Locomotive Alternative Fuels and Cryogenic Commodity Transportation (Projects and Regulations)

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Topics

- FRA projects on use of cryogenic fuel in locomotives
- Feasibility of use of hydrogen as a locomotive fuel. - An example
- FRA approvals for shipment of cryogenic fuel on rail
- Current Regulations and their limitations
- Safety Issues and concerns
FRA Alternative Fuels Team

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LNG Usage on Rail

- LNG pilot projects, for use as a locomotive fuel
  - CN tested the concept in Canada; BNSF tested over several routes and weather conditions in the US; and UP conducted static tests only. All three programs have been terminated.
  - Florida East Coast Railway (FECR) is testing the feasibility on its Jacksonville – Miami route.

- LNG is being moved as a commodity on rail
  - FECR is moving LNG in UN-T75 portable tanks in well cars between Hialeah (Miami) and Port Everglades.
  - Alaska Railroad [AKRR] had moved a few test shipments in UN-T75 portable tanks between Anchorage and Fairbanks, AK.
LNG Pilot Test Program by CN

A tender car fueling two, duel fuel locomotives
Portable LNG Tank Tender in a Train
Types of LNG tender cars

Tank car type tender car
(similar in design to DOT 113C120W)

Portable (ISO) tank tender
Alternative Fuels Program Approvals

• Program requires approval by Associate Administrator Railroad Safety (Aug 2013 Letter)
• Program responsibility of Host railroad
• Pilot Program - Expect multi-year program
• Standards – Developed by Industry (AAR) initially
• Rulemaking – Most likely last step in process
**Example**: A commuter train (600 T) serves a 100 km O-D pair with average speed of 100 km/hr, with 10 trips/day. How much \( \text{H}_2 \) is needed and what are the on-board \( \text{CH}_2 \) storage requirements?

- Total \( \text{H}_2 \) gas required/day = 425 kg
- Assumed storage pressure = 250 barg = 3600 psig
- Max gas storage density (at 20 °C) = 20 kg/m\(^3\) = 1.25 Lb/cft
- Assumed size of composite tank = 1 m (dia) x 15 m (length)
- Nominal volume of each tank = 8.5 m\(^3\) = 300 cft.
- Weight of each tank = 2.5 T = 5,500 lbs.
- # of tanks needed for 10 trip service = 3
Transport of Hydrogen by Rail (Commercial Transport)

- Hydrogen authorized for transport in DOT-113 tank cars
  - No DOT-113’s for Hydrogen currently available
  - Car design subject to Association of American Railroads Tank Car Committee approval

- Hydrogen is authorized in UN-T75’s
  - Requires FRA approval per 49 CFR 174.63
ISO Tanks on a Flat Rail Car
FRA Policies & Guidelines for LNG shipments on rail

- FRA has developed a guidance document related to the details required in an application for approval to transport LNG in Portable Tanks. [“Guidance for preparing an application under 49 CFR § 174.63 for Special Approval by the FRA to transport Liquefied Natural Gas (LNG) in portable Tanks.”]

- RR must convince FRA that the proposed shipments are safe (Safety & risk analysis, train controls, track integrity, speed restrictions, tank protection, etc.).

- FRA requires the RRs to work with and provide information and other assistance to communities & emergency responders along rail corridors.
FRA’s Major Safety Concerns

- Crashworthiness of portable tanks and tank cars for these duties have not been tested under field conditions.
- The performance of these double walled tanks when subject to an engulfing fire is not completely tested or understood.
- The reliabilities and performance of valves, gaskets and other appurtenances used in cryogenic environments and subject to the fatigue and vibration environment of railroad are not known.
- Performance of shut off valves and devices under crash scenarios is not known.
- Risks of shipments (of Flammable & cryogenic liquids) of multiple containers in unit trains vs. manifest trains are not known.
Thank you!!
Questions & Discussion