# National Academy of Sciences (NAS)
# Transportation of Liquefied Natural Gas (Cryogenic liquid) by Highway
# Introduction and Federal Motor Carrier Safety Administration Responsibilities

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# FMCSA Mission and Goals

Mission

To save lives and reduce crashes, injuries and fatalities involving large trucks and buses by advancing large truck and bus safety through collaboration, education, research, technology, and compliance.

Goals

- Reduce commercial motor vehicle related fatalities and injuries;
- Continue fostering constructive relationships across our stakeholder communities;
- Promote the adoption and deployment of new technologies and practices; and
- Nurture a “best-in-class” organization that attracts, retains, supports, and recognizes a diverse and talented workforce.

# LNG by Highway

Moved in trucks with double walled, vacuum insulated tanks and trailers, MC-338.

Approximately 28,000 cargo tanks/trucks operated by carriers that haul LNG

In the last 15 years: 10 highway incidents involving LNG reported to PHMSA: 6 were highway crashes; 3 listed no quantity released; and none resulted in a fire or explosion

**49 CFR Part 172, Section 172.101, Hazardous Materials Table:**

Identification Number: UN1972

Proper Shipping Name: *Liquefied natural gas, see* Methane, *etc., (UN1972):* Methane, refrigerated liquid *(cryogenic liquid), or* Natural gas, refrigerated liquid *(cryogenic liquid), (with high methane content)*

# 49 CFR Part 172, Section 172.101, Hazardous Materials Table:

Hazard Class/Division: 2.1 Flammable Gas

Special Provisions: T75, TP5, 440

*T75*. When portable tank instruction T75 is referenced in Column (7) of the §172.101 Table, the applicable refrigerated liquefied gases are authorized to be transported in portable tanks in accordance with the requirements of §178.277 of this subchapter.

TP5. For a portable tank used for the transport of flammable refrigerated liquefied gases or refrigerated liquefied oxygen, the maximum rate at which the portable tank may be filled must not exceed the liquid flow capacity of the primary pressure relief system rated at a pressure not exceeding 120 percent of the portable tank's design pressure. For portable tanks used for the transport of refrigerated liquefied helium and refrigerated liquefied atmospheric gas (except oxygen), the maximum rate at which the tank is filled must not exceed the liquid flow capacity of the pressure relief device rated at 130 percent of the portable tank's design pressure. Except for a portable tank containing refrigerated liquefied helium, a portable tank shall have an outage of at least two percent below the inlet of the pressure relief device or pressure control valve, under conditions of incipient opening, with the portable tank in a level attitude. No outage is required for helium.

440. When this material is transported by tank car, the offeror must ensure each tank car is remotely monitored for pressure and location. Additionally, the offeror must notify the carrier if the tank pressure rise exceeds 3 psig over any 24-hour period.

# 49 CFR Part 172, Section 172.101, Hazardous Materials Table:

Packaging:

Exceptions: None

Non-bulk: None

Bulk: 173.318 and 173.319

# Section 173.318: Cryogenic liquids in Cargo Tanks:

(f) *Specification MC-338 (§178.338 of this subchapter) cargo tanks* are authorized for the shipment of the following cryogenic liquids subject to the following additional requirements:


Clean Energy
Natural gas (LNG & CNG) fueled vehicles protect our environment.

| Maximum set-to-discharge pressure (psig) | Maximum permitted filling density (percent by weight) | | | |
|---|---|---|---|---|
| | Carbon monoxide | Ethylene | Hydrogen | Methane or natural gas |
| 13 | | | 6.6 | |
| 15 | 75.0 | | 6.6 | 40.5 |
| 17 | 74.0 | | 6.6 | |
| 20 | | 53.5 | | 40.0 |
| 25 | 73.0 | | | |
| 30 | 72.0 | 52.7 | 6.3 | 39.1 |
| 35 | | | | |
| 40 | | 52.0 | | 38.6 |
| 45 | 71.5 | | | |
| 50 | | 51.4 | 6.0 | 38.2 |
| 55 | | | | |
| 60 | | 50.8 | | |
| 70 | | 50.2 | 5.7 | 37.5 |
| 90 | | 49.2 | | |
| 95 | | | | |
| 100 | | 48.4 | 5.4 | 36.6 |
| 115 | | 48.2 | | |
| 125 | | | 5.0 | |
| 150 | | | 4.5 | |
| 175 | 62.5 | 45.8 | | |
| 285 | 56.0 | | | |
| Design service temperature | –320 °F | –155 °F | –423 °F | –260 °F |



173.318(g) *One-way travel time marking*. The jacket of a cargo tank to be used to transport a flammable cryogenic liquid must be marked on its right side near the front, in letters and numbers at least two inches high, “One-Way-Travel-Time __ hrs.”, with the blank filled in with a number indicating the one-way travel time (OWTT), in hours, of the cargo tank for the flammable cryogenic liquid to be transported.

