

NGVAMERICA

Natural Gas Vehicles for America

Natural Gas Vehicle Technology Forum

October 21, 2015

San Francisco, CA



What is NGV America?

- *NGV America is the **national trade organization** dedicated to the **development of a growing, profitable, and sustainable market** for vehicles powered by natural gas or renewable natural gas.*
- *NGV America **represents the full value chain** of the industry including more than 200 companies, environmental and government organizations interested in the promotion and use of natural gas as a transportation fuel.*
- ***NGV America members** produce, distribute, and market natural gas and renewable natural gas across the country; manufacture and service natural gas vehicles, engines, and equipment; and operate fleets powered by **clean-burning gaseous fuels**.*

Who is NGV America?



Shell
LNG



Clean Energy

anga
America's
Natural Gas
Alliance

encana



American Gas Association

SPECTRUM LNG
Natural gas for vehicles
QUESTAR
Fueling

U-Haul
Energy to do more

noble
energy



Sempra Energy
for every day life.



DTE Energy

morris + associates
Build on Our Strengths



VECTREN
Live Smart



AGL Resources

METROPOLITAN
UTILITIES DISTRICT



PUGET
SOUND
ENERGY

ONE Gas

TENASKA

Westport
INNOVATIONS INC.



GE Oil & Gas



Westport

Agility
fuel systems

Piedmont
Natural Gas



TECO
ENERGY



South Jersey Gas

CenterPoint
Energy

HEXAGON
LINCOLN

ET
environmental
Vision • Solutions • Value

Luxfer
Gas Cylinders

APPLIED LNG

SCANIA
POWER FOR LIVING

FCA
FIAT CHRYSLER AUTOMOBILES

Loves

ANGI

Black Hills Energy
Improving life with energy

VOLVO
Volvo Trucks

Kwik Trip
NATURAL GAS

WORTHINGTON
INDUSTRIES

WM
WASTE MANAGEMENT

Laclede Gas

Blu.
good.
clean.
fuel.

TRILLIUM
CNG
Making CNG Work for You

DAIMLER TRUCKS

Corners of NGV America's Mission

- Lead **advocacy efforts** with federal and state regulators and policymakers to advance the marketplace and level the playing field with other transportation fuels
- Through **education & communications** be the most credible voice on NGVs and to support information sharing within the industry
- Serve as forum for collaboration, discussion, & debate in the interest of **developing common standards and best practices** for safety and excellence in the NGV marketplace
- Be the **convening authority** for NGV industry leaders to gather and discuss strategies with business peers, customers, technology experts, and thought leaders

NGV 6.1 – Recommended Practices For CNG Fuel Systems

NGV 6.1 Scope:

- Recommended practice applies to the design, installation, inspection, repair, and maintenance of the fuel storage and delivery system installed in on road vehicles for use with compressed natural gas (CNG)
- System Design Failure Modes & Effects Analysis (DFMEA) approach has been used as a starting point for writing the document.
- **Multi-stage DFMEA process:**
 - Working group initiated – Erick Girouard (Emcara), John Dimmick (CVEF), John Jordan (Agility Fuel Systems), John Eihusen (Hexagon Lincoln)
 - Functional block diagram
 - List of functions
 - DFMEA – Functions, Potential Failure Modes, Causes of Failure Modes and Effects of Failure (Prevention & Detection Design Controls not yet completed)

Functional Block Diagram



- 1.1 Prevent Contamination (I)**
- 1.2 Protect Fill Valve from Damage (I)**
- 1.3 Satisfy Ergonomics
- 1.4 Provide Retention - Cap

- 2.1 Receive CNG (I)**
- 2.2 Prevent CNG Back Flow Following disconnection
- 2.3 Seal Fill Nozzle During Filling
- 2.4 Provide Attachment for Fill Nozzle
- 2.5 Receive CNG Nozzle
- 2.6 Resist breakaway force
- 2.7 Limit connection to appropriate nozzle
- 2.8 Provide identification and pressure class of valve used

- 3.1 Prevent CNG Back Flow (I) (include chatter)**
- 3.2 Store CNG
- 3.3 Transport CNG (I)**
- 3.4 Manage BSR (NVH)
- 3.5 Remove Part
- 3.6 Install Part

