# BULLETIN

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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 assuring acceptance and interchangeability among jurisdictional authorities empowered to assure adherence to code construction and repair of boilers and pressure vessels.

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Glenda Pack and Larry Battle, two members of the Sterilization Department staff at Riverside Methodist Hospital, in front of boiler No. 3. Read more about boilers and health care on Page 10.

On the Cover: (left to right) Karen Hoffman, R.N., Cynthia Rhoads, R.N., and Jill Schaefer, R.N.

*Cover photograph by Greg Sailor.*

## Cover Story



## Features



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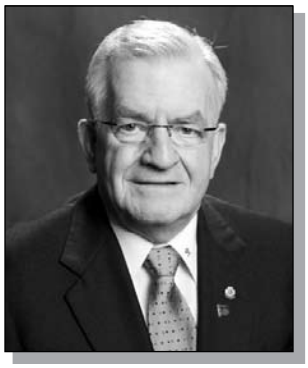


# SAFETY: Today's Decisions Preventing Tomorrow's Disasters

BY DONALD E. TANNER, EXECUTIVE DIRECTOR

One of my favorite quotations comes from an individual who knows quite a bit about life, having endured a successful military career and life as a superstar in the National Football League.

"*Spectacular achievements come from unspectacular preparation,*" was observed by the legendary Hall of Fame quarterback Roger Staubach, who — it should be noted — is now the president and chief executive officer of a large international real estate advisory firm.

Mr. Staubach's words are particularly applicable to what many boiler and pressure vessel professionals experience every day. The preparation and decisions we make are the foundation of what we can expect in the future. That is why decisions must be informed decisions reflecting input of the best information available. While it is easy to dismiss the preparation necessary for an effective decision-making process, it is diligence and choices that dictate our record of success.

Yes, the preparation is often "*unspectacular*." Perhaps even routine. But the achievement — or the continuity of public safety — is indeed "*spectacular*."

We were so much impressed with Mr. Staubach's message that we decided to use it — actually a variation thereof — at May's 76th General Meeting. To that end, we have designated our General Meeting theme: *SAFETY: Today's Decisions Preventing Tomorrow's Disasters*.

We then took things a step further by inviting Mr. Staubach himself to address the General Meeting Opening Session. He graciously accepted.

Those of you familiar with Roger Staubach — and even those who are not — are in for a very special presentation. A Heisman Trophy winner in 1963 (the year he led the US Naval Academy to a #2 national ranking), he later led the Dallas Cowboys to five National Football Conference titles, seven division titles, and two Super Bowl championships.

The 76th General Meeting promises to be another memorable five days. General Session speakers this year are all renowned experts who will provide participants with information each can take back to his or her respective profession.

As for our guests: the Monday afternoon tour should not be missed, particularly by fans of the nighttime drama *DALLAS*. Naturally, a trip to the Dallas area would not be complete without stopping at the Ewing mansion and the Southfork Ranch. On Tuesday, guests will turn their sights on another significant area landmark: Dealey Plaza, scene of the 1963 Kennedy assassination. The afternoon will feature an exceptional luncheon at the famous Neiman Marcus Zodiac Room and conclude with a visit and tour of the original Neiman Marcus store.

Be sure to pencil your calendar for six to seven o'clock Monday night. Attend the National Board's Monday reception and experience the newest and most exclusive Dallas area hotspot: the Glass Cactus, overlooking beautiful Lake Grapevine.

For race fans — and even for those who are not race fans — the Wednesday outing will be a once-in-a-lifetime experience. Our visit to the world-famous Texas Motor Speedway will not only include a tour of this massive race track but also a rare glimpse into the world of NASCAR racing. A great lunch will be served in a garage on the Speedway infield that is home to a fantastic selection of race cars. Everyone in attendance will be afforded the opportunity to take a leisurely lap around the track in an official Texas Motor Speedway pace car. For the adventurous, a ride in an official *race* car — at speeds exceeding 160 MPH — will also be available on an optional basis.

Quite a few of you approached me following last year's Wednesday evening banquet in Phoenix to bring back our featured entertainer. And so we did. Returning by popular demand — for his third National Board appearance — will be the always engaging Johnny Lee.

For those wondering what to wear at the Gaylord Texan Resort: as during the past several General Meetings, the attire will once again be business casual with ties and jackets required for the Wednesday Banquet.

Permit me to thank in advance everyone planning to attend our May 14–18 General Meeting in Grapevine. Consider it your "unspectacular preparation" for what will surely result in "spectacular achievement."

See you in Grapevine! ❖

# New Technologies Advancing Inspection Efficiency

BY AMI JOHNSTON, INFORMATION ANALYST, STATE OF UTAH

Even though the vision of a "paperless office" is difficult to imagine, especially in government, the Utah Labor Commission Division of Boiler and Elevator Safety is headed in that direction. Now the goal is to take things one step further and make our inspection process . . . wireless.

In September 2005, we decided to implement a Web-based program tailored to each inspector's specific needs. We hoped the program, by eliminating both paper and wire, would allow our inspectors to be more self-sufficient and productive. And it has.

Each of the inspectors' vehicles now serves as a mobile office. The inspectors each have a cellular phone and a laptop computer fitted with a wireless "air card." This allows them to connect to the Internet, and therefore our program, from anywhere they can receive a cell phone signal. The inspectors communicate with the office each morning via email, reporting where they will be working that day. Power inverters in the vehicle allow them to have a printer in addition to their laptops, which are now mounted in their cars similar to the method used by the Utah Highway Patrol.

Development of the program has moved along smoothly. It began with a read-only, fully functional search grid that allowed inspectors to view all units due for inspection in their area at any given time. Shortly thereafter, a print function was added. This allowed the inspector to print a list of the items needing inspection and also a worksheet containing all of the pertinent information currently on file for the unit to be used on-site to perform the inspection.

In the next phase, inspectors were given the ability to perform a few crucial updates, scrapping and inactivating units in the field. Currently they are able to submit inspection data to the office. Upon completion of an inspection, the inspector takes the worksheet back to his vehicle, connects wirelessly to the Internet, logs into our Web site, enters or updates all pertinent data, creates an inspection, clicks a button, and the process is complete. At present only Utah inspectors are able to enter inspections online, but we look forward to bringing our insurance company inspectors online when the time is right. In the future the entire inspection process, including the payment of an invoice, will be performed online.

Fifteen years ago the percentage of overdue units was nearly 100 percent; five years ago, it was nearly 50 percent. We sent nearly 20 percent of accounts to collection. The amount of time that elapsed from the date of inspection to the date the owner received a permit was more than 30 days.

Now the time and paper savings are really starting to show. The percentage of overdue units is currently 2 to 5 percent for boilers and pressure vessels. We send only 2 percent of all accounts to collection, and owners receive their permit and invoice within two weeks of their inspection. (We hope to get that down to a week or less very soon.) We have also redesigned our Web site to be more user-friendly and have made our compliance manuals available online to download, reducing our monthly paper order by 50 percent.

In addition, we have made our boiler and pressure vessel registry available online to the general public, virtually eliminating the need for Government Records Access Management Act (GRAMA) requests. This functionality is currently being used by our insurance companies and their inspectors. It contains a fully functional search grid and the ability to save the file in a tab-delimited format that can be viewed on any computer.

The Utah Labor Commission may not be the first or only jurisdiction to proceed in this fashion, but we are proud of what we have accomplished thus far and hope that we can serve as an example for other states that have not yet joined the wireless world. ❖


## PDAs for Inspection

BULLETIN research reveals that at least two jurisdictions are considering using personal digital assistants, or PDAs, in the inspection process. A PDA is a handheld device that, among other things, allows computing and Internet access through a touch screen. According to Mark Rollins, a manager with Thermo Scientific, which produces analytical instruments and laboratory equipment, a PDA would offer inspectors at least three benefits. First, it is even more portable and less obtrusive than a laptop. Second, it would allow inspectors to read and write most document formats, such as Word. Finally, it would help inspectors avoid transcription errors common to paper forms by allowing them to choose from a pop-up list of pre-defined answers. ❖

# The 2007 NBIC – "A New Era"

by Chuck Withers, Chairman, NBIC Committee

Since its beginning in 1945, the *National Board Inspection Code* (NBIC) has undergone various changes to address National Board objectives that promote stability and uniformity among jurisdictions.

To continually improve safety, we must continually move forward. Thus, the NBIC is entering a new era. This new era completely restructures the NBIC by presenting a new vision that reflects the purpose, constitution, and other important considerations of the National Board, its members, and the users of the NBIC.

Why restructure? This is easily answered when we consider the purpose of the NBIC. Since the NBIC is a postconstruction code adopted or followed by most jurisdictions and many organizations in the U.S., Canada, and other countries, we must be proactive in addressing the needs and concerns of all our users. These users have far surpassed just jurisdictions and inspectors. Today they include manufacturers, operators, maintenance personnel, contractors, installers, and other organizations and industries involved with the safety of pressure equipment.

Postconstruction activities begin with safe design and construction and include safety requirements and guidelines for installation, inspection, repairs, maintenance, and operation. Restructuring the NBIC must include the ability to expand within these areas. The vision to restructure is completed when we combine all areas of postconstruction to address our users' needs for the many types of pressure-retaining items.

The National Board Constitution provides additional guidance for this new vision to promote safety of pressure-retaining items. The objectives outlined in the constitution provide useful information to our members, inspectors, and others; promote uniform laws and regulations; and recognize and address standards for acceptance of construction, installation, repairs, and operation of pressure relief devices. These objectives have always been and continue to be a primary force in expanding and improving the NBIC. Focusing on the objectives of the NB Constitution keeps the NBIC moving forward in the right direction.

This new era of restructuring the NBIC will minimize any future need for reorganization. It will also incorporate provisions to address existing and new technologies and needs and concerns of industry and users. It will also provide flexibility for users to select their postconstruction interest and to respond to the National Board strategic direction.

Because the basis and philosophy of the NBIC always considers the jurisdiction as the final authority for safety, there is no reason why the NBIC should not be the single world-class postconstruction code of choice. Therefore, the most important consideration is to provide support for all jurisdictions worldwide to

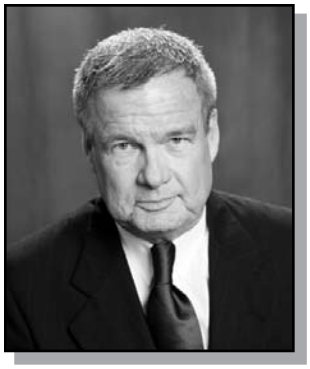
further promote the adoption and uniform use of the NBIC and, thus, improve safety both nationally and internationally.

With regard to changes, the 2007 NBIC will be divided into three separate parts (books) reflecting activities for installation, inspection, and repairs and alterations of pressure-retaining items. Each part stands alone and includes a foreword, introduction, table of contents, glossary, and other appropriate sections needed to address each postconstruction activity. A consistent and complete renumbering and reorganization of each part is made to easily cross-reference and identify specific requirements. Tables, figures, and photographs are clearly identified with the same identification as the referencing paragraph. Each part is similarly organized to assist users in finding requirements within each of the parts. The concept of mandatory and nonmandatory appendices no longer exists.

Coinciding with the restructuring of the NBIC, the committee structure is changed to incorporate subcommittees that will assume full responsibility for developing, expanding, and improving information within each part. Obtaining the needed expertise to support the continued improvement and expansion of each part in the NBIC requires adding a new level of subgroups to function and work under each subcommittee. Any subcommittee or subgroup can then initiate ad hoc task groups for any specific need and disband these groups when the work is completed. The consensus process required by the American National Standards Institute (ANSI) remains with the NBIC main committee, in which no change has been made.

As restructuring progresses, the process of making this new vision a reality is not just being carried out by the National Board and its jurisdictional members. All the hard work and effort by each member of all the NBIC committees has greatly contributed to accomplishing this monumental undertaking. Although there is a tremendous amount of work still to be accomplished, the joint effort put forth by all has ensured the vision will soon be a reality: the new NBIC is scheduled for publication by December 31, 2007.

The new era of the NBIC will afford the greatest flexibility for unlimited expansion to address the needs and concerns of all users involved in all postconstruction activities. Flexibility is provided for users to choose postconstruction categories of interest as well as the ability to purchase all or one part of the NBIC based on their needs and concerns. The vision to combine flexibility with updating and expanding information and providing user-friendly formatting will assist in promoting the use of the NBIC and ultimately improve safety worldwide. ❖



# Synopsizing the Synopsis

BY PAUL BRENNAN, DIRECTOR OF PUBLIC AFFAIRS

Over the past five summers, the National Board has personally contacted jurisdictional authorities to update entries for the annual National Board *SYNOPSIS OF BOILER AND PRESSURE VESSEL LAWS, RULES AND REGULATIONS.* The result is corrected regulatory data — covering each participating state, province, or city — available at no charge on the National Board Web site.

Because most of the modifications to the *SYNOPSIS* are ongoing and many are of a subtle nature, it can be somewhat difficult to ascertain what, if any, jurisdictional changes occur year to year. It is for this reason we have digested below information received this last summer and identified some of the more significant amendments.

First, the jurisdictions reporting no change. They include: Connecticut, Georgia, Idaho, Illinois, and Saskatchewan (although some modifications may be imminent in the last two jurisdictions), New York, Ohio, Rhode Island, South Dakota, Virginia, New York City, Detroit, Los Angeles, Buffalo, and Northwest Territories.

Note that a number of jurisdictions identified only minor changes, i.e., new addresses, phone or fax numbers, email addresses, Web sites, department switches, new date of law passage, and the like. These jurisdictions are: Alabama, Delaware, Hawaii, Kentucky, Missouri, North Dakota, Oklahoma, South Carolina, Wisconsin, Miami (Dade County), Chicago, Newfoundland & Labrador, and Prince Edward Island.

Jurisdictions reporting more significant regulatory modifications are listed below, followed by *SYNOPSIS* sections in which the change(s) occurred. Although many of the changes are minor, *SYNOPSIS* users should consult revised jurisdiction pages for a full review of modified programs.

