FEATURES

DEPARTMENTS

FEATURED IN THIS ISSUE:
The unassuming cover of this 1912 report by Dr. W.F.M. Goss reveals nothing about its "explosive" contents concerning the Coatesville Trials. Article begins on page 10.

Article begins on page 10.

Photograph by Greg Sailor
Cover Illustration by Jim Mellett

BULLETIN

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Joan M. Webster
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Valerie T. Sterling
Publications Editor

Kimberly A. Miller
Publications Coordinator

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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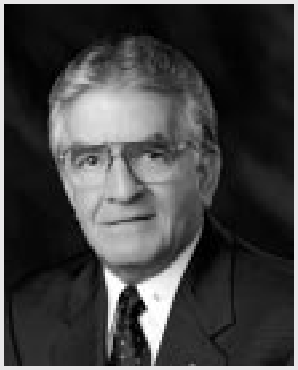
An Open Letter to the Class of 2003



Dear Future Graduate:

As you begin this school year and contemplate your education and professional employment options, please take time to explore a safety career with exceptional promise and opportunity: boiler and pressure vessel inspection.

As you may or may not be aware, the inspection of boilers and pressure vessels is public safety's first line of defense. That's because each one of us comes in close proximity to a boiler or pressure vessel nearly every day. In addition to having at least one in your school, boilers can be found in restaurants, churches, hospitals, office complexes, nursing homes — almost every building in the civilized world.

In <u>one day</u>, more people come in close proximity to a boiler or pressure vessel than the number of people who fly <u>each year</u> in the United States.

If those numbers don't put this essential public service into perspective, consider the following: more than one million new boilers and pressure vessels are installed each year. And that is in addition to the countless millions upon millions already being operated.

The job of reviewing the manufacture, operation, maintenance and repair of this equipment is formidable. Yet over the past two years, inspectors in North America have been responsible for preventing nearly 100,000 potential incidents by identifying and requiring correction of inspection violations.

In the entire world, there are less than 4,000 active inspectors commissioned by The National Board of Boiler and Pressure Vessel Inspectors. Yes, it is an exclusive group. But it is also an extraordinary group faced with an extraordinary challenge.

Presently, there is a critical shortage of boiler and pressure vessel inspectors. That's partly because traditional sources of inspectors such as the armed services are no longer providing the necessary training and experience. Without graduating a new generation of inspectors, the safety of the general public will soon be seriously compromised.

By becoming a National Board-commissioned boiler and pressure vessel inspector, you will join a select fraternity of self-disciplined, highly trained professionals who are internationally qualified to preserve the public trust.

Yes, it is a profession requiring considerable training and preparation, and the National Board Commission Examination is both thorough and rigorous. But boiler and pressure vessel inspection is also a rewarding profession, especially for those who like working independently or who may want the security and benefits associated with public service. Boiler and pressure vessel inspection is particularly appealing to those who may have a genuine interest in welding, electrical wiring and controls, plumbing and piping, fire safety procedures, and building codes and standards.

Where do you begin? Just visit the National Board Web site at <u>www.nationalboard.org</u>, where you will find important career tracking information, as well as links for training opportunities. And please be aware that many jurisdictions offer a training curriculum for those seeking to become inspectors. Contact information for the jurisdiction in which you live can also be found on the National Board Web site by accessing the MEMBERS link.

Remember: carefully weigh each and every one of your career options. However, when seeking a profession that will prove both satisfying and meaningful, please consider the outstanding opportunities, personal gratification, professional respect, and rewards associated with becoming a National Board-commissioned boiler and pressure vessel inspector.

Wishing you success in all future endeavors, I am

Sincerely,

Donald E. Tanner
Executive Director

2002 REGISTRATIONS

A National Board Certificate of Authorization to Register guarantees the third-party inspection process, providing for uniform acceptance of pressure-retaining equipment by member jurisdictions. This important safety process is documented via submission of data reports by the manufacturer to the National Board. These data reports are the only reports carrying the National Board registration number. Once registered, each report is maintained in a permanent file by manufacturer name and National Board number.

The list below identifies boiler, pressure vessel, and nuclear vessel registrations by size for the past five fiscal years. The National Board fiscal year is from July 1 to June 30.

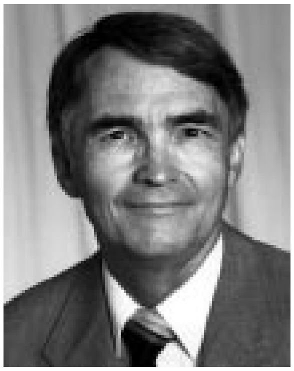
The total number of registrations on file with the National Board at the end of the 2002 reporting period was 34,150,349. ❖

	Size	FY 2002	FY 2001	FY 2000	FY 1999	FY 1998
BOILERS						
square feet of heating surface						
≤ 55	(A)	78,695	87,681	72,700	80,257	81,111
> 55 and ≤ 200	(B)	25,445	24,670	23,614	25,456	23,794
> 200 and ≤ 2000	(C)	9,130	8,959	9,344	12,201	9,316
> 2000 and ≤ 5000	(D)	689	765	976	1,599	906
> 5000	(E)	1,184	1,057	1,605	3,170	1,420
TOTAL		**115,143**	**123,132**	**108,239**	**122,683**	**116,547**
PRESSURE VESSELS						
in square feet						
≤ 10	(A)	671,433	816,778	694,085	678,481	685,430
> 10 and ≤ 36	(B)	340,818	297,047	350,576	286,129	375,089
> 36 and ≤ 60	(C)	60,992	41,149	46,861	37,749	45,501
> 60 and ≤ 100	(D)	10,343	10,503	10,081	10,983	12,074
> 100	(E)	11,585	12,121	12,470	13,930	13,781
TOTAL		**1,095,171**	**1,177,598**	**1,114,073**	**1,027,272**	**1,131,875**
NUCLEAR VESSELS						
in square feet						
≤ 10	(A)	565	1,053	515	354	431
> 10 and ≤ 36	(B)	424	669	362	275	193
> 36 and ≤ 60	(C)	45	89	12	33	10
> 60 and ≤ 100	(D)	15	19	13	9	2
> 100	(E)	17	19	19	26	17
TOTAL		**1,066**	**1,849**	**921**	**697**	**653**
ATTACHMENTS*		79,272	82,745	73,495	78,018	81,324
GRAND TOTAL		**1,290,652**	**1,385,324**	**1,296,728**	**1,228,670**	**1,330,399**

***An attachment is any type of additional information to be submitted with the primary data report.**

Editor's Note:
For more information on the Authorization to Register Program, access *Programs* on the Web site at www.nationalboard.org.

FRANCIS BROWN
STAFF ENGINEER



AUTO-REFRIGERATION: WHEN BAD THINGS HAPPEN TO GOOD PRESSURE VESSELS

Auto-refrigeration is a phenomenon common to liquefied compressed gases. Liquefied compressed gases exist in both the liquid and gaseous phases at ambient temperatures with pressures ranging from 2 psig up to 2,500 psig. That is, there is a gaseous layer over the liquefied gas within the pressure vessel. Some common liquefied gases are shown in the following table:

Ammonia	Carbon dioxide	Chlorine
Hydrogen chloride	Hydrogen sulfide	Liquefied petroleum gases*
Methyl chloride	Monomethylamine	Nitrous oxide
Sulfur dioxide	Sulfur hexafluoride	Tungsten hexafluoride

* Too numerous to list

An example of auto-refrigeration can often be seen when using an LPG (Liquid Propane Gas) grill. On a warm, humid day, moisture in the air condenses on the lower part of the propane tank when the burners are in operation. The withdrawal of propane gas from the tank reduces the temperature of the liquid propane and the tank itself below the dew point temperature, causing the moisture in the air to condense on the surface of the tank. Cooling occurs at very modest rates of gas withdrawal, with the temperature decreasing more as the gas withdrawal rate increases.

Withdrawing gas from the pressure vessel reduces the pressure as well as the temperature within the vessel. The gas that is withdrawn is replaced as the liquid vaporizes by absorbing heat from the remaining liquid and the vessel itself. Auto-refrigeration occurs when the gas is withdrawn at a rate so that cooling exceeds the heat available from ambient sources.

The cooling, if excessive, may lower the vessel metal temperature to the point where failure from brittle fracture is possible. Flaws (cracks) in the welds or the pressure boundary materials that are located in areas of high stress are subject to rapid crack growth when vessel temperatures reach the Nil Ductility Temperature (NDT). The NDT is that temperature at which the behavior of the vessel material (steel) changes from ductile to brittle. Fortunately, pressure decreases as temperature decreases. For example, for a vessel containing liquefied carbon dioxide, a decrease in vessel temperature from 20°F to -20°F (-7°C to -29°C) decreases the pressure from 400 psig to 200 psig. The decrease in pressure associated with the decrease in vessel temperature reduces the stresses from pressure in the vessel material, thus reducing the energy available to produce crack growth. Cracks will not propagate if the total stresses are sufficiently small, even though the vessel material is at or below the NDT.

Total stresses include residual stresses, pressure stresses, and thermal stresses. **Residual stresses** are the stresses remaining in the vessel from the manufacturing process, and are constant. **Pressure stresses** decrease with decreasing temperatures, but the **thermal stresses** induced by the rapid cooling may be increasing. The more rapid the cooling, the higher the thermal stresses. It is very difficult to determine the total stress in a vessel during auto-refrigeration. With the possibility of vessel failure by brittle fracture, appropriate measures should be taken to prevent auto-refrigeration of vessels that were not designed for low operating temperatures.

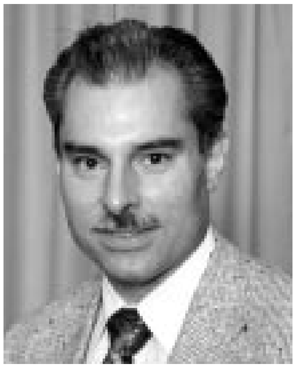
However, vessels that were not designed for low operating temperatures may be cooled to a temperature below the NDT with no apparent damage. Damage will not occur until the total stresses increase to a critical value. To minimize the possibility of damage, the vessel should be very slowly warmed to ambient temperatures in the non-pressurized condition. This will keep the thermal and pressure stresses low, thus minimizing the total stresses in the vessel.

Vessels not designed for low operating temperatures but which have been subjected to auto-refrigeration should be thoroughly inspected for cracks before the vessel is returned to service. This inspection should include a thorough examination of all nozzles (especially the outlet nozzle) and the major weld joints, including the heat-affected zone, of the vessel. A visual inspection of the vessel is inadequate because small cracks may not be detected. The vessel should be inspected by the magnetic particle, liquid penetrant, or ultrasonic method, whichever is most appropriate and compatible with vessel contents and materials.

Compliance with all OSHA requirements for safety of personnel, including entry into a confined space, is essential. Also, knowledge of the vessel contents is required because many of the gases are combustible and may explode when exposed to an ignition source. The vessel interior must be well ventilated and caution exercised when using sources of electrical energy where these gases may be found.

In summary, auto-refrigeration of a pressure vessel not designed for low-temperature operation places the safety of the vessel in question. During auto-refrigeration, a pressure vessel may be cooled to temperatures at which vessel failure by brittle fracture may occur. The thorough inspection required to ensure the vessel can be safely returned to service is both time consuming and costly. Therefore, auto-refrigeration of pressure vessels not designed for low-temperature operation should be avoided. ❖

CHUCK WITHERS
SENIOR STAFF
ENGINEER



ISO/TC11: ITS PROGRESS AND GOAL

ISO/TC11 is a technical committee organized under the International Organization for Standardization (ISO). It was formed to develop international standards for boilers and pressure vessels. An international standard is a technical document available to the public worldwide, generated with the cooperation and consensus of all participating countries. In the case of TC11, the standardization body is ISO. To understand the role and importance of TC11, we must acquaint ourselves with ISO, its national standards bodies (member bodies), and the various organizational groups intimately involved in the process of developing an international standard.

ISO is a worldwide federation of national standards bodies from 143 nations. Its main objective is to develop internationally recognized, technically valid standards allowing products to be bought and sold worldwide without change. For a standard to be of value, governments must accept or adopt it. Acceptance of international standards has become a strategy for global markets to assure foreign market access and eliminate trade barriers. If national standards are replaced by international standards, then the goal of having one global standard can be attained.

