



Research Summary – Validation of recommended emergency actions for liquefied natural gas (LNG) in the *Emergency Response Guidebook (ERG)*

Transportation of Dangerous Goods | Research Development, Promotion and Coordination Division

SYNOPSIS

This research evaluated the recommended emergency actions for liquefied natural gas (LNG) included in the 2020 edition of the ERG. Scientific and emergency response-related literature was reviewed, as well as reports from previous incidents involving LNG. The analysis considered the physical and chemical properties, means of containment, potential hazards, emergency response procedures, and available guidelines for LNG, as compared to those for liquefied petroleum gases (LPG). Research results indicated that, with some amendments, ERG Guide 115 can capture the hazards associated with LNG, and there is no need to create a new separate ERG guide for LNG at this time.

BACKGROUND

LNG consists primarily of methane in a mixture with small amounts of other

hydrocarbons. There has been increased use of LNG as a fuel source in recent years, and there is potential for further increase in the transport of LNG by rail and road. Therefore, it is of interest to ensure that the emergency actions recommended for LNG in the ERG are appropriate.

Dangerous goods with similar physical and chemical properties are assigned to the same guide number in the ERG because they share similar emergency response recommendations. LNG is currently assigned to Guide 115, along with other flammable gases including LPG. Therefore, the recommended emergency actions currently in the ERG are almost the same for LNG and LPG. However, there are some significant differences in the properties of LNG and LPG, as well their means of containment, that may alter their hazard profile if an incident occurs. For example, LNG is transported as a gas liquefied by cooling at cryogenic temperature, whereas LPG is transported as a gas liquefied under pressure.

OBJECTIVES

The objective of this research was to determine if the hazards of LNG and LPG differ significantly enough to warrant the establishment of new guidance for LNG in the ERG.

METHODS

Scientific literature and emergency response reports were reviewed. Information on the various means of containment and the physical and chemical properties of LNG and LPG were gathered. Using all of this information, the hazards that each of the dangerous goods would present in a potential incident were compiled. The recommended emergency actions for LNG currently in the ERG were then considered to identify any gaps. From all of the data gathered, a determination was made as to whether LNG should remain in Guide 115 of the ERG, be assigned to a different ERG guide, or be placed in a new separate ERG guide.

RESULTS

The analysis resulted in the following recommended amendments to various sections of Guide 115, to ensure that appropriate considerations for LNG are included. Each recommended amendment was discussed by Transport Canada and the other partner organizations (i.e., the U.S. Department of Transportation, *Secretaría de Comunicaciones y Transportes* (SCT) of Mexico, and the *Centro de Información Química para Emergencias* (CIQUIME) of Argentina) who develop the ERG together. The agreed wording to be included in the next 2024 edition of the ERG is shown below.

In the section, “POTENTIAL HAZARDS – FIRE OR EXPLOSION”:

- Guide 115 currently does not address the rapid phase transition (RPT) phenomena that LNG may experience when in contact with water.
- Proposed addition: *“When an LNG release is on or near water, exercise caution as rapid phase transitions may occur from the liquid to vapor phase with an associated rapid pressure increase.”*
- Accepted addition: **“CAUTION: When LNG – Liquefied natural gas (UN1972) is released on or near water, product may vaporize explosively.”**
- The ERG partner organizations agreed to this accepted addition to have a concise statement for ease of readability during an incident. Rather than mentioning the RPT phenomenon directly, the potential hazard is highlighted.

In the section, “POTENTIAL HAZARDS – HEALTH”:

- Inhalation issues are more applicable in closed or confined areas versus in open air.
- Original statement: *“Vapors may cause dizziness or asphyxiation without warning.”*
- Proposed and accepted modification: **“Vapors may cause dizziness or asphyxiation without warning, especially when in closed or confined areas.”**
- This amendment will also be made in other ERG guides containing the same original text, including Guides 116, 120, 122, 126, 127, 128, 129, 130, 131, 132, 160, and 174.
- Incorporate “cryogenic liquid”, which is not currently mentioned in the Guide 115 statement regarding contact hazards.



- Original statement: “*Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.*”
- Proposed and accepted modification: “*Contact with gas, liquefied gas, or **cryogenic liquid** may cause burns, severe injury, and/or frostbite.*”
- This amendment will also be made in other ERG guides to which other cryogenic liquids are assigned, including Guides 120, 122, and 168.

In the section, “EMERGENCY RESPONSE – FIRE”:

- Under “Fire Involving Tanks”, the researchers suggested that the second and third bullet points should be combined into one bullet point, so that the user reads them together for context, as pressure relief devices could be affected by icing. This is not a technical issue, but rather a human factors issue.

- Original statements:
 - “*Cool containers with flooding quantities of water until well after fire is out.*”
 - “*Do not direct water at source of leak or safety devices; icing may occur.*”
- Proposed modification: “**Avoiding the container’s pressure relief device and the source of the leak**, cool the container with flooding quantities of water until well after the fire is out. **Activation of the pressure relief device may be delayed, and** icing may occur.”
- Decision by the ERG partner organizations: Keep the original statements as they are. The suggested modification is too long and reduces clarity. However, any feedback from stakeholders would be welcome for consideration for future editions of the ERG.

CONCLUSIONS

The research concluded that, **with some amendments, ERG Guide 115 can capture the hazards associated with LNG** – and this is consistent with the ERG structure of grouping together dangerous goods with similar hazards and similar emergency response procedures. **There is currently no need to develop a new separate ERG guide for LNG.**

FUTURE ACTION

ERG partner organizations will continue reviewing the ERG regularly to ensure that the recommended emergency actions are up-to-date with any changes in the transportation of dangerous goods landscape.

REFERENCES

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KEYWORDS

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goods, TDG, rapid phase transition,
RPT