



# Technology Brief



## Natural Gas Systems Safety Study, 2012

### PURPOSE

The Federal Motor Carrier Safety Administration (FMCSA) sponsored a study to examine potential changes to the current regulations and inspection procedures as they apply to the use of natural gas as an alternative fuel among commercial vehicles. The study provided recommendations on updates in the following:

- Federal Motor Carrier Safety Regulations (FMCSRs).
- North American Standard (NAS) inspection procedures.
- Out-Of-Service (OOS) criteria.

### RATIONALE AND BACKGROUND

Three factors have led to the increasing use of natural gas as an alternative fuel in commercial vehicles:

- **Environmental.** Many regions in the United States did not meet the National Ambient Air Quality Standards. Consequently, air quality management districts in such regions compelled fleet operators to use clean-burning alternative fuels instead of diesel. The most commonly available clean-burning fuel for commercial vehicles has been natural gas.
- **Availability.** In 2009, the United States became the world's leading producer of natural gas due to the discovery of abundant natural gas in underlying shale deposits and the widespread use of hydraulic fracturing technology for extracting natural gas.
- **Economics.** The cost of natural gas is almost half of that of diesel on a diesel gallon equivalent (dge) basis.

The current FMCSRs, NAS inspection procedures, and OOS criteria are targeted primarily toward diesel fuel. The use of natural gas poses new safety hazards that are different from those of diesel fuel. Compressed natural gas is pressurized to 3,600 pounds per square inch, and pressurization hazards need to be recognized. Liquefied natural gas is cooled to -260° F (a cryogenic liquid), and cryogenic hazards need to be recognized. The FMCSRs, NAS inspection criteria, and OOS criteria address the

unique characteristics of gaseous fuels in a limited way and do not address cryogenic fuels. Thus, there is a critical need to determine what updates and other changes that may be needed in the FMCSRs, NAS inspection procedures, and OOS criteria.

### PROCESS

The study conducted with a literature search of existing codes and standards and research on the most frequent safety incidents involving commercial vehicles powered by natural gas. The project examined the following codes and standards for natural gas vehicles compiled by the Automotive Service Excellence, Compressed Gas Association, Code of California Regulations, International Standards Organization, National Fire Protection Association, Society of Automotive Engineers, and United Nations Economic Commission for Europe.

Two databases were examined for incidents involving natural gas commercial vehicles: National Fire Incident Reporting System (NFIRS) compiled by the U.S. Fire Administration, and Master List of Natural Gas Vehicle Incidents compiled by the Clean Vehicle Education Foundation for the U.S. Department of Energy. The two databases provided trends or patterns of incidents that indicated particular problems to be addressed. For example, there were five incidents of transit buses with rooftop-mounted natural gas tanks that struck an overpass.

An analysis was conducted of the gaps between the current FMCSRs, NAS inspection procedures, and OOS criteria and current codes and standards. From the analysis, a preliminary set of findings and recommendations were proposed and vetted among stakeholders. Stakeholders included: a commercial vehicle enforcement agency, truck original equipment manufacturers, natural gas engine manufacturers, natural gas fuel systems suppliers, an engine conversion company, a port authority, owner/operators of fleets of natural gas commercial vehicles, and three associations.



**Figure 1. Types of Labels for Natural Gas Commercial Vehicles**

**FINDINGS AND RECOMMENDATIONS**

Most stakeholders were generally supportive of updated FMCSRs, NAS inspection procedures, and OOS criteria which would address commercial vehicles fueled by natural gas. Most stakeholders also agreed that National Fire Protection Association code 52 should guide the FMCSRs, but it should not be adopted wholesale. In particular, the findings and recommendations fell into the following categories:

1. Fuel system safety requirements for commercial motor vehicles (CMVs) specified separately for compressed natural gas and liquefied natural gas.

- 2. Labeling requirements (see examples in Figure 1).
- 3. Training requirements.
- 4. Accident reporting requirements.
- 5. Vehicle conversion requirements.
- 6. Driver inspection reporting requirements.

For more information, please visit:  
<http://www.fmcsa.dot.gov/facts-research/art-public-reports.aspx> This study was conducted by M.J. Bradley and Associates, LLC Manchester, NH 03101.