Participation in standards development involves making decisions that affect industries, companies, health and safety worldwide. Involvement not only helps us understand what is being written, but also ultimately enables us to influence decisions made within the standard-writing process. Moreover, involvement in the ISO process is the cheapest way to share technology and information, passing on experience between countries.

An important part of the ISO structure is the Technical Management Board (TMB), which is responsible for the technical work of all the committees engaged in developing international standards. Any actions proposed or issues raised by TC11 are subject to guidance, review and approval by the TMB.

As the official member body of ISO representing the United States, the American National Standards Institute (ANSI) sets policy for international participation. ANSI is one of five permanent ISO council members and one of twelve ISO TMB members. Thus, ANSI plays a major role in developing standards both nationally and internationally.

The consensus process for developing standards is the basis for ANSI and ISO policy. Openness, balance and due process are followed when developing standards. Views of all concerned parties are considered and conflict resolution is a mainstay. The belief that diversity equals strength allows for any group, government or individual to voluntarily participate in this process.

Because the committees developing standards are so varied, ANSI operates under the guidance of TAGs (Technical Advisory

Groups). U.S. TAGs — comprised of industry experts — advise, direct and assist both ANSI and the technical committees represented. They represent U.S. interests while still ensuring that ISO and ANSI procedures are followed. ANSI accredits each American TAG and appoints a TAG administrator to serve as a point of contact. The U.S. TAG administrator for TC11 is ASME International.

ANSI can request the assignment of secretariat position for any technical committee in which the U.S. participates. Once the secretariat position has been charged to the U.S., ANSI will appoint a qualified organization (or individual) to act as the secretary for that technical committee. The National Board of Boiler and Pressure Vessel Inspectors has been appointed secretary for TC11.

TC11 was formed under the auspices of the United Nations' Standards Coordinating Committee (UNSCC) in 1945, charged with developing safety and design codes for boilers and unfired pressure vessels. It was taken over by ISO in 1947, and in 1949 proceeded as a committee, with ASME serving as secretary. During this time, ASME's leadership and worldwide standing in the field of boilers and pressure vessels was recognized.

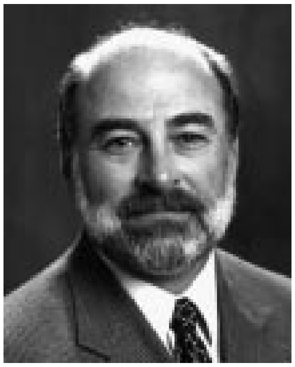
The boiler and pressure vessel industry is an old one, with varied and proven codes of construction presently being utilized throughout the world. The ASME *Boiler and Pressure Vessel Code*, for example, came into existence in 1915 with many other countries developing boiler codes shortly thereafter.

Over the years, TC11 has strived to develop an international standard for a safe design and construction method for boilers and pressure vessels. The difficulty in developing this standard is not the 62 member bodies participating in TC11, but the many proven codes of construction now being enforced by national regulatory agencies. Adequate use and adoption of well-proven national boiler codes or standards makes it difficult to develop just one worldwide standard.

Within the last five years, TC11 has made strides towards the difficult task of developing one standard acceptable to all countries. A new Technical Specification (ISO/TS16528) has just been completed and published by ISO/TC11, allowing for countries to register their codes of construction. The next step for TC11 is to develop a performance-based standard that considers various requirements specified within registered codes of construction. The task is not to make one code of construction fit all, but rather to have all recognized and proven codes fit one standard. If this is accomplished, individual codes can continue to be used for construction. Countries adopting an international standard that ensures quality and safety will allow boilers and pressure vessels to be purchased and installed, regardless of country of origin.

International interest in removing barriers to trade and globalization of markets is altering regulatory enforcement. When TC11 succeeds in developing a performance-based international standard, global advancements in the boiler and pressure vessel industry can be recognized. Benefits such as reducing trade barriers, recognizing and understanding new technology, and expanding foreign market access within the scope of regulatory enforcement, are what TC11 is all about. ❖

JOHN HOH
ASSISTANT DIRECTOR
OF INSPECTIONS



MEDINA: A DEFINING MOMENT

When five people died and 48 were injured in last year's steam tractor explosion at a county fair in Medina, Ohio, there was a great hue and cry among legislators for improved laws to protect citizens from hobby boilers deemed unsafe. In addition to the day-by-day news coverage following this tragic event, newspapers and electronic media everywhere echoed the sentiment that more needed to be accomplished to ensure that such an horrific scene would never be repeated.

Medina was a defining moment that made a powerful case for more diligent monitoring of historical boilers. Having occurred within a public setting (most boiler accidents take place in an industrial environment) where the loss of human life and devastation could have been even more catastrophic, this tragedy was particularly disquieting.

Speculation during the weeks and months following the accident indicated that the regulatory effect on historical boilers would be far-reaching. Many in the hobby prepared themselves for regulatory change, or quite possibly extinction.

One year later, it is interesting to note the final outcome.

The state of Ohio created an Historical Boiler Licensing Board and established licensing requirements for operators. It also created inspection and licensing requirements for historical boilers.

While there had been much rhetoric and hand-wringing in the chambers of other legislatures, Ohio is the *only* jurisdiction thus far to have taken any positive legislative measures to prevent a repeat of the Medina tragedy. (Granted, because the Medina accident occurred in Ohio, it was only a matter of time before new legislation would have resulted.) One state actually diluted its laws following the Medina incident at the behest of an affected hobby association.

While every National Board member expressed concern and reviewed his or her respective regulations, change — even when necessary — is sometimes difficult to achieve. Chief inspectors can only enforce the laws given to them by the legislators. (Some of these laws are exemplary and do an effective job of protecting the public.)

If the public debate was deafening immediately following the Medina accident, it was nothing like the heated dialogue that ensued within the historical boiler hobby.

Take, for example, this reaction posted on an Internet steam hobby organization bulletin board less than a week after the incident: "Keep a close eye on this one and on any knee-jerk reaction by city and state governments to come down hard on hobby steam activity. Fight it if there are any public hearings to ban hobby steam or any adverse publicity. We don't need to have our [hobby] require a boiler license by anyone."

Over the years, I have met a good many people involved with historical boilers. Although passionate about their hobby, an overwhelming majority are very concerned with safety and certainly not given to the type of radical resistance evidenced in the above statement.

But this time, hobbyists failed to take advantage of an opportunity that would have

Courtesy of the Medina County Sheriff's Department

contributed significantly to the betterment of their pastime. Medina was not only a tragedy, it was a chance to organize and take a long, hard look at the deficiencies of historical boilers as well as training opportunities for the people who operate them. More important, it was a chance to correct those deficiencies.

Fact is, working together, exchanging information, educating, keeping open the lines of communication — among all hobbyists and government officials — is how another Medina can be prevented. It is only when these essential components go unfulfilled that accidents occur and more regulation becomes necessary.

While many enthusiasts prefer to keep their hobby unencumbered, there is an obligation from which they cannot escape: the safety of an unsuspecting public. If one chooses to display his hobby boiler at public venues, there is more than an implied responsibility to protect those individuals who may become a part of the audience.

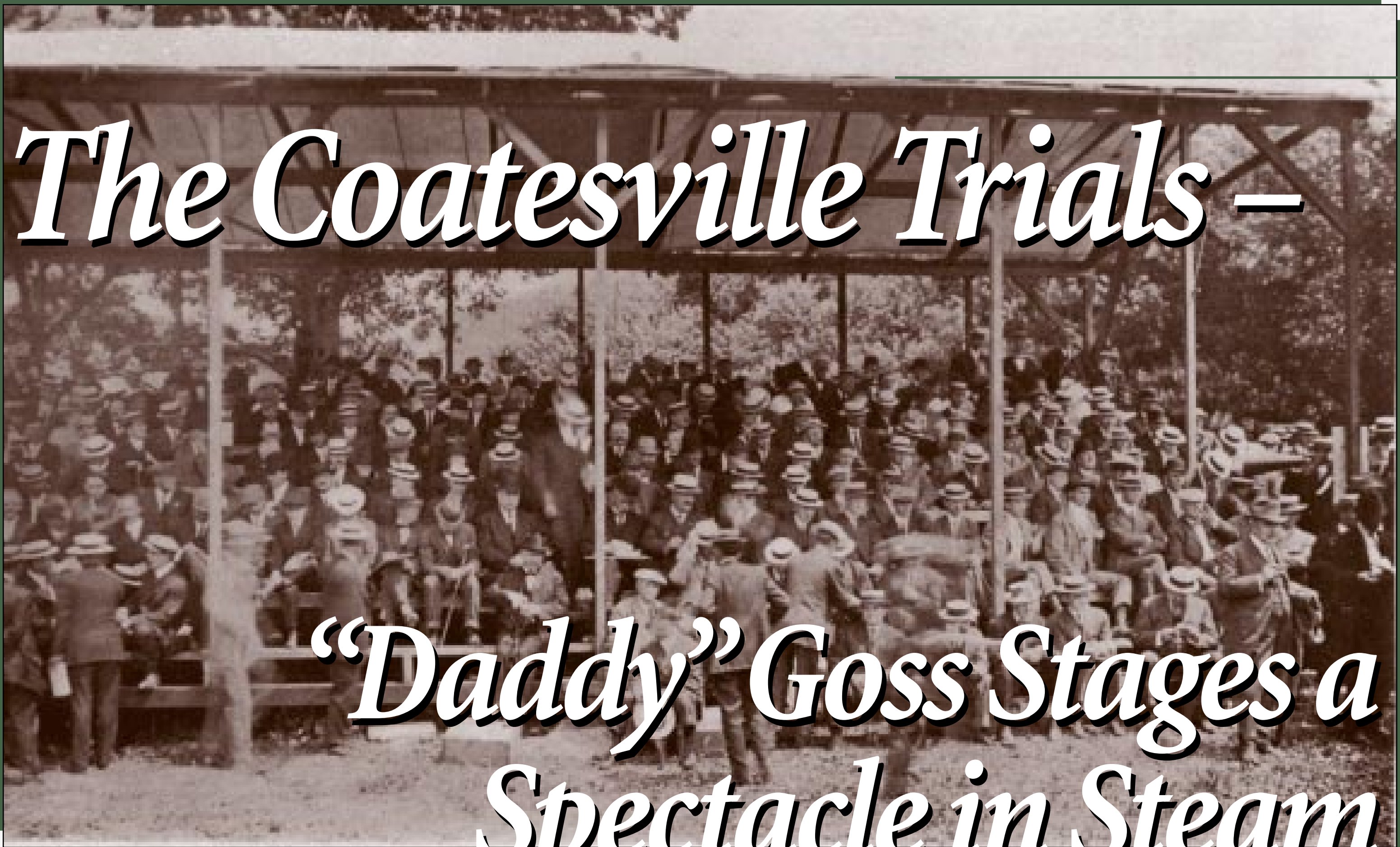
That's the bad news. But there is good: historical boiler hobbyists can still take a more proactive stance by monitoring hobby boilers, being aggressive in adopting uniform standards, and working more cooperatively with government officials. In addition to improving safety, hobbyists might even experience another benefit in the form of lowered insurance rates.

With new enthusiasts continually entering the hobby (some with no training or experience), the risks become increasingly more ominous with each passing month. That is why novices and seasoned hobbyists alike need to adopt a new attitude and a new commitment.

Perhaps eighteenth-century political philosopher Edmund Burke said it best when he opined that the only thing necessary for evil to prevail is for good men to do nothing.

At least until there is another Medina . . . ❖

The Coatesville Trials – "Daddy" Goss Stages a Spectacle in Steam



By Valerie Taylor Sterling, Publications Editor

Thursday, June 20, 1912, dawned clear in Coatesville, Pennsylvania, population 11,000.

The temperature that summer day was seasonal, with a mid-afternoon high predicted to reach the mid-70's.

Flags were flying and banners were hung from just about anything that didn't move.