**ALASKA** — *Rules for Construction and Stamping* and *State Fees*; **CALIFORNIA** — address, amendment date, and *Inspections Required*; **COLORADO** — *Empowerment*, *Date of Law Passage*, *Miscellaneous,* and major changes to *Rules for Construction and Stamping*, and *Inspection Schedule*; **FLORIDA** — *State Department* and *Empowerment*; **INDIANA** — *Rules for Construction and Stamping*; **IOWA** — *Date of Law Passage*, *Rules for Construction and Stamping*, *Miscellaneous,* and major changes in *State Fees*; **KANSAS** — *Fee Schedule*; **LOUISIANA** — *State Department*, *Date of Law Passage*, and *Rules for Construction and Stamping*; **MASSACHUSETTS** — *State Department* and *Rules for Construction and Stamping*; **MICHIGAN** — *State Department*, *Rules For Construction and Stamping*, and *Miscellaneous*; **MINNESOTA** — *State Department*, *Date of Law Passage*, *Rules for Construction and Stamping*, *Insurance Inspection Requirements*, and *Miscellaneous*; **MISSISSIPPI** — address, and *Objects Subject to Rules for Field Inspection*; **MONTANA** — address, *Date of Law Passage*, and *Inspections Required*; **NEBRASKA** — *Date of Law Passage*, *Certificate of Inspection*, and *State Fees*; **NEVADA** — *State Department*, *Date of Law Passage*, and *Miscellaneous*; **NEW HAMPSHIRE** — *State Department*, *Certificate of Inspection*, and *Miscellaneous*; **NEW JERSEY** — *State Department*, *Date of Law Passage*, *Objects Subject to Rules for Construction and Stamping, Certificate of Inspection,* and major changes to *Rules for Construction and Stamping*, *Objects Subject to Rules for Field Inspection*, *State Fees*, and *Miscellaneous*; **NORTH CAROLINA** — minor changes throughout and major changes to *State Fees*, and EXEMPTIONS under *Objects Subject to Rules for Construction and Stamping*; **OREGON** — *State Fees*; **PENNSYLVANIA** — minor changes throughout and major changes to *Certificate of Inspection*, *State Fees*, and *Miscellaneous*; **TENNESSEE** — minor changes throughout, expanded *State Fees*; **TEXAS** — *Date of Law Passage* and *Rules for Construction and Stamping*; **UTAH** — *State Fees* (phone number) and major changes to *Rules for Construction and Stamping*; **VERMONT** — address and major changes to all sections; **WASHINGTON** — address and *Rules for Construction and Stamping* and *Miscellaneous*, major changes to *State Fees*; **WEST VIRGINIA** — *Date of Law Passage* and

*Rules for Construction and Stamping*; **DENVER** — *Date of Law Passage*, *Rules for Construction and Stamping*, and *Municipal Fees*; **NEW ORLEANS** — address, *Date of Law Passage*, and *Municipal Fees*; **OMAHA** — address, and *Rules for Construction and Stamping*; **ALBUQUERQUE** — *Rules for Construction and Stamping*, *Objects Subject to Rules for Construction and Stamping*, *Objects Subject to Rules for Field Inspection*, *Insurance Inspection Requirements*, and *Miscellaneous*; **PUERTO RICO** — address, *Rules for Construction and Stamping*, and *Fees*; **SEATTLE** — address, *Date of Law Passage*, *Rules for Construction and Stamping*, *Fees*, and *Miscellaneous*; **SPOKANE** — address, *Empowerment*, *Inspections Required*, and *Fees*, major changes to *Rules for Construction and Stamping,* and *Objects Subject to Rules for Construction and Stamping*; **MILWAUKEE** — address and *Rules for Construction and Stamping*; **ALBERTA** — address, *Date of Law Passage*, *Rules for Construction and Stamping*, *Objects Subject to Rules for Field Inspection*, *Fees*, and *Miscellaneous*; **BRITISH COLUMBIA** — *address*, *Date of Law Passage*, *Rules for Construction and Stamping*, and *Fees*; **NEW BRUNSWICK** — *Rules for Construction and Stamping,* and *Objects Subject to Rules for Field Inspection*; **QUEBEC** — *Fees*.

## CSD-1 UPDATE

It has been reported that several CSD-1 references in the *SYNOPSIS* are either incomplete or inconsistent with data posted on jurisdiction Web sites. For example, the **Louisiana** *SYNOPSIS* section reflects *no* ASME CSD-1 reference but should, in fact, list the 1995 Edition (*Part CM excepted*) with 1996 and 1997 Addenda. **Nevada** reports that in addition to 2004 ASME CSD-1 (listed in the *SYNOPSIS*), it also subscribes to the 1998 Edition with Addenda.

For **Virginia**, the *SYNOPSIS* identifies acceptance of 1998 Edition Parts CW and CF. Part CG should be included as well.

Three states *not* listing CSD-1 on their respective jurisdiction Web sites actually *have* adopted these important standards: **New Mexico** (1998 Edition), **Rhode Island** (current edition), and **South Carolina** (2001 Edition).

While **Tennessee** lists current ASME CSD-1 edition on the state site, it has actually adopted the 1998 Edition.

As with Tennessee, two additional jurisdictional Web sites listing current editions have adopted the 1998 Edition: **Maryland** (1999 Addendum CSD-1a 1999 Edition) and **Utah** (2001 Addendum CSD-1a 1999 Edition).

**Washington** has included adoption of the 2002 Edition standard on its jurisdiction Web site, but prematurely listed the 2004 Edition in the *SYNOPSIS*. At this writing, it is anticipated the 2004 Edition will be adopted late 2006.

Above mentioned *SYNOPSIS* pages requiring changes or clarification of ASME CSD-1 standards have been modified.

As always, it is recommended *SYNOPSIS* users consult the jurisdiction chief inspector before reaching any decision that may have critical impact or significant financial consequences. ❖

# Super Boiler Project

By Rick Knight, Gas Technology Institute, and Dan Willems, Cleaver-Brooks, Inc.

A development program prompted by the US Department of Energy (USDOE) and dubbed the "Super Boiler" project could save US industry nearly $8 billion per year in energy consumption.

Ever since John Cleaver and Raymond Brooks pioneered the development and production of packaged boiler equipment in the 1930s, the packaged boiler industry has worked hard to make products safer, more economical, and easier to operate. But despite those efforts, rapidly increasing fuel costs and stricter clean air standards have outpaced the ability of the boiler industry to keep up with the latest cutting-edge approaches to performance improvement. Gas-fired industrial steam boilers alone consume 3.6 quadrillion Btu of fuel and emit about 72,000 tons of $NO_x$ per year. Most of those boilers are more than 40 years old and use dated designs not optimized for either efficiency or emissions.

To address this, the USDOE solicited proposals in 1999. The organization chosen to lead the project was the Gas Technology Institute (GTI) of Des Plaines, Illinois. GTI was given strong support from the natural gas industry through the Gas Research Institute and other funding bodies. In 2002, Cleaver-Brooks, Inc. of Milwaukee, Wisconsin, joined the project team.

Since then, GTI and Cleaver-Brooks engineers have designed a compact firetube boiler system that can achieve 94 percent (HHV) efficiency simultaneous with $NO_x$ emissions below 5 ppmv (corrected to 3 percent oxygen). This performance was proven in a laboratory test boiler of 90 horsepower capacity. GTI engineers have calculated that nationwide application of the Super Boiler could potentially save 600 trillion Btu and 62,000 tons of $NO_x$ annually. At a natural gas price of $8 per million Btu, this will save US industry $5.6 billion per year, in addition to avoiding 23 billion tons per year of greenhouse gases.

The ultra-high efficiency of this first-generation Super Boiler prototype is realized with a compact heat recovery system that features nanoporous membrane technology in a patented Transport Membrane Condenser (TMC) and Humidifying Air Heater (HAH). The TMC/HAH system removes water vapor from the flue gas and recovers both sensible and latent heat to increase energy efficiency by 8 to 10 percent over a typical firetube boiler. The reduced $NO_x$ emissions result from a staged combustion approach with interstage cooling that is integral to the boiler design. The approach can achieve this unprecedented $NO_x$ reduction at very low excess air for additional efficiency gain while still maintaining excellent CO burnout. The firetube Super Boiler also uses an advanced convective pass design with extended surfaces which, together with the compact intercooled furnace design, delivers a 40 percent smaller size than conventional boilers of similar output.

In April 2006, the project team began the first industrial field demonstration of the Super Boiler heat recovery system installed on a boiler incorporating the new convective pass design but using a conventional ultra-low-$NO_x$ burner. The system, with close monitoring by GTI engineers, is currently in operation at a manufacturing plant in Alabaster, Alabama, and has been supplying all of the facility steam needs since July 2006. Fuel-to-steam efficiency has been confirmed in the range of 93 to 94 percent, and $NO_x$ in this case is maintained below 9 ppmv.

Cleaver-Brooks plans to license the technology from GTI and, subject to the outcome of field demonstrations, may proceed to introduce the heat recovery technology by the end of 2007. Plans are also in the works for the application of Super Boiler technology to large industrial watertube boilers with high-pressure superheated steam capability. The application of the technology to industrial watertube boilers is estimated to save US industry an additional $2.1 billion annually, which, in addition to applying the technology to firetube boilers, would bring the total financial benefit to nearly $8 billion per year. ❖

# Steam Its Vital

It is a fact: Americans are growing older. According to a 2005 report from the Centers for Disease Control and Prevention (CDC), by 2050, one in eight Americans will be 75 years of age or over.

As we do grow older, we can face health challenges related to chronic conditions. Sometimes these conditions require hospitalization. Thus, in the coming years, the role of hospitals in caring for Americans, including the elderly, will grow increasingly important.

Something contributing to that care — something often overlooked — is steam. From heating rooms to sterilizing surgical instruments, steam and the boilers producing it are an essential part of a hospital. This is no more readily apparent than in a hospital such as Riverside Methodist Hospital in Columbus, Ohio.

Riverside, which opened in 1892, employs 5,800 people and works with a medical staff of 1,200 doctors. From 2001 through 2005 it was named to the "100 Top Hospitals: National Benchmarks for Success" list by Solucient, a leading health care information company. In 2006 Riverside was named — for the fifth year in a row — to the *U.S. News & World Report* annual ranking of "America's Best Hospitals" for excellence in patient care.

With regard to the ranking, Bruce P. Hagen, president of Riverside, says, "For Riverside to be recognized on this prestigious list of the top hospitals in the nation is truly a tribute to our physicians, nurses, staff, and volunteers. It is affirmation of what our patients think, the quality of care we deliver, and the commitment of our physicians and employees."

"The power plant, with its six watertube boilers running 24 hours a day and 365 days a year, is in effect the heart of the hospital."

*Photography by Greg Sailor*

# Role in Health Care


Courtesy of Riverside Methodist Hospital, Columbus, Ohio.

Of course many of those employees are not involved directly with patient care. But what they do behind the scenes is just as crucial to a patient's well-being as what doctors and nurses do on the hospital floor. Two such employees are Chris Maples and Ann Fryrear.

Maples is one of five managers in Facilities Engineering. He has worked at Riverside since 1984 and manages the paint shop, plumbing shop, and power plant. "It keeps me busy," he says. "I can't tell you how many pairs of shoes I've worn out in 22 years." He started at Riverside as a mechanic and in 1991 began working in the power plant. In 1992 he became a licensed boiler operator, and in 2000, a manager.

The power plant, with its six watertube boilers running 24 hours a day and 365 days a year, is in effect the heart of the hospital. Built in 1958, it is 135 feet long and 70 feet wide. It houses the boilers and associated equipment, some of the chillers, and two emergency generators. The plant employs four

Chris Maples

Boiler operators Tom Looker, left, and Woody Sarver work on boiler No. 6.

full-time licensed boiler operators and two relief operators, who are also mechanics.

The six boilers all have their original burners. Numbers 1-5 were built by Erie City Iron Works. Numbers 1-3 were installed in 1958 and numbers 4 and 5 in 1968. Each produces 14,000 pounds of steam per hour. Number 6, built by Nebraska Boiler and purchased for $500,000, was installed in 1992. It produces 30,000 pounds of steam per hour.

The boilers have been rated at 160 psi, but run at 115 psi. Each has two safety valves, one set at 140 psi, the other at 145 psi. The primary fuel is natural gas; the backup fuel is No. 2 fuel oil stored in a 20,000-gallon underground tank. That amount, Maples says, may last no more than 24 hours during very cold weather. Exhaust flows into a common chimney built in 1958 — a white-brick chimney with black-brick top. The chimney stretches 154 feet.

Water for the boilers is manually mixed with four chemicals before being pumped into the boilers. The chemicals are a polymer dispersant, which holds dissolved solids in boiler water in suspension for removal by blowdown; a neutralizing amine, which exits the boiler with steam to raise condensate pH (which in turn helps protect condensate return piping); an oxygen scavenger, which works with the deaerating feedwater heater to remove free oxygen from boiler water; and an alkalinity booster, which raises the pH of boiler water.

