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## ON THE COVER:

*What do ten years of Incident Reports reveal about safety in the boiler and pressure vessel industry? Feature begins on page 10.*

## INSIDE:

*One man's trash is another man's . . . steam car! That was the challenge facing (l to r) Richard, Crash, DP and Geo on the Junkyard Wars television show. To find out how they fared, turn to page 16.*



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DONALD E. TANNER  
EXECUTIVE DIRECTOR



## THE BIG PICTURE

In a deviation from our traditional format of intricately dissecting the previous year's Incident Report statistics, this year I want to share with you what I call *The Big Picture*.

First, the good news. When compared to the year 2000 incident statistics, 2001 accidents are down 17 percent and deaths are down 14 percent. The collective number of **Low-Water Condition** and **Operator Error or Poor Maintenance** accidents (accounting for nearly 80 percent of the accidents recorded) is also down significantly.

Now the bad news: the number of injuries sustained in 2001 climbed more than 210 percent! The injury-per-accident ratio, or the odds of being injured during an accident, plummeted to 1 injury for every 26 incidents — denoting one of the most dangerous years since the National Board standardized its incident data-collecting process in 1991. In 2000, there was 1 injury for every 99 incidents.

Further, the number of **Unknown/Undetermined** accidents in 2001 has exceeded 7 percent. This percentage has almost doubled since the introduction of the **Unknown/Undetermined** category as part of our Incident Report in 1999.

Why is this so alarming?

While being able to identify and isolate a problem may not necessarily give us complete comfort, it does provide certainty — the knowledge of what needs to be corrected. Instead, the information that eludes us could conceivably be data that otherwise might find its way to other accident categories. Or it might possibly underscore a problem of a more serious magnitude.

Simply put: what we do not know *can* hurt us. Our lack of understanding or knowledge of the perils of boiler and pressure vessel safety puts everyone at risk. Just ask the 84 people who were reported

as sustaining boiler and pressure vessel-related injuries last year.

With **Operator Error** apparently causing over 90 percent of the deaths recorded in 2001, our objective should become increasingly clear: to embrace training as *the* most important and effective means of reducing accidents, injuries and deaths. And we must do more to inform the general public — to insist that everyone who works on and around boilers has the essential knowledge to protect themselves as well as those around them.

Over the past two years, the number of people who have attended boiler and pressure vessel training courses in North America has reached record proportions. Through this renewed interest in education, I think we as an industry can claim some modest progress in having reduced accident risks.

Recently, however, economic events have prompted many companies to reduce their training participation. For our industry and its future, that suggests a less than optimistic picture. *The Big Picture*.

If you are like me, we share a certain pride in what we are able to contribute to this very important industry. *Our* industry. When all is said and done, none of us wants to be measured in terms of numbers. Or statistics. Or even Incident Reports. We want to be evaluated on how each of us as professionals have dedicated ourselves to protect an unsuspecting public.

Numbers reveal only what was. It is up to *you* to determine what will be.

That, my friends, is not just *The Big Picture*.

It is a window of opportunity. ❖

# 2001 INCIDENT REPORT

This report was compiled from data submitted by National Board jurisdictional authorities and authorized inspection (insurance) agencies as of December 31, 2001. It also includes materials submitted from several insurance companies that insure boilers but do not provide inspection services.

Please note: deaths and injuries are industry-related. They include, but are not limited to, owners and operators of boilers and pressure vessels.

This survey notes a 75 percent response rate from National Board jurisdictional authorities and a 41 percent response rate from authorized inspection agencies. The total number of surveys mailed was 89, with a 64 percent response rate overall. ❖

OBJECT EXPERIENCING INCIDENT	ACCIDENTS	INJURIES	DEATHS
<b>POWER BOILERS</b>			
Safety Valve	4	0	0
Low-Water Condition	161	3	0
Limit Controls	8	0	0
Improper Installation	2	0	0
Improper Repair	1	0	0
Faulty Design or Fabrication	2	0	0
Operator Error or Poor Maintenance	82	50	7
Burner Failure	29	2	0
Unknown / Under Investigation	7	1	0
<b>SUBTOTALS</b>	<b>296</b>	<b>56</b>	<b>7</b>
<b>HEATING BOILERS: STEAM</b>			
Safety Valve	2	0	0
Low-Water Condition	519	0	0
Limit Controls	17	0	0
Improper Installation	10	0	0
Improper Repair	11	0	0
Faulty Design or Fabrication	31	0	0
Operator Error or Poor Maintenance	406	0	0
Burner Failure	29	0	0
Unknown / Under Investigation	66	0	1
<b>SUBTOTALS</b>	<b>1091</b>	<b>0</b>	<b>1</b>
<b>HEATING BOILERS: WATER (includes hot-water supply)</b>			
Safety Relief Valve	6	0	0
Low-Water Condition	195	1	0
Limit Controls	19	0	0
Improper Installation	13	2	0
Improper Repair	10	3	0
Faulty Design or Fabrication	30	0	0
Operator Error or Poor Maintenance	260	1	0
Burner Failure	26	3	0
Unknown / Under Investigation	72	0	0
<b>SUBTOTALS</b>	<b>631</b>	<b>10</b>	<b>0</b>
<b>UNFIRED PRESSURE VESSELS</b>			
Safety Valve	6	2	0
Limit Controls	4	0	0
Improper Installation	8	2	0
Improper Repair	8	0	0
Faulty Design or Fabrication	16	0	0
Operator Error or Poor Maintenance	142	14	4
Unknown / Under Investigation	17	0	0
<b>SUBTOTALS</b>	<b>201</b>	<b>18</b>	<b>4</b>
<b>TOTALS</b>	<b>2,219</b>	<b>84</b>	<b>12</b>

FRANCIS BROWN  
STAFF ENGINEER



## MANUFACTURERS' DATA REPORTS FOR ASME SECTION VIII, DIVISION 1 VESSELS

**R**equirements for completion of manufacturers' data reports (MDRs) are based on the *ASME Boiler and Pressure Vessel Code* and interpretations. Supplemental National Board requirements associated with vessel registration include the assignment of National Board numbers. Occasionally, manufacturers' data reports submitted for registration are received with incorrect or incomplete information.

Listed below is a summary of the items most often found in error on MDRs for vessels manufactured in accordance with ASME Section VIII, Division 1.

### Impact Testing Requirements and Exemptions:

A "YES" entry, with the Charpy impact test temperature, is required on the MDR for all pressure vessels, unless exempted by the applicable subparagraphs of UG-20, UCS-66, or UHA-51. Per Interpretation VIII-1-92-118, when a "NO" is entered on the MDR, the specific subparagraphs granting exemptions from impact testing for each vessel component must be listed. Note that bolting materials are subject to the same requirements as other pressure-retaining materials.

### Material Specification:

Materials used in the construction of boilers and pressure vessels must be identified in the MDR by the complete ASME material specification, which includes the grade and/or class. Materials conforming to non-ASME specifications may be reclassified and remarked per UG-10. Reclassi-

fied material also must be listed on the MDR by the appropriate ASME material specification.

### Weld Type:

Weld types are not the same as weld categories. Weld categories indicate the generic location of the weld, and are defined in UW-3. Weld types indicate weld joint geometry, and are defined in Table UW-12. When appropriate, the weld type should be indicated on the data report form by number as shown in Table UW-12.

### Inspection Openings:

Inspection openings are required, and must be documented in the MDR for all pressure vessels, unless specifically exempted in UG-46.

### Head Description:

Section VIII provides for the description of the type of head used for a pressure vessel. The information required for specific head designs is:

Type of Head	Data Entered
torispherical	crown and knuckle radii
semi-ellipsoidal	elliptical ratio
conical head	conical apex angle
toriconical	knuckle radius and conical apex angle
hemispherical head	hemispherical radius
flat head	flat diameter

### Nozzle Attachment:

Information regarding the method of attaching a nozzle to the pressure vessel is required, and is indicated on the MDR by referencing the appropriate sketch as shown in Fig. UW-16.1, or

the appropriate weld type as shown in Table UW-12. The term “welded” is not specific enough.

**Weld Efficiency:**

The weld-joint efficiencies for the longitudinal and circumferential welds must be indicated on Section VIII MDRs. The joint efficiencies are defined in Table UW-12, and may be modified by UW-11(a)(5)(b). The efficiencies for seamless and resistance welded heads and shells are defined in UW-12(d).

**Synopsis:**

A synopsis of requirements for completing manufacturers’ data reports for vessels to be registered with the National Board follows:

**Forms:** Use only standard ASME or National Board forms.

**Computer-Generated Data Reports:** ASME Interpretation VIII-1-83-17 requires a computer-generated data report form to be identical to the ASME/National Board forms in format. The National Board applies this interpretation to all ASME Code sections. A sample computer-generated form (complete except for signatures) must be submitted to the National Board for review prior to submitting the actual data report for registration. The data entered on an MDR must be 8 point minimum, where 1 point is 0.01384 in. (0.0346 cm).

**Line 1 of All Data Reports:** The manufacturer’s complete name and physical address (including the postal code) as shown on the Certificates of Authorization by ASME and the National Board.

**National Board Registration Numbers:** Each manufacturer must begin with the number 1 and continue consecutively without skips or gaps. MDRs may be submitted out of sequence, and should be submitted to the National Board as soon as possible after the vessel is completed.

**Code Edition and Addendum:** The ASME Code edition and addendum to which the item is designed and fabricated must be entered.

**Construction Materials:** All materials must be identified by the complete ASME material specification (includes grade and/or class) as shown in the applicable ASME Code section.

**Code Case:** The number of any code case(s) must be entered on the data report form.

**Partial Data Reports:** These must be identified on the primary report by part name, unique serial number, and the manufacturer’s name. Partial data reports must be attached to the primary data report form.

**Supplementary Sheets:** The applicable ASME Code supplementary sheet must be used and submitted with the MDR, when additional space is required. Reference to supplementary sheets should be made on the MDR.

**Size:** The length and diameter of pressure vessels or the heating surface dimensions of boilers are required.

**Signatures:** Each data report must be signed and dated by the manufacturer’s representative and the authorized inspector. The authorized inspector must indicate his/her National Board commission number and endorsements as well.

**Method of Completion:** The report must be either completely typed or completely handwritten. It is permissible to add a handwritten notation on a typed form, provided it is initialed and dated by the manufacturer’s representative and by the authorized inspector.

**Original:** An original data report with attachments must be submitted to the National Board to complete the registration process. ❖

**Editor’s Note:** \_\_\_\_\_  
For more information regarding completion of MDRs, please contact Francis Brown at [fbrown@nationalboard.org](mailto:fbrown@nationalboard.org).