In fact, it was by official proclamation that Coatesville's homes and businesses (and indirectly, its citizens) were bedecked in their finest. At their meeting earlier that week, the Coatesville Business Men's Association had passed the following resolution:

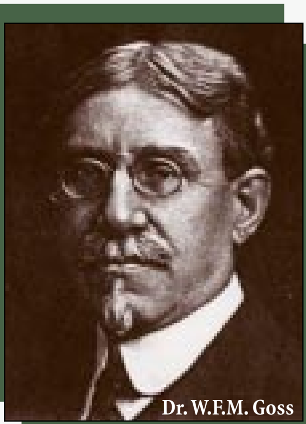
> WHEREAS, On Thursday, June 20th, there will assemble in Coatesville an army of representatives of the leading railroad companies of the world and others to witness at the same mills where the first boiler plate was made in America, over one hundred years ago, the test of the Jacobs-Shupert non-explosive firebox, which it is fondly hoped and confidently believed will not only revolutionize boiler construction, but prove one of the greatest life-saving inventions of the age, and
>
> WHEREAS, The citizens of Coatesville are justly proud of the fact that this new invention is to be manufactured in our town and at the same works which for more than a century, through prosperity and adversity, has kept the fires of progress aglow and grown in magnitude with the passing of the years to the immense proportions they are today, therefore be it
>
> RESOLVED, That as a mark of respect to our distinguished visitors and to show our appreciation of what the iron and steel mills are to Coatesville, The Coatesville Business Men's Association, in session this 18th day of June, does hereby request that on Thursday, June 20th, the flags and the national colors be displayed from business site and private residence and that our people by every token of respect give our distinguished visitors a most cordial welcome.

By early afternoon on Thursday the 20th, it seemed like the entire town had gathered in a landfill located about a mile southwest of Coatesville. One local newspaper reported the next day that 8,000 to 10,000 people had gathered there — townspeople and invited guests from all over America and as far away as Germany.

The preparations for this day had taken months, including building a grandstand on a hillside overlooking the landfill, to seat the town's and other dignitaries. Since the grandstand could only accommodate 300 people, thousands more spilled out into the surrounding hillsides.

The gala event? — blowing up a boiler on purpose! Actually, as many as two boilers. A competition of sorts.

Why so much excitement over a boiler explosion? Why would anyone deliberately wish to cause such a calamity? And why Coatesville? To answer these questions, we must first meet the man behind the event, Dr. William Freeman Myrick Goss.



Dr. W.F.M. Goss

W.F.M. GOSS

At the time of the so-called "Coatesville Trials," Dr. Goss was the dean of the much-respected College of Engineering at the University of Illinois. Throughout his life, his particular interest was steam engines.

Born in Barnstable, Massachusetts, in October 1859, the son of the owner and editor of the *Barnstable Patriot*, young William's mind displayed a mechanical bent early on. As a little boy he built a model steam engine of waste metal from his father's print shop, and at 17 he installed a steam engine on a 17-foot boat. He was graduated from the Massachusetts Institute of Technology in June 1879, after completing a two-year course of study in a newly established program in mechanical arts. Not yet 20 years old, he was hired immediately as an instructor in practical mechanics at Purdue University in Indiana.

When William Goss began teaching at Purdue that fall, he already had a vision of a new approach to the discipline of practical mechanics, centered on shop practice instruction. Straightaway he took it upon himself to institute a shop laboratory. With just five students in his first class, who must have been only a couple years younger than he, Goss set upon a career path which he would follow for the rest of his life.

Within a short time, the range of equipment available in Purdue's novel shop laboratory was expanded, as was the number of students enrolling in its unique practical mechanics program. Soon officials from other colleges were visiting the Purdue laboratory and asking for help in establishing their own manual training programs [*Transactions*, p. 2]. Indeed, Purdue's own program evolved to include the design and construction of the equipment that was then supplied to other schools, establishing "sister" programs in practical mechanics at other colleges.

Around Purdue's campus, the young teacher became known as "Daddy" Goss. After a decade spent developing Purdue's training program and helping to establish similar programs at other schools, "Daddy" was ready to expand on his vision. In the fall of 1890, he became a professor of experimental engineering at Purdue. Under his new responsibilities, he made it his mission to develop shop laboratories for conducting more advanced engineering work. By the fall of 1891, Purdue had constructed a new engineering building; its expanded shop lab included a compound Corliss engine and some testing machines. Goss himself designed the completed lab to comprise a locomotive testing plant, the first of its kind, complete with a full-sized, 100,000-pound steam locomotive named "Schenectady" [*Transactions*, p. 3].

Goss' dreamchild quickly made a name for itself. To date there had been little scientific data available concerning steam locomotives, then the major mode of transportation for people and goods throughout the United States. In a biographical sketch of Goss published by the American Society of Mechanical Engineers (ASME) in 1914, the interest in Purdue's new shop laboratory and its experiments was described as follows:

> So meager was the information concerning the performance of locomotives that every fragment of truth, however simple or easily obtained, at once became a matter of public interest. . . . The laboratory became an active center for testing not only locomotives, locomotive fuels and locomotive lubricants, but also details of car construction such as wheels, axles, draft-gears, couplers and brakeshoes. The problems awaiting solution were always numerous, and the professor in charge was kept busy outlining the means to be employed in solving them. He was in the beginning responsible not only for the effective use of the

> railroad equipment to which reference has already been made, but also for the development of laboratories and courses in materials testing, in hydraulics and in the general field of theoretical and applied thermodynamics [*Transactions*, p. 3].

In recognition of his tremendous contributions, Professor Goss was awarded the honorary degree of Master of Arts from Wabash College in 1888, and Doctor of Engineering from the University of Illinois in 1904.

By the turn of the century, Goss was named Dean of the Schools of Engineering at Purdue, where he continued until 1907. Then, after 28 years of hard work and dedication to Purdue and its practical engineering program, he accepted a position as Dean of the College of Engineering of the larger University of Illinois.

It was in this capacity that W.F.M. Goss was serving when he was contacted by Mr. A.F. Huston, president of the Jacobs-Shupert United States Firebox Company of Coatesville, Pennsylvania.

THE PROBLEMS

By the early twentieth century, the radial-stay firebox was commonly used in American steam locomotives. Although it had evolved from more problem-plagued designs, the radial-stay still left much to be desired in performance, power and repairability. In fact, even under the most normal conditions, the staybolts in the radial-stay boiler were prone to breakage.

In an address given before the Commercial Association of the State of Michigan on April 17, 1912, Mr. F.A. Delano, president and receiver of the Wabash Railroad, commented on the problem his and other railroads faced:

> A modern locomotive boiler has from 1,200 to 1,500 stay-bolts, between 4 and 5 inches apart, on all sides of the firebox. Under the law, five broken stay-bolts are sufficient to condemn an engine. This means that a locomotive boiler must be more than 99 percent perfect to meet approval; and yet it is safe to say that no high-pressure boiler can be cooled down and reheated again (as it must be for each washing out) without breaking at least this number of stay-bolts [*Tests of a Jacobs-Shupert Boiler*, hereafter cited as *Tests,* pp. 15-16].

In response to Mr. Delano's statement, Dr. Goss reasoned that " . . . a boiler that must be fixed after each brief period of service is to be compared with a highway bridge which must be mended after each passing vehicle – it serves an immediate purpose, but it leaves much to be wished for" [*Tests*, p. 20].

Difficulty of repair was not the only issue vexing railroad owners; locomotive boilers were notoriously incident-prone as well. In 1910, the American Railway Master Mechanics' Association published the results of a survey concerning the number of boiler explosions, failures, and casualties suffered by railroad employees and others. The report was based on responses received from 157 railroads owning and operating 43,787 locomotives. It disclosed that during the period from June 1, 1905, to November 1, 1909, there were 246 firebox explosions resulting in the loss of 127 lives, and 2,499 fireboxes damaged by overheating, resulting in 142 deaths. More than 98 percent of these failures were said to have been due to low water [*Tests*, p. 20].

THE BOILERS' DESIGNS

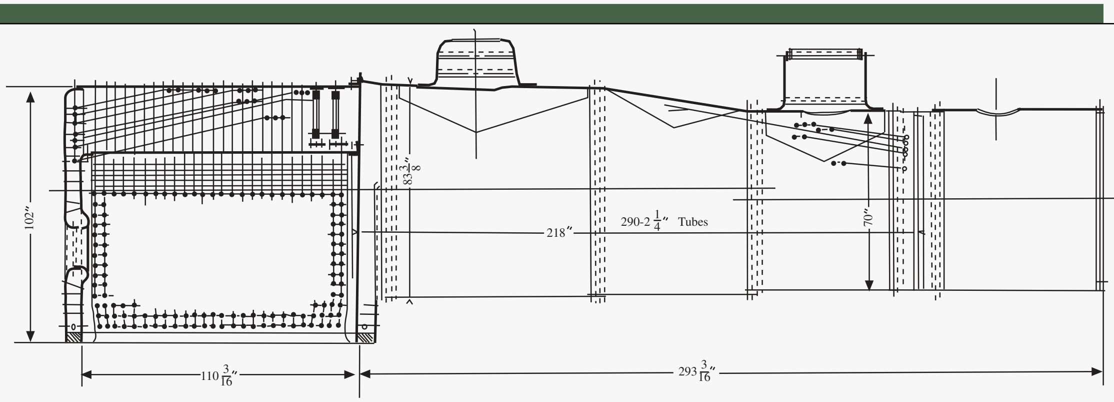
The radial-stay boiler design was the most common in steam locomotives at the time. The crown of the firebox was curved and supported by stays extending to the outside shell or wrapper sheet. In his report, Dr. Goss described the design as "the lines of the stays extended do not necessarily radiate from any single point, but their arrangement suggests such a possibility; hence the term 'radial stays' " [*Tests,* p. 12].

The Jacobs-Shupert United States Firebox Company of Coatesville, Pennsylvania, had developed and tested a new type of boiler. First put in limited service in 1909, the new firebox design eliminated staybolts altogether. It used rivets instead of staybolts to secure the crown- and side-sheets, with the rivets positioned away from the fire, submerged in the water-space of the boiler. Moreover, the new design incorporated a more flexible crown-sheet and a sectional configuration of boiler tubes. Based on tests conducted by the Jacobs-Shupert Firebox Company, the relatively untried sectional design was expected to be at the same time more cost-efficient, stronger (and therefore safer), and more reliable than the common radial-stay design.

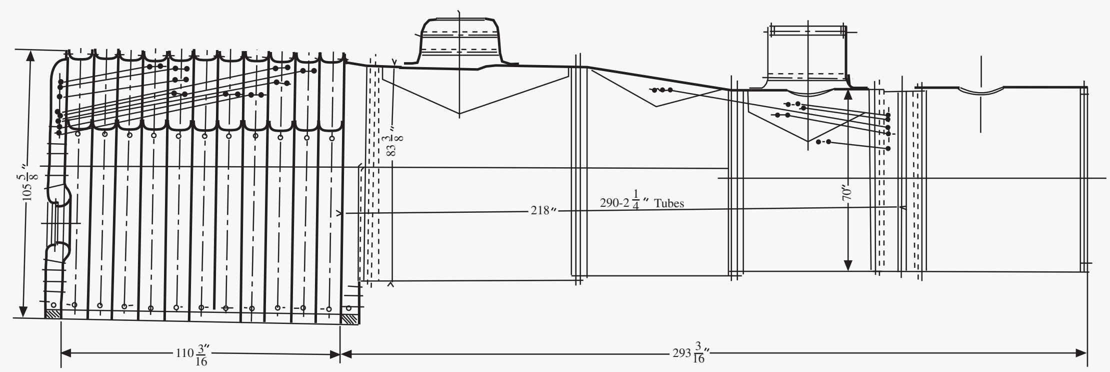
It was time for some "third-party inspection." Enter Dr. Goss.