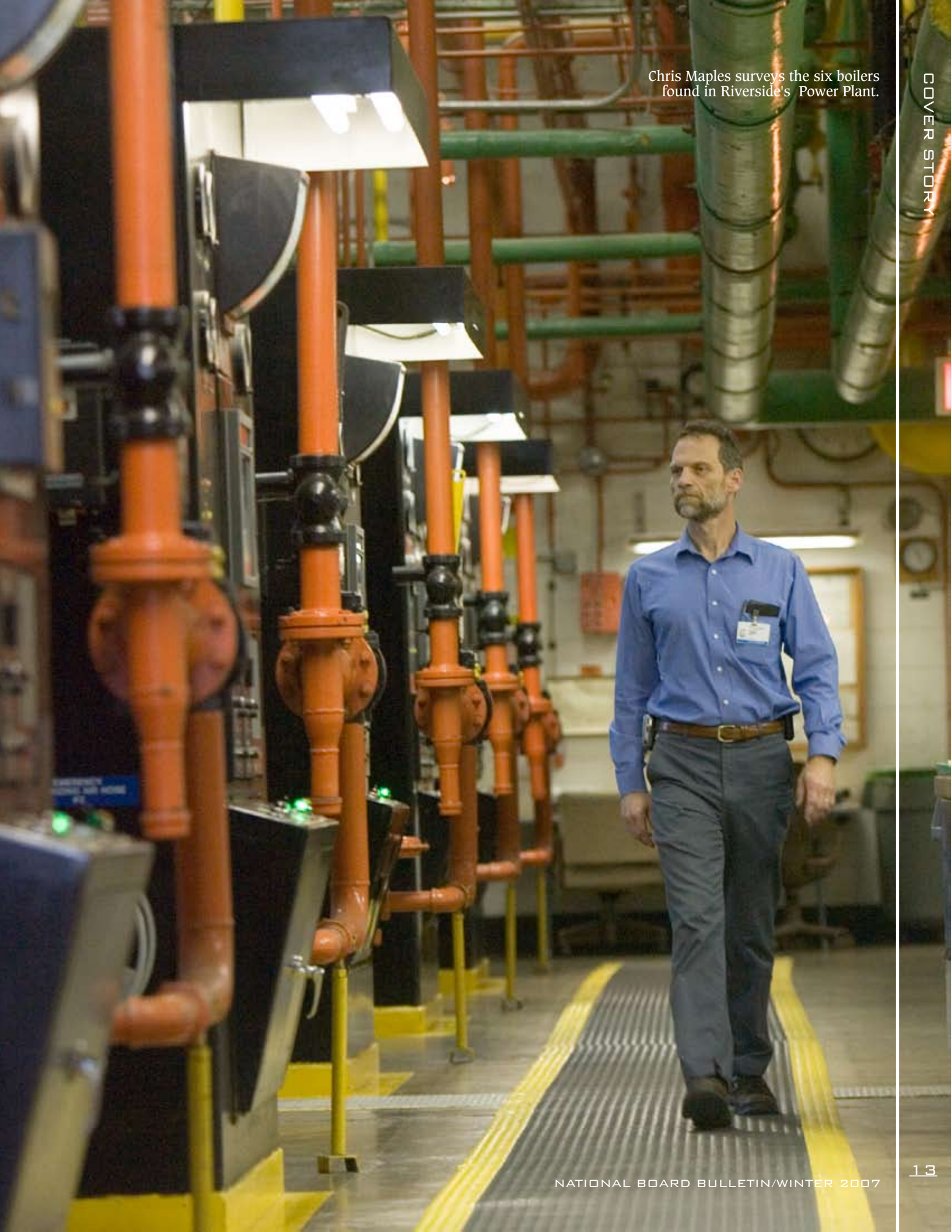
Besides periodic maintenance, which includes daily chemical tests, weekly blowdowns, and monthly safety checks, the boilers are cleaned once a year. This is done when, according to the *Ohio Boiler Code*, they are opened for annual inspection. Every other month, one boiler is shut down to be inspected. The other five remain running to ensure Riverside's steam requirements are not jeopardized in any way.

The boiler will be down from one to three weeks. During this time, the manholes, handholes, firebox, flue passages, and low-water cut-off are opened. The drums are inspected for pitting and scaling. Loose debris is swept up and removed. Every other year the tubes are cleaned with a water jet. In the firebox, loose bricks are put back into place; baffles checked for misalignment and, if necessary, reset; corner joints patched; and the tubes checked for bulging. Any problem with feedwater or blowdown piping is addressed, and the sight glass changed. Since the power plant is primarily gas-fired, there is no need to blow soot.

The boilers provide steam for an area of 2-1/2 million square feet. "The hospital," Maples says, "is like a giant black hole sucking up our steam." Eighty-five percent of the steam returns as condensate.

So what do those continuously running boilers provide steam for? Seven things: humidification, air conditioning, domestic water heating, space heating, cooking, a snow-melt system, and the sterilizing of fungi, spores, bacteria, and viruses that can attach themselves to surgical instruments and cause a patient's illness or death. Of those seven things, the last, at least with regard to health, is the most important.

Despite advances in medicine, infection of surgical wounds remains a problem. According to a 1999 special report issued by the CDC, surgical site infections (SSIs) are the third most frequently reported infection acquired in a hospital or hospital-like setting. Of those kinds of infections,



Chris Maples surveys the six boilers found in Riverside's Power Plant.

Woody Sarver inspects boiler No. 2.

SSIs account for 14 to 16 percent. Factors that may influence the development of SSIs include the patient's age and nutritional status, length of pre-operative stay, pre-operative skin prep, length of surgical scrub, ventilation in the operating room, and length of operation. Another factor is inadequate sterilization of surgical instruments.

For example, in June 2006, a prominent California hospital notified 80 patients they might be at risk for HIV and hepatitis because an instrument used in their surgeries might have been inadequately sterilized. The patients had had stomach reduction surgery or a procedure for gastro-esophageal reflux disease over a period from March 2005 to April 2006. The instrument used was a "bougie," a thin rubber tube that measures the size of the esophagus and the depth of the stomach. Hospital policy required the bougies be sterilized with Betadine solution, alcohol, and a third disinfectant called Steris, which was not used.

According to the CDC, there were 45 million inpatient surgical procedures in the U.S. in 2004. On average Riverside has 95 surgeries a day. During the year 2005, it had more than 23,000. Thus, its sterile processing department (SPD) is continuously sterilizing instruments such as scissors, scalpels, and forceps.

Common methods of sterilization involve the use of chemicals, gas, radiation, and high-pressure steam. Steam sterilization, when it can be used on an instrument (not all instruments, such as an endoscope, can withstand heat and moisture), is the preferred method because it is fast, inexpensive, and the most effective in killing microbes. It is primarily effective because it softens a microbe's protective outer layer, which causes the microbe's sensitive interior to coagulate.

The device most often used with high-pressure steam is a pressure vessel called an autoclave. The word autoclave comes from the Greek word for *automatic*, *auto-*, and the Latin word for *key*, *clāvis*. An autoclave is designed to automatically lock shut when pressurized; thus, a person cannot open it accidentally and get burned with steam.

A precursor of the autoclave, the steam digester or pressure cooker, was invented in 1679 by Denis Papin, who was also one of the inventors of the steam engine. In 1884, an assistant of Louis Pasteur, Charles Chamberland, using the model of Papin's pressure cooker, invented an early version of the autoclave.

In autoclaves, steam enters the chamber jacket, passes through an operating valve, and flows into the chamber at the rear behind a baffle plate. The steam flows forward and downward through the containers of surgical instruments and exits at the front bottom. A pressure regulator maintains jacket and chamber pressure at a minimum of 15 psi, the pressure needed for steam to reach 250°F (121°C)—the temperature that kills any living organism.* A safety valve protects against overpressure.

In general, autoclaves use one of two steam cycles: gravity displacement or dynamic air removal. In the former, displaced air flows through a steam-activated valve out the drain; in the latter, which is more efficient, a vacuum removes air before steam enters the chamber. In both, the temperature in the chamber increases as pressurized steam replaces air.

The cycles progress through three stages: conditioning, exposure, and exhaust. In the conditioning stage, air is removed, steam enters the chamber, and the load is heated to a set temperature. In the exposure stage, the load is subjected to high-pressure steam for a scientifically determined time called the thermal death time (TDT). This is the time required to kill a known population of microbes at a set temperature. Temperature and time are inversely related: if the temperature is increased, TDT decreases; if the temperature is decreased, TDT increases. Total time during the exposure stage consists of heating time, actual

*Or usually kills any living organism. In 2003, a single-celled microbe discovered in a magma vent in the Pacific Ocean not only survived in an autoclave for 24 hours at 250°F but multiplied. At 266°F, it stopped multiplying but survived. Scientists dubbed it "Strain 121."

kill time, and, to ensure safety, additional time equal to 50 percent of the kill time. Finally, in the exhaust stage, steam is replaced with air, and the chamber returns to atmospheric pressure.

The sterilization process does not start when instruments are loaded into an autoclave; it starts before they even reach it. According to Ann Fryrear, the day-shift supervisor in the Riverside SPD, the instruments first pass through two major areas: decontamination and assembly. In each area, detailed procedures are followed.

In the decontamination room, which is separated from the sterilization room by a wall of steam-heated washers, soiled instruments are disassembled, cleaned by hand, and placed into baskets. The baskets are loaded into the washers and cleaned with detergent for fourty minutes. In the sterilization room, the baskets are removed from the washers, the instruments reassembled, and each checked for cleanliness and functionality. The instruments are then placed in containers with lids or wrapped with blue sterilization wraps. The blue-wrapped packs and sealed containers, which are porous enough for steam to penetrate, are placed onto carts, and the carts loaded into the autoclaves.

The SPD is a 24-7 operation with four double-loading autoclaves in the department and an additional eight

Cynthia Appiagyei loads an autoclave with surgical instruments.

Ernie Kallay shelves surgical instruments.

single-unit sterilizers in the surgery suite. Because the autoclaves in SPD are continually running, replacing the steam filters can be a problem for Maples. Once a month he sends an employee to SPD to change the filters. "He just has to sit there and wait until the autoclaves are done," Maples says.

The autoclaves usually maintain a pressure of 30 psi, which generates a temperature of 270°F (132°C), more than enough to kill any living microbe. The cycle runs for an hour and a half and includes a cool-down period of thirty minutes. In each load a biological specimen known for its resistance to steam sterilization, *Geobacillus stearothermophilus*, is placed to ensure the time and temperature are sufficient to kill all microbes. Although Riverside is only required to run a biological test once a day (and with every implantable device), Fryrear says for safety's sake, Riverside runs a test with every load.

When the load is finished, the specimen is placed in an incubator. If after three hours there is any growth of spores, which Fryrear says is very rare, the load is recalled and sterilized again. If there is no growth, the containers of instruments are shelved until needed. Sealed containers are considered sterile for six months; those in blue-covered packs are considered sterile indefinitely.

The detailed procedures followed by Fryrear and her staff in SPD ensure every instrument will be thoroughly sterilized before reaching the operating room. But the contribution of Chris Maples and his staff in the power plant cannot be overlooked. After all, the steam generated by boilers makes sterilization by autoclave possible. Thus, the constant monitoring and upkeep of the boilers is essential; for if the hospital's steam requirements are jeopardized, something else — something all-important — is put at risk: the health of patients. ❖

Sources:
- Howard Judelson, "Operation of the Autoclaves," June 28, 2004.
- Gayla Tilton and Myrna Kauffman, "Sterilization: A Review of the Basics," *Managing Infection Control*, June 2004.

# Storage Vessels for High-Pressure Hydrogen

by Francis Brown, Staff Engineer

In his 2003 State of the Union address, President George W. Bush launched the hydrogen fuel initiative. The major thrust of the hydrogen initiative is directed toward the transportation industry, which consumes 2/3 of the 20 million barrels of oil used daily in the U.S. The goal of this initiative is to have a clean, cost-competitive alternative to gasoline by 2015. Clean-burning hydrogen gas is the preferred alternative to gasoline.

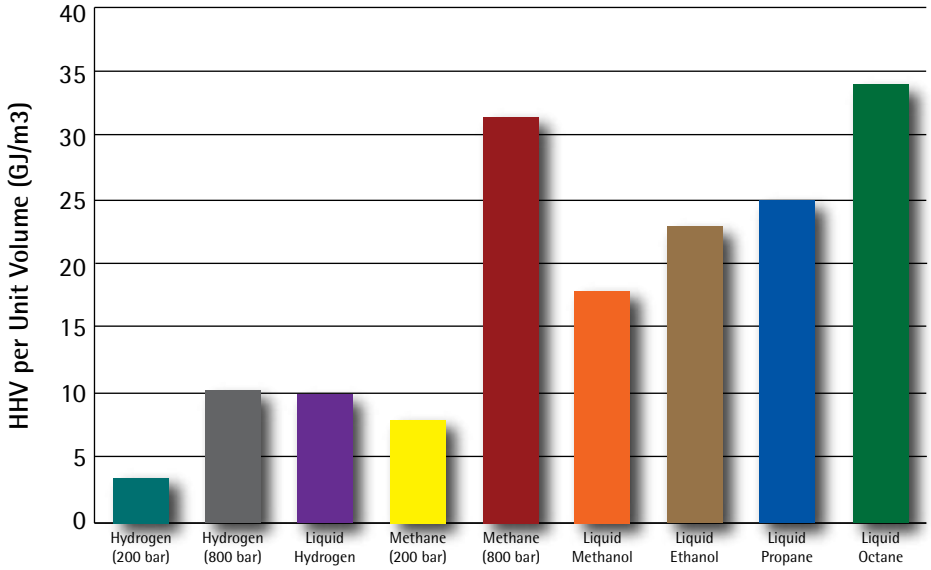
A major problem of using hydrogen as a fuel is its low volumetric energy density. As shown in figure 1, the energy density of hydrogen at 800 bar (11,600 psi) is less than 1/3 of the energy density of octane (gasoline). In fact, hydrogen has the lowest volumetric energy density of any of the commonly used fuels. As a consequence, hydrogen gas must be stored at high pressure to obtain a reasonable energy density. Currently, plans call for storage vessels for hydrogen to have a maximum allowable working pressure (MAWP) of 15,000 psi. Because of its properties, storage of hydrogen gas is a major concern.

Moderately sized metallic pressure vessels require thick walls to contain a 15,000 psi gas. For example, at 15,000 psi, a 48-inch diameter vessel made from a 135,000 psi ultimate tensile strength steel will have a wall thickness of five inches or more. The manufacture of heavy wall vessels is problematical, requiring the plate to be hot-rolled with lengthy welding times, postweld heat treatments, etc. Requirements for the manufacture of steel vessels for the storage of high-pressure hydrogen gas is expected to be defined in the *ASME Boiler and Pressure Vessel Code*, Section VIII, Division 3, beginning with the 2007 edition. Moderate-sized steel vessels will be extremely heavy for installation at the neighborhood gas station. A 48-inch diameter vessel with a five-inch wall 20 feet in length will weigh over 56,000 pounds.

