



# Differences between Light-Duty and Heavy-Duty Vehicles Fueled by Natural Gas To Consider for Emergency Response

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**Office of Research and Information Technology**

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# Outline

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- Purpose
- Background
- Need
- Discussion of differences
- Summary of key concerns for first responders
- Contact information

# Purpose

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- Purpose is to point out
  - Differences between light-duty and heavy-duty vehicles fueled by natural gas
  - Need for a separate emergency response guide and training for incidents involving heavy-duty vehicles fueled by natural gas

# Background on FMCSA



- FMCSA's mission
  - ... *To reduce the number of crashes, injuries, and fatalities involving large trucks and buses*
  
- FMCSA's focus
  - Safety of the operations and maintenance of heavy-duty vehicles (trucks and buses)
  - Enforcement of the Federal Motor Carrier Safety Regulations (FMCSRs)

# Background on Emergency Response to Natural Gas Vehicle Incidents

- National Highway Traffic Safety Administration developed a generic, 4-page brochure in 1996 (which has not been updated)
- Emergency response guide and training for incidents are to be or have been developed for **light duty** vehicles
  - National Fire Protection Association (NFPA) - coming
  - West Virginia University, National Alternative Fuels Training Consortium (NAFTC) - since 2007

## ALTERNATIVE-FUELED VEHICLE CRASHES

### EMERGENCY PERSONNEL

*The purpose of this brochure is to assist law enforcement officers, fire services, emergency medical service providers and other public safety personnel who arrive on the scene of an alternative-fueled vehicle crash. Emergency personnel must identify the specific type of fuel and secure the scene so rescue work can begin. They also need to know when to call for trained personnel equipped with proper protective gear for assistance. The goal is to protect the first arriving emergency responders, occupants of the vehicles, and bystanders at the scene.*

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# Background on Emergency Response Guide (for heavy-duty natural gas vehicle incidents)

- Emergency response guide and training for incidents have not been developed for **heavy-duty** vehicles except for
  - Transit vehicles

**TCRP**  
SYNTHESIS 58

Emergency Response  
Procedures for Natural Gas  
Transit Vehicles

*A Synthesis of Transit Practice*

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# Need for Emergency Response Guide

(for heavy-duty natural gas vehicle incidents)



- In 10/2011, California Highway Patrol (CHP) told FMCSA, “All our [CHP] standard operating procedures (SOPs) assume [commercial motor] vehicles involved in an incident use conventional fuel. We will have to change all our SOPs.” \*

\*personal communication with Lt. George Steffanson, Commander, CHP CMV Enforcement, Oct. 27, 2011

# Need for Emergency Response Guide

## (for heavy-duty natural gas vehicle incidents)

- In 03/2014, the first ***transportation*** fatality from an incident involving a heavy-duty natural gas vehicle in the U.S. was reported
  - A box truck was used to transport a fork lift 300 yards from one facility to another in Howard, WI
  - The fork lift was unsecured in the cargo compartment
  - As the box truck braked, the fork lift rolled forward, the tine of the forklift penetrated the wall between the cargo compartment and driver cab.
  - The tine punctured a compressed natural gas storage cylinder killing the driver