THE CHALLENGE

When A.F. Huston of the Jacobs-Shupert U.S. Firebox Company wrote Dr. Goss at the University of Illinois, he set before Goss a tantalizing project: compare and contrast the newly designed Jacobs-Shupert firebox with the



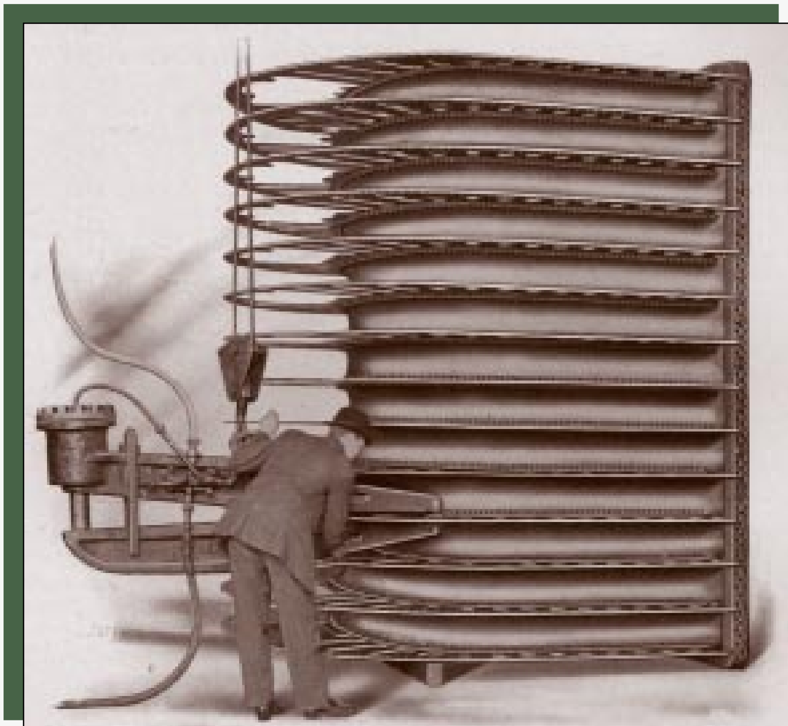
Radial-Stay Boiler



Jacobs-Shupert Boiler

◆ ABOVE: Diagrams of the radial-stay boiler and the Jacobs-Shupert boiler.

◆ RIGHT: Method of riveting together the channel sections and stay-sheets by means of gap riveter.



radial-stay design that was standard in steam locomotives of the day.

The stakes were high for the Coatesville manufacturer. A positive comparison of the new design over the radial-stay would bode well not only for the company, but for the town of Coatesville itself, since many of its citizens were employed by the firebox manufacturer.

What better person to present this challenge to than the widely respected scientist and researcher, Dr. W.F.M. Goss?

Dr. Goss accepted the challenge. After some preliminary investigation, he surmised that the Jacobs-Shupert boiler would be less susceptible to the weakening influences of low-water conditions than the radial-stay boiler because by design, the rivets supporting the crown were so far from the heat source as to be "comparatively unaffected; whereas, in the radial-stay boiler, they are actually in the fire" [*Tests*, p. 33].

Moreover, the design of the crown-sheet in the Jacobs-Shupert boiler would aid in water flow and therefore, boiler efficiency.

THE EFFICIENCY TESTS

As part of A.F. Huston's offer, Dr. Goss was given a free rein in designing and conducting the tests of the two designs of locomotive fireboxes. He spent nearly a year overall, culminating on June 20, 1912, in the landfill southwest of Coatesville.

For Dr. Goss, the challenge was much more than just a comparison of the two types of boilers. As had been his vision throughout his career, he hoped to contribute useful data to the engineering profession, and especially related to the safe and efficient operation of locomotive boilers in general.

Dr. Goss' test parameters included that the two boilers be nearly identical in dimension. Both boilers were chosen at random from the assembly line: the Jacobs-Shupert from the plant in Coatesville and the radial-stay from the Baldwin Locomotive Works in Philadelphia. Each boiler was then "fitted up" while being witnessed by one of Dr. Goss' associates, to ensure identical arrangements. Each boiler had to be a "normal" representation of its type, with the same general dimensions. Each was designed for a working pressure of 225 pounds.

The dimensional comparison comprised 53 elements, meticulously measured and recorded, including:

	JACOBS-SHUPERT BOILER	RADIAL-STAY BOILER
Type of Boiler	Extended wagon top	Extended wagon top
Boiler shell:		
Diameter at front end	70"	70"
Diameter at throat	83 7/8"	83 7/8"
Tubes:		
Number	290	290
Length	18' 2"	18' 2"
Diameter	2 1/4"	2 1/4"
Firebox:		
Grate area, square feet	58.14	58.07
Heating surface:		
Tubes	2759	2759
Total barrel	2777.6	2777.6
Total boiler	3008.4	2984.3
Firebox sections:		
Number	11	
Width	10"	
Boiler stays:		
Crown-bars, number		2
Crown stays, diameter		1 1/8"
Rivets, size:		
Boiler shell	1 1/4"	1 1/4"
Mud-ring	1"	1"

[*Tests*, p. 43].

Once the two boilers were constructed, they were installed side-by-side in a temporary laboratory especially built for such on the grounds of the Lukens Iron & Steel Company, also in Coatesville.

For the purposes of the tests, everything about the laboratory conditions was separate but identical. For instance, the boilers were installed at equivalent heights above the lab floor. Each boiler was independently equipped for testing; nothing was shared. Each boiler had its own water supply tanks and piping. Various instruments and gages measured the amount of water injected into each boiler, the steam output each discharged, the temperatures, water levels and evaporation. There were scales for weighing ashes, and samplers for testing the flue gases emitted. Everything going into and coming out of each boiler was meticulously weighed, tested and evaluated; all was recorded for posterity.

Testing Series A: Oil as Fuel

The first series of tests focused on oil as the fuel for the two boilers. Altogether, nine warehouse tests were made with oil as fuel — five upon the Jacobs-Shupert boiler and four upon the radial-stay boiler. While both boilers were highly efficient in output with oil as fuel, Dr. Goss felt that too much soot was deposited upon the fireboxes' heating surfaces to render the various measurements scientifically valid. Despite his best efforts to circumvent the effects of the soot — including carefully feeding sand into the tubes, as was common practice on the railroads, to "sand blast" them clean — he still could not accept the test results as fair and accurate for either boiler. Dr. Goss eventually threw out all of the oil-fuel test results.

Testing Series B: Coal as Fuel

For the second series of tests, the efficiency of the boilers with coal as the fuel was studied. Altogether, 12 tests were conducted with coal as fuel — six upon the Jacobs-Shupert and six upon the radial-stay. Two different types of coal were used as well, to analyze the effect of carbon content on boiler efficiency. On each boiler, two tests were made with "Scalp-Level" coal (hard, anthracite coal, producing a "short" flame; fixed carbon content 75.90 percent) and four with "Dundon" coal (a soft, bituminous coal, producing a "long" flame; fixed carbon content 49.54 percent) [*Tests*, p. 67].

Moreover, the coal tests were conducted with and without a brick arch in the fireboxes. Without the brick arch installed within each firebox, a comparison of efficiencies was relatively inconclusive. With the brick arch installed in the fireboxes, both boilers were slightly more efficient than without the arch. The Dundon coal was found to burn more efficiently than the Scalp-Level coal, and better with the brick arch in place than without it. Dr. Goss deduced that this was because the arch promoted a "longer flame way, the better mixing of gases, and the conserving of high furnace temperature," all of which were favorable to the long-flame Dundon coal [*Tests*, p. 80].

Overall, Dr. Goss determined that each boiler was about 8 to 10 percent less thermally efficient with coal as the fuel compared with oil as the fuel.

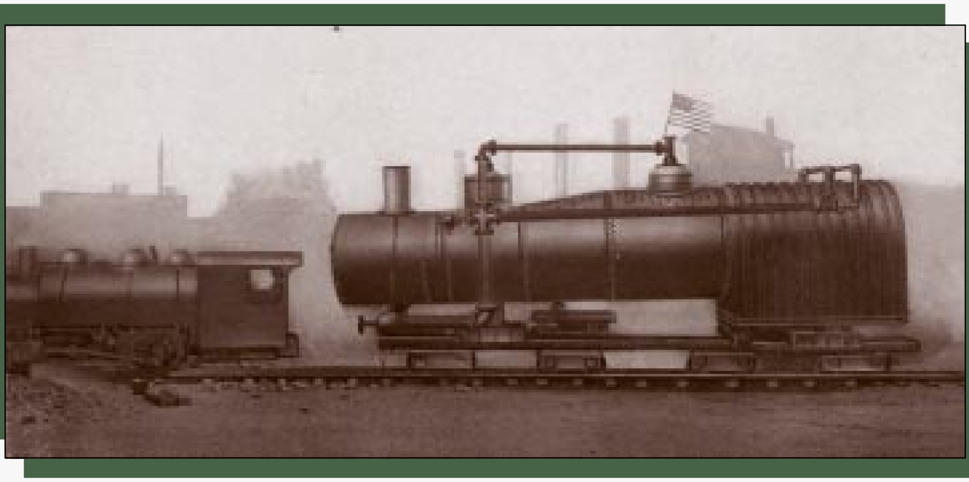
Because of the superior strength of the Jacobs-Shupert firebox, it could be driven to a higher rate of power than the radial-stay firebox, regardless of fuel type — at its best, 19.13 pounds per foot of heating surface per hour, the highest rate of power a locomotive boiler had ever been driven, so far as Dr. Goss was aware.

Testing Series C: Effects of Low Water

The year-long series of tests concluded on June 20, 1912, with the gala event staged in the landfill outside Coatesville.

A few days prior, the boilers were hauled by train from the temporary warehouse to the low-water testing grounds, safely located in the landfill used by the Lukens steel plant for its mill refuse. The fill occupied a small valley formed among the hilly countryside. Besides a small stream, the flat part of the valley was crisscrossed by railway tracks used by the mill's own locomotives to haul the refuse.

Each boiler was transported to its own test platform and placed upon identical concrete piers, about 50 feet apart. The firebox end was placed on the concrete foundation, with timber supporting the front of the boilers, so that any explosion would more likely be directed away from the spectators. The boilers were not secured in any way to the concrete piers, so that "when the explosion or rupture came during the tests, the boilers were free to be lifted off their supports and hurled anywhere that the impact of the explosion might direct in its blind fury" [*The Coatesville Record*, June 20, 1912].



◆ Jacobs-Shupert boiler on its way to low-water testing grounds over the industrial tracks of the Lukens Iron & Steel Company. Note its size as compared with that of the mill locomotive's boiler.

◆ Shelter for the operating staff during low-water tests, consisting chiefly of a Jacobs-Shupert firebox behind an embankment of timber and dirt. The man peeking from the inside provides perspective on the bunker's size.

In the meantime, detailed preparations were made for the protection of those conducting and recording the results of the low-water tests. Safety was paramount to Dr. Goss. He and his staff of observers needed to be near enough to the two boilers to conduct and monitor the tests, yet somehow protected from the results of the desired effects, namely, that one or both boilers eventually exploded. To this end, a bunker was erected at an equal distance (about 225 feet) from the boilers. The bunker's basis? — another Jacobs-Shupert firebox!

Separate water and oil piping had been laid to each concrete pier. The water's source was a small stream, Sucker Run, which traversed the Lukens Steel fill. A small steam-pumping plant had been constructed on its bank, with a main water-feed line laid from the feed pump to the bunker, branching through separate control valves, and off through parallel piping to each boiler. Back on the stream bank, a separate small shelter was framed for the steam-plant attendant.

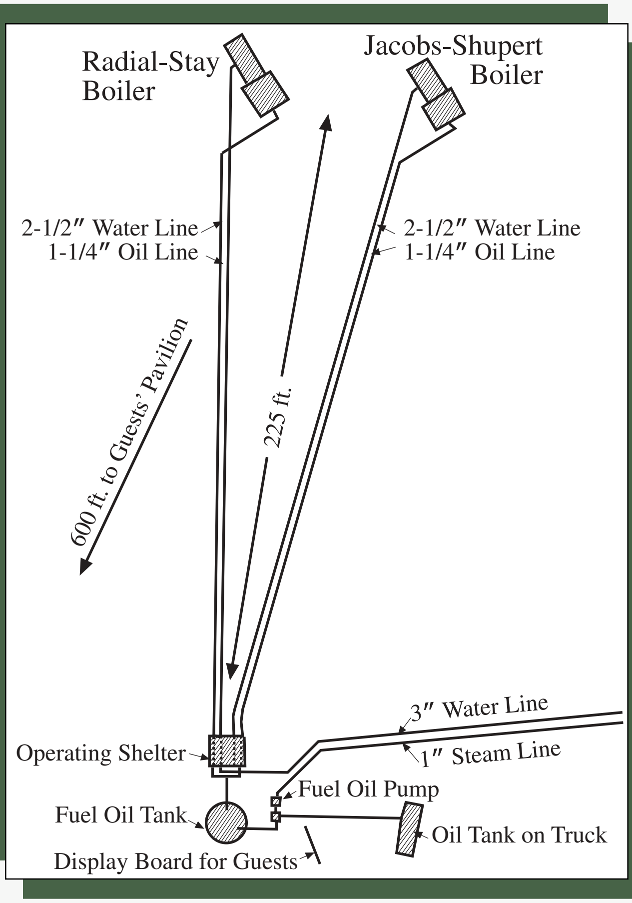
Behind the bunker, an elevated oil tank was installed. Oil was used as the fuel because it would have been too dangerous for a fireman to be shoveling coal into the boilers during the tests. With piping to the burner of each boiler, the fuel was delivered by means of gravity. The oil tank itself drew its oil supply via pump from a steel works' tank car also located just behind the bunker.

