



Natural Gas for Transportation – Codes & Standards Issues

The safe and cost efficient development of the natural gas for transportation market in North America depends on having a robust system of codes and standards that, to the extent possible, is aligned between Canada and the U.S. The ability to share information and explore challenges that may slow or impede market development is also an important consideration.

Fourteen different items have been identified by the Canadian Natural Gas Vehicle Alliance as issues that would benefit from enhanced Canada-U.S. collaboration via the Regulatory Cooperation Council process. The following table lists the issue areas by category. Detailed descriptions follow.

All of the issues identified relate to on-road transportation. A similar list for off-road transportation is not available. To develop an off-road issues list, more in-depth discussion is needed with experts from the marine, rail, and heavy mining industries in conjunction with standards development organizations.

DEVELOPMENT OF COMMON CODES & STANDARDS	
1	New standards needed for LNG vehicles and stations
2	Update existing standard for CNG dispensers and address temperature compensation
3	New standard needed for CNG high flow refueling receptacle
4	New standard needed for station-vehicle communication protocol
5	New fuel quality standards needed for CNG and LNG
6	New standard needed for CNG home refueling
7	New L-CNG standard needed
8	Update LNG codes to add emergency shutdown requirement
INFORMATION SHARING	
9	Improve incident information sharing process related to codes and standards
10	Develop a first responder best practices document
11	Develop a fuel system installation best practices document
CHALLENGES TO EXPLORE	
12	Determine how to address end of life CNG cylinder issues
13	Gather data to better understand methane emissions
14	Migrate CNG refueling infrastructure to 3,600 psi refueling

By-Item Details

1. New Standards Needed for LNG Vehicles & Stations

There are no standards in North America for any of the LNG components used in vehicles and stations. To address this gap, work was initiated in mid-2014 to develop two of the standards needed: (a) LNG1 for the fueling nozzle and receptacle; and (b) LNG2 for the onboard vehicle tank. These documents are being developed as harmonized U.S./Canadian standards and will have performance-based requirements including requirements related to overall performance, safety, and emissions. Additional resources are needed to develop the following new LNG standards: (a) LNG 4.1 – dispenser; (b) LNG 3.1 – vehicle components; (c) LPRD1 - pressure relief device; and (d) LNG 4.4 – breakaway.



2. Updated CNG Dispenser Standard Needed Including Temperature Compensation

The majority of CNG standards were published in the late 1990s and require updating to reflect lessons learned and changes in technology. The CNG dispenser standard, NGV 4.1, was last published in 1999. Within the scope of a dispenser standard update, it is also recommended that a temperature compensated fueling protocol be developed and published to reduce the risk associated with the over-pressurization/over-densification. Based on findings from a recent review of incident data, there are many refueling stations in North America that do not fill at or below the temperature compensation curve resulting in over-pressurization. If a CNG vehicle's fuel cylinders are filled to a level above the temperature compensation curve and the vehicle is being brought inside during winter when the indoor temperature exceeds the ambient outdoor temperature, then there is a risk that the pressure in the fuel cylinders could exceed the allowable maximum pressure.

3. New Standard Needed for High Flow CNG Fueling Receptacle

There is no standard available for a high flow, heavy duty receptacle profile for CNG refueling for commercial trucks and buses. The current version of the CSA NGV1 standard has not adopted these requirements and therefore these components cannot be listed or certified as outlined in the NFPA 52 code. CSA Group is revitalizing the relevant committee, but resources are needed to complete the work.

4. New Standard Needed for Vehicle-Station Communication Protocol

As is already done for hydrogen vehicles, the natural gas vehicle industry has identified the opportunity to apply smart communication technologies to the vehicle-station interface in order to limit or stop the flow of fuel in the event of an upset condition occurring. One direction that is currently being considered includes the addition of a special flow limiting valve placed between the vehicle fueling receptacle and onboard fuel containers. Additional sensors included in the fuel system would then identify when upset conditions occur that could put the vehicle fuel system at risk. When these conditions are detected, the flow limiting valve would close and flow would stop before any long-term damage could happen. Implementation would be challenging given the existing vehicle stock. These vehicles would require "upfit" before they could be refueled with kits likely to involve considerable cost and complexity to install.

5. New Fuel Quality Standards Needed for CNG & LNG

The trend for tighter engine tail pipe emissions and improved fuel economy and performance also demands that a stable and reliable fuel be supplied. At present, there are no fuel standards in North America for either CNG or LNG. There is work being done by the SAE and ASTM to develop a transportation fuel best practice that will define special fuel blends to be used by engine and vehicle manufacturers for certification purposes. This early work could be used as the basis to develop dispensed fuel quality standards. For fuel quality standards to be recognized in state, provincial or federal regulations, they must be first published as accredited national standards.



