



2015 Natural Gas Vehicle Technology Forum
End-of-Life Tank Safety Session

October 20 , 2015

Mike Scarpino

U.S. Department of Transportation
Volpe, National Transportation Systems Center

Topic

Project Background

CNG Fuel Tank Code Requirements

CNG Fuel Tank End of Life

CNG Transit Bus Fleets

Multi-Agency/Industry CNG Fuel Tank Safety Initiative

Next Steps

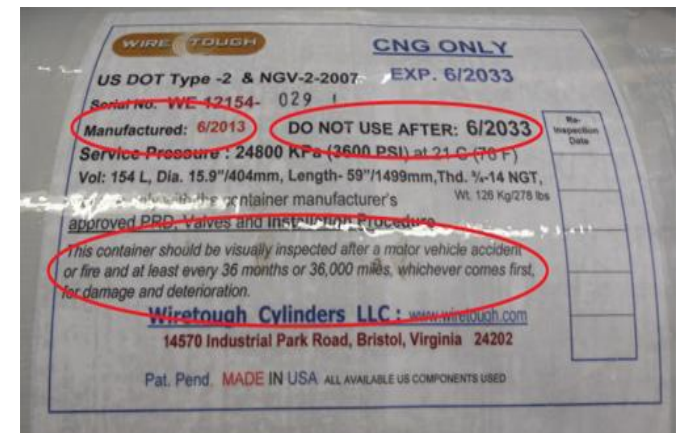
Open Discussion / Q&A

- NGV Industry stakeholders have expressed concerns related to CNG fuel tank safety standards associated with periodic inspections & end-of-life disposal requirements
- Washington Metropolitan Area Transit Authority (WMATA) contacted DOE to look for assistance/direction on 160+ CNG buses with tanks that were approaching their expiration date
- To ensure safe operation and decommissioning of these fuel tanks, a government-industry partnership was been started to provide resources related to training, best practices, case studies, and general outreach/awareness.

CNG Fuel Tank Code Requirements



- CNG Fuel Tanks (Cylinders) **shall be manufactured, inspected, marked, tested, equipped and used** in accordance with ANSI NGV 2 or FMVSS 49 CFR 571.304. NFPA 52 allows either standard.
- Fuel Tanks **should be visually inspected** at least every 36 months or 36,000 miles, whichever comes first, and;
 - After a motor vehicle accident or fire and;
 - After a dispenser malfunction that results in pressure greater than 125% service pressure.
- Fuel Tanks that have reached their labeled expiration date (EOL) or been condemned by inspection **shall be removed from service (and destroyed)**.
- Vehicles **shall be labeled at the fueling connection** with the EOL date and the date for the next inspection.



- All CNG fuel tanks carry a label that says "DO NOT USE AFTER (EXPIRATION DATE)." For instance, it might say "DO NOT USE AFTER 01/2027."
- CNG fuel tanks have a useful life of 15, 20, or 25 years, depending on their construction and how they were certified by the original manufacturer.
- Currently there is no way to safely "requalify" fuel tanks for extended use. So once a fuel tank reaches its expiration date, it must be replaced (and destroyed).
- CNG vehicle owners are responsible for compliance with fuel tank end of life requirements.
 - Currently, there is no state-by-state or national system to track or notify owners when their fuel tanks reach their expiration date

- Awareness of the inspection and EOL requirements varies.
- CNG fuel tanks have a specific service **life that may be different than the variable service life of the vehicle.**
- **Fuel tanks that need to be replaced before the end of the vehicle's life** introduce concerns regarding proper fitment of replacement fuel tanks, brackets and mounting components compared to the original installation.
- **Resale and incorrect disposal of fuel tanks** that have reached their EOL or been removed due to damage has led to failures and loss of life in other markets.
 - a. **Expired fuel tanks are available for sale on internet** auction /surplus sites because they were not effectively destroyed when condemned as a result of damage or EOL.
 - b. **Decommissioning** fuel tanks and/or scrapping CNG vehicles without established procedures (education) **has led to serious incidents.**
- Enforcement of the requirements is uncertain and not consistent

1. State of Texas (*linked to annual vehicle safety inspections*)

- Effective September 1, 2014, when a CNG vehicle comes in for its annual safety inspection, the owner or operator must prove that the vehicle's CNG fuel tank has been inspected, found to comply with applicable federal compressed natural gas fuel container integrity standards, and is not past its expiration date, under rules recently adopted by the Texas Public Safety Commission.