JOHN HOH  
ASSISTANT DIRECTOR  
OF INSPECTIONS



## INSERVICE INSPECTORS' FREQUENTLY ASKED QUESTIONS

**I**nspectors are a curious lot by nature. They ask many questions in order to perform their duties.

As a follow-up to the recent article on manufacturers' frequently asked questions<sup>1</sup>, here is a small sample of questions posed to the National Board by inspectors, and specifically, inquiries from inservice inspectors. Their responsibilities include inspecting repairs and alterations performed in accordance with the *National Board Inspection Code* (NBIC).

### 1 —

**What is the difference between an authorized inspector and the inspector referenced in the NBIC?**

Authorized inspectors have an endorsement on their National Board commissions indicating their qualification to inspect pressure-retaining items during manufacturing or fabrication. The "A" endorsement is an example. The inspector described in the NBIC is a National Board-commissioned inspector (with or without endorsements).

### 2 —

**I have an "A" endorsement on my commission. Does this mean I cannot inspect repairs and alterations?**

Having the "A" endorsement does not prevent you from performing repair and alteration inspections. Your commission provides the qualifications you need for that work.

### 3 —

**As an inspector, am I required to be supervised by a "B" endorsement holder?**

The NBIC has no provisions for an inspector supervisor.

### 4 —

**I frequently inspect repairs and alterations. Am I required to maintain a diary of my work?**

The National Board *Rules for Commissioned Inspectors*, Section 9, Paragraph (k), requires the inspector to maintain a bound (not loose-leaf) record or diary of activities involving acceptance inspections of repairs and alterations. The latest version of the *Rules for Commissioned Inspectors* may be viewed on our Web site at [www.nationalboard.org](http://www.nationalboard.org). Click on *Programs* to find a link to the *Rules*.

### 5 —

**I have authorized an "R" certificate holder to start three new repair jobs this week, but I will be unavailable to perform the acceptance inspections. What should I do?**

NBIC Paragraph RC-1060 indicates the inspector making the acceptance inspection should be the same as the one authorizing the work, but, in all cases, shall be an employee of the same authorized inspection agency. Your backup or relief inspector should become involved as soon as possible to ensure that the necessary inspections are performed.

**6 —****Does the NBIC require inspector involvement for routine repairs?**

NBIC Paragraph RC-2031(b) states that the requirement for in-process involvement of the inspector may [emphasis added] be waived. NBIC Interpretation 95-31 indicates this would also include waiving the requirement for the inspector to witness a pressure test on a routine repair. However, the inspector does have a role in routine repairs as illustrated in NBIC Paragraph RC-2030. All repairs must have the authorization of an inspector before they are initiated. If acceptable to the jurisdiction, routine repairs may be given prior approval by the inspector if the “R” certificate holder has acceptable procedures to cover the intended repairs. Additionally, NBIC Interpretation 95-28 indicates the inspector must sign Form R-1 for all repairs, including routine repairs.

**7 —****I have been requested by an “R” certificate holder to authorize a repair on an old pressure vessel originally manufactured to a foreign standard. It is impossible to obtain a copy of the original standard to use as a basis for the repair. Is it still possible to perform the repair in accordance with the NBIC?**

Maybe. If the “R” certificate holder gains the concurrence of the jurisdiction (where the item is installed) and the inspector, it is permissible to use other codes, standards, or specifications, including the ASME Code. NBIC Paragraph RC-1020(b) addresses this situation.

**8 —****One of the “R” certificate holders I work with wants to use some of the Standard Welding Procedures listed in the NBIC. Can you provide some information on those?**

The list of Standard Welding Procedures accepted for use in repairs and alterations can be found in Appendix A of the NBIC. The procedures can be purchased through the American Welding Society (AWS). For more information on obtaining the procedures, you can visit their Web site at [www.aws.org](http://www.aws.org). Please note that AWS has many Standard Welding Procedures, however not all are accepted by the NBIC.

A Standard Welding Procedure is not valid using conditions and variables outside the listed ranges; therefore, the user of the procedure must follow it with absolutely no deviation.

**9 —****Do welders with existing qualifications need to be re-qualified to use a Standard Welding Procedure?**

No. As long as the welder’s existing qualifications are for the same process and the qualified ranges are supported by the Standard Welding Procedure, no re-qualification is necessary. “R” certificate holders must ensure their welders are qualified in accordance with the original code of construction or ASME Section IX. ❖

<sup>1</sup>“Registration: Manufacturers’ Frequently Asked Questions,” Fall 2001 *BULLETIN*, pp. 4-6.

CHUCK WITHERS  
SENIOR STAFF  
ENGINEER



## AN ANSI STANDARD: REACHING A CONSENSUS ON THE NBIC

In 1945 the *National Board Inspection Code* (NBIC) was developed and introduced as a standard by The National Board of Boiler and Pressure Vessel Inspectors, with no outside involvement. In 1983, however, the NBIC became an American National Standard (ANS).

The National Board made the move to become accredited by the American National Standards Institute (ANSI) in order to develop and maintain the NBIC as a standard to be recognized worldwide, thus maximizing regulatory and market acceptance. Recognition by ANSI would indicate that the NBIC received industry input through a process of consensus.

Consensus is the substantial agreement reached by directly affected interest categories — a concurrence of more than a simple majority, but not necessarily unanimity.

The consensus approach comprises three main principles: **openness, balance and due process**. Openness indicates that any interested party directly affected by the activity in question can participate in the development of any ANS, provided he or she is a U.S. national. Balance is the process of developing a standard using a balance of interest categories, not dominated by any single category. For example, the NBIC Committee is represented by seven different interest categories: jurisdictional authorities, manufacturers, regulatory authorities, owners/users, NB certificate holders, authorized insurance agencies, and general interest. Finally, the principle of due process is maintained throughout the development of a standard.

Anyone has the right to appeal any action made by the standards developer, including developing and revising written procedures and/or standards. All actions involving standards developers are open for public review comments. Every effort is made by the developer to resolve all public comments and issues. Any unresolved issues are reported to ANSI for review and assurance that due process has been followed.

The consensus approach employed by ANSI for development of standards receives widespread support from National Board member jurisdictions, industrial organizations, trade associations, and formal standardization bodies in national, regional and international arenas.

As the “umbrella organization” for the United States’ voluntary consensus community, ANSI’s roles include developing standardization policies and procedures, ensuring standards integrity, and accrediting standards developers.

With many different interest categories participating, cooperation, research and compromise are essential. NBIC draft addenda are published on the ANSI and National Board Web sites to encourage interested parties to submit comments. Because the ANSI process is recognized worldwide as an accepted method for establishing technical standards, the NBIC has become an *international* inspection, alteration and repair code. Widespread participation in the consensus process enhances global competitiveness and safety. ❖



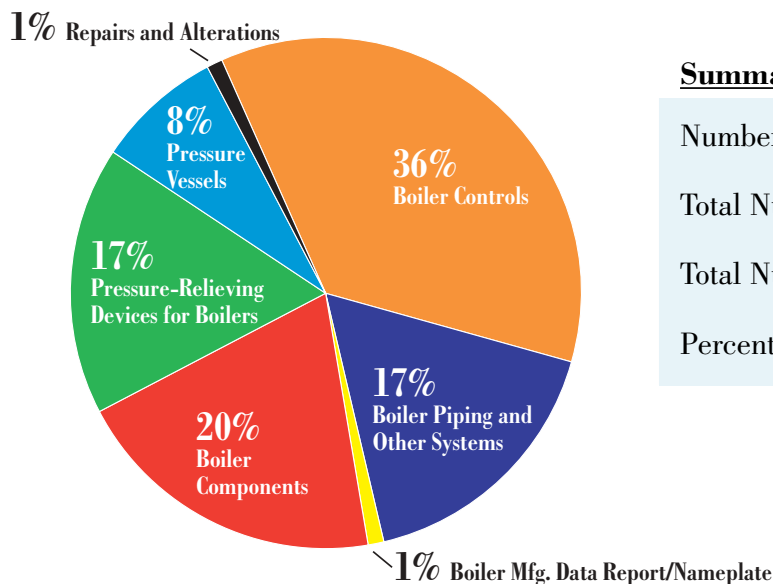
# 2001 REPORT OF VIOLATION FINDINGS

The annual Violation Tracking Report identifies the number and type of boiler and pressure vessel inspection violations among participating member jurisdictions. The National Board of Boiler and Pressure Vessel Inspectors releases this report for the year 2001.

Unlike the annual Incident Report, which identifies causes of boiler and pressure vessel accidents, the Violation Tracking Report identifies problem areas and trends related to boiler and pressure vessel operation, installation, maintenance and repair. The Violation Tracking Report documents how the inspection process identifies problems which lead to enforcing repairs prior to adverse conditions occurring. In addition, the Violation Tracking Report serves as an important source of documentation for jurisdictional officials, providing statistical data to affirm the continued support of vital inspection programs.

## Annual Report 2001

<u>Category</u>	<u>Number of Violations</u>	<u>Percent of Total Violations</u>
Boiler Controls	16,565	36%
Boiler Piping and Other Systems	7,908	17%
Boiler Mfg. Data Report/Nameplate	703	1%
Boiler Components	9,342	20%
Pressure-Relieving Devices for Boilers	8,040	17%
Pressure Vessels	3,676	8%
Repairs and Alterations	364	1%



## Summary for 2001

Number of Jurisdictional Reports	_____	337
Total Number of Inspections	_____	473,185
Total Number of Violations	_____	46,598
Percent Violations	_____	10%

*The Numbers Are In . . .*

# Ten Years of Incident Reports Underscore Human Error as Primary Cause of Accidents

**W**hen the National Board standardized its reporting process for gathering incident statistics in 1991, it was with the objective of creating an accurate and consistent database that would, over time, yield a bona fide method of identifying and correcting the causes of boiler and pressure vessel accidents.

The first composite evaluation of this data, published in 1997, covered a five-year period from 1992 to 1996. With a benchmark in place, the 1997 analysis provided a particularly useful perspective on incident cause and effect. Five years later, it can be stated that the overriding conclusion reached from the second five-year study reinforces the findings of the first: namely, that human error remains the foremost cause of boiler and pressure vessel incidents in North America.

## OVERVIEW

Tragically, a total of 127 persons have lost their lives as the result of boiler and pressure vessel accidents during the past ten years. On average, that is just less than 13 fatalities per year. The annual number of deaths has seesawed over the past ten years [see Figure 1], with the only sustained downward trend — over three years — taking place between 1999 and 2001. While this may appear to be a positive revelation, it must be considered in the context that 1999 saw the most deaths (21) over the ten-year period. The lowest number of fatalities over the reporting period, 8, was recorded in 1994.

In the category of injuries, a total of 720 were recorded between 1992 and 2001 — or an average of nearly 72 per year. Again, 1999 was not only the most deadly in the boiler and pressure vessel industry, it also saw the highest number of injuries with 136 [see Figure 2]. By comparison, the year 2000 experienced the lowest number of injuries at 27.

