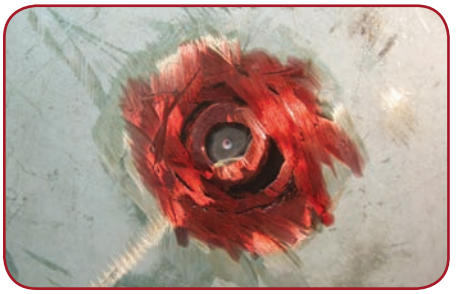


Figure 5.
Head spin hole plug weld after the application of the penetrant.

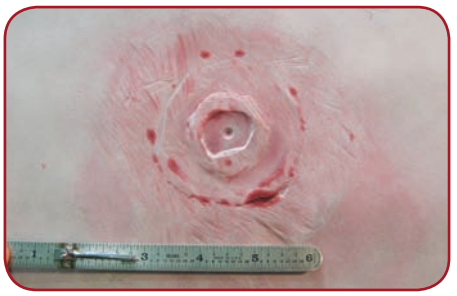


Figure 6.
Evaluating indications in the spin hole plug weld. Most of the dark red indications are rejectable defects per ASME Section VIII.

Once boilers and pressure vessels are in service, PT can be a very valuable tool. The NBIC recommends PT for examination of: firetube boiler tubesheets to find leakage around tubes, external inspection of weld joints, evaluating components subjected to fire damage, historical boilers, fiber-reinforced thermosetting plastic pressure equipment, Yankee dryers, and pressure vessels in liquefied petroleum gas (LPG) service.

During inservice inspections, PT should also be used in areas suspected to have defects. These include, but are not limited to, nozzles (see Figure 1), tubesheets (see Figure 2), knuckles of heads (see Figure 3), and head spin hole plug welds (see Figure 4). To effectively use liquid penetrant on the tubesheet in Figure 2, an extensive amount of work would need to be done. All rust and scale would need to be removed so the penetrant could be cleaned off. Rolled, unfused tube ends would also bleed out dye and cause false indications. The head spin hole plug weld looks acceptable to the naked eye, but shows many defects once it has been liquid penetrant examined (see Figures 5 and 6).

In conclusion, PT can be a very valuable tool during new construction and inservice inspections. PT does have limitations and is not the best method for all applications. However, for quick, low cost examinations in any location, PT is often the best choice of NDE methods. ✪

The 80th General Meeting
LAS VEGAS 2011

Caesar's Palace

Caesar's Palace is a landmark hotel and casino located on the celebrated Las Vegas Strip. Constructed in 1962, the hotel today consists of five towers containing over 3,300 rooms. In addition to serving as backdrop to more than 20 movies and countless TV shows, Caesar's Palace has hosted numerous professional championship boxing matches and world class entertainers such as Celine Dion, Bette Midler, Elton John, and Cher.

Of special interest to guests staying at Caesar's Palace are the Forum Shops, an unmatched collection of over 160 boutiques and premier retail shops, as well as 13 restaurants and specialty food shops. The hotel features five swimming pools including the famous 4.5-acre Garden of the Gods Pool Oasis.

NFL Hall of Fame legend Joe Montana to kick off opening session

If there is a defining moment in the fifteen-year NFL career of Joseph Clifford Montana, it has to be the winning 92-yard drive in the closing seconds of Super Bowl XXIII. That stellar performance was among 31 fourth-quarter comebacks orchestrated by the 1979 San Francisco 49ers' third-round pick from Notre Dame.

Born in New Eagle, Pennsylvania, Joe Montana assembled a resume unequaled in the National Football League: four Super Bowl championships, three-time Super Bowl MVP, three-time All-NFL, and eight Pro Bowls. And there's more: NFL passing titles in 1987 and 1989, five-time NFC passing leader, thirty-nine 300+ yard games, seven 400+ yard games, and an NFL record six 300+ yard passing performances in the postseason.

Mr. Montana in 1994 became just the fifth quarterback to pass for more than 40,000 yards in a career playing with the 49ers and Kansas City Chiefs.

Known as one of the clutch quarterbacks of all time for his come-from-behind victories, the 2000 Hall of Fame inductee owns the career playoff record for attempts, completions, touchdowns, and yards gained passing.

Lorrie Morgan to perform at Wednesday evening banquet

Precious few can say they received their show business start at the delicate age of 13 on the stage of the Grand Ole Opry. But in 1975 Loretta Lynn "Lorrie" Morgan did, when she accompanied her country star dad George Morgan on the song *Paper Roses*.

Ms. Morgan made history in 1984 when she was the youngest person ever to become a member of the Grand Ole Opry. Offered a contract with RCA, she went on to record a string of timeless hit standards such as *Five Minutes, Something in Red*, and *Watch Me*. But it was *What Part of No* that established Ms. Morgan as a bona fide country star.

Through the years, Ms. Morgan's talents have resulted in 14 top-ten hits, 12 albums (seven of which have gone gold and platinum) and four *Female Vocalist of the Year* awards.

Venturing outside the country genre, she has performed with some of the top entertainers in the music world, including the Beach Boys. She accompanied Frank Sinatra on his *Duets II* album, singing a sultry rendition of *How Do You Keep the Music Playing*.

Known for turbulence in both her music and personal life, the stunning blonde Nashville native once addressed the turmoil that seemed to follow her by observing, *"drama is something that lets you know you're alive."*

80th GENERAL MEETING

PRELIMINARY PROGRAM

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

Monday, May 9

Opening Session

10:15 a.m. Remarks
Joe Montana
NFL Hall of Fame*

General Session

1:00 p.m. *TBA - ASME*

1:30 p.m. *COLD IRON & COOL HEADS: HARD-WON LESSONS FROM THE MACHINE FRONTIER FOR THE NEXT GENERATION*
James R. Chiles, Author
INVITING DISASTER, THE GOD MACHINE

2:00 p.m. TBA - US CHEMICAL SAFETY BOARD

2:30 p.m. Break

2:45 p.m. *THE CODE AND COMMON ARC - ASSURING INTEGRITY WHILE BRINGING EFFICIENCIES TO AMERICAN INDUSTRY*
Jim Pillow, Chairman of the Operating Committee
COMMON ARC CORPORATION

3:15 p.m. *JURISDICTIONAL INSPECTION INTEGRITY AND ETHICS*
Michael Zdinak, Assistant Vice President
CHUBB GROUP OF INSURANCE COMPANIES

3:45 p.m. TBA - PRESSURE VESSEL MANUFACTURERS ASSOCIATION

4:15 p.m. TBA

* PHOTO SESSION WITH MR. MONTANA 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 April 25.
- On-Site Registration Desk Hours:

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

- General Meeting Registration is required in order to receive the special $179 room rate at Caesar's Palace.

Reminder

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

ASME Boiler and Pressure Vessel Code Meetings

- Meetings are scheduled all week.
- Check hotel information board for locations and times.
- Meetings are open to the public.

GENERAL MEETING GUEST TOURS

Monday, May 9 Las Vegas City Tour, 1 – 5 p.m.

Those who have never visited Las Vegas – and yes, even those who have – will thoroughly appreciate this excursion around one of the world's most popular and exciting cities.

In addition to various points of interest, stops will include historic Fremont Street (home to vintage Vegas casinos) for a perspective on a bygone era, the magnificent Bellagio with its lush atrium gardens, and a stop at the world-renowned "Welcome to Las Vegas" sign. A perfect end to the afternoon is a visit to the Bonanza Gift Shop – "the world's largest gift shop!"

NOTE: Registrants are not permitted to attend the Monday or Tuesday tours intended for designated guests. This policy is strictly enforced. This tour requires a minimal amount of walking.

Tuesday, May 10 Showcases & Showgirls, 9 a.m. – 4:30 p.m.

Come on down!

Upon departing Caesar's Palace, a luxury motor coach will whisk guests just a short drive down the Las Vegas Strip to the renowned Bally's hotel. Here, they will take one of the most unusual and visually thrilling programs ever offered at the General Meeting: backstage at the Jubilee Theater.

Guests will get the opportunity to visit the costume shop and the dressing areas where dancers prepare for the show (transforming themselves into glamorous showgirls). Attendees will also tour the special rooms housing some of the most beautiful and expensive showgirl costumes in the world. This up-close opportunity also allows guests to see how massive backstage props are operated to produce one of the longest-running and highly rated showgirl revues in Las Vegas history. Each group is hosted by an actual showgirl who will apply her makeup and slip into her costume at the tour's conclusion.

The Jubilee visit will precede lunch at a delightful Las Vegas Strip café. Then it's back to Bally's for a memorable afternoon highlight: a chance to take home wonderful prizes as an audience member of *The Price is Right*.

Just like the TV show, this *Price is Right* production allows contestants the chance to win thousands of dollars in cash and prizes. Games include fan favorites Plinko, Cliff Hangers, The Big Wheel, Hole in One, and The Showcase Showdown. Hosted by Todd Newton, this is a show where everyone comes out a winner.

Showcases and Showgirls is an experience you will regret missing.

NOTE: This tour requires a modest amount of walking, including ascending and descending stairs. Backstage area is not ADA compliant. Guests must be 21 years of age to participate.

Wednesday, May 11 Wild Card Adventure, 9 a.m. – 3:30 p.m.

This year's outing combines two of Las Vegas' most popular visitor destinations with the city's activities of choice: gambling. And eating!

Luxury motor coaches will depart at 9 a.m. sharp for your tour choice of either Hoover Dam or Red Rock Canyon.

