

Natural Gas Vehicle Cylinder Safety, Training and Inspection Project

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This presentation does not contain any proprietary or confidential information

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Purpose of Work

Assure the safety of natural gas vehicle fuel systems in order to...

Help encourage the use of natural gas vehicles in order to...

- displace petroleum
- lower emissions and greenhouse gases
- lower vehicle fuel costs



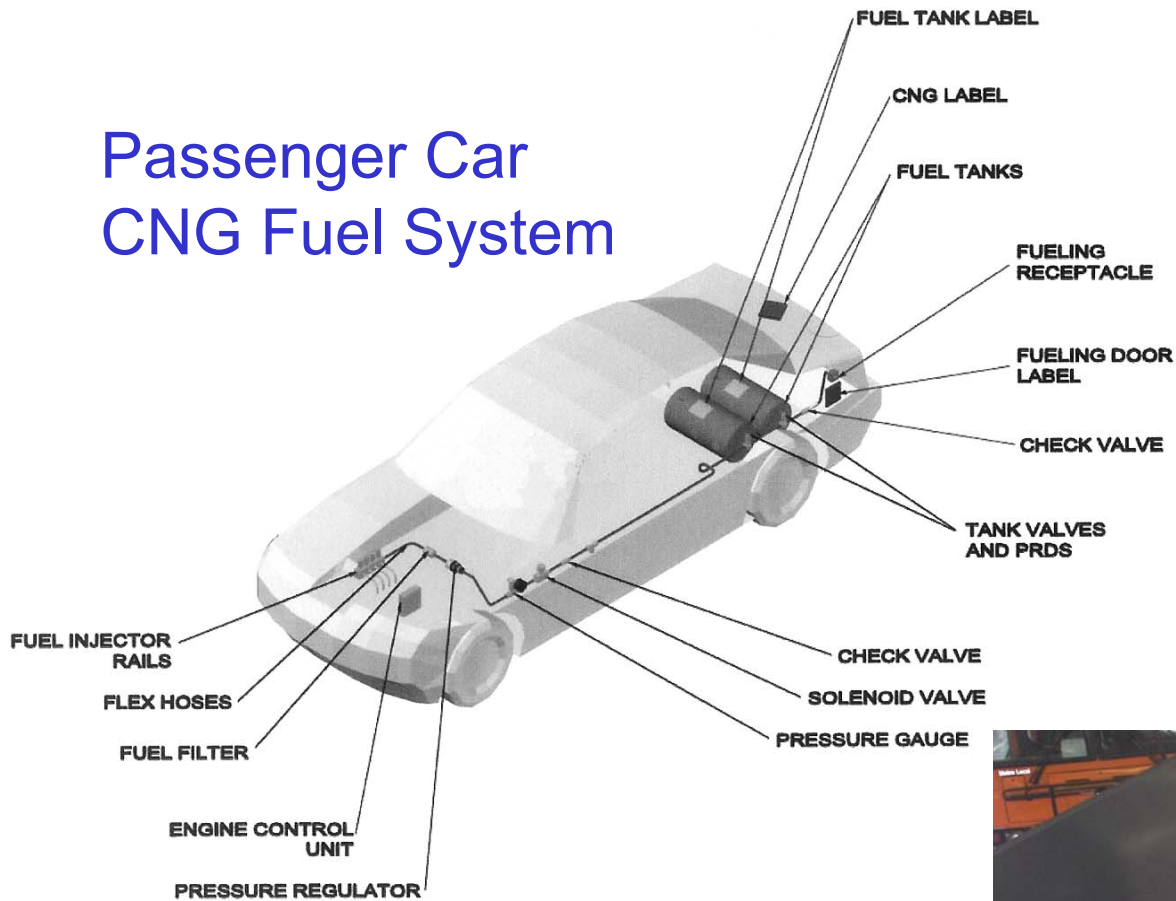
“...We see NGVs as playing an important role, especially in targeted markets where the benefits of natural gas can have the biggest impact. Every dedicated NGV in use displaces 100 percent of the petroleum that vehicle otherwise would use. Therefore, a growing NGV market is good for America since it helps reduce the amount of oil we need to import.”

—**Spencer Abraham**, *Secretary of Energy/U.S. Department of Energy*

NGVs:

- are in widespread use (7 million worldwide)
- are safe (one US fatality caused by NG fuel system)
- are clean (NGVs can reduce emissions 70-90%)
- use domestic fuel (97% of the natural gas used in the US is produced in North America)
- reduce operating costs (gasoline \$2.45/gal, natural gas \$1.45/GGE [both before taxes or rebates])
- are steppingstones to hydrogen vehicles