On top of the bunker, two telescopes were installed, with a perfect view of the water-glasses and steam-gages mounted on the head of each boiler.

Finally, equally elaborate arrangements were made for the safety of the invited guests and townspeople. On a nearby hillside, a large grandstand (seating capacity of 300) had been erected solely for observing the low-water tests. It was located 600 feet from the nearer locomotive boiler.

The view from the grandstand encompassed not only the two boilers and the observation bunker, but a large display board as well, which featured a cross-sectional diagram of a firebox, complete with a crown-sheet and water-space above and below it, marked off in inches. A large black indicator, controlled by the men in the bunker, revealed the water level at all times. In addition, a large dial indicated the steam pressure during each test. A specially strung telephone line linked the guest pavilion with the operating bunker.

The pavilion guests were transported by automobile and special train cars to the landfill, escorted by Jacobs-Shupert Company representatives. The



◆ Ground plan of low-water testing field.

invited guests also had access to a refreshment booth, from which a professionally catered lunch was served. All in all, 259 invited guests were counted, representing about 50 railroads plus various boiler-related manufacturers as well as technical schools and publications.

In the meantime, wives of the invited guests were entertained at the home of Mrs. and Mr. A.F. Huston, whose request to Dr. Goss a year earlier had led to this exciting day.

On the other side of the valley, at a distance from the two boilers of 1,500 feet, interested citizens of Coatesville and surrounding towns were invited to gather for observing the tests. Dr. Goss had predicted an audience of hundreds, but one of the local newspapers later reported an estimate of as many as 10,000. A less elaborate display board, also keeping track of the water level and steam pressure of the boilers, was erected to keep this crowd apprised of the changing conditions during the low-water tests. On that Thursday, many of the townspeople had taken "a holiday" or at least a "half holiday" and arrived early in the day, bringing picnic lunches with them, in order to get good seats for the boiler tests.

On another nearby hillside, a Pathé Frères motion picture photographer was set up to film the low-water tests. A local photographer, also hired by the Jacobs-Shupert U.S. Firebox Company, was taking photos of the events of the day, in order that prints of the experiment could later be distributed to Jacobs-Shupert clients and suppliers across the country.

Both boilers had already been carefully cleaned and inspected, internally and externally, and were under steam early in the day. By 1:00 p.m., the grounds were clear, Dr. Goss and his staff of six assistants were ready in the bunker, and the guest pavilion was "filled to overflowing."

Just after 1:00, a telephone call to the bunker from the pavilion communicated that the last passenger train bearing invited guests had arrived. At that signal, the fire under the radial-stay boiler was suppressed, in order to test the effects of low water on the Jacobs-Shupert boiler first.

Within the bunker, seven men began to conduct the first low-water test as planned. The men's various responsibilities included the official time-keeper (giving signals at 30-second intervals); an assistant charged with updating the display boards; an observer stationed at each telescope; boiler operator; log keeper; and valve operator. Plus Dr. Goss — "expert in charge."

The Jacobs-Shupert boiler was brought up to predetermined conditions, at a level accepted as being representative of a heavy normal load for a locomotive boiler — 225 pounds pressure per square inch and an evaporation rate of about 36,000 pounds of water an hour. Once these conditions were met, the bunker announced to the pavilion via telephone and megaphone that the tests were beginning.

The first mark was at 1:48 p.m. Every 30 seconds thereafter, data was reported and noted in the log in the following order: water level, then

◆ General view of low-water testing grounds, showing location of boilers with reference to each other, shelter for the operating staff, elevated fuel-oil tank, and large display board for indicating to guests in the pavilion the boilers' water levels and steam pressures during the tests.

◆ The radial-stay boiler at the moment of failure. Escaping steam and water through the ruptured crown-sheet mingled with smoke from the stack and formed a cloud several hundred feet in height, completely enveloping its surroundings.

steam pressure, then the number of "pops" blowing.

In the grandstand, gentlemen predicted how long the test would go on before the Jacobs-Shupert blew.

Finally, 55 suspenseful minutes later, a cloud of black smoke issued from the boiler stack. By that time, the steam pressure had fallen to 50 pounds and the water level had sunk to 35 inches below the crown-sheet. The low-water test of the Jacobs-Shupert boiler was ended. It had been boiled nearly dry and no failure had occurred.

As soon as the Jacobs-Shupert test was stopped, its fire was put out and the fire under the radial-stay boiler was restarted. About half an hour was needed to achieve the predetermined operating levels identical to those at the start of the first test. Finally, the announcement was made to the guest pavilion that the second test was commencing.

Again, spectators on both sides of the valley tried to predict how long the radial-stay boiler would last under low-water conditions.

Not long. In fact, only 23 minutes had elapsed (and the water level was 14 inches below the crown-sheet) when suddenly, "a puff of black smoke [issued] from the right-hand side of the foundation that curled around back of the firebox, to be followed by a blast of black smoke from the left, a dull roar, a cloud of smoke and flying debris, and the disappearance of the boiler and all that part of the field, while the cloud swept out to the left and right for about 150 feet, and up for a similar distance" [*The Literary Digest*, p. 144].

One reporter stated that the roar of the explosion was so loud that even some of the invited guests in the grandstand were concerned for their safety and began to look for a place to hide.

Immediately after the noise subsided, spectators rushed to the boilers. In fact, the *Daily Local News* reported the next day that some of the female spectators who rushed in were caught in the ensuing shower of cinders, much of it saturated with the fuel oil, and therefore their Sunday-finest dresses were ruined!

Many of the male spectators rushed to grab up souvenirs of the explosion, namely, the rivet heads and bolts that had blown out of the radial-stay boiler. Many of these were still hot, however, some even red-hot, so fingers were burned. A reporter for the *Coatesville Record* mentioned in the next day's edition that many of the gentlemen decided to scoop up the hot souvenirs with their hats instead — only to find that the rivets burned holes right through their hats, too!

When the smoke and steam finally cleared, fully a minute later, the effects of the explosion were obvious. Fire brick was scattered up to 175 feet in all directions from the radial-stay boiler, which had moved 18 inches off its foundation despite its 40-ton weight. One large piece of the boiler, weighing over 200 pounds itself, was blown 50 feet away. Internally, nearly 200 staybolts had eventually given way and the crown-sheet had "bellied downward into the fire," according to Dr. Goss. The failure was so devastating, in fact, that the radial-stay boiler was declared to be unsalvageable.

Meanwhile, a close inspection of the sectional boiler found that it was pretty much intact, other than a couple of collapsed boiler tubes, and would be ready to be placed in service after some minor repairs.

In the next day's paper, a *Daily Local News* reporter gushed in enthusiasm over the safe design of the sectional boiler: "The tests have demonstrated conclusively that it is possible to construct a locomotive boiler with a firebox of sectional construction immune from the dangers of disastrous explosion, and thus prevent the yearly toll now paid in the loss of life and property caused by the explosion of locomotive boilers. Statistics show that an average of fifty locomotive boilers explode each year, causing a property damage of at least several millions of dollars, the loss of a hundred or more lives, and the injury of many others."

A *Coatesville Record* reporter predicted even bigger things: "When it is taken into consideration that there are an average of fifty locomotive firebox explosions in the United States in one year and that the adoption of the Jacobs-Shupert firebox will completely eliminate them, one can gain some idea of just what this will mean for Coatesville. Eventually it is likely that legislation will be enacted making it incumbent on railroad companies to use nothing but the Jacobs-Shupert firebox as a safety precaution. It is said that a large number of railroad companies, including the Pennsylvania, are holding orders until the test had been pulled off. It is expected that the test will result in greatly increased business at the plant of the Jacobs-Shupert Company here."

In fact, Baron P. Von Eltz, technical attaché of the German consular service and representing the Prussian State Railway, was reportedly asking about opening a "branch factory" for the Jacobs-Shupert firebox in Germany.

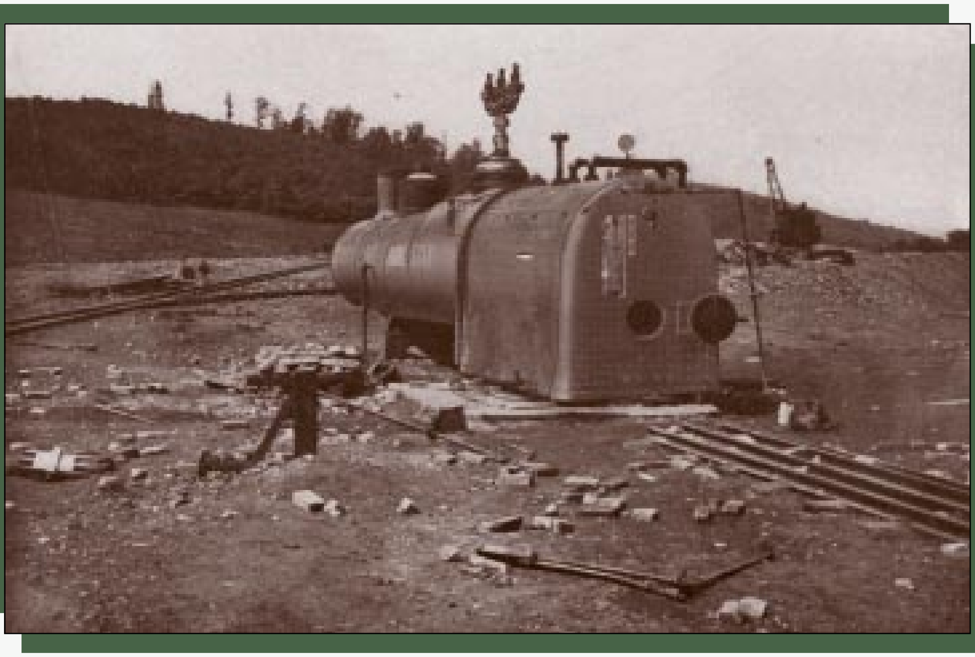
A HAPPY ENDING?

After spending between $30,000 and $50,000 on the year-long "efficiency tests," the Jacobs-Shupert Company was ecstatic that its sectional firebox, the "safety" boiler, had lived up to its designers' claims. It was indeed less prone to failure because of low-water condition than was the radial-stay. The tests were proclaimed a great success.

Unfortunately, the Coatesville Trials did not present the "happy ending" the Jacobs-Shupert U.S. Firebox Company had anticipated. After the Trials, orders did indeed begin to increase for the new sectional boiler. Several railroad lines began to install the Jacobs-Shupert firebox in their steam locomotives.

Ironically, the "safer," riveted design became the Achilles' heel of the Jacobs-Shupert. Within a few months or even weeks of normal use in the big locomotives, boiler scale and hard grit would accumulate right where the sections were riveted together. Small cracks would develop, but because of the riveted design, repair was virtually impossible — the individual, riveted sections were too hard to reach.

The Jacobs-Shupert United States Firebox Company itself was eventually bought out by Lukens Steel, which later became part of Bethlehem Steel, one of the largest steel manufacturers in the United States today.



◆ View showing the radial-stay boiler after its low-water test and the distribution of debris over a radius of 175 feet.

The radial-stay boiler design remained the most commonly used in steam locomotives until the 1950s, when the steam locomotive itself was rendered obsolete by the diesel locomotive.

Meanwhile, after carefully documenting and publishing the results of his extensive tests on the two types of boilers in Coatesville, Dr. Goss was elected president of the American Society of Mechanical Engineers, of which he had been a member since 1885. In addition to his many academic achievements, he was a contributing editor to the *Railroad Gazette*, as well as conducting and publishing research for various associations.