When it comes to number of accidents, there is little positive news. Each year during the 1992 to 2001 reporting period saw at least 2,000 accidents, with a total of 23,338

Figure 1 — Total Number of Deaths

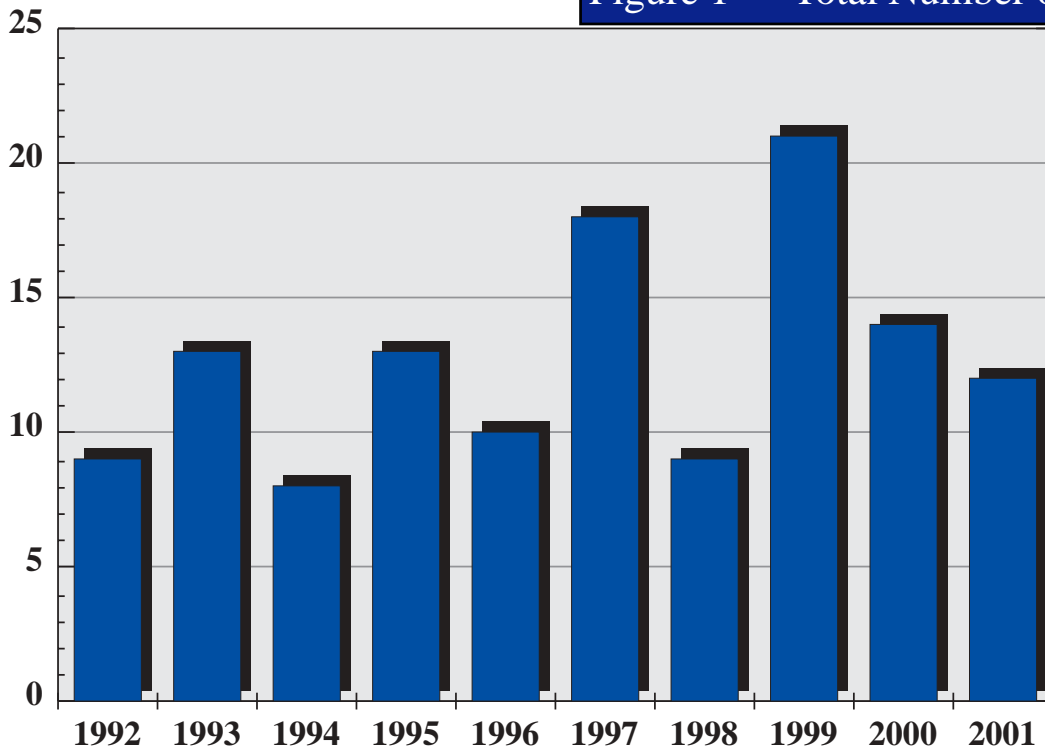
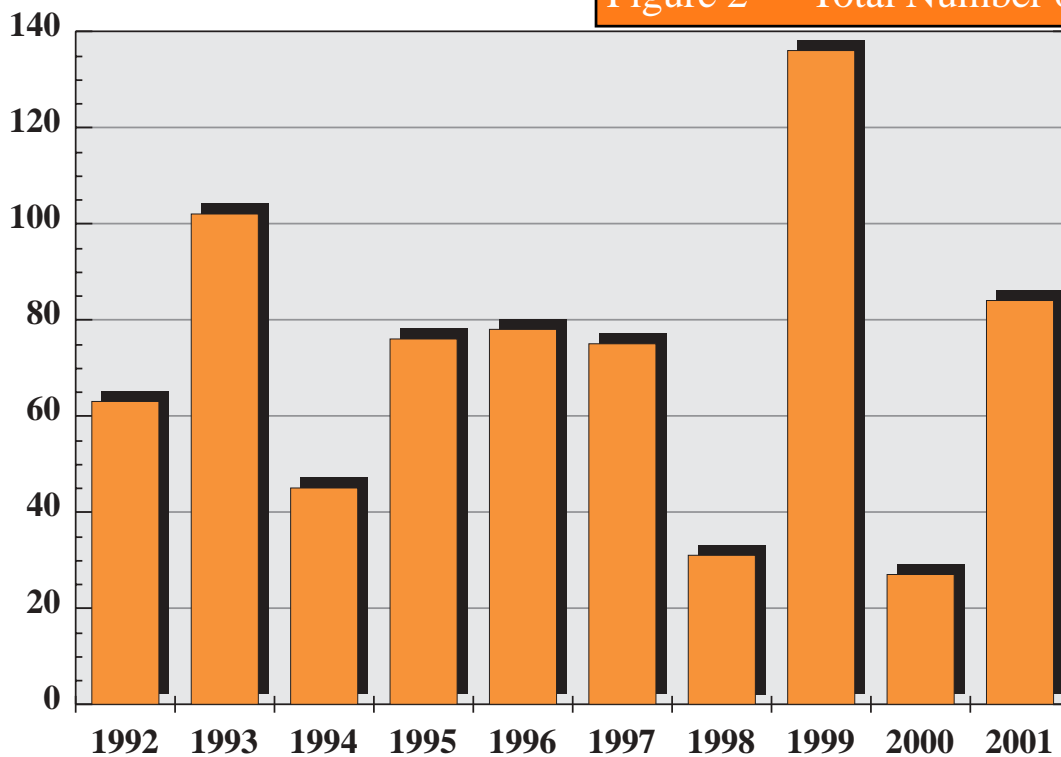


Figure 2 — Total Number of Injuries



accidents. That averaged 2,334 accidents per year. The highest number of accidents (2,686) occurred in 2000 while the lowest number (2,011) took place in 1998 [see Figure 3].

## INJURY-PER-ACCIDENT RATIO

While numbers may climb and fall each year, the one true measure of how the industry is faring can perhaps best be found in a statistic not officially included as part of the reporting system: the injury-per-accident ratio.

Since 1992, this ratio has ranged from 1 injury for every 99 accidents in 2000 (the safest year) to 1 injury for every 16 accidents in 1999 (the most dangerous). Last year's ratio of 1 injury for every 26 accidents was the third worst year for safety during the ten year reporting period. The average ratio of injuries to accidents for the ten-year period was 1 injury for every 32 accidents.

## HUMAN ERROR

Of the 23,338 accidents recorded over the past ten years, 83 percent were a direct result of human oversight or lack of knowledge (i.e., LOW-WATER CONDITION, IMPROPER INSTALLATION, IMPROPER REPAIR, or OPERATOR ERROR OR POOR MAINTENANCE). Human oversight and lack of knowledge were also responsible for 69 percent of the injuries and 60 percent of recorded deaths.

As anyone who has followed these Incident Reports knows, LOW-WATER CONDITION and OPERATOR ERROR OR POOR MAINTENANCE have stood atop the list of *boiler* accident causes for all ten years (includes power boilers, steam-heating boilers and water-heating boilers). While LOW-WATER CONDITION has been the predominant cause during this time period, OPERATOR ERROR OR POOR MAINTENANCE has surpassed its causal counterpart just three times: in 1998, 1999 and 2000. (After this three-year hiatus, LOW-WATER CONDITION regained its position as leading cause last year.)

Other major causes of boiler accidents reflect a mixed combination of human oversight and mechanical breakdown. In five of the ten years, BURNER FAILURE was the third leading cause of incidents (1992, 1994, 1995, 1996 and 1997), followed by LIMIT CONTROLS in 1993 and 2000. IMPROPER INSTALLATION was the third leading cause in 1998, with IMPROPER REPAIR coming in third in 1999 [see Figure 4].

In what comes as a surprise to many, the combined third leading cause for both boiler and pressure vessel accidents last year (2001) was UNKNOWN/UNDETERMINED — a category introduced as part of the Incident Report in 1999.

With UNKNOWN/UNDETERMINED accident causes exceeding 7 percent in 2001, National Board Executive Director Donald Tanner commented: "What we don't know *can* hurt us. While being able to identify and isolate a problem may not necessarily give us complete comfort, it does provide certainty — the knowledge of understanding what needs to be corrected."

Figure 3 — Total Number of Incidents

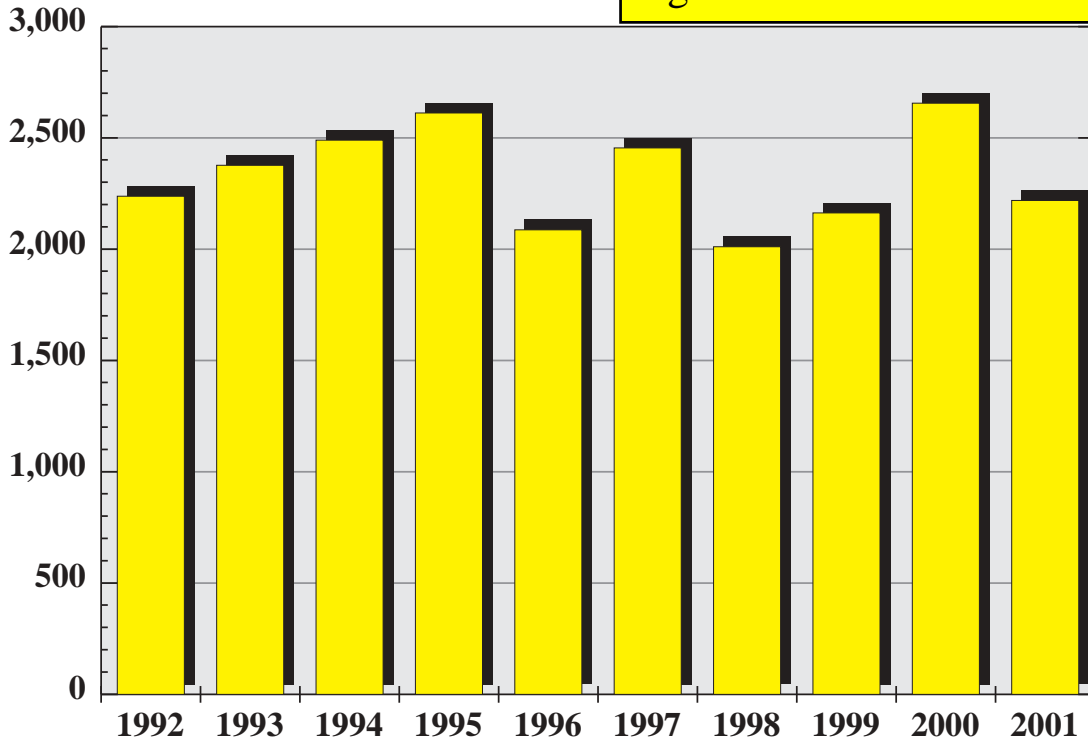
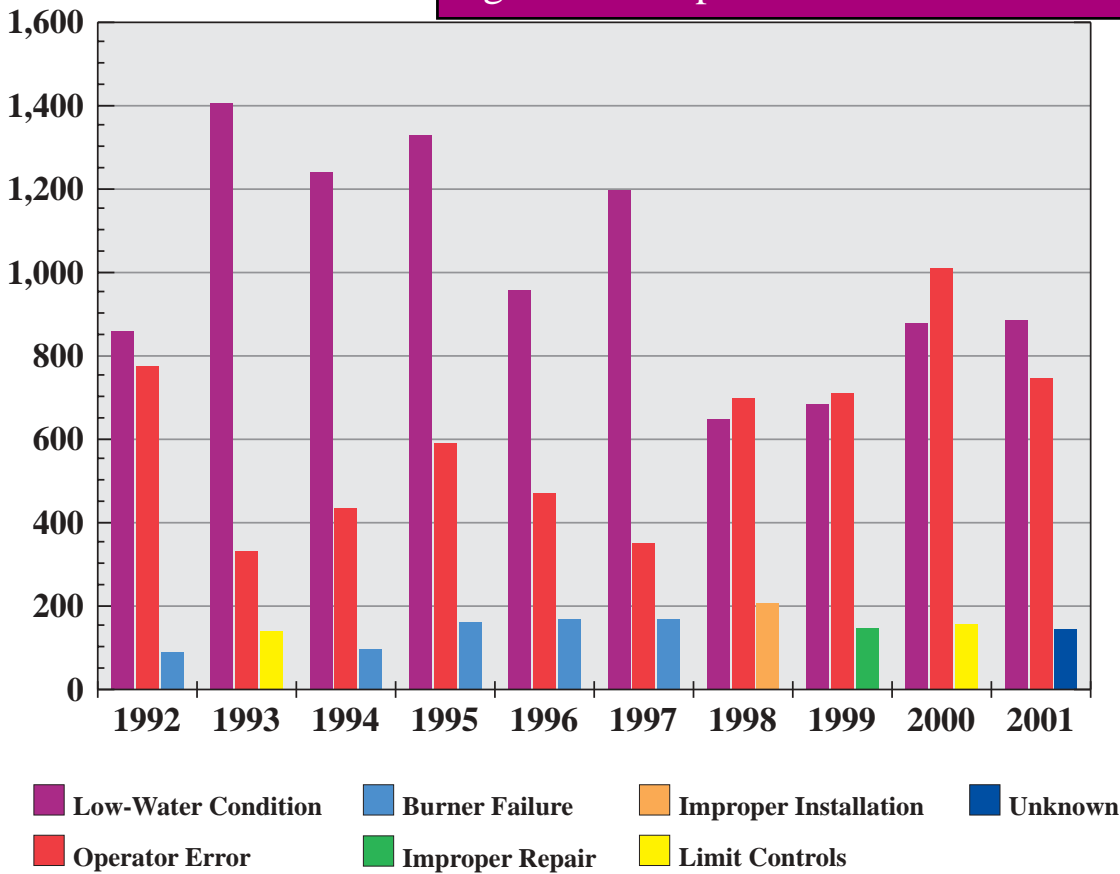