# Need for Emergency Response Guide (for heavy-duty natural gas vehicle incidents)



# Need for Emergency Response Guide (for heavy-duty natural gas vehicle incidents)

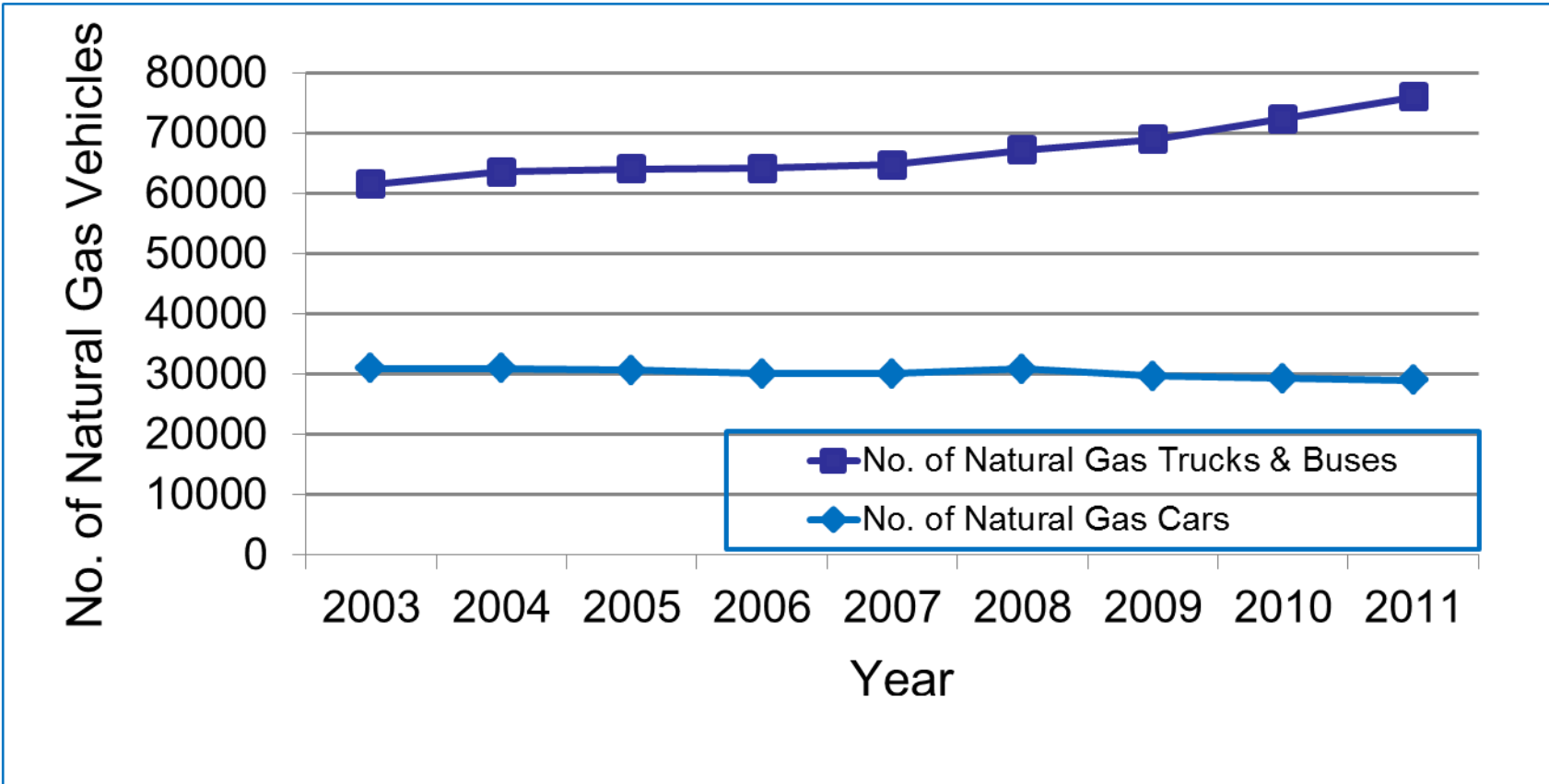


- After the incident, the Howard, WI Fire Marshal noted to the Clean Vehicle Education Foundation the need for an emergency response guide for heavy-duty natural gas trucks

# Summary of Differences between Light-Duty & Heavy Duty Natural Gas Vehicles

Attribute	Light-Duty Vehicle	Heavy-Duty Vehicle
Change in number of vehicles	Stagnating or slightly decreasing	Growing fast
Labeling	Lower right rear	All four sides
Type of Fuel	Compressed natural gas (CNG)	CNG or Liquefied natural gas (LNG)
Quantity of Fuel	1-2 CNG cylinders	≥ 2 CNG cylinders or 1-2 LNG tanks
Fuel Storage Locations	Bottom of vehicle (car or van) Cargo area (pick-up)	Top, back of cab, frame rail, or cargo compartment
Pressure Relief Device or Valve	Bottom of vehicle	Side or top of vehicle
Fuel Line Locations	Bottom of vehicle	Top, sides, or back of vehicle

# Change in Number of Natural Gas Vehicles



data from Energy Information Administration, <http://www.eia.gov/renewable/afv/index.cfm>  
site last visited 6/2015