173.318(g)(3) Each cargo tank motor vehicle used to transport a flammable cryogenic liquid must be examined after each shipment to determine its actual holding time. The record required by §177.840(h) of this subchapter may be used for this determination.

177.840(h) The driver of a motor vehicle transporting a Division 2.1 (flammable gas) material that is a cryogenic liquid in a package exceeding 450 L (119 gallons) of water capacity shall avoid unnecessary delays during transportation. If unforeseen conditions cause an excessive pressure rise, the driver shall manually vent the tank at a remote and safe location. For each shipment, the driver shall make a written record of the cargo tank pressure and ambient (outside) temperature:

(1) At the start of each trip,
(2) Immediately before and after any manual venting,
(3) At least once every five hours, and
(4) At the destination point.

# 49 CFR Part 383: Commercial Drivers License (Endorsements)

*Hazardous materials* means any material that has been designated as hazardous under 49 U.S.C. 5103 and is required to be placarded under subpart F of 49 CFR part 172 or any quantity of a material listed as a select agent or toxin in 42 CFR part 73.

## Part 383: Commercial Drivers License (Endorsements)

## Tank Vehicles (Both HM and Non-HM):

*Tank vehicle* means any commercial motor vehicle that is designed to transport any liquid or gaseous materials within a tank or tanks having an individual rated capacity of more than 119 gallons and an aggregate rated capacity of 1,000 gallons or more that is either permanently or temporarily attached to the vehicle or the chassis. A commercial motor vehicle transporting an empty storage container tank, not designed for transportation, with a rated capacity of 1,000 gallons or more that is temporarily attached to a flatbed trailer is not considered a tank vehicle.

## Part 385 Subpart E: Hazardous Materials Safety Permit:

Highway Route Controlled Class 7;

>55 lbs.: 1.1, 1.2 or 1.3 Explosives, or Placarded 1.5;

PIH Zone A - >1liter / package;

PIH Zone B – Bulk Package >119 gal.;

PIH Zones C or D – Bulk Package ≥ 3,500 gal.; or

Methane or Natural Gas (compressed or refrigerated liquid), or any other compressed or refrigerated liquefied gas with a methane content ≥ 85 percent, in bulk packaging ≥ 13,248 L (3,500 gallons)..



**§385.407 Conditions to issue a safety permit:** The motor carrier must:

Have a "Satisfactory" safety rating;

Certify that it has a satisfactory security program;

Not have a crash rate in the top 30 percent of the national average (0.136); and

Not have a driver, vehicle, hazardous materials, or total out-of-service rate in the top 30 percent of the national average (Driver 9.68; Vehicle 33.33; HM 6.82).

**§385.407 Continued:** The motor carrier must certify that it has a satisfactory security program, including:

A security plan meeting the requirements of 49 CFR Part 172 Subpart I;

A communications plan …to meet the periodic contact requirements in §385.415(c)(1); and

Successful completion by all hazmat employees of the security training required in §172.704(a)(4) and (a)(5) of this title.

## §385.407 Continued:

The motor carrier must be registered with the PHMSA in accordance with 49 CFR Part 107 Subpart G.

**§385.415 Operational requirements:** *Information that must be carried in the vehicle:*

A copy of the safety permit or another document showing the permit number;

A written route plan; and

The telephone number of an employee of the motor carrier or representative of the motor carrier who is familiar with the routing of the permitted material.

## Additional requirements:

The operator of a motor vehicle must follow the communications plan …to make contact with the carrier at the beginning and end of each duty tour, and at the pickup and delivery of each permitted load.

The motor carrier should contact the Transportation Security Administration's Transportation Security Coordination Center at any time the motor carrier suspects its shipment of a hazardous material …is lost, stolen or otherwise unaccounted for.