After he died in 1928, his widow donated his personal materials and his own library of books (nearly 1,000 titles, including 750 bound volumes) to Purdue University, where it now comprises the Goss Collection in the W.F.M. Goss Library of the History of Engineering. "Daddy" Goss had also established a generous trust fund to benefit his beloved Purdue.

But his legacy benefitted more than Purdue.

Upon Goss' death at the age of 68, Stanley Coulter of Indianapolis, a fellow member of the Indiana Academy of Science and a longtime friend of William Goss, wrote:

> To those of us who knew him intimately, he was a modest, unassuming, friendly man, with an infinite capacity for work and an almost uncanny genius for organization. . . . It is hard for one who holds him so dear to speak without some danger of exaggeration, but to this Academy, to education and to science, his passing is an irreparable loss. A rare personality, working quietly, persistently, effectively, winning friends and fame by his loyalty to what to him was the best. He could leave us no greater lesson, no sweeter memory [*Proceedings*, p. 25].

Ninety years have now passed since the Coatesville Trials. Steam locomotives and their fireboxes are nearly extinct by now, relegated to tourist attraction status in museums and parks.

In West Lafayette, Indiana, however, Purdue University still proudly includes the library named for "Daddy" Goss.

Now you know why. ❖

With Special Thanks:

Carol Paczolt
The William Freeman Myrick Goss Library of the History of Engineering, Purdue University, West Lafayette, Indiana

Diane Rofini
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Greg Sailor
Photographer, Columbus, Ohio

Bill Withuhn
Senior Curator of Transportation History,
The Smithsonian Institution, Washington, D.C.

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After the Fire . . .

"I suppose you would like to see what the boiler house looked like after the fire," writes a man named Clyde to his brother, in the above postcard dated May 4, 1910. "I took this picture the next morning."

Both photographic postcards depict a boiler explosion and subsequent fire at a lumberyard near Woodbine, West Virginia. The scene of the accident, strewn with debris and falling lumber, resembles a pile of tinker toys. However, it also reminds us of the destruction that can result from boiler accidents – so common during this era. ❖

e•phem•er•a —
(i fem´ ər ə), *n.*, *pl.* item designed to be useful or important only a short time, especially pamphlets, notices, tickets, postcards, etc.

Know anything else about these photographs? Email ***getinfo@nationalboard.org***.

Boiler Inspectors' Experience: THEN AND NOW

By R.D. McGuire

In the past few years, there have been several articles written regarding the evolution of boiler inspectors, such as how the background of this group has changed, and why there is a shortage. These articles did not compare the different experience of individuals currently entering this profession versus that of the established inspector.

Prior to the 1990s, inspectors were generally older when beginning this career. As a matter of fact, until 1976, National Board rules stated one had to be at least 25 years old before a commission could be obtained. It was an indication that a boiler inspector was expected to be a mature individual, having attained five to ten years' experience as an operator or fabricator of boilers.

In the past, most boiler inspectors had received extensive training through previous vocations, such as serving in the Navy, Coast Guard, Merchant Marines, railroad industry, boiler manufacturing facilities or stationary power plants.

Maritime military experience provided many with a background in boiler knowledge before and after World War II. Many older-breed boiler inspectors were mustered out of the Navy or Coast Guard, having performed the tasks related to maintenance and operation of boilers. The Navy required individuals operating boilers to also perform maintenance on the boilers while in port and during the day at sea when not on watch. This activity involved repairs of boilers, valves, piping and related equipment in the boiler room. Sailors gained a practical, comprehensive knowledge, as few areas of boiler operation were not encountered. At the conclusion of their time at sea, only minimal training was necessary for these individuals to qualify as competent boiler inspectors.

Marine engineers operated boilers and engines aboard merchant ships which carried cargo and passengers. Most of the merchant mariners had attended a marine academy, where courses included intense training and instruction on the construction, operation and repair of boilers, pressure vessels and engines. Studies also included heating, refrigeration, cargo winches, plumbing, and electrical distribution. Once at sea, these individuals were required to operate and maintain all these systems. This resulted in a person well qualified to be a boiler inspector.

Those with locomotive experience had worked in the repair yards of railroad companies. Their duties included the complete overhaul of boilers on steam locomotives, involving both major and minor repairs. It was also necessary to be competent in calculating stayed surfaces for repairs and to be knowledgeable about all aspects relating to boiler maintenance. These locomotive shops were large self-contained facilities that had all the equipment to form materials and perform multiple types of joining, including riveting and welding.

Boiler manufacturing facilities instructed individuals in all aspects of creating a complete boiler from steel plate, including rolling and punching of holes for tubes, inspection openings, manhole openings and joining parts via welding. Many who had worked in boiler manufacturing plants had been trained through an apprenticeship. In most cases apprenticeship programs required the individual to have both technical and practical experience in fabricating boilers.

Stationary engineers spent many years learning all aspects of a boiler plant, usually starting with entry-level jobs and working their way up through various levels, thus exposing them to the machinery and equipment needed to operate any large boiler. In many cases this experience included working with engines, turbines and pumps. These individuals received training in materials, operation, repair and alteration of boilers. They were exposed to the equipment during operation, and exposed to maintenance and repairs during plant shutdowns. There were very few parts of a boiler to which they had not been exposed. Also, during operational periods, they had experienced conditions where operation parameters had reached their limits, creating what might be classified as a crisis situation or emergency.

These are some, but not all, of the various ways experience was gained by inspectors just 30 years ago. Applicants for inspector positions were expected to have had some of these experiences prior to even considering becoming a boiler inspector. The position of boiler inspector was reached only after many years of industry experience. Employers expected and even demanded that individuals meet a minimum criteria of extensive experience before being considered to be tested for the position.

In today's world, the National Board is witnessing a much different type of inspector candidate. This new breed lacks much of the practical experience of his or her previous generation and is focused on a faster track to achieve the same end result. This "quick fix," or bypassing the time necessary for an individual to attain the maturity and experience required for a particular job, is a problem that — if not properly addressed — could have severe repercussions.

Today, many individuals have limited experience with the various aspects of boilers, pressure vessels or related equipment. This places the potential inspector in an impossible situation. For instance, inspectors will see operating conditions that create stresses on boilers or pressure vessels. These stresses may lead to conditions that equipment was not designed to withstand. Such stress can lead to cracking, erosion, corrosion, thinning of the materials, bulging, overheating, or other stresses caused by thermal expansion and overloading. These abnormalities are conditions that only an experienced and trained eye can detect. Inspectors are expected to note the problems and recommend correction.

Today we must realize that the days of old have gone, and are not going to be repeated. The method of hiring will not be changing in the near future. So how is the prospective boiler inspector to receive necessary training to ensure that the retiring generation will be replaced by capable hands?

The old system was not entirely perfect for gaining a comprehensive knowledge required of inspectors. For instance, those individuals with operating experience may not have been exposed to methods of construction in detail, such as welding, metallurgy and forming. Seldom were they exposed to nondestructive examination (NDE) methods nor could they acquire a working knowledge of NDE techniques, what should be detected, or when to use a particular method.

Similarly, those coming from boiler and pressure vessel fabrication backgrounds may have lacked knowledge in such areas as equipment operation, stress development during operation, water conditioning and the effects of untreated water on boilers and pressure vessels. A backward glance reveals that past experiences were, in many cases, limiting.

Recognizing the evolutionary change in our profession, the National Board is altering its training methods to better prepare the inspectors of today. It begins with exposing the candidate to those areas in which a boiler inspector should have experience. Today, employers may believe that an individual with an engineering degree has all the necessary knowledge to be an inspector. A technical background is only a prerequisite to further training and experience in boiler operation, construction, repair and alteration.

Of course, this necessitates allowing individuals time to complete courses which expose them to quality systems, repairs, alterations, metallurgy, fatigue analysis, failure causes, and nondestructive examination methods specific to boilers and pressure vessels. It also means teaching operating and process systems so that inspectors understand the factors that are present in these systems and which may have an adverse effect on pressure equipment.

Make no mistake about it: adequate training requires sufficient time and effort to expose individuals to all facets of construction, operation, inspection, repair and alteration of the equipment being inspected. This will provide the inspector with the tools necessary to competently execute his or her duty.

Although a challenge, creating new methods of exposing students to all of these areas is essential to protecting the public's well-being. And it begins with a broader, more complete introduction to system training. It continues with addressing the practical application of standards and repair rules together with hands-on training in testing and examination methods. But it is up to both the inspector and his or her employer to aggressively pursue continued education and advanced training in order to secure the knowledge of emerging technologies.

In summary, to reach the goal of having well-qualified boiler inspectors, we must first recognize the changes that have occurred, agree how best to adjust, and continue our relentless pursuit of excellence. To this end, the National Board will monitor the industry with the objective of providing innovative training to meet the changing needs of an eager, younger generation of inspectors. ❖


National Board Training and Conference Center

SAFETY BY DESIGN
NOT BY DEFAULT
COLORADO SPRINGS

71st General Meeting Highlights

Photography by Dean Williams

DRUMMING UP ENTHUSIASM for the Opening Session are the Plains Indian Dancers of Colorado Springs.

REGISTERED AND WAITING for the next General Session presentation, attendees huddle in the colorful foyer of The Broadmoor's International Center.

LOOKING FOR A PARKING PLACE: Opening Session speaker Suzanne Somers is chauffeured to the stage by National Board Executive Director Donald Tanner in a 1956 Thunderbird — a car similar to the one that made her famous as the "mystery lady" in the movie classic *American Graffiti*.

National Board Executive Director Don Tanner

Jeff del Papa of the New England Rubbish Deconstruction Society (NERDS)

Actress Suzanne Somers

71st General Meeting Highlights

SUZANNE'S SALUTE: Ms. Somers arrives to an adoring ovation before being escorted on stage by Mr. Tanner.

THREE'S COMPANY: (l to r) Glenn Allen of Contract Inspection Services (Dallas), National Board Assistant Director of Inspections Chuck Walters, and Carl Jeerings of Technical Services (Ogden, UT) share a libation and a story against an awe-inspiring Rocky Mountain backdrop during a National Board reception.

SERENE SETTING: National Board reception attendees enjoy the company as well as the beautiful outdoor location overlooking one of The Broadmoor's three outstanding professional golf courses.

Jerry Sturch, AIA Boiler and Machinery Legislative Committee

United States Air Force Academy's Colonel Scott Borges

Bill Withuhn, Smithsonian Institution

FABIAN'S FORTE: Some Awards Banquet attendees elect to sit out a rollicking dance number belted out by '60s singer and teen idol Fabian.

FLIGHT OF THE FAITHFUL: Visiting the chapel at the U.S. Air Force Academy was an afternoon highlight of the Wednesday Outing (above and left), which also included a morning excursion to the top of Pikes Peak by way of the Manitou and Pikes Peak Railway.

Matthew Brown, National Conference of State Legislatures

Singer Lesley Gore

'60s Singer and Actor Fabian

SAFETY BY DESIGN
NOT BY DEFAULT
COLORADO SPRINGS

71st General Meeting Highlights

★ Fabulous Fabian

★ Lovely Lesley Gore

BOARD OF TRUSTEES ELECTIONS HELD

David Douin

Robert Cate

John Engelking

Board of Trustees elections were held during the 71st General Meeting in Colorado Springs, Colorado, April 29 through May 3.

Illinois Superintendent of Boiler and Pressure Vessel Safety David A. Douin has been reelected chairman of the Board of Trustees. He was first elected to the position last year, filling the vacancy left by Donald E. Tanner, who was named the National Board's executive director in March 2001.

Mr. Douin has served the Illinois Boiler and Pressure Vessel Safety Division for 20 years. He earned his National Board commission in 1982, and was named assistant director of inspections for the state in 1986, and director in 1990.

Mr. Douin has also served as second vice chairman on the Board of Trustees, elected in 1997. He holds National Board Commission No. 9943 with "A" and "B" endorsements.

Louisiana Chief Boiler Inspector Robert R. Cate was elected as member at large on the Board of Trustees. Mr. Cate formerly was elected to the board position of past chairman, which was recently eliminated by a vote of the National Board membership.

Mr. Cate was first elected to the Board of Trustees in 2001. He holds National Board Commission No. 8946 with "A" and "B" endorsements.

Maryland Chief Boiler Inspector John J. Engelking was also elected to the Board of Trustees as member at large. He joined Maryland's Department of Labor, License and Industry in 1999, and was elected to the National Board that same year.