List of Functions

2.1	Fill Valve	Receive CNG (I)	ANSI/CSA NGV1 CSA B109-01 NFPA 52
2.2	Fill Valve	Prevent CNG Back Flow Following Nozzle Disconnect	ANSI/CSA NGV1 FMVSS 303 CSA B109-01 NFPA 52
2.3	Fill Valve	Seal Fill Nozzle During Filling	ANSI/CSA NGV1 CSA B109-01 NFPA 52
2.4	Fill Valve	Provide Attachment for Fill Nozzle	ANSI/CSA NGV1 CSA B109-01 NFPA 52
2.5	Fill Valve	Receive CNG Nozzle	ANSI/CSA NGV1 CSA B109-01 NFPA 52
2.6	Fill Valve	Resist Breakaway Force	ANSI/CSA NGV1 CSA B109-01 NFPA 52
2.7	Fill Valve	Limit connection to appropriate nozzle	ANSI/CSA NGV1 CSA B109-01 NFPA 52
2.8	Fill Valve	Provide identification and pressure class of valve used	ANSI/CSA NGV1
2.9	Fill Valve	Manage BSR (NVH)	ANSI/CSA NGV1 CSA B109-01 NFPA 52
2.10	Fill Valve	Remove Part	ANSI/CSA NGV1

Technology, Codes, Standards & Best Practices

- **New NGV America Technology & Development Committee**
 - Areas of Focus
 - Safety & best practices
 - Codes and standards development
 - Incident investigation and root cause analysis
 - Stakeholder education
 - Ensuring safe deployment of new technology for the NGV industry
 - Awareness and support of industry innovation and technology advancements

Background –

CVEF Critical Issues Meeting – NREL 6/23/14

Critical Issue #1: Indoor Gas Releases

Critical Issue #2: Cylinder Valve Issues

Critical Issue #3: Overpressure and Under-filling of Cylinders

Critical Issue #4: PRD Reliability, Location & Venting

Critical Issue #4: PRD Reliability, Location & Venting

Problem Statement: Reliability, location and venting of PRDs. Discharge from cylinder PRDs can result in additional hazards. PRDs are considered the lesser of two evils, the greater evil being rupture of a CNG cylinder in a fire.

- Review of PRD1 reliability requirements, incidents of PRD unintended activation, causes of unintended activation, interconnected and isolated PRDs, locating PRDs and triggers – extrapolating bonfire tests to vehicle fires, venting PRD discharges to minimize hazards to occupants, bystanders and first responders

Actions taken or currently in process to address critical issues:

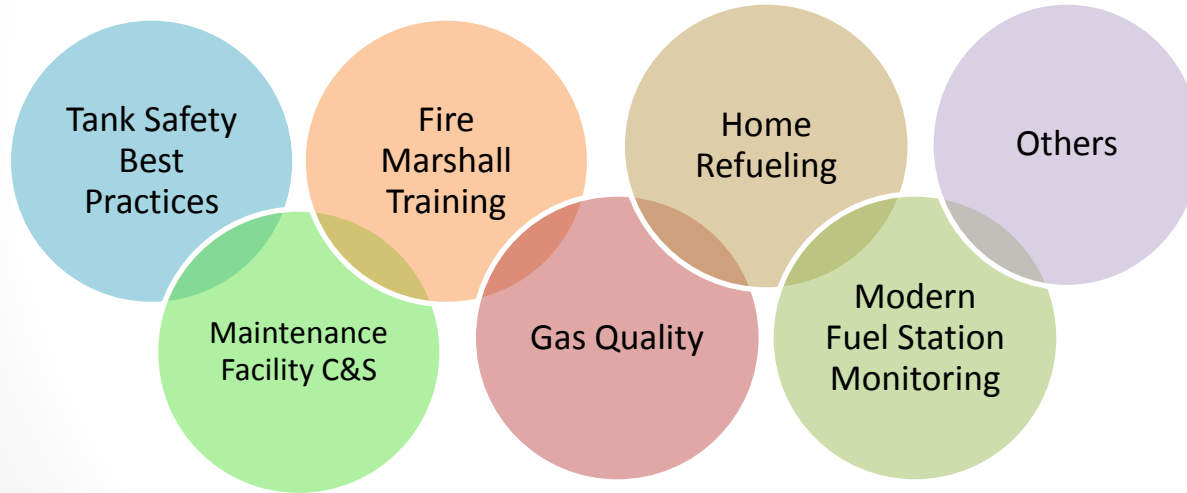
- A. CSA Group established NGV 6.1 RP/Standards task group to address many of these issues
- B. Safety bulletins published by CVEF now on NGVA web site
- C. NFPA completed an online First Responders training program based on CVEF's evaluation of NGV incidents