Metallic vessels for storage of hydrogen will be qualified by a thorough stress analysis and a fracture mechanics evaluation. Each vessel will be subject to extensive nondestructive examination (NDE) as required by ASME Section VIII, Division 3. Each vessel will also be hydrostatically tested to a pressure of not less than 1.25 times the design pressure.

Because of manufacturing complexity and the weight of heavy-wall steel vessels, storage vessels for hydrogen gas will most likely be fabricated of composite materials. A vessel constructed of composite materials consists of a metallic or nonmetallic liner with a fiber-reinforced plastic (FRP) over-wrap. An FRP over-wrap is a reinforcing fiber, such as glass or carbon, combined with a thermoset resin

**Figure 1 – Higher Heating Value per Volume for Different Fuel Options***




*Ulf Bossel, Baldur Eliasson, and Gordon Taylor, "The Future of the Hydrogen Economy: Bright or Bleak?" April 15, 2003.

(plastic) per a specified procedure to make the material (called a laminate) and the vessel shell and heads simultaneously.

One version of a composite vessel consists of a metallic cylindrical liner with a FRP reinforcing wrap with the heads not wrapped (composite reinforced pressure vessel, or CRPV). The FRP wrap is a continuous unidirectional filament of glass or carbon circumferentially wound in a systematic manner under controlled tension over the metallic liner. The FRP wrap is cured in place. The metallic liner and the FRP wrap share the circumferential pressure load with longitudinal loads carried only by the metallic liner. Nozzles or openings are permitted only in the heads. The maximum design pressure for this proposed vessel is 15,000 psi with a maximum service life of 20 years.

Composite vessels may also be constructed of a plastic liner completely wrapped (including heads) by FRP. All loads are carried by the laminate. The laminate used for this type of vessel also consists of a continuous filament of glass or carbon wound in a systematic manner under controlled tension over the plastic liner. The FRP wrap is cured in place. Nozzles or openings are only permitted on the longitudinal centerline of the vessel. Maximum design pressure for this vessel is also 15,000 psi with a maximum service life of 20 years. An all-composite vessel will be significantly thicker than a similar all-steel vessel, but is expected to weigh less than half of an all-steel vessel.

Composite materials are characterized by the burst ratio and the stress ratio. The burst ratio is the ratio of the minimum pressure required to rupture the vessel compared to a specified lower pressure. For composite pressure vessels the burst ratio is the burst pressure compared to the MAWP. Stress ratio is the ratio of the stress in the reinforcing fibers at working pressure to the initial ultimate tensile strength of the fibers, as demonstrated by short-term burst tests. Proposed FRP material will have a burst ratio on the order of 2.25 and a stress ratio of 0.40.

The CRPV described above will be designed by analysis (including fracture mechanics) with the laminate qualified by testing a prototype vessel(s). Tests include the weight percent of fiber in the laminate, a visual examination for defects, a Barcol hardness test, volumetric expansion test, and an acoustic emission test. As a minimum, one prototype vessel must be cyclic pressure-tested for 33,000 cycles followed by a hydrostatic pressure test. In the hydrostatic pressure test, the vessel is pressurized to 1.732 times design. After 60 seconds of hold time, the pressure is increased to burst pressure. Design rules and qualification test requirements for composite-only vessels are in the development stage.

Storage vessels having an expected life of 20 years must be inspected periodically for damage and material degradation. For the inservice inspection of hydrogen storage vessels, damage and material degradation must be identifiable, acceptance criteria must be established, inspection frequency defined, and examination techniques established. There is an extensive knowledge and history of inservice inspection of steel vessels, so this topic will not be discussed in this article.

Types of damage and degradation of composite vessels include crazing, delamination, impact damage, fatigue, stress corrosion cracking, etc. What is the appearance of the damage and degradation in composite vessels? For example, does discoloration indicate FRP delamination? Each type of damage to which a composite vessel may be subject needs to be identified and described.

Any change in the vessel from the as-manufactured condition can be considered damage. Therefore, acceptance criteria are required to establish if the damage is significant or insignificant. The point at which damage is so severe the vessel must be withdrawn from service must be defined. Acceptable damage limits for continued vessel service are required. Acceptance criteria may not only define the limits of acceptable severity of a damaged area, but also spacing of damaged areas.

Inspection frequency of both steel vessels and composite vessels, although different, needs to be determined. Should the inspection frequency be calendar-based or risk-based inspection?

NDE techniques that can be used for steel vessels are well defined. It is expected ultrasonic examination techniques will be the primary means of examining steel vessels. Currently a visual examination is the primary means of inspecting a composite pressure vessel. However, liquid penetrant techniques can be used to detect surface cracks. Other NDE techniques, such as radiography and ultrasonics, do not provide meaningful results.

A few items remain to be addressed before steel high-pressure hydrogen storage vessels can be placed in service. A larger number of items need to be addressed before composite vessels can be placed in service. The clock is ticking; 2015 is not that far off. ❖

*Heard it Through the Grapevine . . .*

# The General Meeting Heads to

Pioneers, livestock, gunfights. Visitors might think they're back in the Old West, but this is all part of the Main Street Days celebration in Grapevine, Texas, located 21 miles northwest of Dallas. The annual May celebration, which in 2007 will mark its 23rd year, is just one event visitors can enjoy in this Texas town.

Grapevine, on the Grape Vine Prairie near Grape Vine Springs, got its name from the tart, wild Mustang grapes covering the area. It is the oldest settlement in Tarrant County, started in 1844, a year before the Lone Star State became part of the United States.

In October of that year, General Sam Houston and fellow Republic of Texas Commissioners camped at Grape Vine Springs to meet with leaders of several Native American nations. The historic meeting ended in the signing of a "peace, friendship, and commerce" treaty, paving the way for settlement of the area by early western pioneers. Before it was named Grapevine (one word) in 1914, this small community was known by a variety of different names, including Cross Timbers (1846 to 1851), Grape Vine Springs, Leonardville, Dunnville, and Grape Vine.

For more than 100 years after its settlement, Grapevine grew slowly. But the opening of the Dallas/Fort Worth International Airport in 1974 spurred tremendous expansion in the city and nearby areas. In 1960 the Grapevine population was 2,821; in 1990 it was 29,202. Today the estimated population (as of July 2004) is 47,500, an increase since the year 2000 of more than 5,000 people.

A thriving population has brought a booming tourist industry to the "small" town. Today, a visitor can find much to do in Grapevine and the surrounding area.

Any time of the year, while visiting this particular region of Texas, you'll find a large number of wineries featuring local sparkling wines and champagnes.

Grapevine's Historic Main Street.

# Texas!

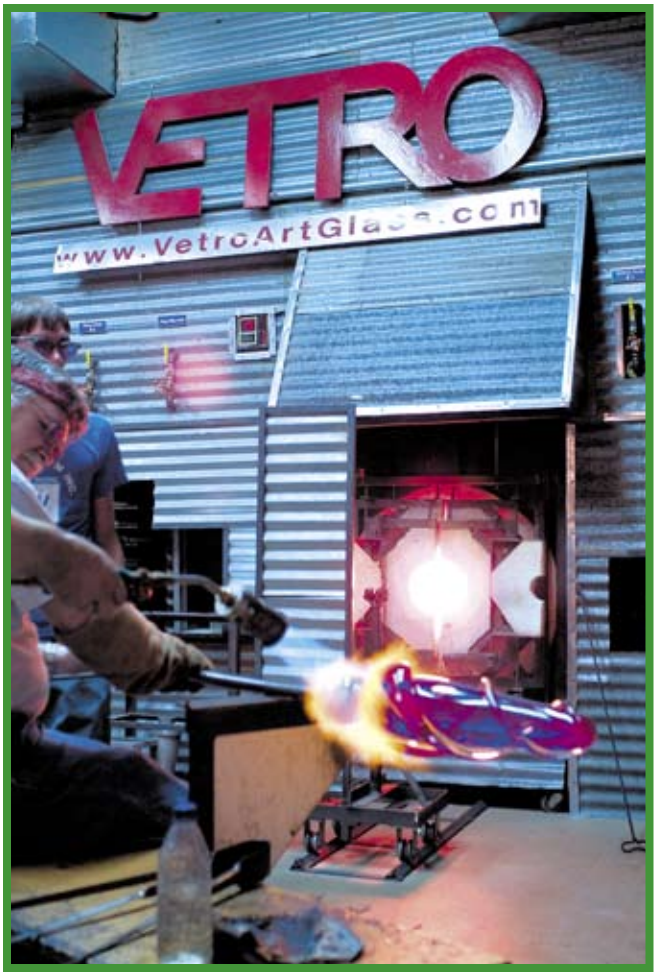

Several of the wineries offer tours, and for a small fee, a variety of wines can be sampled. Follow the Grapevine Wine Trail one afternoon and visit up to seven different wineries, learning about grape growing and winemaking in Texas.

Two of the area's popular wineries, La Buena Vida, shown left, and The Delancey Winery.

Another popular tour is the Grapevine Vintage Railroad, which connects Grapevine with the Fort Worth Stockyards. This excursion takes place on a beautifully restored 1896 steam locomotive and includes turn-of-the-century Victorian coaches and open-air patio cars. This afternoon trip links together several historic communities as it celebrates the "Cotton Belt Route" of the 1870s.

Looking for musical entertainment? The Palace Theater, home of the Grapevine Opry, seats more than 500 and is located right on Main Street. Throughout its history, it has seen headliners such as Willie Nelson, Charlie Walker, and the Judds.

In the mood for a little shopping? Grapevine is definitely the right place for this pastime! Whether on historic Main Street with its quaint homes and businesses — or at one of the shopping centers nearby — the avid shopper can find cookware, original art, vintage clothing, arts and crafts, home furnishings, and a plethora of other options whether whimsical or traditional, modern or vintage.




**The Vetro Glassblowing Studio and Gallery, located in the heart of historic old Grapevine, offers live glassblowing demonstrations.**

One great place to shop is the Grapevine Mills Mall — complete with Texas-themed architecture. With more than 1.5 million square feet, this is the largest shopping center in the Southwest and offers something for everyone. In addition to the many retail stores, this exceptional shopping center features theme restaurants, an ice skating rink, and a movie theater.

Another place to shop is the Grapevine Market, with its sophisticated and unique merchants. Offerings include handmade jewelry, fine art, home décor, quality antiques, and much more! This distinctive market is open Thursdays and Saturdays from March to November.

**Examples of the beautiful glasswork found at Vetro Gallery.**

For those wanting to spend some time in the great outdoors, Lake Grapevine is just one mile north of downtown and offers 146 miles of shoreline — perfect for windsurfing, sailing, and fishing. The extensive surrounding park also offers tennis courts, baseball and softball diamonds, jogging and biking trails, and playgrounds.

Just a short trip away is Dallas/Fort Worth, where sports fans of all kinds can enjoy a game or two — or three or four — as all four major professional sports are well-represented. Football fans can visit Texas Stadium, home of the Dallas Cowboys. The Dallas Mavericks basketball team also calls this area home, playing at the American Airlines Center, where the Dallas Stars hockey team also plays. Major League Baseball is finely represented by the Texas Rangers, playing nearby at Ameriquest Field.

If four major sports are not enough for the true fanatic, the region is also host to FC Dallas (Dallas Burn) of Major League Soccer; the Fort Worth Brahmas of the Central Hockey League; the Texas Tornadoes of the North American Hockey League; and the Frisco Rough Riders, a minor league affiliate of the Texas Rangers.

If you play golf, be sure to bring your clubs. Three championship golf courses spot the horizon. The Grapevine Golf Course, the Dallas Cowboys Golf Club, and the Bear Creek Golf Club contain some of the most

**The American Airlines Center, home of the NBA's Dallas Mavericks and NHL's Dallas Stars.**

challenging golf holes in the Dallas/Fort Worth Metroplex. All three are regularly rated in the top 50 public courses by *Golf Digest*.

For a "traditional western" sport, the Mesquite Championship Rodeo competitions are held Friday and Saturday nights from April through September. The year 2007 will mark the 50th season of this family-friendly event. Some of the excitement includes crazy clowns, even crazier cowboys and cowgirls, magnificent horses, and huge bulls. Only 15 minutes away from Dallas, the rodeo is held in the Resistol Arena, which is 200 yards south of the original facility built in 1958.

If science and history are more "your thing," be sure to take time to visit the many museums around the area. The Age of Steam Railroad Museum in Dallas is open to visitors for a small fee on Wednesdays through Sundays. This is one of the oldest and most comprehensive collections of heavyweight passenger cars in the United States.

Aviation history buffs will find many fascinating sites to explore, such as the Frontiers of Flight Museum in Dallas. Starting in the 1920s and continuing through the present, this trip through aviation history covers every aspect. For a more hands-on experience, the American Airlines Smith Museum in Fort Worth should fit all fingers — big and little! This unique museum allows visitors to hear, see, touch, and be part of aviation history.

If you're into the art scene, the Dallas/Fort Worth area has much to offer. The Kimball Art Museum, open since 1972, offers an outstanding modern-art display. The Meadows Museum, located in Dallas, offers artwork — much of it Spanish art — that covers the span of a millennium, starting in the 10th century. Finally, the Modern Art Museum has held its charter for more than 110 years and is open to the public Tuesday through Sunday.

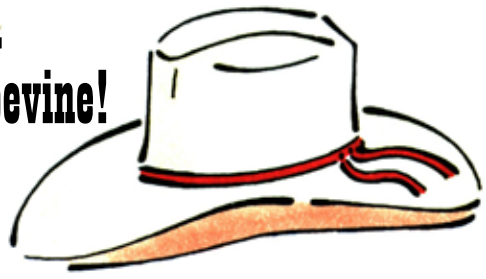
A little farther away is the Fort Worth Nature Center. It has more than 20 miles of hiking trails, along which you're sure to spot a buffalo or whitetail deer. Back toward Grapevine are the Botanical Gardens of Heritage Park, established in 2000. With more than 250 plant species and an 8,500-gallon water garden, this beautiful area is a place you're sure to enjoy. Horseshoe Trails boasts 119 acres of lush vegetation, a walking trail, and a biking trail. Bordering Lake Grapevine, this park is located in a natural wood setting.