Passenger Car CNG Fuel System



CNG cylinders on
roof of transit bus



Purpose of the Project

- Increase the understanding of the safe and proper use and maintenance of vehicular compressed natural gas (CNG) fuel cylinders
- Address CNG cylinder and associated pressure relief device needs related to existing law, codes and standards
- Address and improve available training and inspection programs
- Assure coordination among vehicle users, public safety officials, fueling station operators and training providers
- Provide information learned from CNG vehicle fuel systems to emerging hydrogen vehicle industry

Barriers

- Many NGV users are not aware of need for cylinder safety inspection
- NGV users must be able to find or train qualified cylinder inspectors
- Inspector training and certification testing must meet highest safety standards
- Industry Codes and Standards must be kept up to date for safety
- NGV “incidents” must lead to improvements in C&S
- If possible, cylinder life should be extended beyond 15-20 years
- Knowledge from NGV experience should be used to make hydrogen vehicles safer

Technical Approach

- I – Public and Industry Awareness Campaign
- II – Training Scholarships or Tuition (Funding) Assistance
- III – Evaluate Current Training and Testing Practices
- IV – CNG Cylinder Safety Monitoring & Investigation Activities
- V – CNG Cylinder Recertification
- VI – CH₂/ HCNG Cylinder Safety Considerations

Some Accomplishments

See www.cleanvehicle.org
and click on “NGV Cylinder
Safety, Training and
Inspection Program”

Comes up first when you “Google”
“Compressed Natural Gas Cylinder
Safety”!



Natural Gas Vehicle Cylinder Safety, Training and Inspection Program

Have Your CNG Cylinders Been Properly Inspected?

WHY DO MY CNG CYLINDERS NEED TO BE INSPECTED?	WHAT IS A QUALIFIED CNG CYLINDER INSPECTION?	WHERE CAN I FIND A QUALIFIED CNG CYLINDER INSPECTOR?	HOW CAN I BECOME A CNG CYLINDER INSPECTOR?	IS SCHOLARSHIP ASSISTANCE AVAILABLE?
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Why do my CNG cylinders need to be inspected?

Like a gasoline-or diesel fueled-vehicle, a Compressed Natural Gas vehicle's fuel system should be inspected periodically. In fact, the US Department of Transportation (FMVSS 304) requires this statement on the label of all CNG cylinders used on motor vehicles:

THIS CONTAINER SHOULD BE VISUALLY INSPECTED AFTER A MOTOR VEHICLE ACCIDENT OR FIRE AND AT LEAST EVERY 36 MONTHS OR 36,000 MILES, WHICHEVER COMES FIRST, FOR DAMAGE AND DETERIORATION

Image courtesy of Lincoln Composites, Inc.

What is a qualified CNG cylinder inspection?

Inspections performed by service stations or state agencies may not include a detailed CNG cylinder visual inspection, as outlined in a standard developed by natural gas vehicle industry engineers. Following this standard, a qualified inspector will note cuts, cracks, gouges, abrasions, discoloration, broken fibers, loose brackets, damaged gaskets or isolators, heat damage or other problems and recommend proper action to assure fuel system safety.



Photo courtesy of Cal Macy, Long Beach City College

A qualified inspector must have:

- knowledge of the types of containers used in CNG vehicle systems, and damage allowances for each type, and
- understanding of inspection requirements, tests, procedures, and
- the container manufacturer's current inspection guidelines readily available.

A qualified CNG cylinder inspector also must:

- have a minimum of 2 years experience conducting container

**NGV Cylinder
Safety, Training and
Inspection Program**

Documents of Interest

**Natural Gas Vehicle
Codes and Standards**

**NGV Incident
Reporting Program**

**Take the CNG
Cylinder Survey**

Technical Bulletins

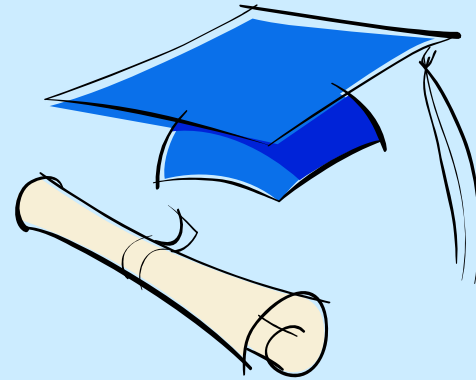
Tech Bulletin 1
PRDs
Tech Bulletin 2
Safety
Tech Bulletin 4
Container Inspection

Web links:

Cylinder Inspectors:
CSA International Certified
CNG Cylinder Inspectors

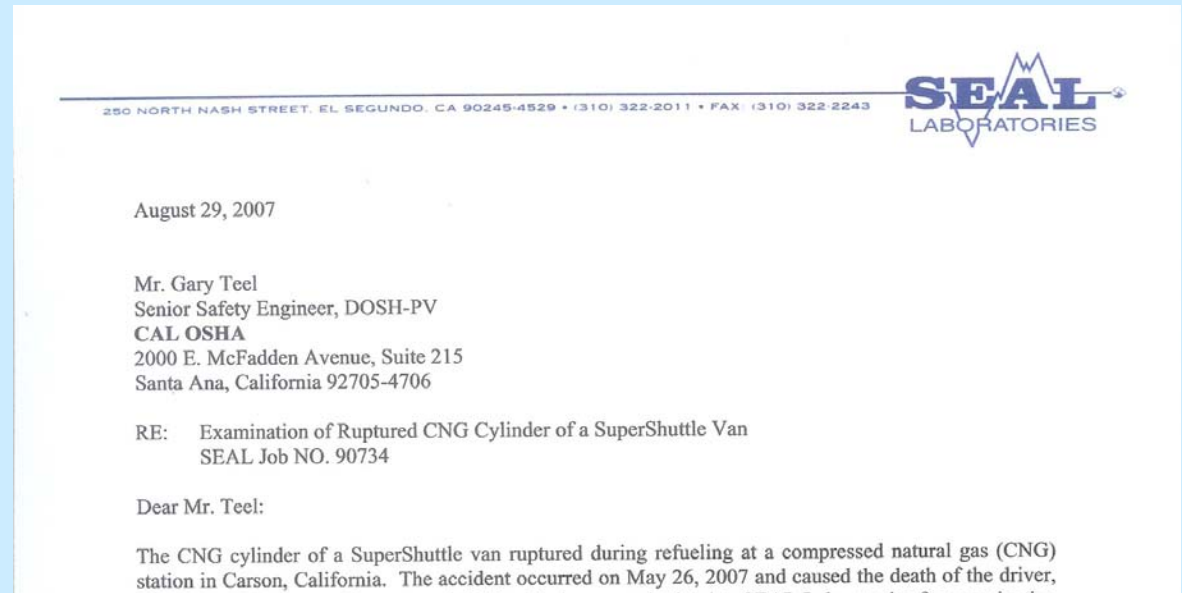
**Vehicular CNG/LNG
Storage Vessel
Manufacturers:**
Chart Industries
Dynetek Industries
Faber Industries
Lincoln Composites
Luxfer Gas Cylinders
Quantum Technologies
Taylor-Wharton
Structural Composites Ind

- 76 advertisements, articles, websites, etc.
- 224 scholarships granted



- All available cylinder manufacturers' inspection criteria provided on CD to CSA for certified inspectors
- Working through NGV industry, AAMVA, NFPA, etc. to inform NGV users of need for cylinder inspection

- Certified inspectors contacted fleets to determine inspection procedures
- Working with CSA to improve/update certification test
- Providing information to NGV C&S organizations (CSA, SAE, NFPA, ISO, etc.)
- Helping with detailed NGV incident investigations



- Considering cylinder “recertification” process
- Reviewed worldwide cylinder inspection procedures and enforcement practices
- Providing “lessons learned” from NGVs to hydrogen C&S development

Some Things to be Learned from the “Other” Compressed Gas Fuel System

Henry E. Seiff
Clean Vehicle Education Foundation

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ABSTRACT

Compressed natural gas vehicles were first commercialized after World War II in Italy. There are now seven million CNG vehicles on the road worldwide. The first US CNG vehicle “incident” in our files dates to 1984. “Those who cannot learn from history are doomed to repeat it” (1), so this paper will explore a few of the things to be learned from CNG vehicle history that can help assure the safety of compressed hydrogen tanks and fuel systems.

A LITTLE BACKGROUND INFORMATION

Compressed natural gas as a motor vehicle fuel has been around for a long time.



Figure 2: 1932 Chrysler “Ironsides” powered by a Mogas Natural Gas System (3)

Although low in number in the United States, worldwide there are seven million natural gas vehicles (NGVs) on the road today and a target

- Information on all 76 incidents in CVEF files, from 1984 – present, available on CD



- Representation on CSA, SAE, NFPA, ISO and other Codes and Standards organizations assures lessons learned make their way into codes and standards.

Technology Transfer

- More and better-trained cylinder inspectors
- Make all cylinder manufacturers inspection standards available to all inspectors
- Improved Codes and Standards to assure continued NGV safety record
- Evaluation of “incidents” and transfer of information to C&S to improve safety
- Bring “lessons learned” from NGV industry to hydrogen vehicle industry

This Year's Activities

Continue and Complete Present
Activities – Contract expires
12/31/08

Summary

Technical Accomplishment Highlights

- 76 advertisements, articles, websites, etc. provide information on cylinder safety
- 224 cylinder inspector scholarships granted
- Collecting “incident” data and supporting investigations to improve safety
- Representation on Codes and Standards groups assures lessons learned make their way into C&S (for both CNG and CH2)

Summary

Potential for Petroleum Displacement

- NGVs use **zero** petroleum fuel, lower emissions and GHG,
- 40% lower fuel cost
- 7 million in use worldwide – proven technology
- a steppingstone to hydrogen vehicles
- This project assures the continued safety of NGVs and brings their experience to the HGV industry