The Hoover Dam tour will feature a series of presentations by professional guides stationed throughout the visually dynamic site. Guests will learn of this unique facility's history, construction, and inner workings. Hoover Dam remains a must-see for everyone who visits the Las Vegas area.

Already been to Hoover Dam? Then you will find Red Rock Canyon a wonderful alternative as well as an opportunity to get an up-close view of the desert's flora and fauna. Be sure to bring a camera to capture picturesque rock formations created by years of erosion and sedimentation.

Following the morning tours, motor coaches will return to Las Vegas and all guests will be reunited at the newly opened Las Vegas Hard Rock Café, located in the heart of the Vegas Strip. General Meeting guests and participants will have exclusive use of the 3rd floor (overlooking the Strip) where famous Hard Rock Café food and drink will be served amongst all of your favorite casino table games. Every guest will be provided complimentary chips to wager during this exciting and unusual event (no cash betting will be permitted). Each game will be hosted by a real gaming agent who will not only take your bet, but provide insight on how to be a more competitive gambler. Guests having the most chips at the afternoon's conclusion will win special prizes.

NOTE: Outdoor tours require a modest amount of walking. Guests are advised to bring hats and sun block for protection from the desert sun.

Please see *InfoLink!* on National Board Web site for tour guidelines and restrictions.

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 $215.00 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 $375.00 if received *on or before* April 25.
Registration fee is $425.00 if received *after* April 25.

Additional Guest Fee(s)
_____ Additional guests at $215.00 each ..... $ _____
(each includes ONE banquet ticket)

Additional Banquet Ticket(s)
_____ Additional tickets at $75.00 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.

o VISA o MasterCard o American Express

Card # _____ Exp. Date _____

Cardholder's Name _____

Signature _____

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

Preference for registration confirmation: o Email o Fax o Mail

REGISTRATION DEADLINE: April 25

Accounting Department Only: AMOUNT $ _____ DATE _____

Online Registration Form

Online registrations are accepted using a secure Web site 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 Caesar's Palace by calling:

866.227.5944

To receive the $179 nightly group room rate,* reference Group Name:

National Board

Group rate reservations must be received by April 4.

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 will not be guaranteed the discounted nightly rate.

A Case for the Code:

Non-ASME Pressure Vessels at Risk

BY ROGER F. REEDY, REGISTERED PROFESSIONAL ENGINEER, REEDY ENGINEERING, INC.

The following are facts regarding the 2006 explosion of a pressure vessel that killed a welder during an air test. The welder was trying to ensure welds were leak-tight when the explosion occurred and he was struck with a large portion of the pressure vessel head.

The welder was assigned to repair a 200-gallon aluminum pressure vessel. The vessel was designed to be pressurized using a ready-mixed-concrete truck's air brake system. When the vessel was pressurized, air pressure would push water from the vessel through a hose to wash the truck's mixer drum and outside surface.

The pressure vessel was reported leaking and in need of repair. This required welding on one of two torispherical heads. The repair consisted of identifying leaks, welding over the damaged area, and leak-testing the weld repair.

The repair complete, the welder closed the pressure vessel and started filling it with air for a leak test. However, the vessel exploded while being pressurized. The welder sustained fatal injuries when hit by the unrepaired pressure vessel head. The explosion was not related to repairs made by the welder.

The subject vessel was defective as designed and manufactured, with the following defects identified as the primary cause of the explosion: neither the engineering design nor manufacturing details were in compliance with ASME Section VIII Pressure Vessel Code as required by most US states and Canadian provinces.

A forensic evaluation revealed the vessel exploded at a pressure of less than design pressure, which was 60 psi. Point of failure was located at the top of the fill nozzle. Fill nozzles for the vessel were located in the torispherical head's knuckle region. The nozzle was attached to the head with a fillet weld only on the head's outside surface.

A significant design flaw indicated fill nozzle openings were not reinforced. No additional reinforcement material was used, so reinforcing had to be inherent in the head. This means the head should have been twice as thick as required for the design pressure.

Further, the fill nozzles were not attached with weld details required by the ASME Pressure Vessel Code. A single fillet weld on the head's outside surface was used, whereas the ASME Code requires full penetration or partial penetration welds with fillet welds, or fillet welds inside and outside where the nozzle is attached. Further, the aluminum used for the torispherical heads was about one-half the strength of aluminum material used for the shell.

When evaluating the as-built vessel by applying ASME Code design formulas and other Code requirements (without considering the other design defects in the torispherical heads), the calculated design pressure of the vessel was only 24 psi. The torispherical head had no additional reinforcement around the opening, therefore the effective thickness was considered to be one-half the actual thickness of the torispherical head, to account for missing reinforcing material. Under these circumstances, the calculated design pressure was reduced to 12 psi (one-fourth design pressure stated for the vessel).

The pressure vessel was made of aluminum and intended to contain water. Water will corrode aluminum, therefore a corrosion allowance should have been added to the required thickness. Based on data from the exploded vessel, a corrosion allowance of more than 1/8 inch should have been used. If that corrosion allowance is accounted for, the calculated design pressure would only be about 2.5 psi.

In response to a question from the Occupational Safety and Health Administration (OSHA) regarding whether the "water tank" was considered to be a pressure vessel, a vice-president and attorney for the truck manufacturer stated, "this tank is not considered a pressure vessel under ASME definitions, because it contains water under pressure using air as a cushion or compression and, the design pressure is less than 300 psi and the water temperature is under 210°F."

Typical Pressure Vessel

Part of Torispherical Head

There was a similar explosion of a new pressure vessel at the vessel manufacturer's facility in 2000, causing an employee's arm amputation and other permanent injuries. Explosion of this new pressure vessel occurred at a pressure of less than normal hydrostatic test pressure.

Other Pertinent Facts

- The manufacturer has sold about 80,000 ready-mixed-concrete trucks in the United States and Canada. Other truck manufacturers have furnished about 20,000 ready-mixed-concrete trucks in these two countries. All trucks are similarly equipped with non-Code pressure vessels.
- There have been other incidents in the United States and Canada resulting in serious and permanent harm to personnel working around these trucks.
- None of the pressure vessels on the manufacturer's ready-mixed-concrete trucks are registered with the National Board.

Issues raised in this report are very serious and must be addressed. However, each state and province is different and the actions to be taken by each jurisdictional authority must vary according to their laws. It is most important that dangerous pressure vessels be removed from the ready-mixed-concrete trucks, or modified so the vessel cannot be pressurized.

Welding Consideration for Pressure Relief Valves

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

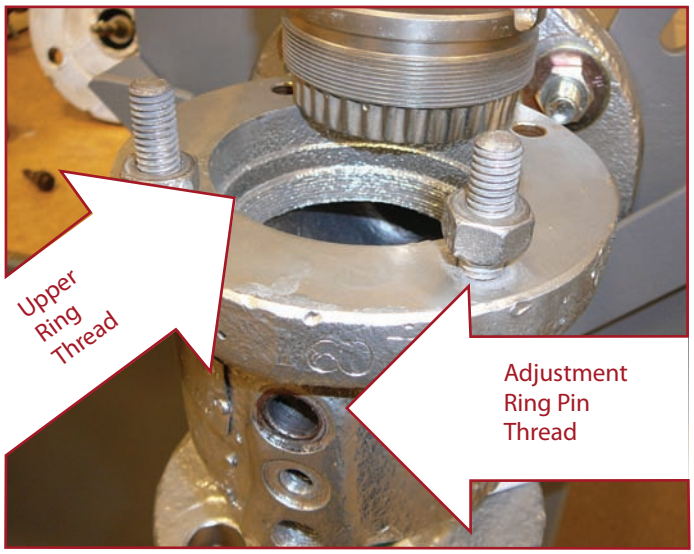
The majority of pressure relief valves needing repair do not require welding as a repair operation. Because of the relatively uncommon application of welding for pressure relief valves, this overview, including applicable National Board Inspection Code (NBIC) requirements, outlines some important elements to consider when welded repairs are needed.

When is Welding Needed?

Where extensive damage to a pressure relief valve has occured, the use of welding as a repair technique needs to be evaluated from both the technical and economic perspectives.

Technical Considerations

The first consideration concerns feasibility of making the weld. Can the materials be identified, and are they suitable for welding? The material specification for a valve body or internal part can usually be determined from the valve manufacturer's data based upon type or model number. For cast materials, part



should bear identification markings as required by material specification. One of the most common materials for valve bodies is cast carbon steel to ASME specification SA-216, grades WCB or WCC. Once material for the part is identified, a suitable welding procedure can be selected.

Some materials are not suitable for welding. NBIC Part 3, Repairs and Alterations, paragraph S7.12 b, prohibits welding of ferrous materials with carbon content greater than 0.35%; therefore, valve bodies made of cast iron cannot be welded. Many other materials, such as brass or bronzes, are also prohibited by their material specifications from being welded.

Once material has been identified and welding suitability confirmed, it must be determined if welding is within scope of the repair organization's Valve Repair (VR) program. Where a full welding program cannot be justified because welding is infrequently performed, VR Certificate holders should consult NBIC Part 3, paragraph S7.3 for using services of a National Board certified R stamp holder to perform a welded part repair. The VR certificate holder supplies to the R stamp holder the code of construction and material identification of the part to be welded. The R stamp holder performs the repair and documents the work on Form R-1. The VR Certificate holder completes the remaining valve repair process, and Form R-1 is attached to the valve repair traveler as a welding record. To use this provision, VR holders must have this process described in their quality control manual. It will be recorded on the VR Certificate under scope of work as "Welding by R Stamp Holder."