# Labeling

- Light-duty vehicles generally have blue diamond label on lower right rear exterior
  - Label must be 4.72 in. long × 3.27 in. high
- Heavy-duty vehicles with GVWR  $\geq$  19,500 lbs will be required, by the next revision of NFPA 52, to have blue diamond labels on vehicle exterior
  - Lower right rear, front, and both sides below the DOT number
  - Labels must be 5.7 in. long × 4.2 in high
  - Note: labels may not be visible on pre-2016 dump and refuse trucks and tractor-trailers

# Examples of Labeling on Vehicle Exterior (US)



# Examples of Proposed Labeling (Europe)

- These labels are being proposed at the International Standards Organization



# Type of Natural Gas

- Light-duty vehicles use CNG
- Heavy-duty vehicles use both CNG and LNG
- Although both CNG & LNG are flammable, emergency responders need to be aware of the important hazard differences:
  - CNG is stored at 3600 psi: a **blast** hazard if a storage cylinder is punctured or a fuel line is cut
  - LNG is stored at -260 °F, a cryogenic “**burn**” hazard
  - CNG when released tends to **rise**
  - LNG when released tends to **sink first and then to rise** as it warms to ambient temperature

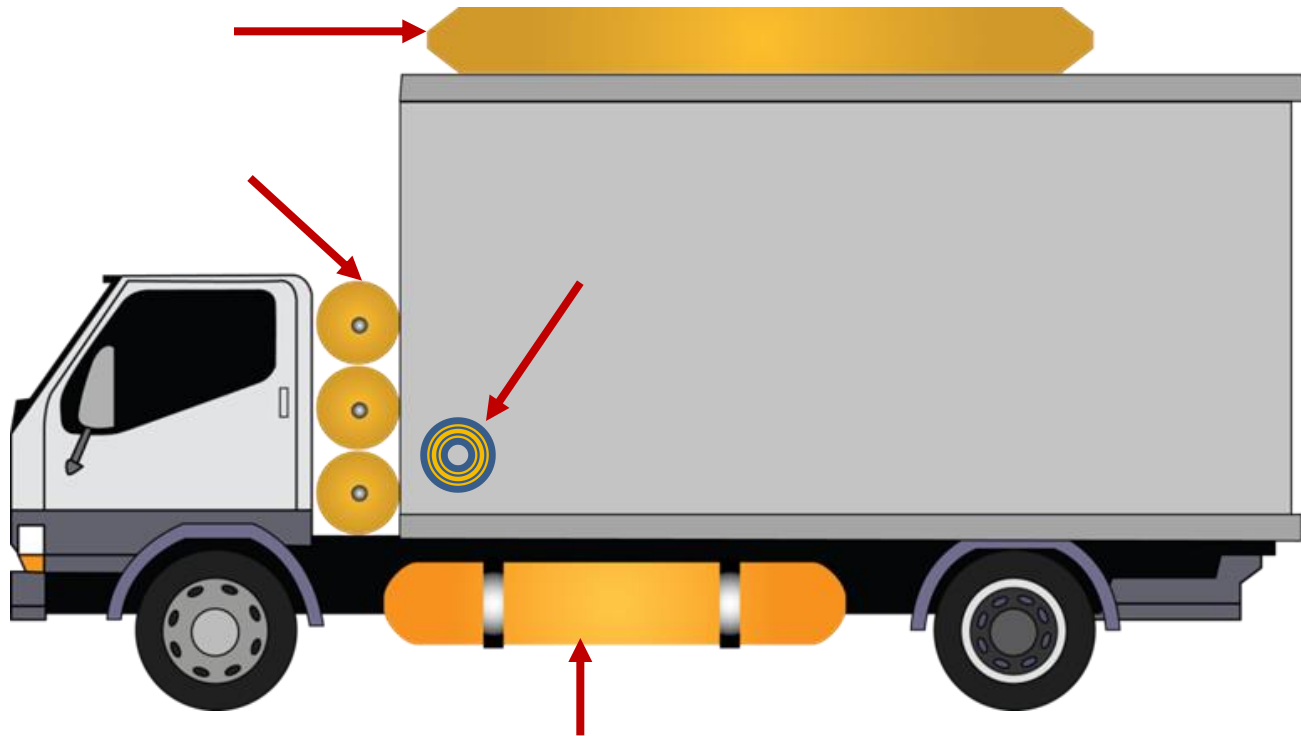


# Quantity of Natural Gas

Light-Duty Vehicle		Heavy-Duty Vehicle	
CNG		CNG	LNG
Standard: 1-2 cylinders	Option: 3-4 cylinders	Typical: 2-6 cylinders	Typical: 1-2 tanks
CNG cylinder typically holds 2712 ft <sup>3</sup> 115 lbs, 18.0 dge		CNG cylinder typically holds 3490 - 6014 ft <sup>3</sup> 148 - 255 lbs, 21.7 – 40.0 dge	LNG tank typically holds 60 -150 gal. 234 – 585 lbs, 38.6 - 96.6 dge)