**The Mesquite Championship Rodeo.**

For those wanting to spend their nights outdoors, the Grapevine area offers tent sites as well as RV sites. Cabins are also available at the nearby Vineyards Campgrounds.

When visiting the Grapevine area, tourists will find a variety of unique and special activities. Whether you are looking for a sporting event, excellent shopping, fine dining, or the great outdoors, Grapevine welcomes you! ❖

**See you in Grapevine!**



## Mail or Fax Registration Form

Name _____

Name on Badge _____

Title _____

Company/Affiliation _____

Telephone _____ Fax _____

Address _____

_____

Email _____

Guest Name _____

Guest Address _____

_____

Additional Guest* Name _____

Additional Guest Address _____

_____

*Additional guests (16 years of age or older) may register for a fee of $150.00.

*Those requesting special or handicapped facilities are asked to contact the Public Affairs Department at 614.888.8320.*

**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 $300.00 if received *on or before* April 30.
Registration fee is $350.00 if received *after* April 30.

Additional Guest Fee(s)
_____ Additional guests at $150.00 each ..... $ _____
(Each includes ONE banquet ticket)

Additional Banquet Ticket(s)
_____ Additional tickets at $40.00 each..... $ _____

AMOUNT ENCLOSED..... $ _____

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

❑ VISA ❑ MasterCard ❑ American Express

Card # _____ Exp. Date _____

Cardholder's Name _____

Signature _____

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

**Preference for registration confirmation:** ❑ Email ❑ Fax ❑ Mail

Accounting Department Only: AMOUNT $ _____ DATE _____

## Online Registration Form – NEW!

Online registrations are now accepted using a new, secure Web site form, accessible via *InfoLink!* at *nationalboard.org*. This allows General Meeting attendees to process payment, receive a receipt, and an email confirmation — all online at the time of registration.

## Hotel Reservation Information

Hotel reservations are the responsibility of attendees and must be made through the

**Gaylord Texan Resort & Spa**
**by calling 866.782.7897**
or
**online via *InfoLink!* on the National Board Web site.**

To receive the $169 group room rate* reference Group Name: *National Board of Boiler and Pressure Vessel Inspectors,* or use online password *A-NBB07*.

Room reservations must be received by April 10.
RATES INCREASE BEGINNING APRIL 11.

Room refunds available *only* with 72-hour notification prior to arrival date.

The National Board is not responsible for attendee reservations.

*Group rate for General Meeting registrants only, plus 8.25% tax.

## Texas Motor Speedway Race Car Adventure* Registration Form

Name(s) _____

_____

**Cost: $135.00 USD per person/ride** **Number of rides:** _____

Credit Card Type ❑ VISA ❑ MasterCard ❑ American Express ❑ Discover

Cardholder's Name _____

Card # _____ Exp. Date _____

Signature (required) _____

Date _____

Email _____

**Fax completed form to BRING IT ON! DALLAS at 972.416.9362, no later than Friday, March 30, 2007.**

**Payments processed by BRING IT ON! DALLAS, LLC.**
*Cancellations must be received in writing and faxed by March 30. No cancellations honored after March 30. Cancellation fee: $10.*

*Signature represents and warrants approval for charging the aforementioned credit card for payment, and denotes agreement with LIABILITY RELEASE.*

LIABILITY RELEASE: signatory releases The National Board of Boiler and Pressure Vessel Inspectors, BRING IT ON! DALLAS, LLC, and their respective agents and employees from and against all claims, demands, suits, actions, losses (to persons or property), damages, injuries (including personal or bodily injury or death), expenses (including attorney fees), or other liabilities of any kind, by or in favor of any persons directly or indirectly arising out of or in connection with the event, regardless of fault.

*** See page 30 for details.**

# The Gaylord Texan Resort

## Welcome to the Gaylord — Texas-style!

Built in 2004, the Gaylord Texan sits on Lake Grapevine, inviting its guests into a wondrous setting. Just six minutes from the Dallas/Fort Worth Airport and 20 minutes from downtown Dallas or Fort Worth, this majestic hotel provides a welcome respite from the big cities. At first glance, visitors will see the ranch-style archway surrounded by pastures with longhorn steer grazing beside the ponds. Underneath the signature glass dome, the colorful Riverwalk and the wide-open Texas Hill Country welcome each and every person to this magnificent hotel.

The "river" that flows through the property is adorned with rocks, arched bridges, and twinkling lights, as well as brightly colored umbrellas and tiled tables. This area beckons guests to shop, dine, and linger awhile as they experience hospitality "Texas-style."

Offering a "Texas experience at every turn," the hotel boasts 1,511 guest rooms, including 141 luxurious suites reflecting the style of different and distinctive Texas regions. Each of the rooms is decorated in a characteristic style: Lone Star, Riverwalk, or Hill Country. Accommodations include custom furnishings, sculpted crown molding, and Southwest-style fabric. Other commodities include high-speed Internet access, two phones, voice mail, in-room refrigerators, and coffee service. (To obtain National Board's room rates, guests MUST be registered for the General Meeting.)

The Gaylord has no shortage of signature restaurants and casual eating places. Some of these include the Old Hickory Steakhouse, the Hill Country Restaurant, the Riverwalk Buffet, The Point, Silver Bar, and Planet Java. With styles ranging from romantic and fine wine to informal and regional, any palate will be accommodated. And for those wanting to dine in the comfort of their room, service is offered 24 hours a day.

For those looking to rest and relax, the Gaylord Texan offers the 25,000-square-foot Relâche Spa, complete with 13 treatment rooms

and nine types of massage. The fitness center includes a 20-meter indoor lap pool and an outdoor pool, as well as personal trainers and experts in every fitness category, to complete the spa experience.

The great outdoors boasts bass fishing, water skiing, and many other water sports at the nearby marina. The Cowboys Golf Club features 18 holes of championship golf adjacent to the property and is the first and only course to be NFL-sanctioned. Those staying just for the General Meeting or for a few more days will not run out of things to do outdoors.

Nearby Grapevine Mills Mall offers hours of shopping, as does historic downtown Grapevine. Both offer unique shopping experiences and exclusive restaurants and entertainment. A planning note: Grapevine does not have public transportation, so guests must use Gaylord's transportation system.

For those wanting nighttime entertainment, the 39,000-square-foot Glass Cactus nightclub falls under the umbrella of Gaylord glass. The nightclub includes five high-energy bars, an entertainment stage, a dance floor, and a multi-tiered deck overlooking Lake Grapevine.

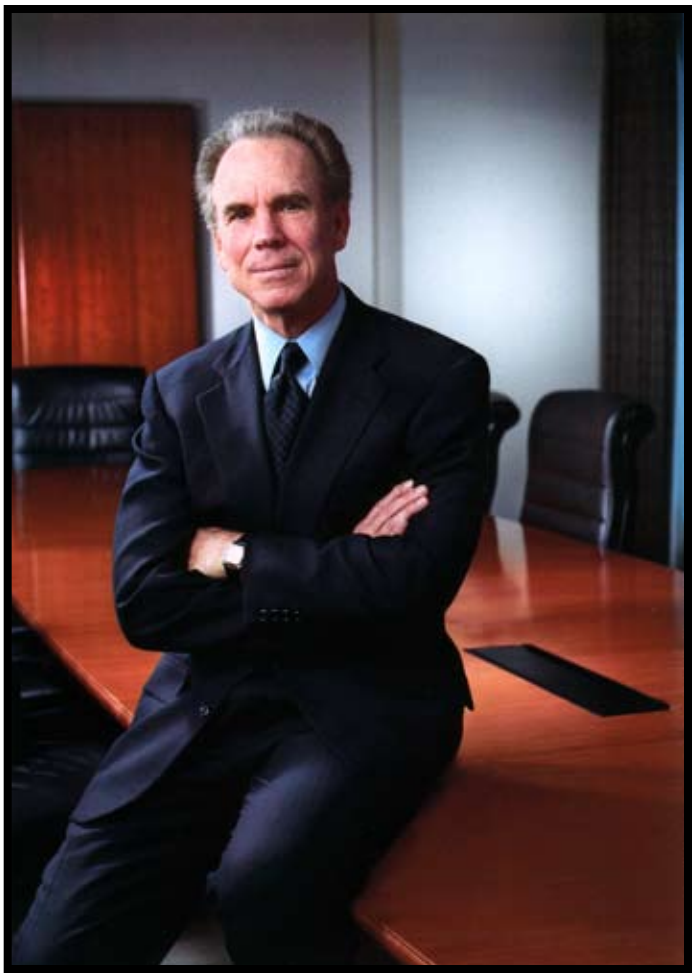
Gaylord meeting facilities cannot be rivaled. Throughout the General Meeting, guests will see part of the 400,000 square feet set aside for just that purpose. Featuring 70 breakout rooms, two executive boardrooms, three ballrooms, and multiple offices and registrations centers, the Gaylord provides more than enough space for any kind of meeting. General Meeting guests will feel comfortable and at home as they attend the daily sessions and tours.

The Gaylord Texan is a part of the Gaylord Entertainment Company, formerly Opryland Hotels and Resorts, a company that has expanded and evolved to bring guests every accommodation they could want or desire. The Gaylord Texan is no exception. ❖

# General Meeting Featured Speaker

## Pro Football Hall of Fame Quarterback

# Roger Staubach



While there are a select number of hall of fame players in every professional sport, few have distinguished themselves on and off the field as former Dallas Cowboys quarterback Roger Staubach.

A native of Cincinnati, Ohio, Mr. Staubach earned the Heisman Trophy as a quarterback at the US Naval Academy in 1963, the year he led Navy to a national #2 ranking. After serving four years active duty — including a tour in Vietnam — he joined the Dallas Cowboys in 1969 and led the team to five NFC titles, seven division titles, and two Super Bowl championships. In addition to being named Most Valuable Player in Super Bowl VI, Mr. Staubach was elected Most Valuable Player by the National Football League (NFL) Players Association in 1971. He was named six times to the Pro Bowl and was four-time NFL Passing Champion.

Mr. Staubach's career passing statistics feature 1,685 completions for 22,700 yards and 153 touchdowns. On the ground, he netted 2,264 rushing yards and 20 rushing touchdowns.

During his years as a player, Mr. Staubach was recipient of all the prestigious National Football League awards, including the Vince Lombardi Sportsman Award, the Byron "Whizzer" White Award, and the coveted Bert Bell Award. A member of the exclusive Dallas Cowboys Ring of Honor, he was inducted into the Pro Football Hall of Fame in 1985.

Today, Mr. Staubach serves as president and chief executive officer of The Staubach Company, a leading international real estate advisory firm headquartered in Dallas. ❖

# Monday Guest Tour

## Monday, May 14

# Southfork Ranch Tour

## 1:00 p.m. – 5:00 p.m.

*All tours depart from Tour and Travel Lobby*

A trip to Dallas wouldn't be complete without a visit to the site of the popular nighttime TV drama *Dallas*.

Those signing up for this Monday afternoon activity will be comfortably transported via motor coach to the Southfork Ranch, where everyone will get an up-close look at one of the most recognized homes in America: the Ewing Mansion. Here, each will have an opportunity to tour the mansion and visit many of the rooms that served as models for sound stage locations in California. Also featured are a number of areas actually used in the series production, such as the mansion pool.

Guests will enter the storied Ewing property by passing under the famous Southfork gate sign and proceed along the familiar mansion driveway. A visit to the *Dallas* Exhibit will bring back fond memories of the TV series and give participants a rare peek at a fascinating collection of *Dallas* photos and memorabilia featuring the entire Ewing family.

Tour participants will see Miss Ellie's kitchen, Jock's living room, the Ewing dining room, JR's master suite, Bobby's board room, and much, much more.

As a very special addition to this tour, visitors will be accompanied by noted area historian Ken Holmes, who will provide his unique commentary on the history of Southfork Ranch, as well as *Dallas* TV lore. ❖

**NOTE: This tour requires a modest amount of walking.**

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

# Tuesday Guest Tour

## Tuesday, May 15

## Historic Dallas Tour

### 9:00 a.m. – 5:00 p.m.

*All tours depart from Tour and Travel Lobby*

Where were you when John F. Kennedy was assassinated?

Many not only remember that fateful event but also the world attention focused on Dallas, Jacqueline Kennedy, the Texas School Book Depository, Lee Harvey Oswald, and then Vice President Lyndon Johnson.

This year's Tuesday outing revisits November 22, 1963, by providing a remarkable inside perspective on the Kennedy assassination through the eyes of Dallas-area historian Ken Holmes. Given Mr. Holmes' extensive study and research, few today know more about events leading up to and the consequences resulting from this American tragedy.

Guests will be transported to Dealey Plaza, scene of the assassination, where they will learn the particulars of that momentous occasion, as well as the questions that confound experts nearly 45 years later. Participants will walk the route where America's 35th president was felled by bullets from an assassin's rifle and actually observe the precise locations where the motorcade was struck.

Adding to this educational adventure is a visit to the window of the Texas School Book Depository where Lee Harvey Oswald stood poised to change history. The morning concludes with a stirring audio tour of the 6th Floor Museum featuring photos and artifacts recounting one of the most important historic events of the twentieth century.

Changing gears on Tuesday afternoon, tour participants will be treated to an outstanding luncheon at one of Dallas' most prestigious landmarks: the Zodiac Room at the original Neiman Marcus department store. Here, guests will dine on Tagliatelle pasta with Ratatouille, and finish with Ricotta Salata and an assortment of exotic dessert selections.