Mr. Engelking's career also included serving with the Kemper Insurance Company in several capacities, including as unit manager, stationary engineer, boiler/machinery inspector and as an authorized nuclear inspector supervisor.

He holds National Board Commission No. 6023 with "A" and "B" endorsements. ❖

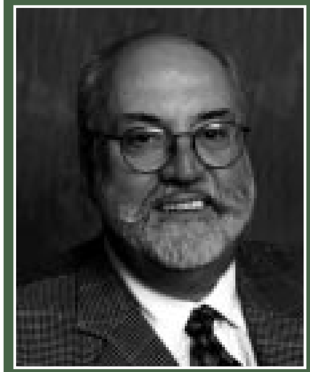
CAREY ELECTED TO ADVISORY COMMITTEE

William Carey

William Carey has been elected to the National Board Advisory Committee representing organized labor. Mr. Carey serves as assistant for the international president of the International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers, bringing 34 years of experience as a boilermaker to the Advisory Committee.

Mr. Carey has been with the International Brotherhood of Boilermakers for the past 20 years. Prior to that, he worked in field construction on fossil fuel and nuclear power plants. A certified welder and veteran of the U.S. Air Force, Mr. Carey resides in Northborough, Massachusetts. ❖

THE NATIONAL BOARD REMEMBERS RUSSELL I. "MUGGS" MULLICAN



Advisory Committee Member Russell "Muggs" Mullican died May 22 in Columbia, South Carolina. Mr. Mullican was en route to Maryland from Florida on May 21 when he suffered a cerebral hemorrhage. He was 60 years old.

The chief executive officer of M & M Welding and Fabricators Inc. of Gaithersburg, Maryland, Mr. Mullican was appointed to the National Board Advisory Committee in 1992 and represented National Board stamp holders.

"The National Board family is deeply saddened to learn of Muggs' untimely passing," commented National Board Executive Director Donald E. Tanner. "His devotion and many contributions to our industry will never be forgotten. We extend our heartfelt sympathy and prayers to his loved ones."

Mr. Mullican is survived by two daughters and grandchildren. ❖

2002 D.J. MCDONALD MEMORIAL SCHOLARSHIPS ANNOUNCED

The names of the 2002 D.J. McDonald Memorial Scholarship recipients were announced during the 71st General Meeting's Wednesday Awards Banquet in Colorado Springs, Colorado. Dana Sander of the South Dakota School of Mines and Technology and Michael Clark of the University of Missouri at Kansas City are this year's beneficiaries.

Dana Sander received his $5,000 scholarship check from South Dakota Chief Boiler Inspector Howard D. Pfaff during an awards ceremony in April. Mr. Sander is a senior, graduating from the South Dakota School of Mines and Technology with a degree in mechanical engineering. Throughout his college career, he has assumed a leadership role in several school projects, including acting as a team leader for the design and manufacture of a new sign for his school's mechanical engineering building, and serving as head design engineer for a patentable prototype yo-yo.

Michael Clark was presented his $5,000 scholarship check in April as well, from then Missouri Interim Deputy Chief Gene E. Reece. Mr. Clark is a junior at the University of Missouri at Kansas City, pursuing a degree in mechanical engineering. He has worked as a fluid mechanics teaching assistant, a steel detailer and a manufacturing engineering intern. With a 3.5 grade point average, Mr. Clark is vice president of the Pi Tau Sigma mechanical engineering honor society and was recently accepted to the Tau Beta Pi engineering honor society. ❖

Dana Sander, left, was presented with a $5,000 check from South Dakota Chief Boiler Inspector Howard Pfaff.

Former Missouri Interim Deputy Chief Gene Reece, right, presented Michael Clark with a $5,000 check.

SAFETY MEDAL NOMINATIONS SOUGHT

The National Board of Boiler and Pressure Vessel Inspectors is calling for nominations for the 2003 National Board Safety Medal Award. Nominations must be received by December 31, 2002.

The Safety Medal Award, the National Board's highest commendation, will be presented at the 72nd General Meeting to be held in Honolulu, Hawaii.

In order for a nominee to be considered for the Safety Medal Award, letters of recommendation must be submitted by three individuals who are personally familiar with the candidate and who can attest to the candidate's contributions relative to boiler and pressure vessel safety.

Each letter of recommendation should include the following information:

- The name of the candidate, title, employer and business address, and a listing of specific contributions or achievements enjoyed by the candidate relative to the award.
- A brief biography of the candidate including positions held, National Board activities, and participation in other industry activities, including any honors and awards known to the individual making the nomination.
- Name, title, employer and business address of the individual submitting the nomination.

Letters of recommendation should be addressed to the Executive Director, The National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Avenue, Columbus, Ohio 43229. ❖

HONORARY MEMBERS NAMED

Tom Wickham, left, with Don Tanner in Colorado Springs.

Jim Corcoran, left, with Don Tanner at 71st General Meeting.

Former Rhode Island Chief Boiler and Pressure Vessel Inspector Tom Wickham and former Connecticut Boiler Inspection Supervisor Jim Corcoran were elected honorary members of the National Board during the 71st General Meeting in Colorado Springs, Colorado.

Mr. Wickham joined the National Board in January 1988 and served on a number of National Board and ASME committees before his retirement. From 1995 until 2000, he was the chairman of the standing committee on examinations of authorized inspectors. Additionally, he served as member at large on the Board of Trustees from 1996 to 2000.

Mr. Corcoran joined the National Board in April 1989 and was also very active in the National Board and ASME. He served on the *National Board Inspection Code* Committee from 1993 to 1999 and as a member at large on the Board of Trustees from 1997 to 2000. ❖

"NB" STAMP BECOMES MANDATORY JANUARY 1

As of January 1, 2003, the National Board "NB" stamp (as shown on the inside front cover of this issue) becomes mandatory for registered pressure-retaining items and National Board certified pressure relief devices, replacing the following terms:

NATIONAL BOARD NATIONAL BD NATL BD NAT'L BD. NB

If a manufacturer or assembler has an existing stock of nameplates with one of these terms, it may continue to use those nameplates until the stock is depleted, as long as the new "NB" symbol is stamped adjacent to the existing term. After January 1, 2003, application of a National Board registration number by a boiler or pressure vessel manufacturer without using the new "NB" stamp will result in the authorized inspector declining to certify the manufacturer's data report.

As of July 2002, over 87% of 3,068 authorized boiler and pressure vessel manufacturers, and all pressure relief device organizations, have been issued the "NB" stamp. Remaining manufacturers will receive their stamps as they renew their authorization to register. All currently authorized manufacturers should have the "NB" stamp by the end of October. ❖

PRICE INCREASES ANNOUNCED FOR NBIC, SERVICES & GENERAL MEETING

The price of the *National Board Inspection Code* (NBIC), as well as prices for select services and fees for General Meeting preregistration and registration, have been increased by the National Board Board of Trustees.

Effective July 1, the price of a single, three-ring bound copy of the NBIC was raised from $70.00 to $85.00 for up to 99 copies. The purchase of a total of 100 or more copies was increased from $55.00 to $65.00 per hard copy.

The price of a single NBIC on CD-ROM combined with one hard copy was increased from $290.00 to $325.00. Additional copies of the popular CD-ROM version also increased, from $220.00 to $240.00 per unit for up to 10 copies. Similarly, prices rose $20.00 per unit for each of the multiple-order categories above 10 copies.

Services affected by price increases include the following:

- Beginning July 1, the new cost for registering all Class E units became $90.00 per unit (up from $85.00). Electronic registration for this classification increased to $90.00 per unit as well (up from $80.00). Registration prices were last raised in 1991.
- The cost for copies of data reports also increased, from $20.00 per sheet to $22.00. The increase covers both regular and priority service.
- Effective October 1 under the new pricing structure, fees to perform reviews of manufacturers' facilities for ASME and/or National Board "R" and "VR" certification will be increased to $130.00 per hour. Fees to perform "NR" surveys will increase to $150.00 per hour for the team leader and $130.00 per hour for the team member.

Increases in the fees for General Meeting preregistration and registration will go into effect beginning with the 2003 event in Honolulu, Hawaii. At that time, preregistration will be increased from $210.00 to $245.00, while onsite registration will be raised from $240.00 to $275.00. Both fees include one ticket for the annual Wednesday evening Awards Banquet. Additional General Meeting fee increases include an increment in the purchase price of a single Awards Banquet ticket from $25.00 to $30.00, and an increase in the guest fee from $95.00 to $110.00. ❖

E. Dennis Eastman

Manager, Engineering and Inspection Services, Province of Newfoundland and Labrador

As roads go, it's been interesting.

Dennis Eastman reflects on the journey by clasping both hands behind his head, leaning back in his chair, and smiling a smile of satisfaction.

For a 42-year-old guy who oversees the inspection of a lot of things in Newfoundland and Labrador that move (i.e., elevators, amusement rides, etc.), and some things that don't (boilers and pressure vessels), the provincial manager of engineering and inspection services readily admits that his life heretofore has been a study in transition.

While many of his contemporaries are contemplating a professional fork in the road, Dennis goes out of his way to explain that he is very happy to be where he is in both his career and personal life. He is also very content to be in St. John's, the easternmost city in North America.

Born in Grand Falls, approximately 280 miles west of St. John's ("Everything is west of St. John's," the provincial manager pointedly observes.), Dennis grew up in a family that included two sisters and his mother and father.

"My dad was a power engineer," the Newfoundland and Labrador official notes with pride. "Because he followed the work early in his career, our family moved quite a bit." During Dennis' childhood, that translated into six moves.

An outstanding math and science student (as well as hockey and basketball player), it was not his academic prowess that prompted Dennis to lean toward an engineering career as he prepared to be graduated from high school. Says the National Board member: "I think it was my father who was more of a direct influence." And perhaps his father's father.

"Actually, the professional lineage goes back to my great-grandfather, who made a living tending horses and boilers for some of the old paper mills in central Newfoundland," Dennis reveals. "Then his son, my grandfather, also worked operating HRT boilers for the paper mills."

Like the two generations before him, Dennis' dad also operated boilers in the paper mills. He eventually worked himself up to First Class Power Engineer and later became a National Board-commissioned field inspector.

With that kind of pedigree, it was only natural for Dennis to attend the mechanical engineering program at Memorial University in St. John's. During the co-op program, Dennis worked for 16 months in a 1,000-ton-per-day pulp and paper mill and eight months with a natural gas transmission company as an engineer-in-training, to gain experience and earn money for his education.

However, a few months after his final work term, what looked like a sure thing turned sour when an economic recession hit. "When I earned my mechanical engineering degree in 1982, the economy was not conducive to finding a job," Dennis laments with an uneasy smile, "particularly for new graduates."

Acknowledging that he wasn't prepared for a detour in a career that had hardly begun, Dennis and a college friend (also looking for his first post-graduate job) opted to form their own advertising sales company.

Much to the surprise of Dennis and his partner, the company generated considerable revenue. But selling advertising required both young men to cold-canvass local businesses, a discipline the future National Board member found rather awkward.

"At the time I was frustrated with having an engineering degree and not being able to use it," Dennis recalls. "But what I didn't realize was how the sales calls were improving my interpersonal and communications skills. Interestingly, the more successful we were, the more confident we became."

With a newfound spirit and attitude, the duo set out to expand their business by entering a partnership to operate a local luncheonette and takeout business. "Like our sales experience, we learned quite a bit on the job — especially about business and hard work," Dennis emphasizes.

Within a few months, Dennis and his partner had doubled the luncheonette's business. "At 23 years old, we felt pretty good about ourselves," the provincial official recollects. "And then one morning we arrived early only to find that everything had been removed from the restaurant: equipment, counter, chairs, food . . . *everything*! The original owners of the luncheonette — our new partners — had spirited everything off in the middle of the night." And so Dennis and his partner learned yet another lesson — about trust.

When Dennis' business partner left for Antarctica to pursue a job opportunity, the future provincial official decided to reenter the job market. Wondering *when* or *if* he was ever going to use his degree, Dennis sold life insurance for two years while taking courses in business, finance and marketing. When Dennis learned of an opportunity with a local energy management company, he decided to get into technical sales.

"I was on the new job for about three months when I got a call from my dad, who had been working as a boiler inspector for the province," the official notes with a smile. "He told me of an opening in the department for a boiler and pressure vessel design review engineer."