Figure 4 — Top Three Causes of Boiler Incidents



## DANGEROUS EQUIPMENT

When it comes to equipment categories, UNFIRED PRESSURE VESSELS proved by far to be the deadliest. During the ten-year reporting period, a total of 64 persons were killed by UNFIRED PRESSURE VESSELS, followed by POWER BOILERS (44 fatalities), WATER-HEATING BOILERS (14), and STEAM-HEATING BOILERS (5).

UNFIRED PRESSURE VESSELS were also the leading cause of injuries (289), followed again by POWER BOILERS (250), WATER-HEATING BOILERS (92), and STEAM-HEATING BOILERS (89).

In a peculiar twist, however, the above listing is reversed when it comes to total number of accidents over the ten-year period, with STEAM-HEATING BOILERS causing the most overall with 9,588 incidents, followed by WATER-HEATING BOILERS (6,928), POWER BOILERS (4,311), and UNFIRED PRESSURE VESSELS (2,511).

Indeed, the yearly breakdown finds STEAM-HEATING BOILERS causing the most incidents in seven of the last ten years, while UNFIRED PRESSURE VESSELS recorded the fewest incidents each year [see Figure 5].

## BRIEFLY NOTED

Additional observations from the ten-year reporting period reveal:

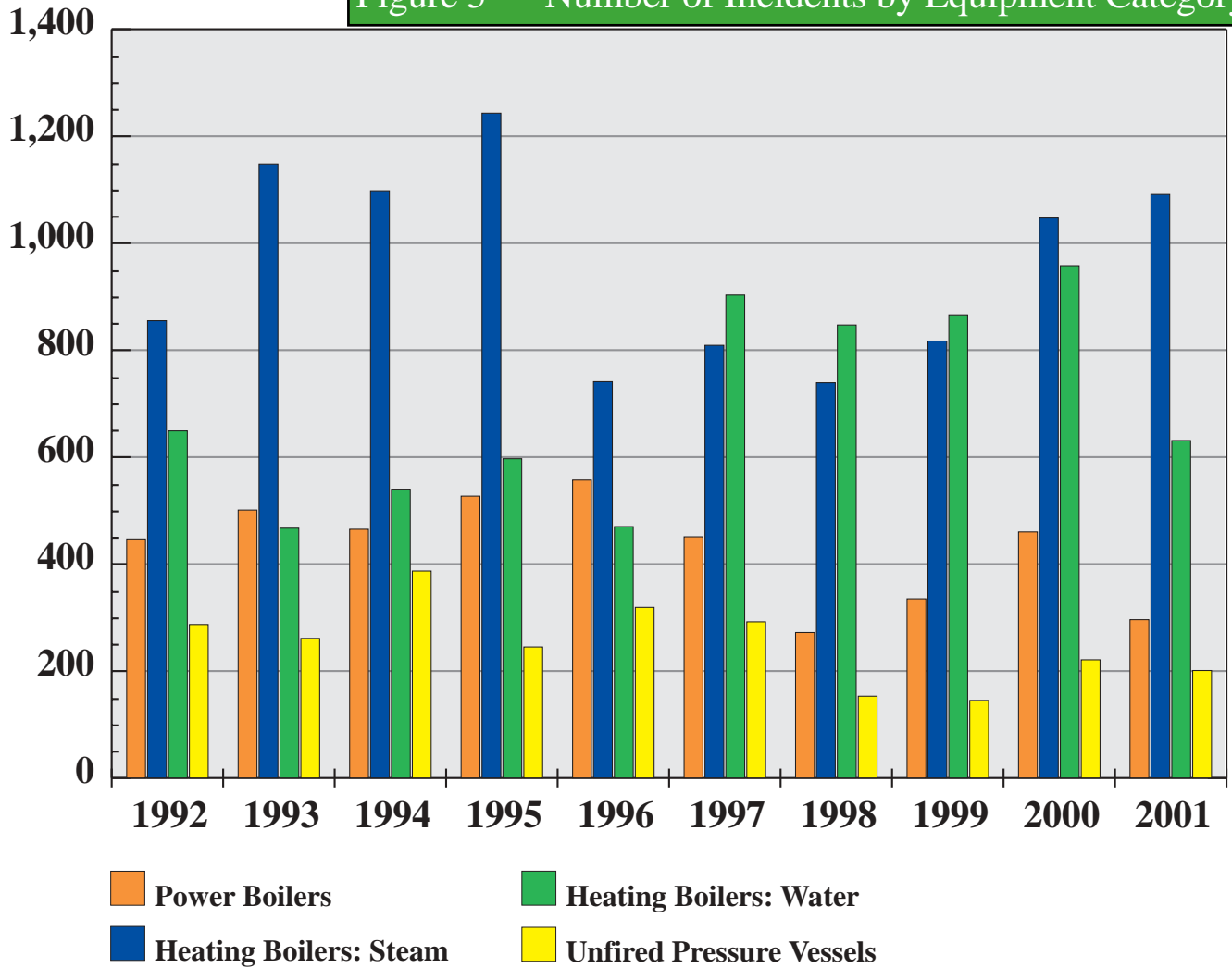
- A dramatic 40 percent increase in deaths during the 1997 to 2001 reporting period, as compared with 1992 to 1996.
- For the tenth year in a row, OPERATOR ERROR OR POOR MAINTENANCE remains the leading cause of UNFIRED PRESSURE VESSEL accidents, usually followed by FAULTY DESIGN OR FABRICATION and IMPROPER INSTALLATION.
- In each of the equipment categories, incidents related to the SAFETY RELIEF VALVE were recorded least often over the ten-year period.

Commenting on the results of the ten-year Incident Report comparison, the National Board's executive director emphasizes the need to keep all statistical information in proper perspective.

"Since establishing the National Board Violation Findings program two years ago," Mr. Tanner observes, "we have been able to track nearly 100,000 boiler and pressure vessel inspection violations [see page 9 for 2001 report]. Had these violations not been identified and corrected, our Incident Reports may have reflected numbers of a more catastrophic nature."

*For a complete listing of Incident Reports, access INCIDENT REPORTS on the National Board Web site at [www.nationalboard.org](http://www.nationalboard.org). ❖*

Figure 5 — Number of Incidents by Equipment Category



*All Incident Reports have been compiled from data submitted by National Board jurisdictional authorities and authorized inspection (insurance) agencies. Included is information submitted from several insurance companies that insure boilers but do not provide inspection services.*

*Please note: deaths and injuries are industry-related. They include, but are not limited to, owners and operators of boilers and pressure vessels.*

# A Steam Car in a Day: Building Under Pressure

By Jeff Del Papa with  
Valerie Taylor Sterling,  
Publications Editor

Photographs courtesy of the NERDS.

*“This planet needs a lot more kids who think taking the lawnmower’s engine apart is more fun than playing a videogame.”*



**JEFF DEL PAPA:** Team leader and organizer for the New England Rubbish Deconstruction Society (the NERDS).

**T**his from a man who took apart the engine of his own family’s lawnmower when he was just 2-1/2 years old.

Jeff Del Papa has always been mechanically inclined. Now his hobby is building bicycles — and the occasional steam car — out of scavenged items.

A steam car from scrap?! Wait, it gets better.

Not only building a jalopy from junk. Building it within a 10-hour period.

In an actual junkyard.

On camera.





**MASTERPIECE:** The NERDS make some adjustments to this, the finished product. Hard to believe they cobbled together this steam car from scrap, in under 10 hours. Their motto: "It only has to work for 20 minutes!" Photo by Dom McCarthy.

*Junkyard Wars* is the popular, Emmy-nominated American cousin of the British engineering television show *Scrapheap Challenge*. The show pits two teams against each other to solve an engineering challenge . . . in a junkyard. Then they compete to see which team's creation meets the challenge better. Now in its sixth season and growing in popularity, the show obviously appeals to full-time engineers and part-time tinkerers alike.

Three friends from Massachusetts recently became the first American team to compete on the British version of the show. Their challenge: to design and build a coal-fired,

4-passenger steam car from items scavenged from a junkyard, all within a 10-hour period.