If welding is in the VR stamp holder's program, the next issue is availability of an appropriate qualified welding procedure. To assist in this area, NBIC Part 3, paragraph S7.12.2, provides for use of American Welding Society (AWS) standard welding procedures accepted by the NBIC. A list of these procedures is included in NBIC Part 3, paragraph 2.3. As long as the AWS procedure is used without deviation, it is considered "pre-qualified," and a qualification by the VR Certificate holder is not required. VR holders must have a copy of procedures in their records, and each welder using the procedure must be qualified for performance.

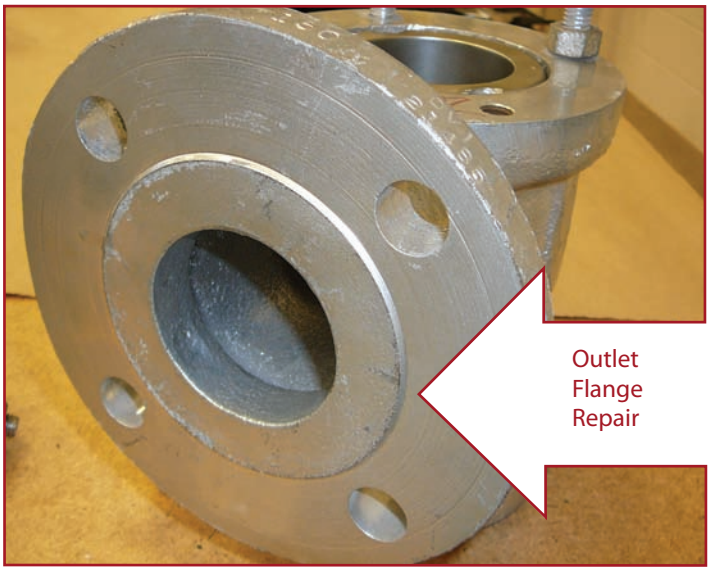
The need for post-weld heat treatment should also be evaluated. This is usually needed for higher alloy steels or heavy wall castings. Original code of construction should be consulted for guidance in this area.

After determining a correct qualified welding procedure (based on material and thickness to be welded) and obtaining

a qualified welder for said procedure and material, an economic judgment must be made.

Is Weld Repair Economical?

When time and repair costs related to welding are factored together, it is often more economical to replace the part with a new one meeting original manufacturer specifications. This is particularly true for internal parts such as the valve nozzle or disk where machining would be needed after welding is completed. Direct costs associated with welding and machining are often insignificant when compared to costs incurred due to the protected system being down. Replacement of part is almost always quicker and therefore more economical when costs associated with the down time are considered along with expense of the welding and subsequent machine operations for internal parts.



Additionally, most internal parts are manufactured to very tight tolerances. Although material may be suitable for welding, heat input into the part may result in warping or loss of dimensional integrity.

Weld repairs are usually considered when the valve body has a defect that needs to be addressed. Valve bodies are not readily available as spare parts, and the time to procure a valve body may be prohibitively long.

Valve Body Problems Requiring Welded Repair

The most common welded repairs are those to valve bodies. Excessive wear on internal threads is one typical problem found on valve bodies needing welded repair. The valve body incorporates machined threads where adjusting ring pins are installed, where the upper ring screws into the valve body, or where the body to bonnet bolting is installed. In service, corrosion forms in these threads, and a small amount of material is lost whenever the threaded part is removed. After a number of repairs, tightness of parts cannot be assured. The repair process is to perform weld buildup on the threaded area followed by machining back to the original thread specification.

Another common problem is damage to flange faces caused by corrosion, leakage across the flange, or lack of care when flange bolts are removed. Sometimes when bolting is corroded, a torch is used to cut the bolts in half, often resulting in flame cuts on the flange face. Gaskets then cannot seal on the damaged surface when valve is reinstalled. If a flame cut or corrosion is not too deep, defects are sometimes removed by machining the flange face. Care must be taken to ensure remaining flange thickness still meets applicable flange standard, as stated in ASME B-16.5. When cuts are too deep, the gouge can be ground to sound metal and a weld build-up performed, followed by machining back to desired thickness and surface finish. Final inspection is done by consulting the flange dimensional standard.

Loss of material due to corrosion or erosion is another potential problem. General corrosion over a large portion of the valve body would likely be a good reason to consider replacement (complete valve replacement is often a better choice). Localized loss of material, often at bottom of the body where moisture can collect, may be a candidate for weld build-up, followed by grinding back to original contour.

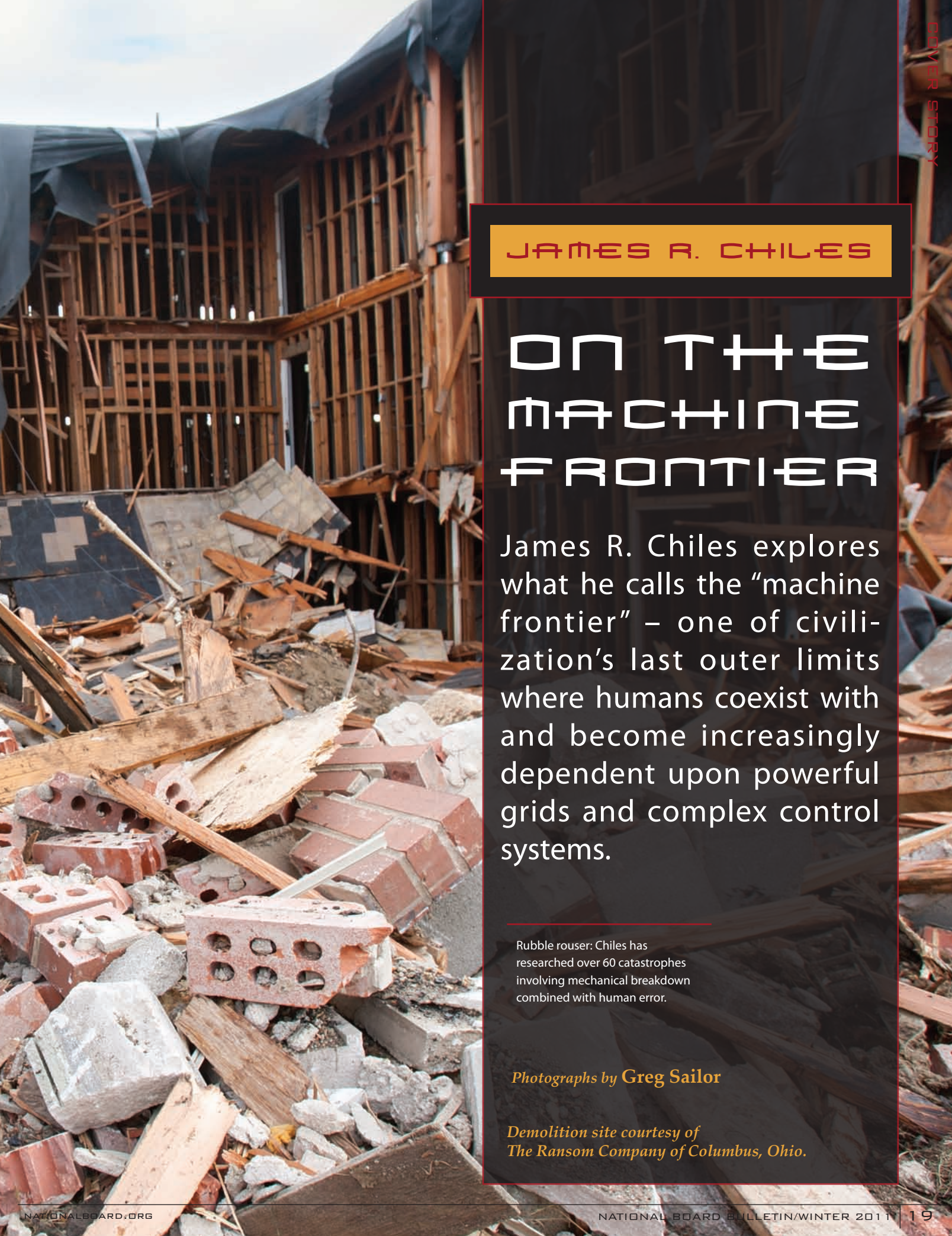
A valve subjected to excessive external loading, perhaps due to insufficient pipe supports or clearance problems, may result in cracking of valve body. Repair of a cracked component first requires removal of defect by grinding or other suitable method. Suitable nondestructive examination may be needed to verify crack is completely removed (Ref: NBIC Part 3, paragraph S7.12 c). Dye penetrant (PT) testing is a common method of "chasing the crack." Once the crack has been completely removed, the cavity formed is filled with weld metal and the final surface is re-established by grinding or machining.

A weld on the valve body not included in scope of repairs done by a VR holder is the attachment weld for a valve being permanently attached to a boiler. This weld is done during initial construction of the boiler by an ASME S or PP stamp holder. When valve is removed and reattached to a boiler for repair, the weld must be done by a National Board R stamp holder.

Conclusion

Many considerations must be evaluated to ensure weld repairs made to pressure relief valves are done correctly. The final product must be capable of performing its intended function. While a weld repair may be helpful in returning a damaged valve to service, care must be taken to ensure the valve will meet applicable ASME and NBIC requirements. VR program requirements that must be addressed by VR stamp holders are outlined in NBIC Part 3, Repairs and Alterations, paragraph S7.12. Repair organizations not familiar with these requirements should consider other repair options or seek competent technical assistance.