2. Pacific Gas & Electric (*linked to fueling station access*)

- PG&E is addressing CNG fuel tank safety risks with a requirement to provide a signed CNG fuel system inspection certificate for any vehicle to be fueled at a PG&E CNG facility
- The inspection consists of a completed Certificate of Inspection of Compressed Natural Gas Vehicle Fuel System form accompanied by the automobile repair/inspection business work order showing the business letterhead, date, qualified inspector name and qualifications summary, and the results of the inspection.

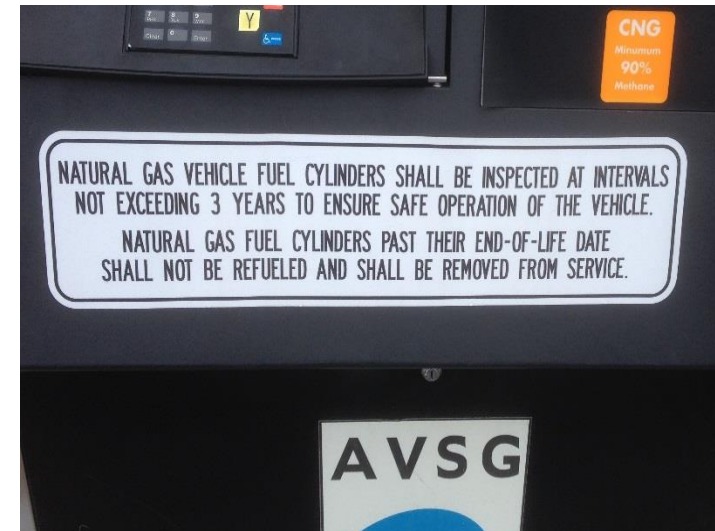
3. State of California Lower-Emission School Bus Program

- The CNG Tank Replacement Option provides funding to help offset the cost of replacing CNG tanks in qualifying school buses which are near the end of their service life.

A growing number of buses purchased each year are fueled by CNG (Industry estimates approximately 25% of new transit buses per year). Over 10,000 CNG Transit Buses are now on the road in North America. *(With 4-8 fuel tanks per bus this means that some **50,000+ CNG fuel tanks need to be accounted for**).*

- The average transit bus is in service for 12-15 years. Buses funded through Federal Transit Administration (FTA) programs are required to remain in service for a minimum of 12 years. A growing number of CNG buses have reached or are approaching the 15 year lifespan of both the bus and fuel tank.
- WMATA recently approached DOE for guidance on procedures/best practices associated with the retirement of 164 CNG transit buses from 2001-02, which hold a total of 1,148 fuel tanks (7 per bus). This highlighted the need for training, tools and resources.
- The transit industry often has meticulous fueling and maintenance data for CNG fuel tanks.

- Initial site visits were made to WMATA, MBTA, Greater Portland METRO, & University of NH.
- Coordinators were included in the site visits and their knowledge of the requirements varied.
- One transit agency was unaware of the fuel tank EOL requirements.
- All echoed the need for the need for training, SOPs, tools and resources.
- Awareness of the fuel tank expiration date is critical to ensure replacement vehicles are delivered to support continued operations.
- The fuel tank expiration can affect the resale value of the vehicle, as well as eliminate the ability to use the vehicle as a spare fleet vehicle. And may introduce liability issues.
- Fuel tank replacement may be necessary.



- User Groups,
Education, Training

 1. Support user groups that facilitate sharing of best practices for CNG fuel tank safety and decommissioning.
 2. Provide education on the safe and proper way to decommission and dispose of expired CNG fuel tanks (immediate need)
- Fuel Tank Testing

 3. Evaluate/characterize the conditions of CNG fuel tanks at end of life under real world operating conditions
 4. Consider options for the identification and tracking of in-use CNG fuel tanks over their life-time, and
 5. Develop R&D recommendations for improved fuel tank technologies that would enhance safety and performance.

PHASE 1:

- DOE Tiger Team Technical Assistance for fleets experiencing fuel tank expirations
- Engage user groups to develop best practices and case study reference materials for DOE Alternative Fuels Data Center (AFDC) website and partner sites
 - Fuel tank decommissioning
 - Fuel tank disposal
 - Matching CNG fuel tank life to vehicle lifecycle
 - Others as need is identified

PHASE 2:

- In-person outreach on the topic of aging CNG fuel tanks
 - Fleet managers
 - Station owners
 - Secondary market outreach
 - Current and future possibilities for inspection and end of life enforcement
- Online training courses and videos covering CNG fuel tank decommissioning process

- Transit and School Bus Fleets
- Refuse Fleets
- Taxi/Shuttle Fleets
- CNG Station Operators
- Technician Training Centers
- Recycling Groups
- Insurance Companies
- Clean Cities Coordinators
- Secondary Market Audiences
- Others?