Mr. Del Papa (a.k.a. D.P.) is the team leader and organizer of the NERDS (short for New England Rubbish Deconstruction Society). The other team members included Bill Yerazunis (a.k.a. Crash), chief designer and team captain; and George Homsey (a.k.a. Geo), lead "scrounge" (scrapheap searcher).

In July 2000, the NERDS were flown to London, where they would race against a scrapheap steam car built by a British

team, the Beach Boys. The race comprised three laps (for a total of 2,100 yards) around the *Scrapheap Grand Prix* Circuit at the National Motor Museum in Hampshire, England.

The *BULLETIN* recently talked with team member Jeff Del Papa, to discuss the NERDS' adventures in this unusual television genre: educational engineering in a game-show format.

**BULLETIN:**

All three of you lived in Massachusetts. How did you get on the British *Scrapheap Challenge* television show in the first place?

**Mr. Del Papa:**

In January 2000, The Learning Channel (TLC) on American cable television experimented by airing two episodes of a British show they were calling *Junkyard Wars*. By the first commercial break, I knew I had to be part of it. We applied, and the rest is "television history."

**BULLETIN:**

When were you told of your "challenge"? Were you able to prepare in advance?

**Mr. Del Papa:**

No, you do not find out until the morning of the shoot — that is part of the fun. Sure we speculate, but the possibilities are nearly endless. Teams really do find out, on camera, the morning of the "build." I can assure you it is not scripted — whatever happens is up to the contestants. The producers have been very surprised sometimes at what teams come up with.

**BULLETIN:**

How much did you and your team members already know about boilers?

**Mr. Del Papa:**

Crash and I were somewhat familiar with boilers, but not of the size we used for our steam car.



In real life, Crash (Dr. William Yerazunis) is a research scientist and mechanical designer for Mitsubishi. He holds a Ph.D. and several patents. He restored the Land Rover that he drives to work.

At that time, Geo (George Homsey) was an MIT graduate student studying theoretical biology and computer science. He is a machine artist, designer, computer scientist, futurist and extreme engineer.

And I was the organizer and actual team leader (also Web master, mailer of T-shirts, travel coordinator, etc.). I design and build my own recumbent bicycles as well as musical instruments out of scavenged materials.

Our team was also assigned an official "representative of British standards," a delightful chap by the name of Richard Gibbon. His day job is head of engineering collections for the National Railway Museum in York, and he is an employee of the Crown. He was basically the safety expert for our team.

Each team's safety expert knows in advance what the challenge is going to be, and has submitted suggested designs, with a critical-parts list. On the night before the "build," the team meets its assigned expert in the hotel bar, and the running joke is that you cannot ask what they do for a living.

**BULLETIN:**

Did you actually build the boiler used to power your steam car?

**Mr. Del Papa:**

No. For our episode, the "junkyard" contained three boilers with current inspection certificates, and a like number of engines in various sizes. All planted, but necessarily so. It's not possible in 10 hours to build a certifiable boiler large enough to drive a car, especially if none of the team is a UK code-certified welder. In fact, it may not be possible to complete the paperwork needed to certify a boiler of that size in 10 hours, never mind build the thing.

Their basic rule for seeding: if it is not possible to safely improvise a part with the time and tools provided, then they will provide something that can be pressed into service. If there are specific safety regulations, the relevant (and certified) part will always be provided. It will require some ingenuity to make it work, however — it will never just "bolt on." And if we happen to find such a part that is not one of the known good ones, they will not let us use it.

**BULLETIN:**

So it's not a real junkyard?

**Mr. Del Papa:**

It is and it isn't. The set we filmed in was a corner of a real working scrapyards, in the rather industrial "Canning Town" part of London.

On the other side of the wall, there were people in hydraulic claw loaders, literally tossing cars through the air. For stuff like steel tubing and random shapes, the crane just tosses a couple of tons over the wall to re-stock for the show. There was also a lot of construction debris. For example,

the plywood we found had clearly been a concrete form in its prior life.

But the scrapyards' contents are also tailored by adding or removing items, based on the particular challenge. The tailoring does not decrease the challenge significantly. In fact, sometimes they seed decoys: the right item, but the wrong size. And if the idea of your episode is that you will make some specific part (a pump, for example), they will make sure there are not any ready-made ones for you to find.

Still, this is TV and they do have to make sure that, at the end of the day, they have two machines, with at least one of them likely to complete the course, and the other at least able to fail in an instructive way.

**BULLETIN:**

How did you get started on your steam car?

**Mr. Del Papa:**

Our team decided to try to build as small and light a car as possible, while still being able to hold the four of us. The fewer parts, the better.

We decided to look for some kind of car to use as the basis of our machine. One of the first difficulties we would face as a result, however, was that the existing gearing was going to be a poor match with a steam engine. An internal combustion (IC) engine has to be turning at fair speed before any power can be tapped. This means a clutch, so it can keep running when not moving, and step-down gearing between engine and wheels.

By contrast, steam engines hit their "red line" at a speed usually below that of an idling IC engine. They also can produce full torque from a standstill, so they do not normally use a clutch. Therefore we needed gearing that was in some ways the opposite of that normally found in automobiles.

Another point: to meet the show's boiler safety rules, we had to have two ways to put water into our boiler while it was at pressure.

**BULLETIN:**

How did you approach searching for parts (the “scrounge,” using *Junkyard* terminology)?

**Mr. Del Papa:**

Based on our design theme, we came up with a basic “shopping list” of items to look for as we snooped through the junkyard, and then we scattered. After all, we only had 10 hours total to design, scrounge and put the steam car together!

The first thing I found, and dragged the rest of the team out to see, came as a real shock to my American teammates. A true British oddity, in the form of a road tax-beating three-wheeled green “Reliant Regal Saloon” (classified as a “motorcycle with sidecar”). Crash was dubious — he was certain it would roll over in a turn.

In its favor, it was very light, with rear-wheel drive, and a separate frame. As a bonus, the body was easy-to-remove fiberglass (used to keep the weight down to the motorcycle limit).

Other components we found in the junkyard were:

- A double-acting, single-cylinder engine, with reversing gear. Looked to be about 3" bore and 4" stroke. By our calculations, it would make around 4 horsepower.
- A small launch boiler. It even had a smokestack attached. Could have been 10% bigger, but the other ones we saw weighed as much or more than the car we were planning to use.
- Empty water jugs (as used for water coolers).
- A large piece of light sheet steel, to make a heat shield.
- A bunch of pipe sections and valves.

**BULLETIN:**

Were you ready then to start building?

**Mr. Del Papa:**

Yes, the Reliant’s plastic body was going to be a real timesaver. Out came the reciprocating saw and circular saw.

We cut it in half [horizontally], just above the top of the tires, and removed most of the nose, to access the engine compartment more easily (and to give the driver and motorman an easy escape route, should a steam-line break during competition).

While we Yanks were delightedly tearing hunks of bodywork off, team expert Richard was busy with the hacksaw and the pipe threader. As an expert on British boiler regulations, and having passed an inspection before, we had handed him the job of boiler plumbing.

Steam boilers are surrounded with a tangle of pipes and valves. Ours included 13 valves, two accessory fittings (blast nozzle inlet pipe and pressure gage), and the vent pipe from the safety valve, all without including the plumbing on the engine. All of the pipes exposed to steam had to be rigid iron pipe, with threaded fittings at each joint. Each pipe had to be cut to length, threaded on both ends, and the joints sealed with Teflon tape.

We got lucky and found a nice wire-reinforced, flexible, steam-rated hose to use for the connection between boiler and engine, and some ordinary garden hose to connect to the water tanks. The blast pipe was originally either a drain hose from a washing machine or an automotive radiator hose. The engine condensate drains were fitted with some fuel line, to keep our driver, Crash, from getting drenched at startup (steam engines, especially older ones, can be incontinent).

The area formerly occupied by the rear seat got a sheet metal cover, and then a second steel plate on box section spacers, to provide an air gap. The boiler was installed smack in the middle (roughly over the differential). The feedwater pump was on the passenger side. Plywood seats were installed over the rear wheels for the fireman and water tender (Richard and Geo, respectively), and a grab bar was installed for them to hang on to.



**IN PROCESS:** With the minutes ticking down, the NERDS team works to complete construction of their steam car. The “studio” where much of this episode was filmed occupied a corner of a real junkyard. From left to right: Jeff, Crash (in black hat), Richard and Geo.

Up front, footrests materialized, one for the driver (Crash) and one for the motorman (me), along with guards for the chain drive, and a shelf in front for 5-gallon spring-water bottles, our reserve supply.

After lunch, our steam plumbing was completed when I found an injector hidden in the pile. We now had two ways to fill our boiler, and thus (after inspection) could actually fire it.

**BULLETIN:**

Were there safety precautions taken other than a boiler inspection?

**Mr. Del Papa:**

Yes, in fact, they devote an entire day to safety, in between the “build day” and the “race day,” although on the show there’s no mention of it.

Before filming had even begun, the teams’ experts had given the producers a checklist of safety considerations:

- Ensure that all boilers have a current boiler certificate.
- Make sure that pipe fittings are assembled correctly.
- Pressure test all high-pressure lines on completion.



**A CLOGGED INJECTOR:** Crash works to clean “gunk” out of the injector while Richard tinkers with the boiler.



**SMALL BUT POWERFUL:** The pot boiler’s top-mounted firehole presented special challenges for Richard, the NERDS’ fireman.

- Check general quality of manufacture.
- Make sure that engines and boilers are installed so as not to cause damage.
- Ensure that operators wear safety goggles, riggers’ gloves and hat, and have no bare skin exposed when driving or working on the machine when it is in steam. Boiler suits — cotton or fire-resistant type — should be worn.
- Ensure that operator training is given to team members so that they can operate the vehicle safely.
- Ensure that boilers are inspected by a boiler inspector before the operator training session.
- Ensure that team experts pay particular attention to the firing rate and the water level at all times.

On “safety day,” they spent most of the day checking over our vehicles before they hauled them from the junkyard to the racetrack. The health and safety inspectors required us to add things like belt guards, so no fingers or clothing could be caught. The machines do not have to be “consumer grade” safe, but all rotating parts must have covers, all riders on the thing must have a clear escape route, etc. They also had us walk the course, so we knew what to expect and could plan our race strategies.

The production company goes to great lengths to ensure everyone’s safety, from the team members themselves to the hosts to the camera crew.

**BULLETIN:**

Were any problems found during your inspection?

**Mr. Del Papa:**

Yes, there were a couple of problems, but nothing which caused us to fail the inspection. Our injector had managed to get itself clogged at some point. We had to take it off and very carefully clean out the lump of gunk that was keeping it from working properly. The inspector asked us to change

our gage to one with known good calibration and to rearrange our safety valve vent as well.

**BULLETIN:**

The boiler your team used was much smaller than the Beach Boys' boiler. Was that good or bad during the race?

**Mr. Del Papa:**

It was interesting — when we found it, we did not realize what good fortune our small boiler would represent. Ours came up to pressure very quickly. Less than 15 minutes after lighting the fire, we had a full head of steam.