The remainder of the afternoon will allow guests to tour the celebrated store, as well as shop within the parameters of their respective credit cards. ❖

**NOTE: This tour requires a modest amount of walking.**


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

# Wednesday Outing

## Wednesday, May 16

# Texas Motor Speedway Adventure

## 9:00 a.m. – 3:00 p.m.

*All tours depart from Tour and Travel Lobby*


Gentlemen . . . and ladies: start your engines!!

And hold on to your helmets for the ultimate General Meeting adventure!

The destination: Texas Motor Speedway, the second-largest sporting venue in the country and host to two NASCAR races, one Indy Racing League race, and two million fans each year.

Stand in the track infield and imagine 150,000 screaming racing enthusiasts. Experience the smell of hot rubber. The sounds of victory.

And that's just the beginning of this not-to-be-missed, heart-pounding tour adventure.

Everyone will get a chance to ride an official Texas Motor Speedway pace vehicle on the very same track that has featured *all* of the racing greats from Indy 500 winner Johnny Rutherford to NASCAR superstar Dale Earnhardt Jr. Even though the *pace* vehicle doesn't approach the numbing speeds of a *race* car, each General Meeting guest will experience the extraordinary feel of a 24-degree, high-banked racing surface, and the ultimate thrill of crossing the finishing line.

Tour high points include behind-the-scene looks at the race-time control tower, pit road, track infield, victory lane, luxury suites, and the concourse.

And the highlight of the day will be a great catered lunch . . . in an infield garage lined with NEXTEL cup and Busch race cars. ❖

**NOTE: This outdoor/indoor tour requires a modest amount of walking.**

## RACE CAR ADVENTURE (Optional)

For those looking for a bit more speed, the Texas Motor Speedway is making available to General Meeting guests a limited number of race car rides.

Imagine! Riding shotgun in a two-seat stock car driven by a professional driving instructor at speeds exceeding 160 MPH!!

(IMPORTANT NOTICE: Race car rides are limited and only available as an option for $135 per person, inclusive of taxes, gratuity, and fees. Advanced reservations required. See page 24 for form.)

Participants must wear socks, closed-toe shoes, and clothes that will be comfortable under a driver's suit (shorts allowed). All safety gear, including driver's suit (up to 3X), regulation helmet, and safety device, will be provided by the raceway. One rider per car.

CAUTION: All race car participants must sign waiver. This activity requires rider to enter/exit through 15" x 30" side vehicle window and fit into five-point safety harness. (Refunds issued to those not fitting criteria.) Not recommended for persons with back or neck problems or individuals with serious injuries. ❖

Guests who participate do so of their own choosing and assume any and all risk. The National Board, including members and staff, assumes no responsibility (financial or otherwise), nor is it liable for any personal or material consequences that may result. By registering for this activity, participant acknowledges aforementioned conditions.

# Preliminary Program

## for the 76th General Meeting of The National Board of Boiler and Pressure Vessel Inspectors

## Monday, May 14

Opening Session

10:15 a.m. Remarks
NFL Hall of Fame Quarterback Roger Staubach*

General Session

1:00 p.m. *Tools to Reduce the Cost and Risk Associated with Welding and Brazing*

Bob Silvia, Chairman of the Board
NATIONAL CERTIFIED PIPE WELDING BUREAU

1:30 p.m. *Sustainable Energy Efficiency Initiatives of Dallas/Fort Worth International Airport: Improving Operational Performance While Reducing Air Emissions and Energy Consumption*

Jim Crites, Executive Vice President of Operations
DALLAS/FORT WORTH INTERNATIONAL AIRPORT

2:00 p.m. *Safety by Design*

Patrick Hoffman, Corporate Vice President for Safety
SIX FLAGS OVER TEXAS

2:30 p.m. Break

2:45 p.m. *TBA*

3:15 p.m. *Next Generation Nuclear Power Plants*

Ted Alexovich, Manager of AP 1000 Projects Quality
WESTINGHOUSE ELECTRIC COMPANY

3:45 p.m. *The Value in the Details: A Customer Perspective*

Earl Harlow, P.E., Mechanical Integrity Engineer
PLASTICS MT. VERNON, INC.

4:15 p.m. *The Surviving World Steam Project*

James Hefner, Coordinator
SURVIVING WORLD STEAM PROJECT

* Autograph session with Mr. Staubach follows Opening Session.

**Grapevine Weather & Wardrobe:** Sunny summers and mild winters draw visitors to Grapevine throughout the year.

During the General Meeting, expect fairly high temperatures, as the area has a summer average of 95 degrees. Spring temperatures, however, are more comfortable around 65 degrees. Either way, the climate should be perfect for enjoying time outdoors at Lake Grapevine or for shopping around town.

Don't worry, though, if cold or rainy weather is in the forecast at the beginning of May. The Gaylord provides plenty of fun under the climate-controlled glass atrium, including tropical gardens, great shopping, fun-filled activities, and fine dining.

Guests should be comfortable in light cottons and other "breathable" cottons. A light jacket or sweater may prove useful for cooler mornings and evenings. Don't forget other warm weather musts: sunglasses, comfortable shoes, and lots of sunblock!

**General Meeting Dress:** 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).

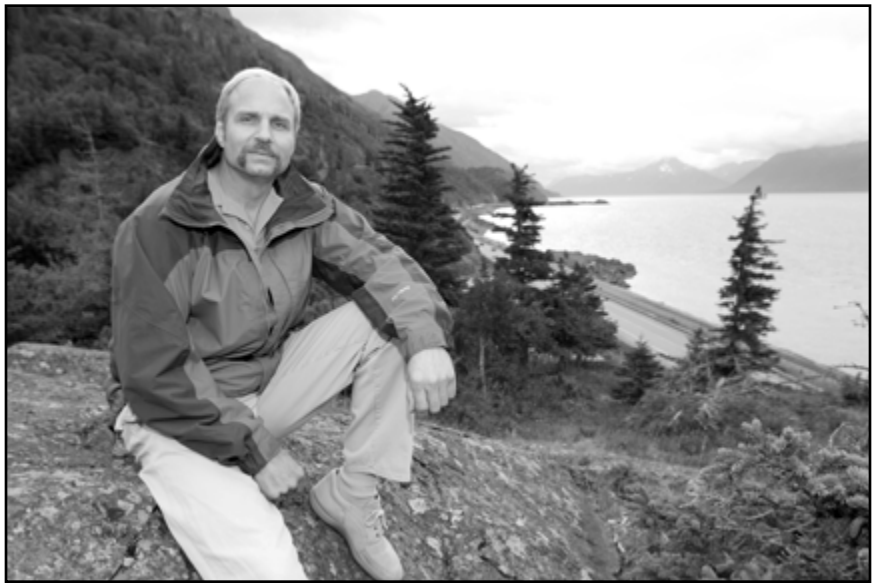
**Reminder:** General Meeting details can also be found on *InfoLink!* located on the National Board Web site at *nationalboard.org*.

To obtain a discount of $50, all preregistration forms and fees must be received by April 30.

Preregister beginning January 5 via *InfoLink!* on the National Board Web site at *nationalboard.org*.

Distribution of any and all literature, other than informational materials published by the National Board and ASME, is strictly prohibited at the General Meeting. ❖

# Mark Peterson
## Chief Boiler Inspector, State of Alaska



BULLETIN *photograph by Danny Daniels*

Ask any National Board member about Mark Peterson and the reaction is often one of bewilderment. Ask about *Rudy* Peterson, and confusion melts into a knowing smile.

Ask Mark Peterson about how he became Rudy Peterson and uncertainty is revisited: "It's a variation of Rudard, my middle name," the Alaska chief boiler inspector volunteers. "I have no idea how my parents came up with it, but I've been called Rudy since before I could walk."

Born in Council Bluffs, Iowa, Mark Rudard Peterson lived in three cities before he was five years old — thanks to a father in the construction business. "We left Council Bluffs when I was two, moved to San Francisco and then on to Tahoe City, California," he fondly recalls.

"My dad began building houses around Lake Tahoe," Rudy explains. It was here the future National Board member would lead a rather uneventful, yet at times unorthodox youth.

In the winter, Rudy, his brother, and two sisters would earn extra money shoveling snow from driveways. And roofs.

"We got over 10 feet of snow each winter," he explains while combing his fingers through a closely trimmed Fu Manchu moustache. "Back then there were quite a few flat roofs. And at $20 to $25 per roof, there was no shortage of work!"

Or opportunity. On occasions when the Peterson children had to clean a pitched roof, they would practice their skiing by trundling down a slick-shingled surface en route to the street by way of the customer's driveway.

Graduated from high school in 1973, Rudy gave serious thought to becoming a marine biologist. "But the money for school just wasn't there."

Shortly after launching a career in construction, Rudy was able to enroll part-time at a junior college. He lasted one semester before his interest and his money ran out.

Moving to Carson City, Nevada, where his parents then resided, Rudy returned to construction work. Working during the day and attending school at night, the Iowa native abandoned all notions of becoming a marine biologist. "Instead, I just wanted to be a biologist," he explains.

At a spring dance in 1974, Rudy met Donna, a college education major. When Rudy and Donna married in the fall of 1975, little did they suspect what would happen next: a 22-year odyssey that would involve Russia, Venezuela, and nearly a dozen states.

Having moved to Ogden, Utah, so Donna could complete her college courses, Rudy secured a position in October of 1975 as an x-ray technician helper doing nondestructive examinations. The following summer, he traveled alone (Donna was attending a teaching educational tour in Russia) to Mobile, Alabama, to accept a job as radiographic technical helper.

"After three days of driving," the mustachioed inspector reveals, "I approached the company's project manager who told me he didn't have room for another technician! He then questioned my sanity for having driven across country for a job paying only $3.85 an hour."

Rudy quickly found himself outside the company's security gate, out of work, and seemingly out of luck.

Experiencing a change of heart, the project manager summoned a sullen Mark Peterson from the gate area and offered him a job as a level 2 radiographer to conduct radiography and penetrate testing on aluminum tanks. Achieving the level of project radiology safety monitor in 1978, Rudy was sent to New Orleans to work on nuclear power projects.

Arriving in The Big Easy, the Iowa native assumed the role of roving technician and a 2-1/2-year responsibility that would take him beyond Louisiana to power projects in Michigan, Texas, North Dakota, New Jersey, Arkansas, Georgia, and California.

In 1980, looking for his next professional challenge, Rudy accepted a new job in Punto Fijo, Venezuela, working as a refinery expansion technician.

"I was there about a year when I was involved in a serious motorcycle accident," he laments. In New Orleans at the time, Donna flew south to supervise Rudy's four-month recovery. "She was closely monitoring my condition and arranging to obtain the best treatment available in that part of the world. I was told by one Venezuelan medical official that I had the distinction of being the person in his hospital with the longest stay in intensive care . . . who *survived*!"

It wasn't long after Rudy's recovery in 1981 that the Petersons' lives approached a sense of normalcy. Moving to Parachute, Colorado, they prepared for the birth of their first child, Jason. And Rudy landed a position x-raying piping systems as an oil company project manager/technician. Two-and-a-half years later, the Alaskan official secured his next position with Unocal to develop in-house NDE procedures and programs. It was during this period he passed the National Board Commission examination.

"I eventually moved the family to Kenai, Alaska, in 1989 to oversee Unocal's owner/user program as a senior plant equipment inspector," Rudy explains. Although the family (now including recently born daughter, Jamie) relented to making the 2,300-mile jump to the forty-ninth state, Rudy had to sell the idea to Donna, who had established her own career as director of the Mesa College School of Education.

"We arrived in January," Rudy offers with a nod, "during Alaska's longest cold spell. For seven weeks, temperatures never got above zero [degrees] and it frequently dropped to -45!"

Having acclimated to Alaska's harsh weather in 1993, Rudy invited his parents to visit. It was during this reunion of generations that tragedy struck: Rudy's dad and 11-year-old Jason died in an automobile accident.

Rudy returned to work at Unocal a changed person. "This was an organization where I thought I could be content for the rest of my career."

But it wasn't. As the petroleum company's project began to wind down, Rudy started scouting other employment avenues. In 1997, he became a boiler inspector for the state of Alaska. Nine months later, he was chief inspector.

Currently, Rudy, his six deputy boiler inspectors, and one trainee are responsible for inspections covering the largest jurisdiction in North America. "Alaska is comprised of more than 570,000 square miles or 365 million acres with over 6,600 miles of coastline," he explains with a sigh. "We also have the country's lowest population density."

But having fewer people does not mean fewer boilers, Rudy is quick to add. "It just makes having to find the equipment in a larger area more difficult."

While their journey to Alaska has been circuitous, the Petersons feel their best days are before them. Jamie is now 18 and attending college in Oregon. Donna is supervisor of the Kenai Peninsula Borough School District (a system physically larger than the entire state of New Jersey).

And Mark Rudard? Now an excellent skier, he no longer finds it necessary to seek out a nearby rooftop.

His neighbors are breathing a collective sigh of relief. ❖

# Crider, Dodge, and Guerra Join National Board

Wesley Crider has been elected to the National Board representing the state of Vermont. He is assistant state fire marshal and boiler inspector.


Wesley Crider

Mr. Crider began his career in 1973 as a boiler and pressure vessel inspector for Hartford Steam Boiler before working for the New Hampshire Insurance Group. In 1988 he began working as an inspector for the Vermont Department of Public Safety.

He served for 20 years in the US Navy during the Korean and Vietnam conflicts, retiring as a chief machinist mate serving aboard aircraft carriers.

Mr. Crider resides in Marshfield, Vermont, with his wife Anna. He has two children, William and JoAnn.

He holds National Board Commission No. 7357 with endorsements "A" and "I."

Peter L. Dodge has been elected to the National Board representing the province of Nova Scotia. He is chief inspector and manager of boiler and pressure vessel services.


Peter L. Dodge

Mr. Dodge began working for the province in 1995 as a boiler inspector. He began his career in 1982 as computer programmer in the department of environment before moving to Technical University to complete research on wave energy. From 1983 to 1995, Mr. Dodge held various positions including that of regional manager, chief engineer, quality control manager, and equipment designer for MBB Power Services.