Columbia
Canon



JAMES R. CHILES

ON THE MACHINE FRONTIER

James R. Chiles explores what he calls the "machine frontier" – one of civilization's last outer limits where humans coexist with and become increasingly dependent upon powerful grids and complex control systems.

Rubble rouser: Chiles has researched over 60 catastrophes involving mechanical breakdown combined with human error.

Photographs by **Greg Sailor**

Demolition site courtesy of The Ransom Company of Columbus, Ohio.

He's written about technology and history for over 30 years. His assignments have taken him into limited access areas to research safety and chronicle system breakdowns. He has interviewed dozens of experts and spoken with ordinary people thrust into extraordinary events in his pursuit of sharing lessons learned from system failures. His message: Across two centuries, causes of technological catastrophes cluster into a dozen classic patterns of mistake and malfunction. Accidents on the machine frontier are avoidable with good practice gleaned from past mistakes.

"Machines going crazy are among the few things left on this civilized planet that can still inspire deep dread," he writes in the introduction of his book, Inviting Disaster: Lessons from the Edge of Technology. *The book was published in 2001 and examines over 60 disasters, calamities, and near misses caused by human error combined with mechanical malfunction. In 2003, the History Channel took notice and created a television series by the same name, which Chiles narrates. He also appeared in History Channel's* Katrina: American Catastrophe, Engineering Disasters, Life After People, Wild West Tech, *and* Megadisasters. *Additionally, he appeared on National Geographic's* Seconds from Disaster *series. In 2007 he published a second book,* The God Machine: From Boomerangs to Black Hawks, the Story of the Helicopter. *He maintains a blog called* Disaster-Wise.

Chiles has written about steam and pressure throughout his career. "Pressurized gas and steam has played, and continues to play, a key role throughout the industrial world," he says. "Rigorous inspection and quality control is essential." Here, Chiles shares exclusively with the BULLETIN his candid thoughts about safety lessons common to many industries and what he's learned from trailblazing along the machine frontier.

ON WRITING ABOUT DISASTERS

MY "AHA" MOMENT CAME WHILE writing an article about lessons from the 1965 Northeast blackout. I came to appreciate the vast machine we have built. The power grid is so complex we cannot predict exactly how power will flow from second to second. We can keep it within boundaries most of the time, but it's beyond our total understanding and control, as we've learned from the occasional new and different blackout. That's how I came to rough out the notion of a machine frontier: we're all on it. The original idea of *Inviting Disaster* was for ordinary people to learn trouble-shooting and resilience lessons from how extraordinary events play out on this ever-changing frontier. I believe people should understand they could find themselves in the middle of a developing catastrophe. In such cases, a little knowledge, if it's correct and pertinent, can go a long way. I don't agree with the popular notion, "a little knowledge is a dangerous thing." A little knowledge might be all you have, and it might be enough. There are many cases where maintenance people saw early, subtle signals of impending disaster and told the experts about it, though sounding the alarm was outside their job description.

ON MACHINE FRONTIER EXPANSION: The Grid, SCADA Systems, and Shaving Margins

IT'S BEEN NEARLY TEN YEARS SINCE CHILES' Inviting Disaster *was released. Since then a few concerns stand out to him as growing and worth our attention. One is the consequence of widespread failure in highly automated systems running the "heavy grid" – which Chiles loosely defines as critical power, energy, and communication systems holding society together and controlled by complex, computerized models* [*supervisory control and data acquisition (SCADA) systems – that collect data from remote locations and feed it to a central computer where a manager then controls the data.*]

I have concerns about SCADA and how robust it is. While there is absolutely no going back, we should understand the risks of such systems that are now key to our water, power, gas, and telephone systems. A SCADA glitch came up as a suspect in the recent San Bruno gas pipeline explosion, for example. Intense computerization can make the grid vulnerable, leaving us without simpler modes of local control. Imagine if the carburetor in your car, the electronic controller unit, was directed by wireless signals through stations up and down the highway. What if that wireless grid went down? Without the external control system, you couldn't run your car. This is not theoretical in some power plants; engineers who once ran them locally have been displaced by remote controls. One solution is for plants to be directed through an independent, secure communications network that couldn't be disrupted by problems arriving via the Internet, at least until the grid could be cleansed of sneaky, SCADA-attacking viruses intentionally scripted to bring down control systems. I've heard that a major railroad has such a system – they laid cables along rail lines so control systems are not subject to upsets over the Internet.

Another concern I have is the tendency to shave the margins of safety. High-voltage power transmission systems and highway bridges are being loaded up, and there seems a lack of willingness to build up or even maintain them in some areas. And margins are being shaved. You see it in the nuclear-power industry – uprating some plants and repermitting others for longer than originally envisioned. This can be okay but only if regulatory scrutiny is dialed up; not just with computer models assuring us everything will be fine.

Observation: "A little knowledge might be all you have," Chiles warns.

ON REDUCING OPERATOR ERROR

OPERATIONAL ERROR CAN OCCUR WHEN unprepared people try to use routine methods to handle an upset, due to lack of understanding or experience. These situations are anything but routine. Good training gives practical knowledge of where dangers are most likely to show up and equips operators to detect early warning signals. Operational error also happens when people are in a hurry and take shortcuts. People become impatient with standard procedures and neglect routine actions, like restarting checklists after being interrupted. Accidents are also more likely during a handoff between shifts, or when equipment is being started up or taken offline, such as the "turnaround" period at a refinery.

ON TRADE FEARS AND FALSE SIGNALS

TRADE FEARS ARE SCENARIOS UNIQUELY dreaded by an occupation or industry culture. For instance, highway patrolmen fear they'll come across a relative in a car wreck. A fuel-vapor explosion is one trade fear in the boiler industry. "Going solid" in a nuclear reactor plant is another. The problem with a trade fear among operators is any indication of its occurrence can put them into a narrow frame of mind, called cognitive lock. All of a sudden, because you are trained to be scared about it, you can move into an instantly confirmed hypothesis – even if it's a false signal. A false signal is when you believe an event has happened when it has not. But if the signal is wrong, your response could cause more problems, like at Three Mile Island. In that incident, instruments did not give an accurate reading and operators thought pipes were "going solid" when they weren't. They responded by trying to drain water out and eventually exposed the reactor core. Trade fears are not necessarily bad, but what's better is making sure people aren't fooled into thinking a trade fear is happening when it really isn't. Good, comprehensive training and mentoring reduces the effects of trade fears.

ON TRAINING AND EXCELLENCE IN LEADERSHIP

AN INDUSTRY WON'T HAVE WORLD-CLASS training if they don't have world-class leadership. I've never seen high performance in an organization lacking leaders with the right attitude – someone willing to take the heat and push people to excellence even when they don't want to be pushed. An experienced and respected leader brings out the best in others – and is remembered years later.

One remarkable thing about the San Jose, Chile, mine rescue was how the leader, foreman Luis Urzúa, kept his crew alive when they were running out of food and hope. Urzúa brought out the best in them. That's what a leader should do. A concern I have in industry is when managers rotate through every couple of years or less, and never have to accept consequences of their actions that shaved the margin of safety. A sure way to open a door to a disaster in the complex, high-energy system is cut the lines of accountability.

I'm sure the National Board can give many examples where something was fairly close to failure but an experienced inspector saw it coming and said, "You don't have permission to operate until you fix this." It's the pointy-tip of the spear – if inspectors don't catch these things, who would? Rigorous inspection combined with experienced operators is critical for safe operation of complex systems.

ON TRANSFER OF KNOWLEDGE

ACROSS MANY INDUSTRIES I HEAR A concern about the generational cliff. Who will replace the old hands when they retire? It's happening right now. Transfer of knowledge, and the good judgment to go with it, is one of the greatest and as-yet-unacknowledged challenges of our age. It cannot be done in a year or two. It has to be planned years in advance. It's important to scout out people with the right skills and inclination, train them up, and get them into your field. This won't happen on its own, not anymore. You could call it a competition for new blood. Stakes are extremely high given how many technological fields now offer a potential for catastrophic events. Many companies and agencies will compete for a too-small pool of smart, motivated, disciplined young folks.

ON STUDENTS, MATH, AND HEROES

THERE'S GOT TO BE CLEAR AND PERSUASIVE reasons for high school freshmen to choose the tougher road and take math and science courses necessary for an engineering career, but there aren't any right now. Schools must move students through as long as they've met basic requirements, as opposed to mastering a tough subject. Take statistics. I'm a student of World War II logistics and was surprised to learn statistics (called Operational Research) was one of the most effective weapons we had in the war. It was more important than the A-bomb and any tank or bazooka. Statistics enabled rigorous decision-making based on what worked and what didn't. What a shame it is if you ask a high school student about statistics, and if it's not sports-related, he or she doesn't see any use in it. It seems like a grind – something nerds use rather than celebrities or sports stars. Math and science are not in the popular lexicon.

Back in the 1900s engineers and inventors were our heroes. It was the age of building up our infrastructure, and now we're in a new scary, rusty age of trying to hold it together. That doesn't sound like much of a heroic era. What would be a driver to motivate young people toward a long and difficult path with few heroes to emulate? I wish I knew.