On the other hand, our steam vehicle would require some real planning during the race, as management of our small boiler would demand anticipating the requirements of the course as much as several minutes ahead of the current position. While response to the throttle was as fast or faster than that of an internal combustion engine, our “pot” boiler and coal-lump fire could not be just turned up and down as needed. If you need a bigger fire now, you should have added more coal several minutes ago!

While Richard, our fireman, had stoked many boilers and was familiar with the behavior of the specific type of coal provided (Welsh, supposedly the best available), he had never fired a boiler like ours. Its spiraling tubes and top-mounted firehole meant it had its own special requirements.

We were not too concerned, however, as Richard clearly learns fast — during the evening of the “build,” he chatted with the other experts. At the track then, he had me breaking up the big lumps of coal into walnut-sized pieces, and went around muttering to himself about a “4-inch-thick fire” and fussing with the firehole.

Geo was to man the pumps and spin the various valves — actually the most safety-critical job on the vehicle. The boiler's water level and pressure need constant monitoring, of course. Geo had to be careful to not let the water level get too low. Moreover, the feedwater he would pump into the boiler was cold by comparison with its contents, so he had to add it in small amounts. Too much at once would cool the contents and cause a serious drop in boiler



**A LUMP OF COAL . . .** is too big for the NERDS' small boiler. Jeff's race-morning task is to break the Welsh coal into walnut-sized pieces.

pressure, which we especially did not want to happen while trying to climb the long grade. Geo had to watch the course and add water at just the right time, so it could heat while steam demand was low.

Unlike the Beach Boys' boiler, our boiler was not large enough to run our engine in full gear all the time. If we were to avoid having to stop and wait for the boiler to rebuild a head of steam when climbing the long grade, I would have to constantly optimize the valve settings. On a railroad or traction engine, this process is called “notching up.” It was my job to save some steam for the hardest spots, without being so miserly that it slowed us down unnecessarily.

**BULLETIN:**

Tell us about the race.

**Mr. Del Papa:**

The race itself was to be a “Le Mans” start (includes running to the vehicle), followed by three laps around the track. We also were required to make one pit stop to pick up water and coal.

After firing up our boiler and reviewing our strategy, we pushed our car up to the starting line and put on our fancy helmets. Then the four of us lined up next to the four Beach Boys, and the start was called. We raced to our seats, slammed the transmission into gear, and opened the throttle. After a lurch or two, we were off and running, chasing the smooth-starting machine of the Beach Boys through the flat, narrow part of the course, where passing was impossible.

There was some confusion at the tight turn, but we managed to pass their machine by taking the inside.

I have no idea how fast we were going. While we had tried to preserve the speedometer, it apparently was already

dead. The course was far from flat, but with careful notching up, the boiler twice managed the long grade without a stop to rebuild pressure.

We were cruising along the level bit of the course when the television production staff waved us to a stop. The Beach Boys' engine coupling had broken, and they were stopping the race to let them fix it. So we stoked our fire, filled the boiler, and set the engine to slow turning, so it would stay warm while we waited. It took about 10 minutes for them to fix their machine, and we restarted from where we had stopped. The pit stop in our second lap took only a few seconds. Then we charged off after the Beach Boys. Even though we were a lap up, we still could be caught — their boiler was large enough to let them climb in full gear.



**STEAMING UP FOR THE START:** The Beach Boys (left) and the NERDS steam up their boilers in preparation for the race, as cameramen and production crew look on. The NERDS' smaller boiler required only 15 minutes to come to full steam.





Again we caught them on the flat section. Again we couldn't get past until the turn. (Crash's years as a Boston commuter came in handy when passing in tight spaces.) Unfortunately, the second restart, from the pit, had left us a little low on steam. About halfway up the hill the pressure started to fall. But they were not on our tail — it seems they had broken down again.

We were now two laps up, and they had incurred a 30-second penalty for pushing their car, so we could afford to stop by the side for a “blow up” (letting the boiler come up to pressure). As we waited for a full head of steam, they pushed past us. We did not panic. In fact, we waited until they cleared the climb, so we would not be on their tail. Pressure up, and the course open, we got under way again. We came flying down the hill, and with them sitting in the pit, we put up our arms in victory as we took the tape.

**BULLETIN:**

Was it fun? Would you do it again?

**Mr. Del Papa:**

We actually did get to do it again: since our steam car defeated the Beach Boys', we were brought back for another challenge . . . but that's another article.

All in all, *Scrapheap Challenge/Junkyard Wars* is an amazing, exhilarating, exhausting experience, and every



**ROUND THE BEND:** (Left) The Beach Boys take the turn, the steam from their large-sized boiler making it a little difficult to steer.

(Right) The NERDS' smaller boiler ultimately proved itself quite capable of propelling four men and their steam vehicle across the finish line in first place.

participant that I have had the chance to talk with, would, without hesitation, accept an offer to do another challenge. After all, where else do you get people encouraging you to cut a car in half on TV, and call it “educational”? ❖

**SOURCES:** \_\_\_\_\_

[www.the-nerds.org](http://www.the-nerds.org)

[www.rdfmedia.com](http://www.rdfmedia.com)

[www.channel4.com/scrapheap](http://www.channel4.com/scrapheap)

Mr. Del Papa will discuss *Junkyard Wars* and the NERDS' improvised steam car at 1:15 p.m. on Monday, April 29, during the General Session of the 71<sup>ST</sup> General Meeting in Colorado Springs, Colorado. This particular episode will also be shown. ❖

## NEW MEMBERS IN INDIANA, MISSOURI AND CONNECTICUT



**Allan E. Platt**



**Gene Reece**



**Dan Willis**

**T**hree new members have been elected to the National Board, representing the jurisdictions of Indiana, Missouri and Connecticut.

Allan E. Platt, lead boiler inspector for Connecticut, was elected to National Board membership during the February Board of Trustees meeting. Mr. Platt has served the state of Connecticut for more than 23 years, including as boiler inspector for the Department of Public Safety. Other professional experience includes working as senior stationary engineer for the University of Connecticut and as stationary engineer at the Southbury Training School. He has also worked in the fields of labor relations and accident investigation.

Mr. Platt holds National Board Commission No. 11284.

Gene Reece, interim deputy chief with the Missouri Fire Safety Division, has served the Division of Fire Safety since 1997, first as a boiler and pressure vessel inspector. Prior work experience includes five years at Lubrication Engineers Inc., preceded by ten years as district manager for American Water Treatment and ten years as service manager for Betz Laboratories.

Mr. Reece also served in the United States Navy for two years and in the U.S. Navy Reserve for four years. He was graduated from Southern Illinois University at Edwardsville with majors in English and Art. He holds National Board Commission No. 12046 and Team Leader Certification.

Dan Willis, chief inspector of the Indiana Department of Fire and Building Services, also was elected to National Board membership during the February Board of Trustees meeting.

Mr. Willis has served the state of Indiana for almost 12 years, including as field inspector, authorized inspector supervisor and conformity assessment coordinator. Prior work experience includes ten years as a boiler and machinery inspector for American States/Safeco Insurance Company.

He also served for four years in the United States Navy, from 1975 to 1979.

He holds National Board Commission No. 9417 with "A" and "B" endorsements, and is a National Board Team Leader. ❖

### ERRATUM

The National Board issues the following correction to the Winter 2002 article entitled "The California State Railroad Museum: On Track to Preserve an American Legacy." [Page 14, first full paragraph] should be changed to read as follows:

Early boilers were constructed of **wrought-iron** plates riveted together. . . . **Cast iron** was too brittle, and steel's greater cost compared to **wrought iron** discouraged steel's use by boiler manufacturers early on.

The National Board apologizes for any inconvenience that may result. ❖

## Retired National Board Commissioned Inspectors Recognized

<b>Retired Inspector</b>	<b>Retired Card Number</b>	<b>Commission Number</b>	<b>Years of Service</b>
Melvin Johnson	648	6402 N	30
Donald Farquhar	649	4908	39
Jeremiah McCarthy	650	4676	40
Edward F. Barnes	651	6251 N	34
William L. Read	652	4756	39
Edward Plucinski	653	6159	31
Lester H. McLean	654	4078	43

### National Board Retired Inspector's Card and Certificate

Upon request, the National Board will issue a retired inspector's card at no charge. These cards are intended to recognize the many years of service the retired inspector has rendered in helping to ensure public safety through inspection of boilers and pressure vessels.

To obtain a National Board retired inspector's card, the inspector must be retired and have 25 years of service as an active National Board commission holder.

Each retirement card is serialized and indicates the endorsement(s) for which the inspector has been qualified.

Requests for a retirement card and certificate are accepted by phone or mail. Contact the National Board Commissions and Examinations Department, 1055 Crupper Avenue, Columbus, Ohio 43229, or call 614.888.8320, ext. 241. ❖

## 72<sup>nd</sup> General Meeting Call for Presentations

The National Board of Boiler and Pressure Vessel Inspectors, in conjunction with ASME International's Boiler and Pressure Vessel Committee, has announced a call for presentations to be delivered at the 72<sup>nd</sup> General Meeting, April 28 through May 2, 2003, in Honolulu, Hawaii.

The General Meeting is conducted each year to address important issues relative to the safe operation, maintenance, construction, repair and inspection of boilers and pressure vessels.

To be considered, presentations should address one or more aspects of the aforementioned subject areas and be limited to no more than 30 minutes. Additional subject areas may include safety valves as well as other unit components, testing, codes and standards, risks and reliability, and training. Presentations of a commercial or promotional nature will not be accepted.

Those interested in submitting presentations for consideration should send a typewritten abstract of no longer than 200 words in English (do not include supplementary materials) to: Paul Brennan, Director of Communications, The National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Avenue, Columbus, Ohio 43229. Submissions may also be sent electronically via email to [pbrennan@nationalboard.org](mailto:pbrennan@nationalboard.org). Submissions must be received by August 31, 2002.

For more information on submitting presentations for consideration, contact the communications department at 614.888.8320. ❖

RICHARD MCGUIRE  
MANAGER OF  
TRAINING



## HELP WANTED: NEW INSPECTORS

Those familiar with the National Board homepage have seen various announcements posted of openings for boiler inspectors, something we do to assist member jurisdictions in need of additional staff. These advertisements, in the form of our “news bars,” call attention to the fact that, in an economy rife with announcements of layoffs and corporate bankruptcies, the boiler inspection field is wide open in terms of immediate need and long-term career dependability.

Presently, there is a genuine shortage of boiler and pressure vessel inspectors. Traditional sources of inspectors, such as the armed services, are no longer providing the necessary training and experience. Within the next several years, the number of qualified inspectors could reach a critically low level.

And that is disturbing news. The inspection of boilers and pressure vessels is key to public safety.