# Fuel Storage Locations

- Light-duty vehicles generally have CNG fuel cylinders at the bottom
- Heavy-duty vehicles may have natural gas fuel tanks or cylinders as shown below:



# Roof-Mounted CNG Tanks



Photo courtesy of Clean Vehicle Education Foundation

# Pressure Relief Device and Valve Vent Locations

- In light-duty vehicles, pressure relief device (PRD) vent for CNG is generally located
  - Bottom of car or van
  - Cargo area of pick-up
- In heavy-duty vehicles, vents for the PRD [for CNG] or pressure relief valve (PRV) [for LNG] are typically on the side or on the top of the vehicle
- The next revision of NFPA 52 will require the locations of vents from PRDs and PRVs to be labeled [per adoption of an FMCSA recommendation]
- Persons should not stand ***in front of or next to*** vents from PRDs and PRVs, especially during a release

# Example of CNG PRD Vent Location Label

 <b>WARNING</b>	
	<b>CNG Vent Hazard</b> <b>During vehicle fire:</b> <b>Keep people away</b> <b>Prepare for large flame</b> <b>Let fire burn</b> <b>Gas vents here</b>
	<b>Failure to comply may injure or kill.</b>
<small>M0291 Do not paint over this label. Replace if damaged or lost</small>	

# Fuel Line Locations

- Fuel lines run between the fuel storage locations and the engine
  - Vent lines from PRDs and PRVs should be considered *potential* fuel lines
- In light-duty vehicles, fuel lines are typically at the bottom of the vehicle
- In heavy-duty vehicles, fuel lines can be on the top, side, or back of the vehicle
- “Cut sheets” are generally furnished to show fuel lines
  - Purpose is to show first responders where NOT to cut (e.g., where NOT to use “Jaws of Life”)