ON THE MINDSET DURING A CRISIS

A GOOD MINDSET TO HAVE DURING A CRISIS is a combination of keen awareness, almost fear, balanced by confidence. Confidence comes from the knowledge of how others survived similar situations. People will very rarely have to face crisis situations, but if and when it happens, the situation may be survivable. If you know the job you're performing is dangerous and how it can go wrong, you're halfway to safety. The guys working with nitroglycerin aren't fooling themselves. They understand the dangers and plan for the bad day. I really admire people who work in high-risk industries on a daily basis – who not only survive but thrive. What's more, they have practical lessons for the rest of us on how to expand our zones of survivability.

ON BEING INVOLVED IN A DISASTER

OCCASIONALLY I GET THE CHANCE TO interview those who helped head off a catastrophe, like Brian Mehler, an operator who kept Three Mile Island from melting down and breaching the pressure vessel. Part of the difficulty interviewing such people, whom I regard as industrial heroes, is they don't want to be seen as claiming to be better than other operators. They want to be part of the team and they don't care what the public thinks about who the heroes and villains were.

Leaders should make a commitment to attend the funerals of employees killed in the line of duty – it will make them more careful. This relates to National Board's theme for the upcoming General Meeting: "SAFETY: Consider the Alternative." So, bosses: if you don't want to go to the funerals of those killed in a disaster, you should think twice before signing off on something you're not comfortable with.

What's more important to consider than any operator error is the mindset of those who direct the *system*. After a disaster, have leaders of the systems learned from it and "gotten religion?" Are they saying, "We're going to do better – we're going to hire the

right people and train them well,"? Or do they say, "That was a fluke. We'll sit tight until regulators, reporters, and lawyers go away." Because in heavy industry, bad people don't kill people – systems kill people.

ON THE FIRST FEW MINUTES OF A SYSTEM FAILURE

IN THE EVENT OF AN ALL-OUT EMERGENCY, action to stabilize the situation cannot wait very long. A lot depends on the nature of the emergency, but commonly the first thing is to stabilize it, doing the minimum until the situation is clearer. At that point, take a breath and evaluate the problem with your team and work out a plan in close cooperation. In a crisis it's easy to get tunnel vision and stop evaluating whether a hypothesis is working or not. It's common for unprepared operators to get locked into a line of desperate action, then experimentation, even as the situation worsens. More than anything, don't panic. You know the old saying, "Don't just stand there, do something!" Sometimes it should be, "Don't just do something, stand there!" Sometimes it's better to pause, construct a hypothesis and a plan, and test the plan. Use team wisdom and maintain your situational awareness. Oftentimes the most critical actions are taken in the first few minutes.

ON THE IDEAL SAFETY PROGRAM

IF I WERE TO DEVELOP MY OWN SAFETY program it would be designed and taught by people who actually run it; experts who know the weak signals of impending failure and can think through consequences of alternative actions. That was a guiding principle of Admiral Hyman Rickover's Nuclear Navy program – designers, operators, and trainers were experts in the field. Engineers and operators were trained by experts, and training was constantly renewed and always rigorous, with many realistic drills. New lessons were distributed every time there was a close call or upset, and there was tracking and accountability. Yes, Rickover's style was very demanding, but it also stands as a model for future operations on the edge of technology where success is absolutely critical and prototypes must move to production without a single catastrophic failure.

ON THE DISAPPEARANCE OF KIRK, SCOTTY, AND THE NOSTALGIC MACHINE AGE

OUR NOSTALGIC VIEW OF MAN AND machine can be seen in Captain Kirk and Scotty from *Star Trek* – a captain at the helm who knows exactly what should be done and an engineer who knows exactly how far he can take the machine. It wasn't all fiction; at least it wasn't years ago. One example in my book is Captain E. W. Freeman of the steamer *Roddam*. He knew exactly what he could do with his ship and how to break it loose. [*It was trapped by its anchor chain in the harbor when Mount Pelée at Saint-Pierre, Martinique, exploded and set the ship on fire in 1902.*] It makes great movies but we're not in that age anymore, and every year we have fewer such commanders of vessels or systems. Why? Machines and systems are too complex and opaque for such a freewheeling, individualistic style. Take the captain of Deepwater Horizon [*the offshore oil drilling rig that exploded*

Safety Matters: Joe Ball, director of National Board's Pressure Relief Department (middle, above), gives Chiles a tour of the testing laboratory.

in April 2010, causing the largest offshore oil spill in US history]. His most memorable question during the event was, "When do we get off the rig?" He was hardly in command. In fact, from information to date, it's a mystery about who was in command. On an old-style ship you knew exactly who was in charge. Most vessel masters stationed on deepwater rigs today are there to fill regulations.

To some extent we still have traditional chain of command with airliners. But even so, there's a trend for the captain to do less diagnosis in the air; rather, digital data is transmitted back to base and analyzed before he acts. Yes, there are still flight decks with a pilot, an engineer, and a first officer, but systems are much more complicated and sometimes the crew can't handle things alone. Whereas with an old-style, triple-expansion steam engine, not much happened that an operator couldn't fix because only a small number of things could go wrong. Old steam engines were very robust but they weren't powerful, reliable, or efficient compared to a steam turbine. It's a radically different work setting now. Now you get a much more complicated system operated close to the margins to cut costs. The general principle is that highly efficient systems are more complex and require a team of people to run them. There's nothing romantic about it. That's why we don't have many Kirks and Scottys left.

ON "THE AGE OF THE 'THINGY' "

WE ARE IN WHAT I LIKE TO CALL "The Age of the 'Thingy' " – a time in which we enjoy, but don't understand, critical pieces of the vast, unseen technological world supporting our lifestyle. We have these little devices in front of us. They're fun and affordable and useful, but we don't know how they work; and we can't fix them. It's frustrating. I see a disconnect compared to the curiosity and invention of the early Twentieth Century. Many people don't have a clue all that goes into the grid. The antithesis to "The Age of the 'Thingy' " is "The Age of the Understood and Fixable Machine" – knowing how something works and the means to fix it.

IN CONCLUSION: A SAFER FUTURE

IF I HAD MY WAY, THERE WOULD BE A LOT fewer catastrophes and disasters to write about. After close calls we'd learn from them earnestly, but such near misses would be as close as we come to technological drama. I'm no expert – I'm not an operating engineer or an inspector – I'm just a feature writer. But I've been privileged to go into limited access areas and talk to people in a wide variety of occupations, and I do what I can to spread the word.

Mr. Chiles will address the General Session on Monday afternoon, May 9, at the National Board/ASME General Meeting in Las Vegas. The topic: *Cold Iron & Cool Heads – Hard-Won Lessons from the Machine Frontier for the Next Generation.*

National Board

Pressure Relief Testing Laboratory

Celebrating 20 Years of Service and 30,000 Tests Completed

Today it is a worldwide leader in safety valve testing and capacity certification used by manufacturers around the world, but its origins trace back to 75 years ago when National Board first responded to reports of disastrous safety valve failures.

It happened in 1935 when National Board received complaints that safety valves were not relieving the amount of steam specified on valve stampings. The Executive Committee took immediate action to determine the complaint's validity. They contracted the Mechanical Engineering Department lab at The Ohio State University to run tests.

Capacity tests were conducted on 18 valves from several different manufacturers. Results showed discrepancies and were reported to the ASME Boiler Code Committee, which appointed a special committee to prepare Code revisions to correct the problem. This resulted in new verification rules required by safety valve manufacturers, including stamped relieving capacity on safety valves for power boilers, ASME "V" stamp, and capacity tests performed by an authorized inspector – all of which was included in the *Power Boiler Code*, 1937 edition.

It was a two-year process establishing a new precedent in safety valve inspection – and gave the National Board Testing Laboratory its start. Since then the lab was housed in a few different locations in Columbus until the current facility was built in 1991.

Today the lab staffs 10 people (department director, four technical staff, lab manager, two technicians, and two administrative personnel). Since opening in 1991, approximately 1,500 tests have been performed each year. During the 2009-2010 fiscal year nearly 1,900 tests were completed for clients from the United States and 13 other countries. In 2010, testing was up 23% from 2009, and in January 2011 the lab hit a milestone, completing 30,000 tests.

Witnessing the successful completion of the lab's 30,000th test on January 5th, 2011, (from left to right): Tim Brown, Joe Ball, and David Hennon (Pressure Relief Department); Ron Driver, Lytle Williams, and James Smith of Wacker Polymers in Calvert City, KY, (VR holders re-qualifying for their VR stamp); Tom Beirne and Brandan Ashbrook (PRD); and Executive Director David Douin.

Testing is primarily performed so pressure relief device manufacturers can qualify products for application under *ASME Boiler and Pressure Code*. Test procedures start with an initial series of tests to determine a capacity rating value the system designer will use for design of a boiler or pressure vessel's overpressure protection. The certification program includes tests of randomly selected production items to verify quality and testing procedures and periodic retesting to ensure the design continues to function properly.

Additionally, some tests are done on repaired pressure relief valves submitted as part of the qualification process for obtaining National Board valve repair (VR) certification. Valves are tested for operation and flow capacity, which should be equal to or greater than the original manufacturer's rating. Successful completion of testing demonstrates repair procedures and specification results in a valve are equivalent to new valve standards.

Smaller numbers of tests are done for research and development, testing to other standards such as UL or DOT, validation of proposed code updates, or to assist in incident investigations.

Although some basic test procedures have been used successfully for years, standards and equipment within the industry continue to change and evolve. For instance, in 1998 rupture disks were added to ASME Code Section VIII. To accommodate different device characteristics, new test rigs were developed. A high-pressure air test system was added for tests of pressure relief valves designed for new refrigerants having higher system operating pressures.