Every day, every one of us comes in close proximity to a boiler or pressure vessel. Boilers are found in schools, restaurants, churches, hospitals, office complexes, nursing homes — indeed, almost every building in North America.

Each year, more than two million new boilers and pressure vessels are installed. The job of reviewing the manufacture, installation, operation, maintenance and repair of this new equipment — in addition to the millions upon millions already in operation — is overwhelming. In the last two years alone, since Violation Findings became an active National Board program, nearly 951,000 inspections have been reported, with

nearly 100,000 boiler and pressure vessel safety code violations identified.\*

That is quite a challenge for the fewer than 4,000 inspectors commissioned by The National Board of Boiler and Pressure Vessel Inspectors. And that challenge continues to grow.

Once each year, the National Board offers “Introduction to Boiler Inspection.” Held during the summer, this two-week course is designed to expose class members to the responsibilities and rewards of being an inspector.

Boiler inspection is a noble profession, and stable: inservice inspectors are unusually insulated from changes in the economic climate. Especially when there is so much demand for these safety professionals. It is a career in search of dedicated, talented young people — particularly those having diverse interests involving welding, electrical wiring and controls, piping, firing safety procedures, and building codes and standards.

If you are seeking a profession that will prove both satisfying and meaningful, consider the outstanding opportunities, personal satisfaction and rewards associated with becoming a National Board-commissioned boiler and pressure vessel inspector. ♦

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\* Limited to those jurisdictions reporting violation findings. See “Report of Violation Findings: Annual Report 2000” [Summer 2001 *BULLETIN*, p. 7] and “Report of Violation Findings: Annual Report 2001” (current issue, p. 9).

■ The 2002 “Introduction to Boiler Inspection” course begins July 8. Please visit the National Board Web site at [www.nationalboard.org](http://www.nationalboard.org) or call the training department at 614.888.3320, ext. 300, for more information. ♦

## 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: \$2,200

June 10–21  
August 5–16

**(B) Authorized Inspector Supervisor Course/ (O) Owner-User Inspector Supervisor Course** (Duties and attributes of a supervisor) — TUITION: \$1,100

August 19–23

## 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
Aug. 27	Aug. 28	Aug. 29
Sept. 24	Sept. 25	Sept. 26
Nov. 12	Nov. 13	Nov. 14
Dec. 17	Dec. 18	Dec. 19

## CONTINUING EDUCATIONAL OPPORTUNITIES

**(IBI) Introduction to Boiler Inspection Seminar** — TUITION: \$2,200

July 8–19

**(CWI) Certified Welding Inspector Review Seminar** — TUITION:

Full Seminar (all three courses):  
\$995 AWS Member  
\$1,070 Non-AWS Member

Structural Welding (D1.1) Code Clinic:  
\$320 AWS Member  
\$395 Non-AWS Member

Welding Inspection Technology (WIT):  
\$420 AWS Member  
\$495 Non-AWS Member

Visual Inspection Workshop (VIW):  
\$320 AWS Member  
\$395 Non-AWS Member

May 13–17 (CWI Exam May 18)  
August 26–30 (CWI Exam August 31)

## CONTINUING EDUCATIONAL OPPORTUNITIES

**(M) Manufacturers and Repair Organizations Seminar** — TUITION: \$1,100

July 29–August 2  
September 30–October 4

**(R) Boiler and Pressure Vessel Repair Seminar** — TUITION: \$300

June 24–25  
August 26–27

**(VR) Repair of Pressure Relief Valves Seminar** — TUITION: \$1,100

July 22–26

**(WPS) Welding Procedure Workshop** — TUITION: \$600

June 26–28  
August 28–30

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](http://www.nationalboard.org).

### REGISTRATION FORM

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

Name \_\_\_\_\_

Company \_\_\_\_\_

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.*

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.

### HOTEL INFORMATION

single arrival date: \_\_\_\_\_

double \_\_\_\_\_

smoking \_\_\_\_\_

nonsmoking \_\_\_\_\_

departure date: \_\_\_\_\_

# JOHN A. LEMIRE

PRINCIPAL SAFETY ENGINEER, STATE OF CALIFORNIA



Many chief boiler inspectors recall their first National Board meeting as a memorable occasion. For California Principal Safety Engineer John Lemire, it was more like a defining moment.

“Having only been a National Board member for about two months and already late in arriving at the 1993 General Meeting, I walked into my first members’ meeting and was immediately informed that *I* was the deciding vote to elect a new member-at-large,” he relates with a look of bewilderment. But that was only the beginning.

“Because the session was in San Diego and my home jurisdiction, I was also the General Meeting co-host to that year’s Opening Session speaker: former President Gerald Ford,” John offers with a chuckle.

“It certainly was a challenging way to begin my National Board association,” he emphasizes. And not unlike his first week on the job with the State of California Pressure Vessel Unit. “I was called upon to investigate a triple fatality involving a black liquor boiler!”

Thinking on one’s feet is an attribute with which few are eminently qualified. But for John Lemire, it goes with the territory of overseeing engineering safety operations for North America’s most populated jurisdiction.

“I guess it’s the result of being lucky enough to see and do quite a few things in my life,” he comments upon reflection. “Having been virtually all over the world, one

develops a sense of confidence that can be a big ‘plus’ professionally.”

Given that rationalization, John’s confidence must have begun to develop almost as soon as he could walk. Born on Staten Island in New York, the 58-year-old official’s first recollections as a child were of California’s Mojave Desert.

“My father was a supply corps officer in the Navy,” he explains. John was three years old when the family moved from New York to California, where his father ran the ship’s store.

“Two years later, we were in the middle of a war. My family couldn’t follow my father on his next duty assignment to Japan, so we went to live in Scotland with my mother’s family,” John recalls. “I attended first grade at a boarding school.”

John’s first exposure to the educational process proved to be anything but a fond childhood remembrance. “I recall being served porridge every morning for breakfast and my classmates and I being required to take cold baths before classes so that we would remain alert during the school day,” he explains. “But at night, I slept in a bed with huge quilts that were warmed by a bed warmer (a metal box containing hot coals) before I went to bed. You were warm until dawn.”

It was in 1951 that John, along with his mother and older sister, headed to Yokuska, Japan, to rejoin his dad. The following year, the Lemires returned to California — this time relocating to Orlinda before John’s dad left the Navy and purchased a chicken ranch in Sebastopol.

John spent his high school years helping on the ranch, yet still finding time to play basketball and tennis. “After high school, I decided to attend the California Maritime Academy to both advance my

education and secure some practical work experience.”

Then 18 years of age, the future National Board member found the varied, three-year curriculum at the academy to be an ideal way to prepare for his career. His first year at the academy was followed by a hands-on year at sea, where he learned boiler machinery operation and repair while sailing to exotic ports of call from Rio to Tokyo.

Graduating around the time of the Vietnam conflict, he was expected to fulfill a three-year military commitment. “Although at the time not having any idea as to what I wanted to do professionally, I did know that I enjoyed working on machinery,” he explains. “That’s why I chose to become a marine engineer.

“Through the efforts of the Engineers Beneficial Association, I fulfilled my military obligation by working with several different shipping companies.”

Beginning his career as a 3<sup>rd</sup> assistant engineer, John spent the first six months on T-2 tankers transporting oil from Alaska up and down the coast of California. “The next four and one-half years had me serving in the capacities of 3<sup>rd</sup> and 2<sup>nd</sup> engineer on ships carrying ammunition and supplies to Vietnam.”

Returning to California in 1968 during shore leave, the only thing about his future John knew for certain was that he wanted to marry Lois (now his wife of 31 years). “But I still had no idea what I wanted to do for a living instead of going to sea,” he chuckles.

“A ‘head hunter’ arranged a position for me with Continental Insurance Company in 1970,” he recalls. “Because the company felt I had enough boiler operation experience to secure a National Board commission, I was hired as a field representative to perform boiler, machinery and fire inspections.”

With the births of daughter Julie and son Kevin, the California official sought to increase his salary by applying for a job with the state in 1974. He was offered three — in one week.

“It just so happened that they had three openings and I qualified for all of them,” he grins. Again quickly thinking on his feet, John opted for the position of industrial safety engineer with California’s Occupational Safety and Health Administration (OSHA) Department because it was closer to his Oakland home.

Shortly after he became district manager in 1987, the state’s OSHA was disbanded in favor of a federal program. Believing he was out of work, the New York native was surprised to receive a call from the state’s then principal safety engineer, who offered him the job of pressure vessel unit – senior engineer.

Promoted to principal safety engineer in 1992, John has since overseen a lot of changes within his 34-member department, including its computerization program, the adoption of NFPA 58, and a current revamping of the Compressed and Liquefied Natural Gas Safety Orders as well as the Boiler and Fired Pressure Vessel Safety Orders. His impressive record of accomplishment notwithstanding, adoption of the *National Board Inspection Code* and CSD-1 are priorities John would like to achieve before he retires.

“With Lois’s recent retirement, I’ve been giving a lot of thought to it myself,” John reveals with a nod. “I’m looking forward to volunteering with our church, spending more time at our cabin in the mountains, and just plain old relaxing.”

When that time comes, John admits, he may miss the action. But he will not abandon the well-conditioned response of being able to think on his feet.

“It’ll just be a lot more comfortable,” he acknowledges with a wink, “doing it from a sofa. . . .” ♦

ROBERT SCHUELER  
SENIOR STAFF  
ENGINEER



## NEW RULES FOR OLD LOCOMOTIVES: REVERSE ENGINEERING REQUIRED

In recent years, the appeal of historic steam locomotives has increased to the point that more and more of these magnificent machines are being called back from retirement.

Until recently, the last rules regarding construction of steam locomotives dated back to 1952 (ASME Code Section III, “Boilers of Locomotives”). About this same time, however, the last steam locomotive was constructed for traditional shipping use. By 1960, modern diesel-electric models replaced most steam locomotives.

Since then, those steam engines not scrapped outright have been languishing in railroad yards, along derelict spur lines, and even in people’s backyards, subject to the age-old problems of corrosion and erosion. A few were refurbished by museums, relegated to serving as stationary centerpieces.

Yet history comes alive when the engine’s bells ring, the whistles blow, and the steam hisses. New regulations have evolved around these historic locomotives in their current tourist-industry applications.

The Federal Railroad Administration (FRA) and the railroad industry itself worked in harmony to institute a new set of standards, known as Code of Federal Regulations Rule 49CFR230. Mandatory since February 2000, these comprehensive regulations establish not only the requirements for recertification of a steam locomotive but also for ongoing inspections.

### Recertification

Placing a steam locomotive back into service safely after years of nonuse requires verification

of structural integrity both during the period of reconditioning and throughout daily operation.

The larger part of this task is the initial recertification of the locomotive, a process that can take up to two years to complete. Also known as reverse engineering, this process requires that the locomotive be completely disassembled and the integrity of each of the pressure parts established.