DRAFT Timeline User Group Forums

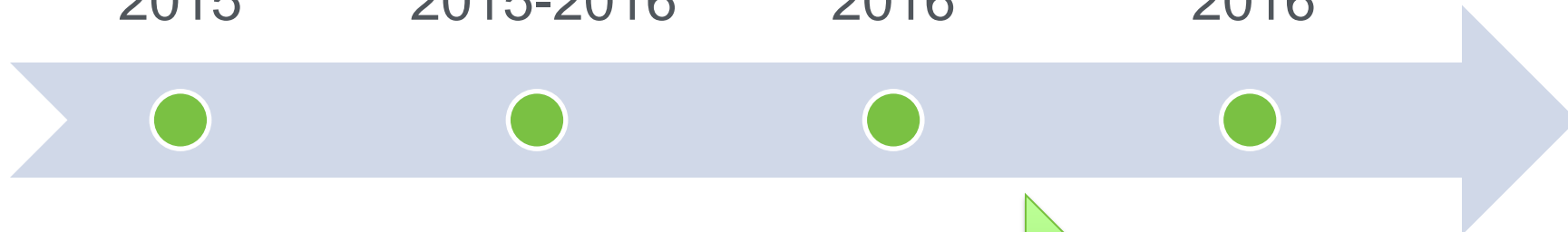


Summer
2015

Fall-Winter
2015-2016

Spring
2016

Summer
2016



Tiger Team Efforts

- Online Content Development
- Workshop Content Development
- Launch Online Document Resources

- Launch Targeted Outreach
- Launch Online Training Course(s)
- Launch Online Training Videos

User Group Engagement

Future Work

- Fuel tank end-of-life training and outreach to other CNG stakeholder groups
- Updates to online resources based upon results of fuel tank testing project
- Other topics as determined by user groups

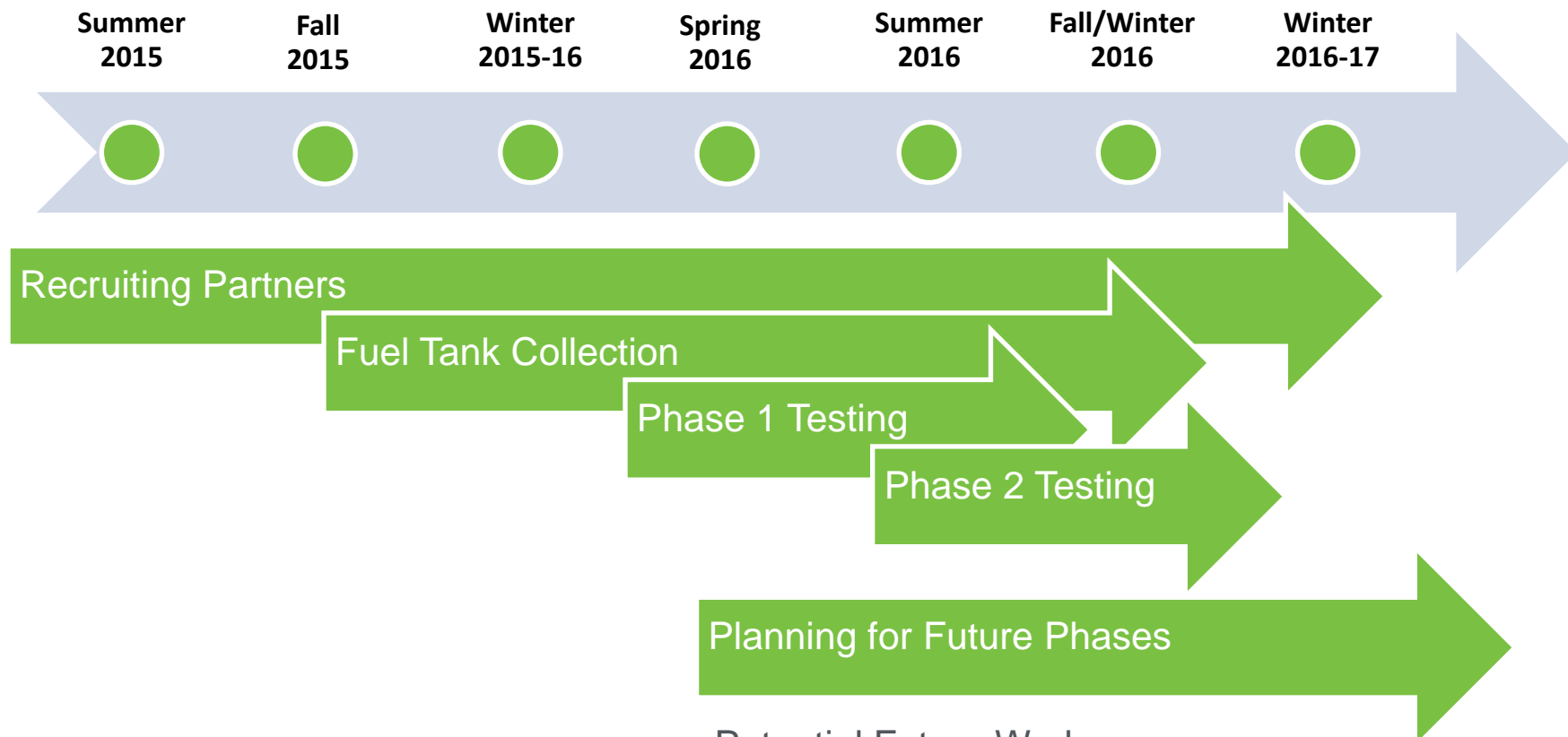
- Obtain a statistically significant number of tanks from CNG service and their corresponding operating life data (number of fills, magnitude of fills, maintenance and history inspection, etc.) for testing.
 - **PHASE 1** - Characterize CNG tank conditions at the end of their 15 year life as defined by the CSA NGV 2 *Basic Requirements for Compressed Natural Gas Vehicle (NGV) Fuel Containers*.
 - **PHASE 2** – Using hydraulic cycling tests, determine how tanks might fail under routine operating conditions after the 15 year mark and how the operating history of tanks correlate to their failure and aging under routine filling conditions
 - **FUTURE PHASES** – Other destructive testing TBD
- Issue Technical Reports containing:
 - Testing results
 - Recommendations on changes to CNG tank standards