Next steps to address these critical issues:

- A. Relief valve design to replace use of pressure activated PRDs
- B. In conjunction with CIs 2 and 3 address on board pressure management needs
- C. Continue development of best practice for installation of TPRD's and vent installations
- D. Participate in a coordinated NGV industry/first responder/AHJ/government education program on NGV safety

Technology, Codes, Standards & Best Practices

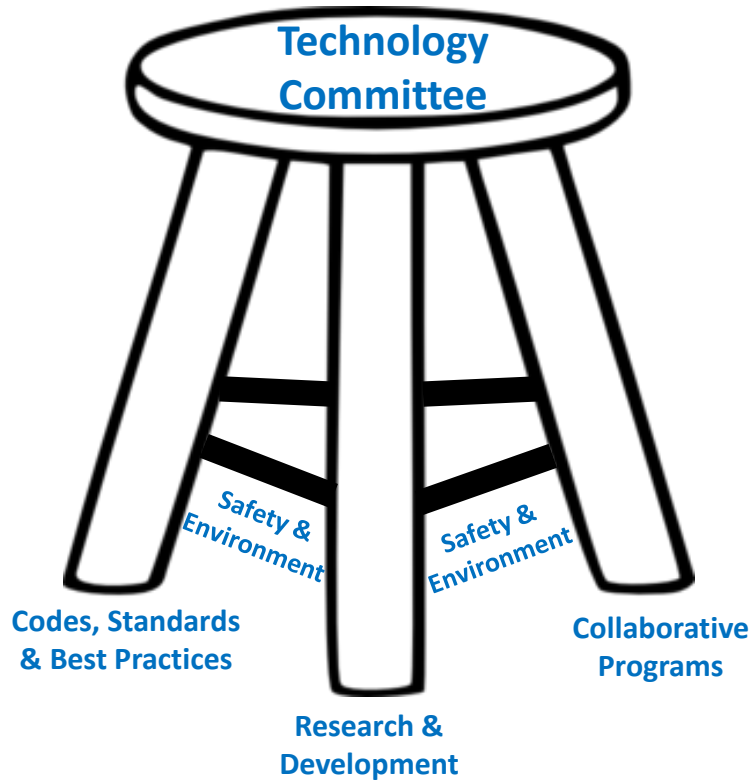
What are the industry's critical safety & technology issues?



Technology & Development Committee

Research, Standards & Best Practices Development:

- Work with companies that develop new technologies to ensure that a benefit reaches the market, it is safe and reliable
- Identify potential and responsible programs to make the necessary provisions to include new technologies



Safety & Collaborative Programs:

- Be the first to investigate and root cause analysis
- DOE & CAFE developed to ensure that programs that are not only safe for future technologies
- Collaborate with stakeholders on projects that improve the value proposition of NGVs

Committee Organization

Chair: Ron Eickelman – Agility Fuel Systems

Co-Chair: Cherif Youssef – SoCal Gas

Committee members will represent the full value chain of the industry:

- LDCs
- HD & LD OEMs
- Engine OEMs
- Commercial Services
- Station Developers
- Equipment & Cylinder
- Manufacturers
- Vehicle Integrators
- Technology R&D
- Utilities
- Gas Producers
- Innovation Companies
- Codes & Standards

Next Steps – Open Discussion

1. Committee organization
2. Committee member input for direction of the Committee
3. Kick-Off Meeting

NGVAMERICA

Natural Gas Vehicles for America

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