Changes in the pressure relief device industry have also affected type and volume of work performed at the lab. ASME Code rules are more widely used throughout the world, resulting in mandatory test programs requiring new overseas manufacturers to qualify products before entering the market. US manufacturers have added overseas manufacturing locations to serve new markets and lower costs. Each new manufacturing plant requires its own series of tests to qualify Code stamping of pressure relief devices built at that location. Renewed interest in construction of nuclear power plants has contributed to a recent increase in testing of sample valves used in that industry.

"It's the challenge of serving a changing industry that keeps our work interesting," says Pressure Relief Department Director Joseph Ball. "I am proud we have kept up with increases in our testing load due to changes in the pressure relief device industry. Our staff works hard to support the increased testing schedule, and I don't see any letting up as we go forward."

Other challenges faced by the test laboratory are related to the safe operation of its own pressurized equipment. Systems in the 20-year-old lab require more maintenance and upkeep. "Numerous valves throughout the plant need serviced or are beginning to wear out. We are in a period of going through and replacing them," reports Ball. "Our steam test systems and boilers are operated intermittently, which can present challenges in upkeep. We've found textbook examples of corrosion during steam system inspections and repairs."

Overall purpose of the laboratory is safe operation of pressurized equipment. Pressure relief devices exist solely to protect equipment by keeping pressure from exceeding safe limits when system controls fail or other operational problems occur. Independent testing by an outside authority recognizes this safety function and promotes continued efforts by industry to assure products will operate as expected. The work performed at National Board's test lab continues a legacy of safety service to the boiler and pressure vessel industry and general public that continues after 75 years.

- In 1935, National Board arranges to use Robinson Laboratory on OSU's campus to put safety valves to the test. It was the first testing lab of its kind.
- In 1972, National Board decides it needs its own lab in order to test more valves at greater capacity.
- In 1974, the new lab, nearly 3,000 square feet, is built on a leased plot of land on site of Columbus and Southern Ohio Electric Company's Picway Generating Station 12 miles south of Columbus.
- In the late 1980s, American Electric Power acquires Columbus and Southern Ohio Electric Company and gives notice to National Board its lease will not be renewed. Six acres of land, about a five-minute drive from National Board headquarters, is purchased and construction of the new lab begins.
- In March 1991, the lab at Picway Station closes after serving the industry for 17 years and completing 15,766 tests.
- In May 1991, testing at the new facility in Worthington, Ohio, begins. Since then 30,000 tests have been performed on all types of pressure relief devices.

Laboratory Specifications:

- Testing area is approximately 3,600 square feet.
- Steam is produced by two 900 psi steam generators located in a 1,400-squre-foot boiler room behind testing area and capable of producing almost 20,000 pounds of dry saturated steam per hour.
- Boiler room also houses three high-pressure air compressors and other support equipment.
- Lab features three test systems using steam, air, and water. Pressure relief devices can be attached to each system. Systems can handle devices set up to 500 psi. A high-pressure air system for testing smaller pressure relief devices up to 1,400 psig is also included.
- A computer-based data acquisition system captures data for fluid flow computation and analysis.
- Tests can take anywhere from 15 minutes to an hour to perform.

New Benzene Extraction Unit Makes Gasoline Cleaner

By Kimberly Dusek, Reliability Engineer,
Marathon Petroleum Company LLC

When the Environmental Protection Agency (EPA) passed new regulations to control benzene emissions in February 2007, Marathon Petroleum Company LLC undertook construction of a new unit to meet the changing environmental standards at its Robinson, Illinois, refinery. The project became known as Mobile Source Air Toxics (MSAT) II project, a multi-year effort to design and construct the 65 million barrels per day (MBPD) benzene extraction unit. With this unit, benzene content in Robinson gasoline will be reduced from approximately 1.5 volume percent to 0.3 volume percent, an amount the EPA believes will aid in the reduction of total toxic emissions from mobile sources (cars, trucks, etc.) by 330,000 tons and volatile organic compound (VOC) emissions by over 1 million tons by 2030 (source: http://www.epa.gov/oms/toxics.htm).

This unit consists of more than 125 pieces of equipment, including 43 heat exchangers, 15 vessels, and nine columns; most impressive being the Reformate Splitter Column, a 202 feet tangent to tangent by 15 feet and 13 feet (a tapered transition near the weld area) diameter vertical pressure vessel. The vessel varies in thickness from 7/8 inch to 1-1/8 inches. Thickness at the weld joint is 7/8 inch. The vessel was constructed out of SA-516 Gr. 70 normalized and built to ASME Section VIII, Division 1, 2007 edition of the Code. It was built in Belgium by G&G International NV and fully hydrotested by the manufacturer. When it came time for shipment, however, vessel size and refinery location made it impossible for the vessel to be shipped in one piece. The solution came with the idea to cut the vessel into two smaller and more manageable pieces, ship them separately, and then weld back together onsite. The weld filler wire diameter was 0.045 inches and conformed to ASME SFA 5.20 for flux-cored arc welding. The manufacturer of the filler wire shows a dual classification of E71T-1C-DH8/T-1M-D and E71T-9C-DH8/T-9M-D. Welding polarity was direct current electrode positive (DCEP). In addition to this filler wire being a flux core, an external shielding gas was used. Shielding gas composition was 75%Ar/25%CO2.

Reassembly of this vessel was completed as an R-stamped *National Board Inspection Code* repair by Freitag-Weinhardt, Inc. and witnessed by a Hartford Steam Boiler authorized inspector. The empty weight of the vessel is 924,534 pounds. To complete reassembly, a Liebherr LR-1800 crane rated for 800 tons, outfitted with more than 1.8 MM (million) pounds of counter weight, and having a main boom length of 345 feet was used to set the bottom portion of the column on its foundation. Once set, the top section was suspended above it, lowered, and fitted to the bottom section for welding. A bevel groove joint in conjunction with flux-cored arc welding (FCAW) was used to join the two vessel sections together.

Kimberly Dusek is a mechanical engineer graduated from the University of Illinois at Urbana–Champaign. She is a fixed-equipment reliability engineer for Marathon in Robinson, Illinois, who has a CWI, API 510, API 570, and is a National Board Owner-User Commissioned Inspector.

Touch Down—
Top section of column being set in place. Weld joint is at approximately 2/3 the total height, where the safety-orange barricade encircles the column.

Due to several concerns and with the acceptance of the authorized inspector, non-destructive examination (NDE) was used in lieu of hydrotesting the repair as allowed by the *National Board Inspection Code*. Potential damage to tray internals due to filling/draining of water, potential fouling of internals with contaminants from hydrotest water, and possible chloride stress corrosion cracking from chlorides in the hydrotest water were all concerns that led to this decision. Working with Ben Bailey, State of Illinois boiler and pressure vessel superintendent, a rigorous inspection and NDE plan was put into place to alleviate any apprehension with not hydrotesting the vessel and using the FCAW process. In addition to extensive visual inspection throughout the entire welding job, NDE performed on the vessel consisted of:

- Wet fluorescent magnetic particle testing (WFMPT) of the inside and outside surfaces of the weld after the root pass and first filler pass;
- 100 percent radiography at 50 percent of weld out and of the final weld;
- WFMPT of the inside and outside surfaces of completed weld; and
- 100 percent shear wave ultrasonic examination of final weld.

Overall it took years of planning, months of building and construction, weeks of preparation, and many days of welding and inspection to create and install this vessel. Through the determination of many engineers, craftsmen, and inspectors, it will fulfill its job in the new benzene extraction unit and help make gasoline cleaner.

Completed weld showing welder's identification mark and numerical location marks for NDE.

Shear Wave ultrasonic examination of the completed weld.

MICHAEL KLOSTERMAN

Chief Boiler Inspector, State of Iowa

Most people achieve adulthood before encountering a true test of their mettle. For others, it can present itself at a very early age.

No one knows that better than Mike Klosterman.

Born to a military family in Albuquerque, New Mexico, the future Iowa chief boiler inspector counted three states home before his family settled in Oregon during the mid-1960s. "It seemed like I got a new sibling every place we moved," Mike offers with a grin. The final count: three brothers, two sisters.

When his parents divorced in 1968, then-Mike Bellus and the children went to live with their mother. To put food on the table, Jill Bellus held down two jobs while at the same time studying to become a registered nurse. That essentially left family kid-rearing duties to the eldest child: Mike.

"I was in the third grade when all of this responsibility was handed to me," the Iowa state official recalls. "Well," he offers upon further reflection, "actually, there wasn't much of a choice."

And so the grit of 8-year-old Michael Bellus was about to be measured. By adult standards.

Among his daily routine: cooking, some cleaning, and getting his brothers and sisters to school each morning (himself included), and to bed every evening. And then there was the constant resolution of kid-type issues, such as when his younger brother almost caught the house on fire by hiding a light bulb under his bed covers to keep warm.

BULLETIN Photograph by Randy Milder

Mrs. Bellus moved the family to the balmy confines of San Diego in 1969. In addition to securing a nursing job, the mother of six met and married Jerry Klosterman. Following his Navy discharge in 1971, Mr. Klosterman packed up the family and moved to his home-

town of Rhodes, Iowa, a small farming community of about 300.

The Iowa chief inspector (now Mike Klosterman) explains his stepdad took a manufacturing job while his mother resumed her nursing career. Having reached the sixth grade, Mike's baby-sitting duties gradually came to an end as Jerry and Jill Klosterman assumed more of the day-to-day responsibilities overseeing the children.