He was graduated from Dalhousie University/Technical University with a bachelor's degree in engineering. He resides in Dartmouth, Nova Scotia, with his wife Shelagh. He has four children, Chris, Alex, Jennifer, and Rebecca.

He holds National Board Commission No. 11758 with endorsements "A" and "B."

Justo E. Guerra has been elected to the National Board representing Arizona. He is chief boiler inspector for the state.


Justo E. Guerra

Mr. Guerra worked for 31 years for the City of Los Angeles Department of Water and Power. He spent time as the chief safety engineer and finished his work there as the corporate safety manager before retiring in August 2004.

Mr. Guerra resides in Phoenix, Arizona, with his wife Rosa. He has three children, Belinda, Benjamin, and Tito.

He holds National Board Commission No. 12957. ❖

# In Memoriam: Tom Wickham, Former Rhode Island Chief

The National Board was saddened to learn of the October 15 passing of former Rhode Island Chief Inspector Tom Wickham. He was 65.

Tom Wickham

Mr. Wickham retired from the state in 2000 following six years' service as an inspector and 13 years' service as chief boiler and pressure vessel inspector. The native of Richmond, Rhode Island, became a member of the National Board in 1988.

During his tenure with the National Board, Mr. Wickham served on a number of committees, including the Standing Committee on Examination of Authorized Inspectors, of which he was chairman. He also served on the National Board Board of Trustees from 1996 to 2000.

An Honorary National Board Member, Mr. Wickham was active in Richmond politics, having represented the city as Democratic Party chairman and as a member of both the Richmond Town Council and Richmond Planning Board.

"Tom's lifelong passion for baseball and the Boston Red Sox was second only to his commitment to boiler and pressure vessel safety," explains National Board Executive Director Donald Tanner. "His contributions to our industry will be with us for many years to come."

Mr. Wickham is survived by his wife Marjorie; sons Thomas Wickham Jr. of Richmond and Matthew Wickham of Hinesville, Georgia; four grandchildren; sister Gertrude Beaufort; and brother Robert Wickham, both of Warwick. ❖

# Chuck Walters, National Board Director of Inspections, Remembered

The National Board regrets to announce the October 28 passing of Director of Inspections Chuck Walters. He was 59.

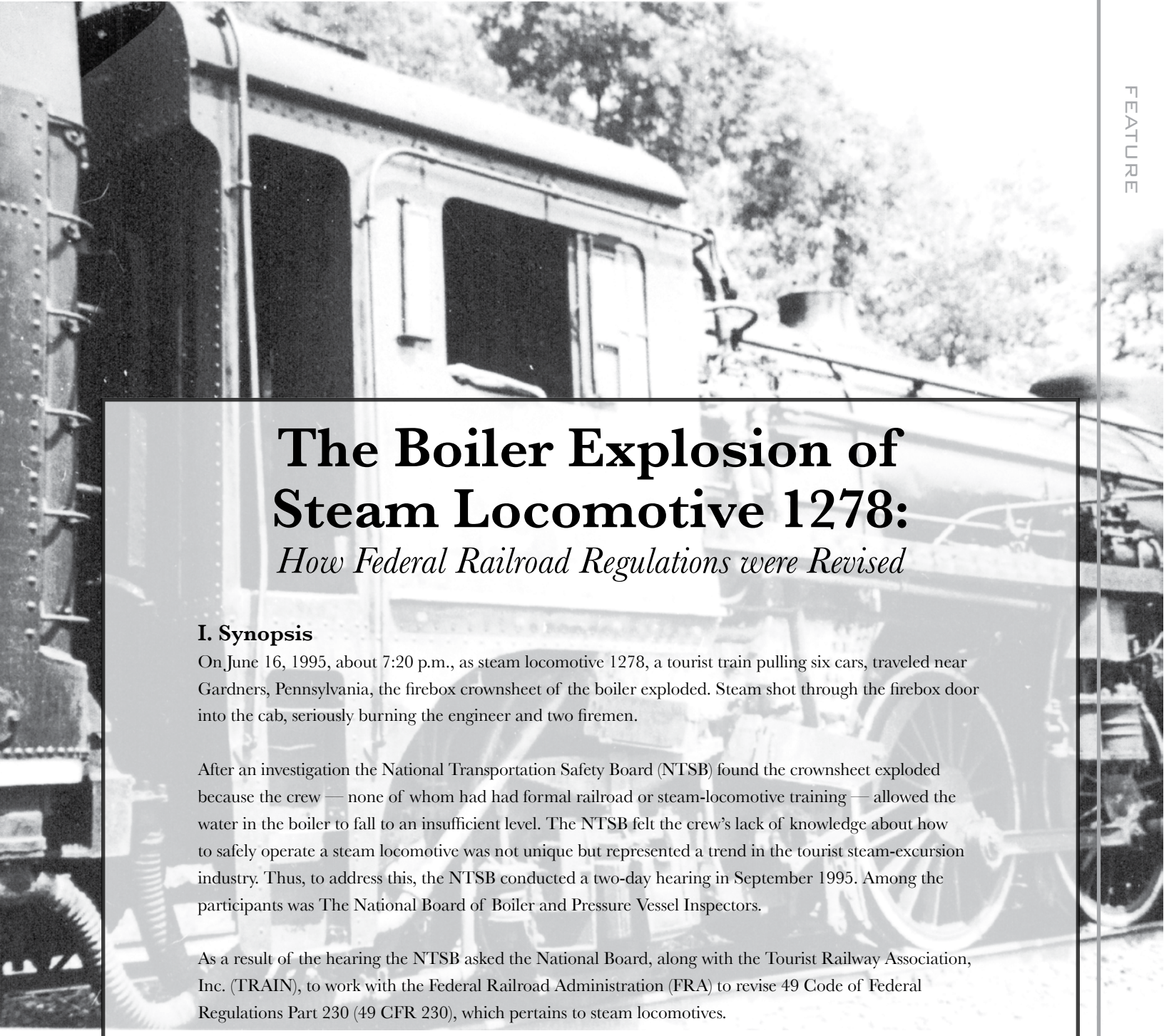

Chuck Walters

A native of Southern California, Mr. Walters joined the US Navy in 1964 and was honorably discharged in 1971. He began his career as an inspector for the state of Oregon in 1974 and was named chief boiler and elevator inspector four years later. In 1986, he became a member of the National Board field staff performing ASME joint reviews and nuclear surveys primarily in Asia, Canada, and South America. In 1997, Mr. Walters joined headquarters staff in Columbus, Ohio, as assistant director of inspections. He assumed the position of director of inspections in April 2006. Mr. Walters celebrated 20 years with the National Board in August 2006.

"Although the National Board family is deeply saddened by the loss of a wonderful human being and associate," explains National Board Executive Director Donald Tanner, "the entire industry mourns the untimely departure of a consummate professional whose contributions in the discipline of safety will leave a lasting impression."

A former first vice chairman of the National Board Board of Trustees, Mr. Walters over the years served as an active member of numerous ASME and National Board committees. More recently, his duties included instructing National Board's N, NS, B, PEC, and IBI training courses.

Mr. Walters is survived by his wife Mary, four daughters, eight grandchildren, and his beloved Labrador Retriever, Toby. ❖



# The Boiler Explosion of Steam Locomotive 1278:

## *How Federal Railroad Regulations were Revised*

### I. Synopsis

On June 16, 1995, about 7:20 p.m., as steam locomotive 1278, a tourist train pulling six cars, traveled near Gardners, Pennsylvania, the firebox crownsheet of the boiler exploded. Steam shot through the firebox door into the cab, seriously burning the engineer and two firemen.

After an investigation the National Transportation Safety Board (NTSB) found the crownsheet exploded because the crew — none of whom had had formal railroad or steam-locomotive training — allowed the water in the boiler to fall to an insufficient level. The NTSB felt the crew's lack of knowledge about how to safely operate a steam locomotive was not unique but represented a trend in the tourist steam-excursion industry. Thus, to address this, the NTSB conducted a two-day hearing in September 1995. Among the participants was The National Board of Boiler and Pressure Vessel Inspectors.

As a result of the hearing the NTSB asked the National Board, along with the Tourist Railway Association, Inc. (TRAIN), to work with the Federal Railroad Administration (FRA) to revise 49 Code of Federal Regulations Part 230 (49 CFR 230), which pertains to steam locomotives.

### II. The Accident

Steam locomotive 1278 was built in April 1948 by the Canadian Locomotive Company, Ltd., and designed for passenger service. In June 1987, after years of passing from one owner to another, it was bought by Gettysburg Railroad of Gettysburg, Pennsylvania, and leased to Gettysburg Passenger Services, Inc., a steam-excursion service that in 1994 carried about 50,000 passengers.

With side doors and an enclosed cab, locomotive 1278 weighed 234,000 pounds. It had a radial-stay, straight-bottom, wagon-top boiler with three courses or diameters. Boiler pressure was 250 psi. The firebox grate was 45.6 feet square; the water space at the back was 3-1/2 inches. The crownsheet was 3/8 of an inch thick. The lowest water level the water glass could indicate was 3-1/8 inches above the highest point of the crownsheet.

Crown stays, which supported the crownsheet from the boiler roof sheet, were alternating rows of straight-thread and button-head stays. This had been implemented so if the crownsheet failed because water dropped too low, it would be pushed off the straight-thread stays but held for a while by the button-head stays. In other words, failure would be progressive instead of catastrophic.

On the day of the accident, June 16, locomotive 1278 made two 16-mile round trips from Gettysburg to Biglerville, Pennsylvania. About 6:00 p.m. it started its last trip, leaving Gettysburg for Mount Holly Springs, about 20 miles north. There its 310 passengers were to eat dinner at local restaurants before returning to Gettysburg.

The locomotive crew consisted of an engineer, who was 48 years old and who that day had made both trips to Biglerville and back; and two firemen, ages 18 and 21, who reported for work at 5:00 p.m. Though the engineer had some 30 years' experience running steam locomotives, he had had no formal training. To satisfy the FRA's engineer certification requirements as stipulated in 49 CFR 230.101, Gettysburg Passenger Services simply completed a generic form from the American Short Line and Regional Railroad Association, which represents independent railroads, and sent it to the FRA. The two firemen had had no formal training and learned about steam locomotives on the job. Once a year, before the start of tourist season, Gettysburg Passenger Services, which was not required to have a formal training program, did offer a five-hour training course taught by the engineer.

Shortly after 1278 left Gettysburg, it passed a freight train, which farther up would link with 1278 to help it climb a grade. At Aspers, about halfway between Gettysburg and Mount Holly Springs, 1278 stopped to receive the freight train. During the stop, one of the firemen shut off the feed pump. He did so because a one-way check valve between the feed pump and boiler had been leaking all day, and he was afraid the water would leak onto the track and cause the locomotive's wheels to slip when it started moving again.

After linking with the freight train, 1278 began to climb the grade. At the top, about two miles away, sat Gardners, Pennsylvania. It took the locomotive 10 minutes to reach the top; during that time the feed pump remained off. According to the engineer, during the climb, the train was "working hard." Boiler pressure dropped from about 230 psi to 175 psi, but the firemen said they were not worried, because they thought the water glass, mounted on the backhead of the boiler, would indicate if water in the boiler got too low.

At the top of the grade the crownsheet exploded. Of the explosion, one fireman said, "[When] the crownsheet failed…it just sounded like a muffled .22 [rifle] pop. I instinctively turned towards the noise . . .. I remember getting hit with it — it just got dark because of all the soot and the smoke in the cab. And I remember feeling intense heat and thinking . . . I've got to get out of here. I jumped out [through the door]."

That fireman received second- and third-degree burns over 10 percent of his body. His recovery took 1-1/2 months. The other fireman, who had jumped through the cab window, also received second- and third-degree burns and broke his legs. The engineer received third-degree burns over 65 percent of his body and during the next nine months required several surgeries and extensive therapy. No passengers or other crew members were injured.

## III. The Investigation

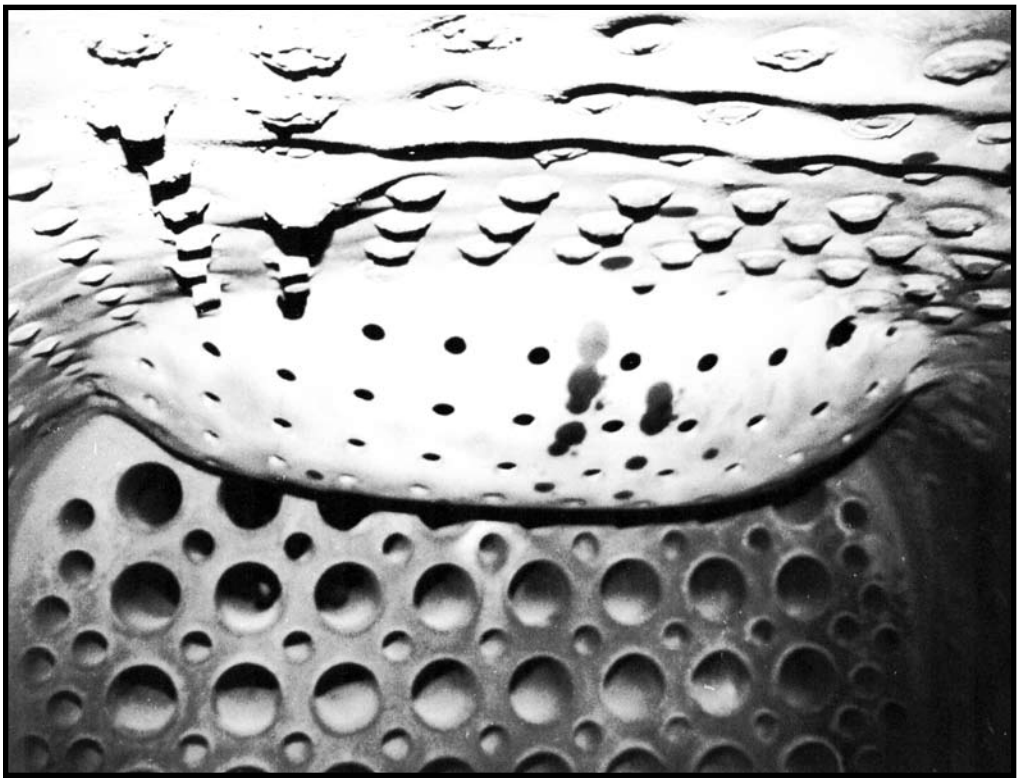
On June 20, 1995, an NTSB representative arrived in Pennsylvania to investigate the accident. The representative was assisted by Gettysburg Railroad, Gettysburg Passenger Services, the FRA, the Hartford Steam Boiler Inspection and Insurance Company, and TRAIN.