To achieve compliance with Rule 49CFR230, the condition of each of the following must be determined and thoroughly documented:

- Boiler sheets: 1<sup>st</sup> course, 2<sup>nd</sup> course, 3<sup>rd</sup> course, and rivets
- Firebox sheets: rear flue sheet, crown sides, door, combustion chamber, and inside throat
- Wrapper sheets: throat, back head, roof and sides
- Steam dome: base, middle cylinder portion, top and lid
- Arch, flue and circular tubes: outside diameter (OD), wall thickness, length, number and condition
- Thermic siphons: number, OD, plate thickness and condition
- Water bar tubes: OD and wall thickness
- Superheater tubes: OD, wall thickness, length, number and condition
- Dry pipe: OD, wall thickness, material and condition
- Stay bolts: smallest stay diameter, average spacing and condition
- Crown bar bolts and rivets (smallest stay diameter, average spacing and condition)
- Roof sheet bolts and rivets (smallest stay diameter, average spacing and condition)
- Braces: backhead, throat sheet and front tube sheet (number, total area stayed, and sectional area)

Editor’s Note: \_\_\_\_\_

For more information about historic steam locomotives, please see “The California State Railroad Museum: On Track to Preserve an American Legacy” in the Winter 2002 issue of the *BULLETIN*.



- Safety valves: number, size and manufacturer
- Heating surface
- Grate area
- Water level indicators, fusible plugs, and low-water alarms: location and level
- Boiler steam-generating capacity

### National Board-Accredited Repair Organizations

Rule 49CFR230 provides that all repairs and alterations to an operating steam locomotive be performed in accordance with an American National Standard. Any “R” certificate holder using the NBIC for repairs and alterations is permitted to do this work.

In order to document the recertification of an historic steam locomotive, an “R” certificate holder must complete several forms. National Board Forms R-1 and R-2 are to be referenced on FRA Form 19 and attached; then FRA Form 19 is to be referenced on FRA Form 4 and attached. The owner/operator then submits all to the FRA within 30 days.

### Inservice Inspection

Once the locomotive is certified for service by the

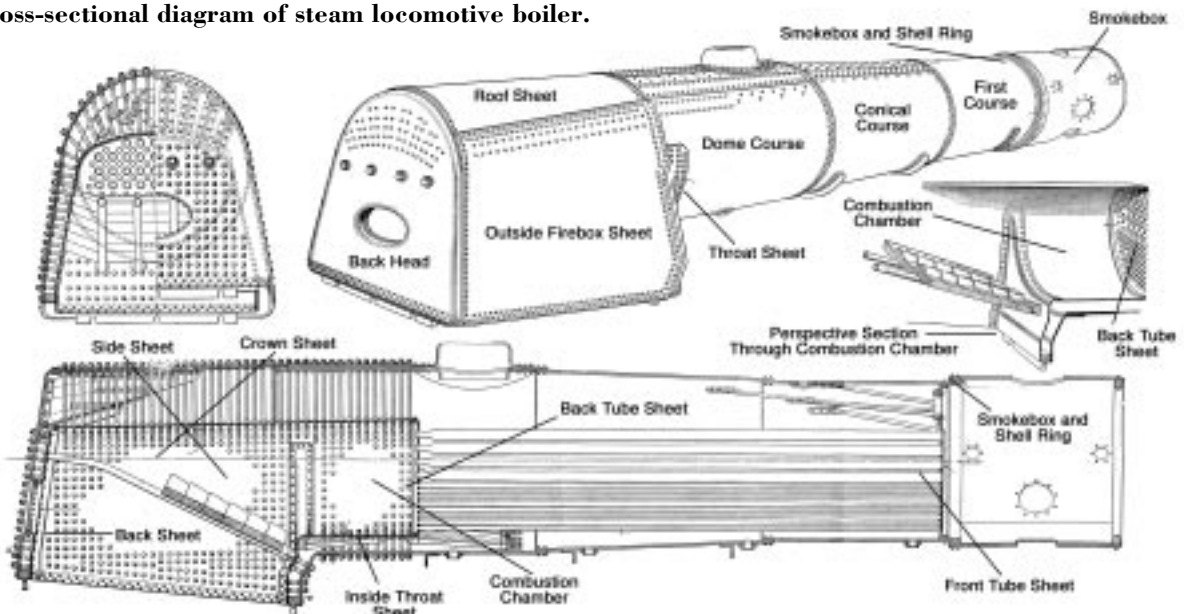
FRA, the inservice inspection frequency becomes a function of firing days:

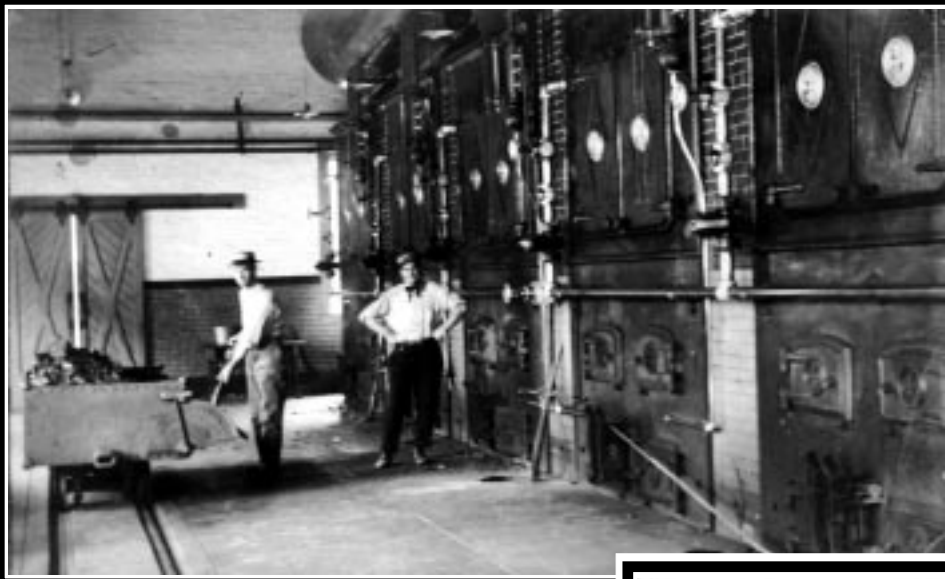
- 1) Daily inspections (FRA Form 2, performed by the owner/operator)
- 2) 31- and 92-day inspections (FRA Form 1, performed by the owner/operator)
- 3) Annual inspection (FRA Form 3, performed by the owner/operator with an FRA representative present for the inspection)
- 4) Four firing years or 15 calendar years: recertification of the locomotive with a new FRA Form 4 inspection and reverse engineering.

### Future Developments

Completion of FRA Form 4 requires reverse engineering of the pressure parts in their reinstalled condition. An effort is underway by the Engineering Standards Committee Inc. (formerly the Tourist and Historic Railroad Working Group) to produce a guide document providing the methodology and algebra for this work. Committee members are currently researching old code formulas and industry standard practices in combination with the new law, in order to satisfy all requirements safely. ❖

Cross-sectional diagram of steam locomotive boiler.





**e•phem•er•a —**

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

*Before 24-hour news programs, before live streaming footage from the Web, before the age of pagers and cell phones, there were postcards.*

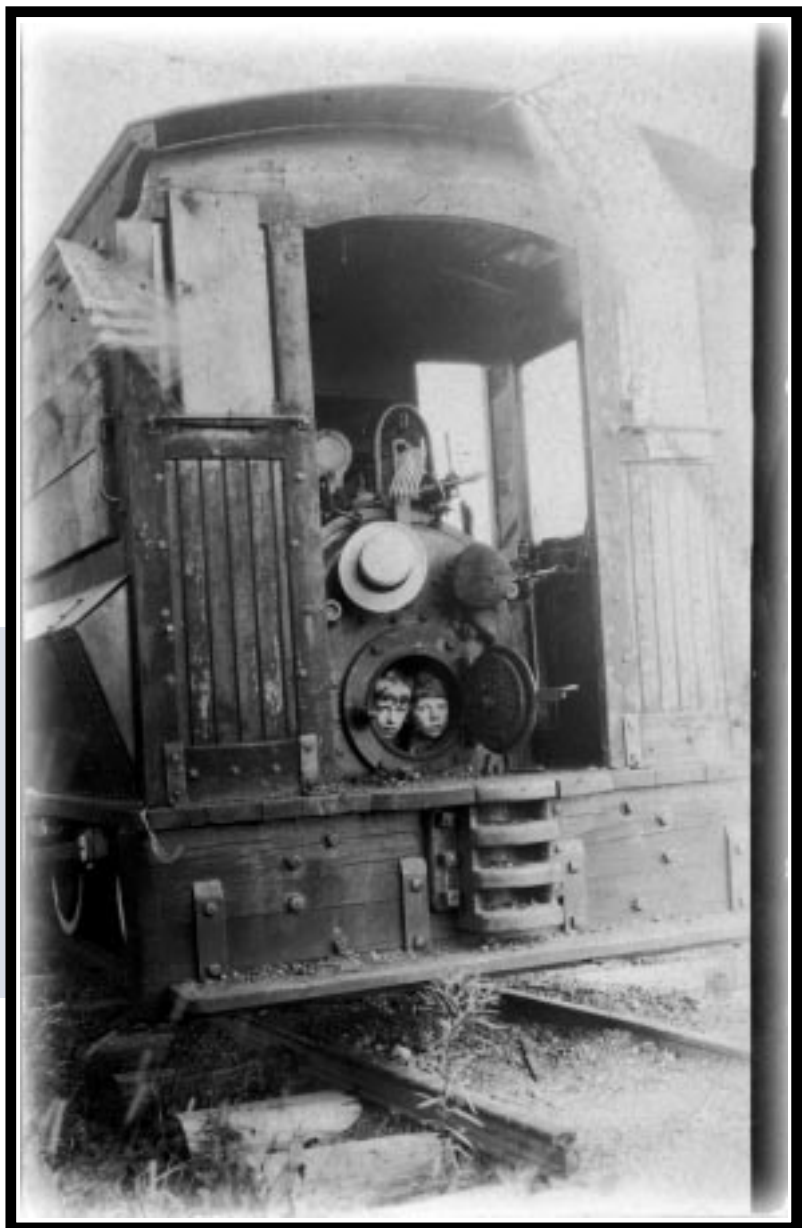
*Photographic postcards like the ones featured were often sent to far-off friends and relatives to convey the news of the day. Anything from the tragedy of a boiler accident, to the light-hearted pursuits of children at play, to the mundane routines of everyday life, could all be captured on a postcard.*

Above:

Two boiler workers take time out from summertime coal-shoveling duties to pose in front of five HRT boilers . . .

Right:

. . . But do they know where the children are? We do: passing a summer day inside the firebox of a narrow gage locomotive!



**Note:** On both postcards, summer activity is indicated by the straw hats. Know anything else about these photographs? Email [getinfo@nationalboard.org](mailto:getinfo@nationalboard.org). ❖

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