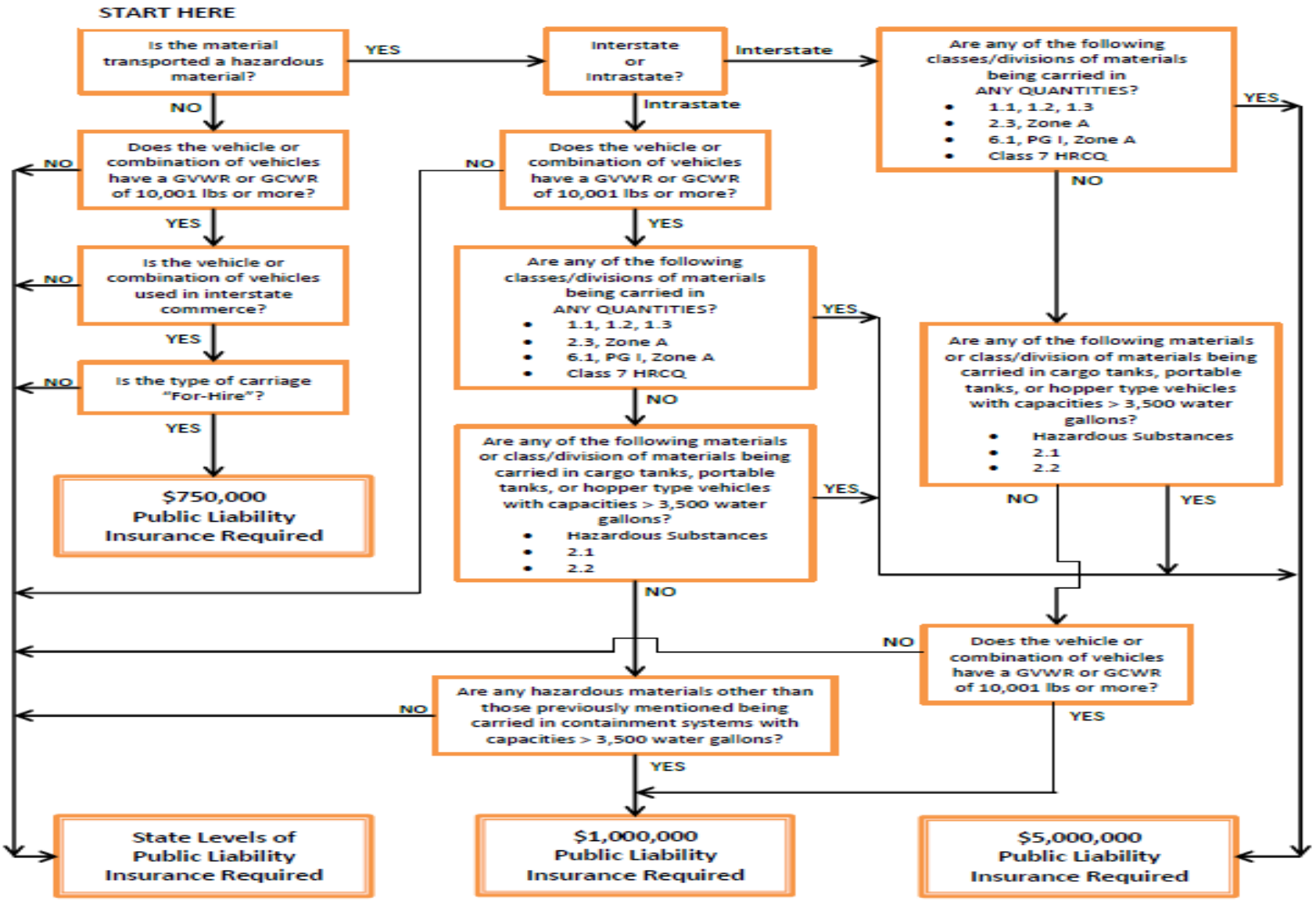
**Enhanced Oversight:** HMSP Carrier with:

Hazardous Materials (HM) BASIC equal to or greater than threshold for the past two months.

Any two or more BASICs, other than the HM BASIC, equal to or greater than their HM thresholds for the past two months.

48 months of insufficient data for the most current 48-month period.

# PUBLIC LIABILITY FOR COMMERCIAL MOTOR VEHICLES
# FLOW CHART



## Cargo Tank Facility Oversight

49 CFR Part 107 Subpart F—Registration of Cargo Tank and Cargo Tank Motor Vehicle Manufacturers, Assemblers, Repairers, Inspectors, Testers, and Design Certifying Engineers

Approximately 3,500 CT Facilities Registered with FMCSA

# Cargo Tank Facility Oversight

## 49 CFR Part 180 Subpart E—Qualification and Maintenance of Cargo Tanks

| CT FUNCTION TYPE | CARGO TANK_FUNCTION TYPE |
|---|---|
| E | EXTERNAL VISUAL INSPECTION |
| L | LINING INSPECTION |
| V | INTERNAL VISUAL INSPECTION |
| H | PRESSURE TEST |
| K | LEAKAGE TEST |
| T | THICKNESS TEST |

## Cargo Tank Motor Carrier Oversight

49 CFR Part 385 Subpart A – General, §385.1: This part establishes:

FMCSA's procedures to determine the safety fitness of motor carriers, to assign safety ratings, to direct motor carriers to take remedial action when required, and to prohibit motor carriers receiving a safety rating of "unsatisfactory" from operating a CMV.

The safety assurance program for a new entrant motor carrier initially seeking to register with FMCSA to conduct interstate operations. It also describes the consequences that will occur if the new entrant fails to maintain adequate basic safety management controls.

## Cargo Tank Motor Carrier Oversight - Continued

49 CFR Part 385 Subpart A – General, §385.1: This part establishes:

The safety permit program for a motor carrier to transport the types and quantities of hazardous materials listed in §385.403.

The provisions of this part apply to all motor carriers subject to the requirements of this subchapter, except non-business private motor carriers of passengers.

Subpart F of Part 385 establishes procedures to perform a roadability review of intermodal equipment

**https://www.fmcsa.dot.gov/rolloverprevention**

# Questions

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