With newfound freedom to pursue interests heretofore elusive, Mike's love of sports began to evolve into a passion he enjoys today. Moving on to high school, he became more interested in playing baseball, football, and basketball.

"I wasn't tall enough to play basketball so it was suggested I might want to wrestle," he chuckles. "A major portion of my high school wrestling career was spent looking up at the gymnasium lights and wondering how to get out of this mess!"

Mike admits to not being a very good student, but says he was motivated by keeping a passing average to participate in sports.

While having no idea what to do after high school, the New Mexico native spent his teenage summers working at local farms doing typical farm chores.

Mike recounts the farm experiences marked his first appreciation for safety. "Farmers use a lot of power equipment, much of which can be dangerous. Baling equipment, conveyors, tractor mowers: it's easy to lose a finger or an arm by not watching what you're doing. I was 15-16 at the time and I considered myself lucky not to have been in an accident."

Mike celebrated his 18th birthday with a few friends, namely the entire Rhodes community. "My mom and stepdad bought a keg of beer and the whole town showed up. It was particularly memorable since the drinking age in Iowa was 18 back then."

Achieving the age of 18 didn't necessarily bring wisdom to the future state official. Or maturity. In 1977, his junior year, Mike dropped out of high school following a disagreement with the wrestling coach. "Looking back, it was a dumb kid thing," he laments. "But now being 18, I could join the service."

On February 7, 1977, Mike enlisted and was consequently shipped to the Navy Great Lakes Training Center near Chicago. Following basic training, the Iowa official indicated he wanted to become a Navy signalman. But as usual, the Navy had different ideas. "They told me I was more suited to becoming an engineer.

"They shipped me to boiler school and handed me a variety of manuals," he continues. "But when it came time to take my final exam, I failed miserably." And for an interesting reason: "I never was good at taking written tests. Take me out of a classroom and put me into a boiler room, and I do much better."

Given an opportunity to retake – and pass – the second written exam, Mike shipped out on the troop transport *USS Tripoli*. "I worked mess duty for the first three months before getting a proper introduction to the boiler room," he explains. "On the *Tripoli* for 3 ½ years, I worked my way up to boiler room second-in-command."

In February of 1981 after turning down $20,000 to re-enlist, Boiler Technician Third Class Michael Klosterman was discharged and returned to his family in Rhodes. In April, he accepted a position as power plant engineer with the State of Iowa at the Iowa Veterans Home. "During my 17 years at this facility, I developed an interest in umpiring baseball and fast pitch softball games and refereeing basketball and volleyball games." In 1987 at a slow pitch softball game, he met and also developed interest in Chris, his wife of 21 years.

The year 1995 was a milestone of sorts for both Mike and the Iowa Veterans Home. A power plant retrofit not only introduced new automated technology, it brought state boiler inspectors. "I had no idea these inspectors existed," he admits with a grin, "let alone ASME and National Board codes."

Three years later, Mike applied for and was hired as a state inspector with the proviso he earn a National Board Commission. His frustration with taking written tests resulted in Mike failing the commission examination three times before passing it in 2001.

With Iowa's chief boiler inspector on disability in the early 2000s, department communication with its constituencies frequently became problematic. "It was tough on staff back then because in addition to doing inspections, our department was also launching a new boiler database."

Mike became temporary chief boiler inspector in late 2004 and was named permanently to the position a year later. With the support of four boiler inspectors and a full- and part-time clerk, the department oversees (with the insurance industry) approximately 23,000 boiler and pressure vessels.

Currently with 30 years of experience as a state employee, Mike is extremely positive about the direction of the Iowa boiler program and the support he receives from labor commissioner Dave Neil. "It's all good," he offers with a wink. And that includes life at home.

But Chris reveals Mike's obsession with sports has reached epidemic proportion. "At home he has this *man* room with all kinds of *man* stuff," she explains with unapologetic emphasis on the word *man*. "It's where he goes to be alone, watch games, and keep all of his sports things."

And there is one additional *man* fixation. "Mike makes a killer barbeque on the grill," she nods with a smile.

The New Mexico native agrees. "Mess duty and cooking for five kids will do that to you!"

2011: Another Busy Year

BY KIMBERLY MILLER, MANAGER OF TRAINING

The National Board training department is gearing up for another busy year in 2011. Currently there are 27 classes scheduled for a total of 36 weeks of training, most being conducted on our campus in Columbus, Ohio.

Of course, commission courses are a high priority with 18 of the 36 weeks dedicated to training students to become inservice and new construction commissioned inspectors.

The *New Construction Commission and Authorized Inspector Course* (A) is on the calendar five times this year: March, June, August, September, and December, with an additional class date contracted in China in early spring. Students spend nine days in the classroom and inspection room learning the discipline of becoming an authorized inspector; the two-part examination is then administered on day 10. As always, this course is in high demand so enrolling early is encouraged.

The *Inservice Commission Course* (IC) has three dates set for this year: February, June, and October. 2011 is only the second year for this course to be taught. We anticipate the first year popularity of this course to continue in the foreseeable future. Students attending this training spend nine days learning code requirements in the classroom, as well as learning about the equipment they will see in our hands-on inspection room and subsequently in the field. Day 10 offers students a mock examination to better understand their strengths and weaknesses. This allows pupils to focus on areas of study before taking the actual exam. Although taking the Inservice Commission exam is not required, there is a 15% higher pass rate among candidates who sit for the mock exam.

Did you know examination questions may be submitted to the National Board for use in any commission or endorsement exam? To do so visit www.nationalboard.org, Commissioned Inspectors/Submit an Exam Question.

Also on the calendar for 2011 is a menu of nuclear training offerings which include three *Authorized Nuclear Inspector Course* (N) dates, one *Authorized Nuclear Inservice Inspector Course* (I), and one *Authorized Nuclear Inspector Supervisor Course* (NS). With growth in the area of nuclear power, we expect all five classes to be very popular.

The remaining training calendar consists of two *Authorized Inspector Supervisor* (B) class dates: (January and July); three *Pressure Relief Valve Repair* (VR) seminars (April, July, and September); and three *Boiler and Pressure Vessel Repair* (RO) seminars (April, August, and October). The *Boiler and Pressure Vessel Repair Seminar* has been redeveloped for 2011 to provide students a step-by-step repair guide beginning with obtaining and/or renewing National Board accreditation. It moves through the entire repair process and ends with proper documentation and registration (valuable information for anyone involved in the repair process).

The training department will also be involved in reviewing team leader training for current and prospective National Board and ASME team leaders as well as Inservice Inspection Seminars held within the jurisdictions. With several industry meetings scheduled at the Training and Conference Center in 2011, it definitely will be another busy year!

TRAINING WRAP-UP CLASS OF SUMMER/FALL 2010

All class photos are accessible for download at nationalboard.org/training.

JULY 2010 A CLASS

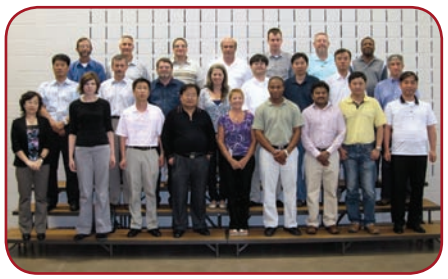
NATIONAL BOARD AUTHORIZED INSPECTOR COURSE

JULY 2010 N CLASS

NATIONAL BOARD AUTHORIZED NUCLEAR INSPECTOR COURSE

JULY 2010 RO CLASS

NATIONAL BOARD BOILER AND PRESSURE VESSEL REPAIR THREE-DAY SEMINAR



AUGUST 2010 B CLASS

NATIONAL BOARD AUTHORIZED INSPECTOR SUPERVISOR COURSE

AUGUST 2010 C CLASS

NATIONAL BOARD AUTHORIZED NUCLEAR INSPECTOR CONCRETE COURSE

AUGUST 2010 IC CLASS

NATIONAL BOARD INSERVICE COMMISSION COURSE

SEPTEMBER 2010 A CLASS

NATIONAL BOARD AUTHORIZED INSPECTOR COURSE

OCTOBER 2010 N CLASS

NATIONAL BOARD AUTHORIZED NUCLEAR INSPECTOR COURSE

OCTOBER 2010 NS CLASS

NATIONAL BOARD AUTHORIZED NUCLEAR INSPECTOR SUPERVISOR COURSE

NOVEMBER 2010 A CLASS

NATIONAL BOARD AUTHORIZED INSPECTOR COURSE

NOVEMBER 2010 IC CLASS

NATIONAL BOARD INSERVICE COMMISSION COURSE

NOVEMBER 2010 VR CLASS

NATIONAL BOARD PRESSURE RELIEF VALVE REPAIR SEMINAR

2011 Training Courses and Seminars

COMMISSION/ENDORSEMENT COURSES

(B) Authorized Inspector Supervisor Course
TUITION: $1,495
July 11-15, 2011

(I) Authorized Nuclear Inservice Inspector Course
TUITION: $1,495
Check Web site for schedule.