CNG Fuel Tank Testing – Key Audiences and Stakeholders



- Natural Gas Vehicle Technology Forum
- Industry Associations
- Tank Manufacturers
- OEMs
- Bus Manufacturers
- Fleets
- First Responders
- Governments and Regulatory Bodies

DRAFT Timeline CNG Fuel Tank Testing



Potential Future Work

- Developing Smart Tank Technology
- Policy changes based upon testing results
- Other topics as determined by testing group

Suggested Outreach Activities for Clean Cities Coalitions and Stakeholders



- Discuss the cylinder requirements at stakeholder meetings and events.
- Contact/meet with stakeholder fleets that operate older CNG vehicles to see if they are aware of their cylinder expiration dates, as well as proper disposal requirements.
- If you have identified a Transit Agency or other fleet with a large number of vehicles that are effected by the EOL requirements, make them aware of the DOE led Multi-agency and Industry CNG Fuel Tank Safety Initiative which will be producing training, best practices and case studies on the subject.
- Evaluate the need for local implementation of regulation or policy strategies to ensure compliance.
- Contact Tiger Team Technical Assistance if you or your stakeholders have any general or technical questions or issues.

Fall/Winter 2015:

- Participate in project discussions/working groups
- Share best practices for how your organization has handled CNG fuel tank decommissioning
- Share data and EOL fuel tanks for testing
- Financial contributions

Contact
Kay.Kelly@nrel.gov
for more information

Future:

- Attend educational workshop, once developed
- Direct technicians to online courses, once developed
- Utilize online case study and document resources, once developed
- Financial contributions

Information to be
distributed through DOE
Clean Cities, APTA and
other partners.



Mike Scarpino

U.S. Department of Transportation
Volpe, National Transportation
Systems Center
(617) 494-3373
michael.scarpino@dot.gov

Dennis Smith

U.S. Department of Energy
Clean Cities
(202) 586-1791
Dennis.A.Smith@ee.doe.gov

Kay Kelly

National Renewable Energy Lab
Clean Cities
(303) 384-7554
Kay.Kelly@nrel.gov



Clean Cities Website: www.cleancities.energy.gov

Alternative Fuels and Advanced Vehicles Data Center: www.afdc.energy.gov

Fuel Economy: www.fueleconomy.gov

Clean Cities Coordinator Contact Information and Coalition Web Sites:
www.afdc.energy.gov/cleancities/progs/coordinators.php

Clean Cities Technical Response Service: technicalresponse@icfi.com,
800-254-6735



U.S. Department of Energy