After moving into the position in 1985, Dennis quickly learned that the National Board commission was "the industry benchmark in the field of pressure equipment inspection." He immediately began studying the ASME Code and taking a community college welding course two nights a week. "With more than 30 years' experience in the field, my father was a tremendous help to me at the time," Dennis explains. "During my first two years with the jurisdiction, I spent my vacations following him to different locations to learn the inspection process." A side benefit to this experience — an even closer relationship with his father.

Soon after passing the commission examination in 1989, Dennis applied for the newly vacant position of his supervisor. Named that year as manager of engineering services, he served in that capacity until 1992 when he succeeded retiring chief inspector Harold Maye.

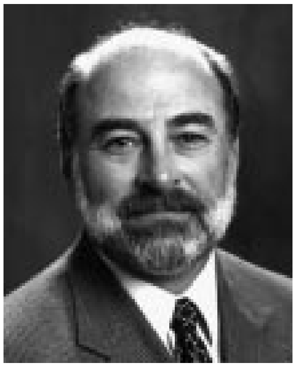
Dennis has now served 17 years with the province's engineering and inspection services. In 2000, he took a one-year leave of absence to move to Prince Edward Island and serve as general manager of ACIC, a not-for-profit pressure-retaining equipment design review organization.

"It was a good experience for me professionally," Dennis explains, "and my family and I enjoyed our time on Prince Edward Island. But when my leave of absence was over, we were happy to go home."

Now having returned to St. John's with his wife, Mary, and seven-year-old son, Lucas, the National Board member of ten years is back where he belongs.

Where all roads lead west . . . ❖

JOHN HOH
ASSISTANT DIRECTOR
OF INSPECTIONS



AN INVESTIGATION: Fact or Fiction?

It is a warm, sunny morning at a manufacturer's facility. The quality control manager and the authorized inspector are enjoying a conversation prior to performing some inspections. They are not yet aware of an unannounced visit by an investigator from the National Board.

The investigator has been sent there because the National Board has reason to believe the manufacturer has been stamping National Board numbers on pressure vessels, but not submitting the manufacturer's data reports to the National Board to complete the registration process.

Based upon information from the National Board's files, the investigator knows the last National Board number and date of registration attributed to this manufacturer. In the course of today's investigation, he will find a National Board number stamped on a vessel ready for shipment, which is considerably higher than that reflected in the National Board's records.

After discussing this discrepancy with the quality control manager, the investigator discovers that the manufacturer has been stockpiling a file of data reports rather than submitting them to the National Board. Why? The quality control manager explains that management does not want to pay the registration fee, and that he thought registration was optional.

The manufacturer is violating the agreement it made with the National Board when it was granted authorization to register. Each vessel exhibiting a National Board number must be registered with the National Board. Under the agreement, there is no option once the National Board number has been stamped; the manufacturer <u>must</u> follow through with the registration process. If a manufacturer chooses not to register a vessel, then the vessel cannot exhibit a National Board number. It is a concept that is often misunderstood or misapplied.

What can manufacturers do at this point? They are provided with a choice of two options. The first is to immediately submit all of the subject data reports to complete the registration process. The second option would require the manufacturer, accompanied by a representative of its authorized inspection agency, to remove the National Board number (including any reference to the National Board) from the vessels in question.

Meanwhile, what about the inspector? This inspector was present at the manufacturer's facility when the investigator appeared. In most National Board investigations, the inspector is unavailable. In either situation, the investigator will review as much documentation as necessary to obtain the facts. This includes the inspector's bound diary. This inspector, due to his presence, was able to discuss some questionable diary entries.

Now it's time for a little introspection. As an inspector, do you have enough confidence in your diary entries which, in your absence, will be used by an investigator to gather

information? Hiding or locking up the diary is not an option. The inspector's bound diary must be available during an investigation.

During some recent investigations, there have been some basic issues with diaries that simply compounded the original problem. The National Board's *Rules for Commissioned Inspectors* outlines various requirements pertaining to the authorized inspector's diary and its contents. [Editor's note: The full-text version of *Rules* is available on the National Board Web site; access our homepage at www.nationalboard.org, then click on *Programs*.]

An authorized inspector's duties include maintaining a bound (not loose-leaf) record or diary of activities. The method of binding must prevent the insertion of pages, which potentially could hide a problem.

The bound diary must also provide for continuity of inspections. "Continuity of inspections" can be described in several ways. The bound diary can include the inspection details noted by the inspector to ensure all required inspections have been performed during a project. Or it can serve as a checklist of sorts when multiple inspectors are involved during one project. Granted, when multiple inspectors are involved, there is a possibility of redundant inspections, but that is not a problem. The danger lies when an inspection is missed altogether because one inspector thought the other person had already performed it. Good detailed entries in the bound diary will help prevent problems.

Another issue which comes up frequently is the lack of evidence that the inspector has monitored the quality system. The *Rules* make this a mandatory requirement.

How does monitoring differ from the inspection being made at each visit by the inspector? The routine inspection is focused on a specific activity in the manufacturing process, whereas monitoring is observation and/or verification that the quality system meets NBIC or code of construction requirements and that the company is following that system in all aspects.

National Board registration would be described in the manufacturer's quality system, therefore subject to monitoring.

The manufacturer in this story provides for the following registration requirements in its written quality system:

> First, [it is stated that] the quality control manager will issue a National Board number only after completion of a successful hydrostatic test of the pressure vessel. Secondly, he or she is to keep a log of these numbers with the corresponding manufacturer's serial number and the issuance date. Then he or she is to submit an original data report to the National Board no later than 30 days after the form is certified by both the quality control manager and the authorized inspector.

Through monitoring, the authorized inspector can ensure that the manufacturer is complying with the requirements for National Board registration. The inspector is reminded that his or her commission number and name is on each manufacturer's data report, indicating that the unit is registered with the National Board, thereby meeting all code requirements. This is a statement that allows this unit to be accepted across Canada and the United States.

Finally, the investigation in this story may serve as a reminder to manufacturers and authorized inspectors alike. For manufacturers: When in doubt, ask the National Board for clarification of registration requirements. For authorized inspectors: Double-check that you are monitoring every aspect of the manufacturer's quality system, and keep a record of that monitoring and other inspection activities by maintaining detailed entries in a bound diary. ❖

The Authorized Inspector and Partial Data Reports

Occasionally, calls to the National Board concern the use of the National Board commission number and endorsement(s) when certifying a partial data report for a code-stamped part. The confusion seems to relate to the part's final destination, i.e., will the completed pressure-retaining item, incorporating the code-stamped part, be registered with the National Board or not?

If the part has a National Board registration number, then the authorized inspector must use his or her National Board commission number and endorsement(s) when certifying the partial data report. If the part does not have a National Board registration number, the authorized inspector must not use his or her National Board commission number and endorsement(s). ❖

RICHARD MCGUIRE
MANAGER OF
TRAINING

BACK TO SCHOOL . . . FOR YOU, TOO?

As summer comes to a close and fall fast approaches, we are reminded that with a new season comes new opportunity. Just as students have now resumed their educational odyssey, perhaps it is time for us professionals to consider our educational needs as well.

For those involved in the practice of law, few can dispute the reputation of a Harvard law degree. Likewise, those in business know the benefits of an M.B.A. Similarly, the training courses offered at the National Board will no doubt bolster the knowledge and confidence level, as well as the professional career, of those working in the boiler and pressure vessel industry.

Successfully completing a training course offered by the internationally recognized National Board is a symbol of distinction that any boiler or pressure vessel manufacturer, inspector or operator can proudly acknowledge. Indeed, most classes include students from all over the world.

The National Board curriculum continues to change to meet the needs of all aspects of the boiler and pressure vessel industry. For instance, one very important aspect of the inspection industry is repair, and the National Board's "R" course is a first step for many organizations to meet the requirements for obtaining an "R" stamp qualification. This is why we emphasize the importance of the two-day fall seminar *Boiler and Pressure Vessel Repair*, to aid those organizations performing or planning boiler or pressure vessel repairs and/or alterations in accordance with the NBIC.

Inspectors and repair organizations are not the only ones invited to enroll in classes at the National Board. For example, the National Board's fall course offering *How to Complete a Data Report/Highlights of the NBIC* will prove invaluable to many manufacturers. Indeed, as most manufacturers can attest, preparing, completing and filing data reports correctly is one of the most consistently challenging aspects of their job. So much so, in fact, that some years ago the National Board *BULLETIN* devoted an entire regular column to data reports.

The benefits gained from taking National Board courses are certainly considerable, especially when weighed against the limited financial resources necessary to bring industry professionals to this state-of-the-art facility, located next to National Board headquarters.

Students returning to school this fall should not be the only ones who come away with newfound knowledge, increased confidence in their abilities, or internationally recognized certifications. These benefits are also available to anyone in the boiler and pressure vessel industry, simply by enrolling in one of the National Board's fall classes. National Board training courses are designed to provide the necessary tools to update and strengthen an inspection or manufacturing career. ❖

Editor's Note

For a complete listing of National Board seminars and courses, access www.nationalboard.org and click on "Training and Conference Center."

ENDORSEMENT COURSES

(A) Boiler and Pressure Vessel Inspection Course (ASME Code Sections I, IV, V, VIII – Divisions 1 and 2, IX, X and B31.1) —
TUITION: $2,500

October 28–November 8
March 10–21, 2003

(B) Authorized Inspector Supervisor Course/
(O) Owner-User Inspector Supervisor Course
(Duties and attributes of a supervisor) —
TUITION: $1,250

February 10–14, 2003

(NS) Nuclear Supervisor Course (This course is a combination of the previously offered S and IS courses; covers NB-265 and ASME Code Sections III and XI) —
TUITION: $1,250

December 2–6

(N) Basic Nuclear Inspection Course on Fabrication, Nondestructive Examination and Inspection of Welded Pressure Vessels (ASME Code Sections III, IX, SNT-TC-1A, QAI-1 and NQA-1) —
TUITION: $1,250

March 31–April 4, 2003

CONTINUING EDUCATIONAL OPPORTUNITIES

One-Day Seminars:
Two one-day seminars or two participants earn 5 percent discount

Section IX – TUITION: $250	**Section VIII –** TUITION: $250	**Data Report and NBIC –** TUITION: $100
Sept. 24	Sept. 25	Sept. 26
Nov. 12	Nov. 13	Nov. 14
Dec. 17	Dec. 18	Dec. 19

(CWI) Certified Welding Inspector Review Seminar —
TUITION:
Full Seminar (all three courses): $1,150
Structural Welding (D1.1) Code Clinic: $375
Welding Inspection Technology (WIT): $440
Visual Inspection Workshop (VIW): $335

November 18–22 (CWI Exam on November 23)
February 3–7, 2003 (CWI Exam on February 8)

CONTINUING EDUCATIONAL OPPORTUNITIES

(R) Boiler and Pressure Vessel Repair Seminar —
TUITION: $335

October 7–8
December 16–17
January 22–23, 2003
February 10–11, 2003
March 17–18, 2003

(RTL) Review Team Leader Seminar —
TUITION: $300

November 12–14

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

October 7–11
January 27–31, 2003

(WPS) Welding Procedure Workshop —
TUITION: $670

October 9–11
December 18–20
February 12–14, 2003
March 19–21, 2003

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, 614.888.8320, ext. 300, or visit the National Board Web site at *www.nationalboard.org*.

REGISTRATION FORM

Please circle the program(s) and date you wish to attend. Please print.

Name ____________________

Company ____________________

Mailing Address ____________________

____

Email Address ____________________

Phone ____________ NB Commission No. ____________

Please enclose check; money order; VISA, MasterCard or American Express number; or company purchase order for the total amount of all programs you wish to attend.

The National Board is in no way liable for credit card information sent electronically, via mail, or facsimile.

HOTEL INFORMATION:

❑ single ❑ double

❑ smoking ❑ nonsmoking

arrival date: ____________

departure date: ____________

Amount enclosed $ ____________

Cardholder ____________ No. ____________ Exp. ____ / ____

This form must be received at least 30 days prior to the beginning of the applicable program. For those requiring special assistance facilities, this form must be received at least 60 days in advance of the activity. The National Board will confirm arrangements one month prior to the program. Course fees subject to change without notice.