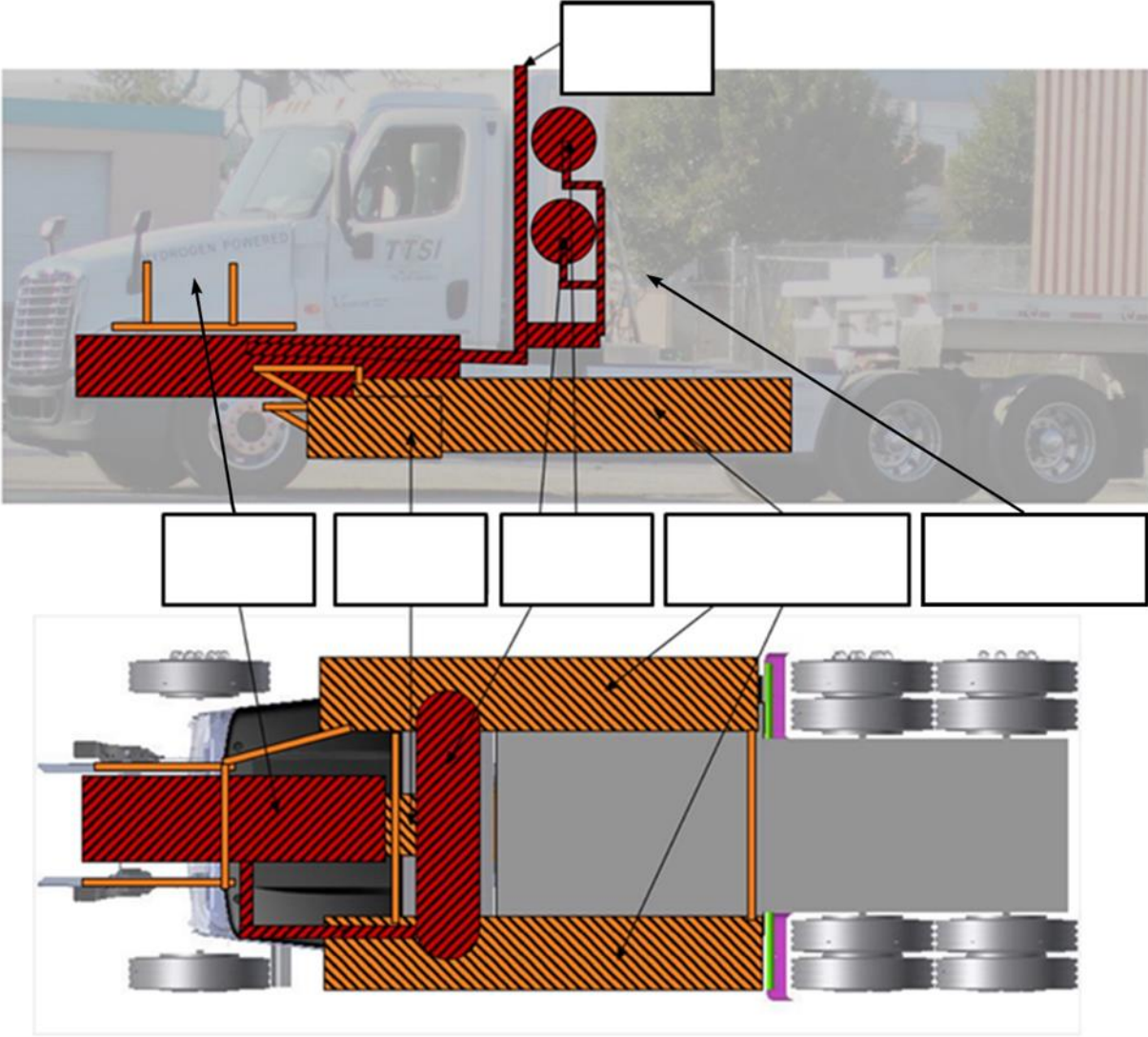
# “Cut Sheet” Example

**Key**

- Hydrogen storage, PRD vent, or line
- NEVER CUT - Hydrogen storage, PRD vent, or line
- High Voltage Source, or line
- NEVER CUT - High voltage Source, or line
- 12V Battery

**⚠ WARNING**

Never cut hydrogen or electrical storages/sources for any reason: personal injury may result (for more information, refer to Safety Handbook)



# Summary of Concerns for First Responders to Heavy-Duty Natural Gas Vehicles

Attribute	Heavy-Duty Vehicle	Concerns for First Responder
Change in number of vehicles	Population growing fast	Expect more heavy-duty than light-duty natural gas vehicles
Labeling	All four sides	Know where to find markings & labels in case one side is hidden (e.g., roll-over)
Type of Fuel	CNG or LNG	Discern the type of natural gas present to infer hazards
Quantity of Fuel	≥ 2 CNG cylinders or 1-2 LNG tanks	Be aware that more fuel means a greater potential hazard
Fuel Storage Locations	Top, back of cab, frame rail, or cargo compartment	Recognize locations to be prepared to access shut-off
Pressure Relief Device or Valve	Side or top of vehicle	Stay away from PRD & PRV vents
Fuel Line Locations	Top, side, or back of cab	Avoid cutting fuel lines



# Contact Information

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# Partners in Future Project

- **Federal Motor Carrier Safety Administration**  
Reduce crashes, injuries, and fatalities involving large trucks and buses
- **National Highway Traffic Safety Administration**  
Save lives, prevent injuries and reduce economic costs due to road traffic crashes
- **U.S. Department of Energy**  
Ensure America's security and prosperity by addressing energy, environmental and nuclear challenges
- **State commercial vehicle enforcement officers**  
Enforce commercial vehicle regulations