(N) Authorized Nuclear Inspector Course
TUITION: $1,495
May 16-20, 2011
October 31-November 4, 2011

(IC) Inservice Commission Course
TUITION: $2,995
June 6-17, 2011
October 17-28, 2011

(NS) Authorized Nuclear Inspector Supervisor Course
TUITION: $1,495
November 7-11, 2011

(O) Owner-User Inspector Supervisor Course
TUITION: $1,495
July 11-15, 2011

(A) New Construction Commission and Authorized Inspector Course
TUITION: $2,995
June 13-24, 2011
August 15-26, 2011
September 12-23, 2011
December 5-16, 2011

CONTINUING EDUCATION SEMINARS

(RO) NEW! Boiler and Pressure Vessel Repair Seminar (Three-Day Course)
TUITION: $725
April 12-14, 2011
August 23-25, 2011
October 4-6, 2011

(VR) Pressure Relief Valve Repair Seminar
TUITION: $1,495
April 4-8, 2011
July 11-15, 2011
September 26-30, 2011

(WPS) WELDING PROCEDURE WORKSHOP
TUITION: $795
October 18-20, 2011

Miami Hyatt Chosen Host Hotel for 82nd National Board/ASME General Meeting

National Board Executive Director David Douin has announced the 2013 General Meeting will take place at the Hyatt Regency in downtown Miami, Florida. Date of the meeting will be May 13 – 17.

Connected to the Miami Convention Center and just minutes from the bustling Art Deco District of South Beach, the Miami Hyatt overlooks the Miami River and Biscayne Bay. "Having the convention center directly connected to the hotel means there will be no shortage of rooms for meeting purposes, thus keeping all General Meeting activities under one roof," noted Mr. Douin.

"In addition, the hotel offers everything we look for in determining a General Meeting host location," he said. "It's just 10 minutes from Miami International Airport, features a very reasonable room rate, and is conveniently close to great local restaurants and attractions."

The Hyatt Regency Miami is easily accessible to everything from Brickell Village and Coral Gables to the Latin flavor of Little Havana. A free elevated tram service with a hotel terminal allows hotel guests easy access to points of interest in the downtown Miami vicinity.

Additionally, the hotel features a heated outdoor pool, fully equipped gym, restaurant, deli, and a lounge overlooking the picturesque Miami River. It is also within close proximity to the Bayshore and Miami Beach golf courses.

Reminder: Technical Scholarship Deadline

Open submission period for the 2011 National Board Technical Scholarship ends February 28, 2011. Up to two $6,000 scholarships will be awarded to selected students meeting eligibility standards. Recipients will be notified of their awards by March 31, 2011.

The scholarship is available to children, step-children, grandchildren or great-grandchildren of past and present staff and members of the National Board, as well as past and present commissioned inspectors.

Application instructions and full requirements can be accessed on the National Board Web site under ABOUT US. For further information, please contact National Board Scholarship Coordinator Connie Homer by email at chomer@nationalboard.org.

Ponce, Sheeron, and Whitman Become National Board Members

New Texas Member

Luis Ponce has been accepted to National Board membership representing Texas. Mr. Ponce served 20 years as a machinist mate in the US Navy and retired as a chief petty officer. In 2003 he became deputy boiler inspector for the Texas Department of Licensing and Regulation. In 2007 he served as an inspection specialist until assuming his current role of acting chief boiler inspector in 2010.

Luis Ponce

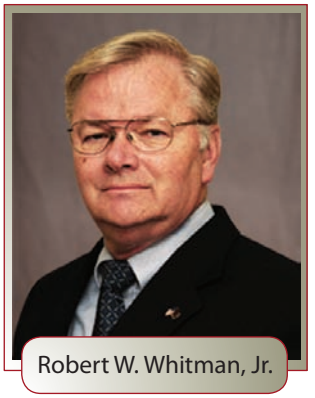
New Pennsylvania Member

Martin J. Sheeron, Jr. has been accepted to National Board membership representing Pennsylvania. Mr. Sheeron served the US Army Corps of Engineers, from 1969-1972. From 1968-1995 he was employed by the Philadelphia Naval Shipyard in various capacities working with high-pressure naval boilers. In 1995 he joined the Commonwealth of Pennsylvania as a boiler inspector and was subsequently promoted to boiler inspector supervisor, a position he has occupied for over 14 years. Mr. Sheeron also served 14 years as an ASME and National Board review team leader.

Martin J. Sheeron, Jr.

New Delaware Member

Robert W. Whitman, Jr. has been accepted to National Board membership representing Delaware. Mr. Whitman worked for E. I. DuPont deNemours & Company as an engineering specialist from 1972-2004. During that time he was a National Board owner/user inspector (1985-2004), VR shop supervisor (1998-2004), and Level II UT and VT (1995-2004). He retired from DuPont after 32 years of service. In 2004 he went to work for the State of Delaware as a senior deputy boiler inspector.



Robert W. Whitman, Jr.

Given Elected Chairman, Washington Elected Member at Large

North Carolina Bureau Chief Jack M. Given, Jr. was elected chairman of the National Board Board of Trustees at the Board's October 19 meeting. Mr. Given served as a member at large on the Board of Trustees from April 2008 until September 2010.

Additionally, New Jersey Chief Boiler Inspector Milton Washington was installed as a member at large.

Jack M. Given, Jr.

Milton Washington

Japanese Delegation Meets with National Board

Four delegates from Japan along with one representative from Scientech met with National Board senior staff on November 9. The delegates are considering revisions to their nuclear quality assurance/quality control system and wanted to learn about National Board's role in the training, examination, and commissioning of National Board nuclear inspectors.

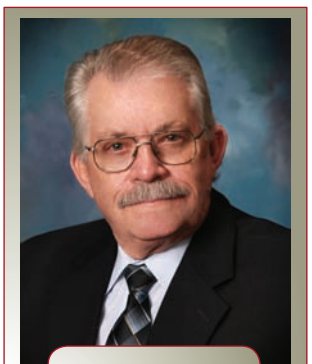
The Japanese contingent included: Mr. Itaru Saito and Mr. Toshiyuki Zama representing Japan Nuclear Technology Institute (JANTI), Mr. Kazuya Seki of The Federation of Electric Power Companies (FEPC), Mr. Yuzo Fujii representing JANUS (Japanese consulting company in the nuclear and environmental fields), and Ms. Deann Raleigh of Scientech, who coordinated the visit.

Member Retirements

Jack Davenport retired as director, boiler section, from the Commonwealth of Pennsylvania on September 25. Mr. Davenport served in the US Navy from 1961-1987 and retired as a master chief machinist mate. From 1987-1989 he was an on-site supervisor for Airco. In1989 he became a technician for Livingston HVAC before becoming a boiler inspector for the Commonwealth of Pennsylvania in 1995. In 2004 he became assistant director, boiler section, and in 2007 assumed the role of director. Mr. Davenport also became a National Board and ASME team leader in 2000.

Daniel C. Price retired as chief mechanical inspector, Yukon Territory, on August 18. Graduated from the New Brunswick Institute of Technology in 1972, he began his career as a power plant technologist in New Brunswick. In 1973 he went to work as an operating engineer and subsequently as generating plant boiler operator. He became a boiler inspector in the Northwest Territories in 1979 and served as chief inspector from 1984. In 1989 he was promoted to chief mechanical inspector in the Yukon Territory. Mr. Price took the National Board commission exam in 1994 and became Yukon's first National Board member.

James Harlan retired as acting director – senior deputy boiler inspector, from the State of Delaware on September 30. Mr. Harlan served in the US Navy from 1961-1968 as a nuclear reactor operator. From 1968-1980 he was employed by the insurance sector as a boiler and safety inspector. From 1980-1992 he worked for the State of Maryland as a senior deputy boiler inspector before assuming the role of acting director – senior deputy boiler inspector, for the State of Delaware in 1992. He served in that role for eighteen years.



Jack Davenport

Daniel C. Price

James Harlan

BLAST AT MCBAIN SCHOOL

On Friday, December 18, 1953, the halls of Northern Michigan Christian High in McBain, Michigan, were silent but for "Beat Luther" signs rallying the Christian Comets toward victory against their rivals in a home basketball game later that night.

The school's oil-fired hot water heating boiler exploded at 5:40 a.m. It rattled neighboring homes and businesses and destroyed the boiler, boiler room, and an unfinished addition being constructed on the south side of the school. Herm Heims, the school's janitor, was dressing for work when he heard the explosion. He normally arrived at the school around 5:50 a.m. each morning – just ten minutes after the blast.

According to an article in the *Cadillac Evening News* dated December 18, 1953, "the force of the explosion all but obliterated the 20x20 boiler room, leaving only portions of the flooring, covered by debris, dust, and snow." The boiler ripped apart. Pieces scattered over a wide area. The bulk of it jammed into the gymnasium door entrance. Another chunk flew approximately 150 feet and landed on the front walk of the school building. A 1,000-gallon fuel oil tank, containing about 250 gallons of oil, tore loose from its saddle and hurtled nearly 60 feet – but it did not burst.

"In this inspector's opinion, hot water heating boilers are as dangerous or more dangerous than steam boilers," wrote Royal Beckwith, state boiler inspector. His report explained that an explosion from a small hot water heating boiler can cause great destruction due to the fact that one cubic foot of water, when converted into steam, increases its volume approximately 1,700 times. His report indicated a failed aquastat and possibly a failed stack switch as cause of the explosion.

Because the incident occurred at such an early hour there were no casualties. "Had the explosion taken place two hours later, the lives of workmen in the new addition as well as the lives of the 120 students at the school would have been imperiled," reported the *Cadillac Evening News*. ✪

ONE NIGHT ONLY

LORRIE MORGAN

MAY 11, 2011

GENERAL MEETING WEDNESDAY BANQUET