The only part of the train sustaining major damage was the firebox itself. Toward the front of the firebox, beside the rear tubesheet knuckle (the top corner of the firebox where the crownsheet meets the vertical tubesheet), there was a bulge in the crownsheet. It had a maximum depth of about a foot and covered an area of about 60 crown stays. Crownsheet holes around the stays were elongated. A six-inch tear showed in the crownsheet knuckle next to the flue sheet. That the crown stays were alternating rows of straight-thread and button-head stays probably prevented a more catastrophic event such as the boiler shooting off its frame.

The investigation, focusing on determining why water in the boiler had been allowed to drop to an insufficient level, found it was not a single factor that caused the low-water level but a couple of factors: the crew's lack of proper training (as mentioned above) and the poor condition of mechanical devices due to inadequate cleaning.

The FRA requires a railroad company to inspect its locomotives every month and record results on an inspection report, form No. 1, which the company keeps on file for FRA review. Item 10 of form No. 1 asks, "Was the boiler washed and the gage cocks and water-glass cock spindle removed and the cocks cleaned?" Although the engineer of 1278 indicated on form No. 1 for April and May 1995 that all necessary cleaning had been done, an inspection of devices after the accident showed the cleaning to be insufficient.

The two devices for monitoring water level in a boiler are a water glass and gage cock. The FRA requires "every boiler be equipped with at least one water glass and three gage cocks." The reason is if one kind of device fails, there is a backup. Locomotive 1278 did use both kinds, but they were in poor condition. With regard to the water glass, significant deposits had built up in the passages of the valves. About 75 to 85 percent of the spindles were plugged with hard scale. With regard to the three gage cocks, only the



***A bulge in the top corner of the firebox's crownsheet was found to be approximately a foot in depth and covered an area of about 60 crown stays.***

highest one was clear. The middle one was half plugged with deposits, the lowest one, completely plugged. Thus, neither the water glass nor gage cocks could give an accurate reading of the water level. Such a buildup in both kinds of devices, investigators were convinced, would not have accumulated between monthly washings if the boiler had been thoroughly cleaned.

Thus, in its final report the NTSB concluded that "the probable cause of the firebox explosion on steam locomotive 1278 was the failure of Gettysburg Passenger Services, Inc., management to ensure that the boiler and its appurtenances were properly maintained and that the crew was properly trained."

## IV. The Aftermath

In September 1995 the NTSB held a two-day hearing as part of its investigation of the locomotive accident near Gardners. The National Board participated in the hearing and was asked to work with the FRA and other railroad industry representatives to revise 49 CFR 230.

The National Board Steam Locomotive Committee had already recognized before the hearing (and before the accident at Gardners) that 49 CFR 230 needed revision. In fact, in 1994 the Board sent a letter to the FRA proposing inclusions in the code to reduce the possibility of different kinds of accidents. The letter was entered into the record at the NTSB hearing.

After the hearing, the FRA and the Engineering Standards Committee for Steam Locomotives (ESC) formed "The Steam Task Force of the Tourist and Historic Working Group," which included representation from the National Board. In an early meeting, the task force identified several objectives in revising 49 CFR 230:

- Harmonizing FRA and *National Board Inspection Code* (NBIC) terminology and standards
- Modernizing rules to reflect current operating realities
- Eliminating any incentives, financial or otherwise, for operators not to follow rules
- Encouraging use of new technologies
- Producing a more clearly written, understandable, and enforceable rule

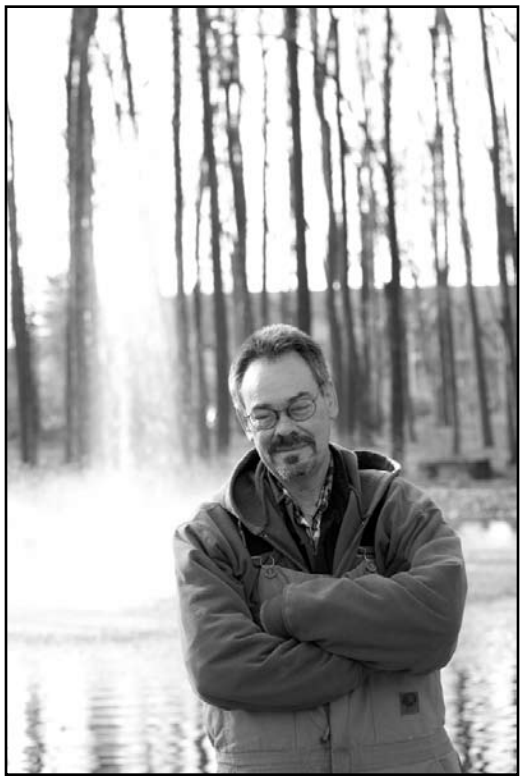
The task force met approximately six times over the next year and a half to produce a document reflecting those objectives. In 1998 revised 49 CFR 230 was accepted by all parties with little criticism.

Since that time, there has been an ongoing series of improvements in the railroad industry. First, a number of schools have been conducted to help FRA inspectors with their inspection of steam locomotives. Second, the NBIC has added a guide for the inspection of steam locomotives (NBIC, Appendix 3, Paragraph 3-2010) and has coordinated the rule in NBIC, Appendix 3, Paragraph 3-1200 with the rules in 49 CFR 230. Finally, the ESC has published a *Compilation of Calculations* guide book to help owners comply with regulations.

The joint effort of the National Board and railroad industry representatives — an effort arising from the locomotive accident at Gardners — has made these improvements possible. ❖

**Source:**
National Transportation Safety Board, "Steam Locomotive Firebox Explosion on the Gettysburg Railroad Near Gardners, Pennsylvania, June 16, 1995," Special Investigation Report.

# Andy Wenneker
## Grounds and Maintenance Associate



BULLETIN *photograph by Greg Sailor*

You have probably seen Andy Wenneker in the National Board parking lot, leaf blower in hand, directing yellow leaves into pillowy piles. Or in a hallway, perched on a ladder, changing a burned-out light. You might think, then, that in his spare time Andy, whose official title is grounds and maintenance associate, watches TV shows such as *Bob Vila* or *This Old House*.

Would you believe his favorite show is *Hell's Kitchen* — the show in which world-renowned, acerbic-tongued chef Gordon Ramsay gives 12 people a chance to compete for the title of executive chef?

That is not surprising when you learn that in the early 1980s Andy worked as a banquet chef at The Worthington Inn, a four-star restaurant and hotel in Worthington, Ohio. "I worked under four executive chefs who were just like Ramsay," he says. "To learn about preparing and presenting gourmet foods and desserts was fascinating."

Andy and one of the chefs, Chef Rinaldi, prepared a buffet for the 250 people attending Andy's wedding reception in 1987, when he married Melany. On July 12, 1990, their son, August, was born. Andy and his family live between Mt. Gilead and Cardington, Ohio, on 1-1/2 acres of land. Melany works as a stay-at-home mom and homeschools August.

It was Andy's cooking background that, in a roundabout way, brought him to the National Board. From his job as banquet chef he moved on to be a cook/manager for Worthington City Schools, then accepted a position in the custodial department at Dublin City Schools in Dublin, Ohio. Shortly thereafter he transferred to the grounds and maintenance department.

In 1999 he heard there was an opening for a grounds and maintenance associate at the National Board. He sent his résumé and was soon hired. He started on July 12, 1999, his son's birthday.

So with his cooking background, Andy, if he did not work at the National Board, would want to be a professional chef, right? Not exactly.

"I'd want to be a farmer," he says. "My mom's family had all been farmers."

Which explains why Andy, who holds a degree in agricultural science from The Ohio State University, parceled his garden into six raised beds. In them he grows blackberries, raspberries, peas, lettuce, beans, and tomatoes.

But of course he still cooks; in fact at home, he does most of the cooking, sometimes with the help of August, who likes to work in the kitchen. At present, though, August has something else on his mind — learning to drive. Andy is teaching him, but they are taking it slowly. "We're starting out in shopping mall parking lots," Andy says with a smile.

Ah, the caution of a driving instructor—perhaps another position he can add to his varied résumé. ❖

*"Do You Know . . .?" is a* BULLETIN *feature introducing readers to the dedicated men and women who comprise the National Board staff.*

# Growth of Nuclear Power Requires Preparation

BY RICHARD MCGUIRE, MANAGER OF TRAINING

In the United States all indicators are pointing toward the expansion of the nuclear industry. The Nuclear Regulatory Commission (NRC) is gearing up for an influx of permit applications; at least four applications for construction permits have been received already. It has been decades since we have seen such growth in the nuclear industry.

Imagine how many people will be involved in the construction of these new nuclear plants. To prepare, we must provide training for the next generation of fabricators and inspectors on the requirements of the ASME nuclear code.

To apply the ASME "N" stamp to nuclear components, it is necessary for the fabricator to obtain authorization from ASME. It is a requirement all components be inspected by an Authorized Nuclear Inspector (ANI). An ANI must possess a National Board Commission with the "N" endorsement.

Currently, there isn't a training program to increase ASME Code knowledge for fabricators of nuclear components. However, the "N" endorsement course is appropriate for fabricator personnel. Since the ANI must attend the course, fabricator personnel who attend will receive the same training as the ANI, which should enhance compliance with Code requirements.

The "N" endorsement course covers in detail the ASME quality system requirements and the fabrication details necessary for Code compliance. Code compliance is mandatory for the components to meet ASME and NRC requirements.

The National Board has seen a marked increase in the number of participants in the "N" endorsement course. In 2006, an additional course was required to meet the demand; we had over 20 participants. The enrollment in the "N" course for all of 2006 was double the enrollment in each of the five preceding years.

A "C" endorsement course was held in December, the first offering of this course in six years. The "C" endorsement is required for the inspection of nuclear concrete containment structures under the rules of ASME Section III, Division 2.

The National Board can tailor a seminar to the requirements of ASME Section III, addressing the needs of manufacturers, material organizations, and constructors. If a company manufactures specific types of components, we can develop a course to cover Code requirements. Contact me at 614.431.3214 to discuss details. ❖

## ENDORSEMENT COURSES

**(A)** **Authorized Inspector Course** — TUITION: $2,500

March 12–23 June 11–22

**(B)** **Authorized Inspector Supervisor Course** — TUITION: $1,250

February 5–9

**(N)** **Basic Nuclear Inspector Course** — TUITION: $1,250

March 26–30

## CONTINUING EDUCATIONAL OPPORTUNITIES

**(PEC)** **Pre-Commission Examination Course** —
TUITION: $2,500 Full two-week course
$660 Self-Study (week 1) portion
(self-study materials sent upon payment)
$1,190 Week 2 of course

February 19–March 2 April 30–May 11

**(R)** **Boiler and Pressure Vessel Repair Seminar** — TUITION: $400

March 5–6 June 4–5
April 11–12 (Minnesota)

**(VR)** **Repair of Pressure Relief Valves Seminar** — TUITION: $1,250

March 26–30

**(WPS)** **Welding Procedure Workshop** — TUITION: $670

June 6–8

## REGISTRATION FORM

Please circle the seminar/course(s) and date(s) you wish to attend. Please print.

☐ Mr. ☐ Ms. ☐ Mrs.

Name* _____

Title _____

Company _____

Address* _____

City* _____

State/Zip* _____

Telephone* _____

Fax _____

Email* _____

NB Commission No. _____

### Payment Information (check one):

☐ Check/Money Order Enclosed
☐ P.O. # _____
☐ Payment by Wire Transfer
☐ VISA ☐ MasterCard ☐ American Express

Cardholder _____
Card # _____
Expiration Date _____
Signature* _____

***Required**

### Hotel Reservations

A list of hotels will be sent with each National Board registration confirmation.

All seminars and courses are held at the National Board Training and Conference Center in Columbus, Ohio, unless otherwise noted, and are subject to cancellation.

For additional information regarding seminars and courses, contact the National Board Training Department at 1055 Crupper Avenue, Columbus, Ohio 43229-1183, 614.431.3216, or visit the National Board Web site at nationalboard.org.


## "Shower of Bricks and Debris"

The year was 1909, and it was a cold day in Gardiner, Maine. March 15 also proved to be a day of devastating loss and destruction for the small town, when a boiler exploded at 10:15 a.m. at a local ice house, killing two men.

The day after the accident, a local newspaper wrote that a "shower of bricks and debris fell within a radius of 900 feet onto the ice." The newspaper also wrote there had been no warning of impending danger. However, the inquest that followed proved otherwise.

The boiler in question had been serving the Rich Ice House for about 30 years after being purchased second-hand from another company. A few years earlier, it had endured a fire that completely burned down the engine house.

At the inquest, a total of seven witnesses attested the boiler was leaky from the beginning and had to be repaired several times. The foreman of the plant reported that while in the boiler room 20 minutes before the accident, he had noticed the boiler was losing steam. There were four inches of water in the glass and a pressure of 80 pounds. Another witness recounted a conversation with a young man who had been working on the boiler that morning. The boy stated there were "blisters" on the boiler, and he had "put his hammer through one."

After the witnesses were dismissed, the jury deliberated for about half an hour before rendering the verdict that the deaths of the two men were caused by the explosion of the boiler at the Rich Ice House. ❖