6. New Harmonized CNG Home Refueling Standard Needed

There is currently no nationally recognized, harmonized standard for a home refueling appliance. CSA Group is currently developing a harmonized set of performance and safety requirements that outline the design, installation, safe operation, and maintenance of CNG refueling equipment that could be used for both residential and commercial fueling. The standard would need to be designed to allow this type of refueling device to be categorized as an appliance and therefore be inspected and approved by the building inspectors and not the fire marshal. Resources are needed to develop this standard.

7. New L-CNG Standard Needed

CNG generated from a cryogenic supply of natural gas is not odorized and therefore additional sensors are necessary in and around the fueling station. Standards specifically addressing the safety issues associated with odorless fuel or standards associated with onsite odorization need to be developed and recognized by the local Authorities Having Jurisdiction in each of Canada and the U.S.

8. Updated LNG Codes Needed to Add Automatic Shutdown Requirement

There is no communication between a bulk LNG delivery truck and a LNG refueling station when the fuel is transferred to the storage vessel. An average LNG trailer will carry 10,000 imperial gallons in a single load. LNG trailers do not have excess flow valves which serve as a critical barrier if a hose or a fitting fails. They also are not compartmentalized. In an emergency, a driver must manually activate an emergency shut off valve on the trailer as well as manually activating the emergency shutdown device at the station. The addition of a requirement for an automatic shutdown system in the existing codes in Canada and the U.S. would enhance the safety of LNG transfer.

9. Improve Incident Information Sharing Process Related to Codes and Standards

At present, when an incident occurs, available information is collected by the U.S.-based Clean Vehicle Education Foundation (CVEF) and forwarded to CSA Group who directs the information to the appropriate committee for review. Quite often, there is a lag in acquiring information due to legal issues and ongoing litigation. In addition, it is not entirely clear as to whether information on Canadian incidents is, in fact, distributed via the current system. A more formal system for gathering and relaying incident information would benefit the North American natural gas vehicle industry and enhance overall public safety. As part of considering how to improve the current system, work would also need to be carried out to determine how to resource the activities that CVEF currently conducts given that CVEF's funding from U.S. DOE is scheduled to end in mid-2015.

10. Develop a First Responder Best Practice Document

A CNG and LNG vehicle and station first responder best practice document is needed. Development could follow the model followed for hydrogen and fuel cell vehicles (SAE J2990-1) and for hybrid and electric vehicles (SAE J2990). This work needs to be completed and implemented across North America. The availability of this type of best practice would enhance safety and existing training efforts.



11. Develop a Fuel System Installation Best Practice

There is no single industry best practice document that addresses the proper selection, positioning, and installation of the common components included in a natural gas vehicle fuel system for CNG or LNG aftermarket conversions. While the primary market development focus in North America involves factory-built vehicles, there will continue to be a modest level of vehicle conversion activity. This activity should be done in a manner that is safe and consistent. The current lack of guidance in this area results in significant variation in the quality of aftermarket conversions.

12. Determine How to Address End of Life CNG Cylinder Issues

As the initial wave of natural gas vehicles fitted with fuel containers that have a defined end of life date reach their limits, the North American natural gas vehicle industry is struggling with how to identify, contain, and control these fuel containers so that they are taken out of service and rendered inoperative. There currently is a gap in the regulations and no system-wide method of enforcement to manage or regulate compliance in either Canada or in the U.S. It is also not clear if retest and recertification of these stale fuel containers is safer than replacement since, in some cases, direct replacement parts are not available so new tank/bracket assemblies are being substituted and these assemblies may not be crash tested. Further safety studies are needed to categorize risks appropriately.

This issue could be addressed by requiring that tank expiry dates be included as part of the vehicle registration record. When annual licensing fees are paid, new vehicle tags would be issued only when tanks are within safe operation dates as indicated by the tank expiry date.

13. Gather Data to Better Understand Methane Emissions

The regulation of fugitive methane emissions from both CNG and LNG applications is an area of potential future change. There is currently no understanding in the industry of when methane-specific requirements will be enforced and what the impact will be for CNG and LNG vehicles and stations. The standards committees require information and technical data to support development requirements, to carry out performance tests, and to develop pass/fail criteria that can be incorporated in certification programs for vehicle and station components and equipment. Criteria need to be developed to allocate vehicle system level methane emission requirements to component level standards.

14. Migrate CNG Refueling Infrastructure to 3,600 psi Pressure

There are two service pressures used in North America – 3,000 psi (P30) which is the service pressure for the majority of NGVs in Canada and 3,600 psi (P36) which is used for all vehicles in the U.S. Having two different pressures has created a series of enforcement and maintenance issues that put the vehicle fuel containers at risk if any type of illegal adaptor is used for refueling. Migration to a single P36 level system needs to occur to ensure that lower pressure systems are not refueled to higher pressures. Recent changes to Canada's CSA B108 code now allow for P36 refueling at both public and private CNG stations.



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