Getting LNG Onto the Rails

By: Robert Fronczak
AVP Environment and Hazmat

Of: Association of American Railroads

For: Energy by Rail Conference

Date: October 27, 2016

ASSOCIATION OF AMERICAN RAILROADS

Outline

- Current Status
- The Alaska Railroad Project
- The Need
- Other Cryogenic Liquids Transported by Tank Car
- What DOT Should Do?
- FRA testing

Current Status

- Methane refrigerated liquid (Liquefied Natural Gas – LNG) is not allowed in tank cars in the US
- A special permit (SP) is required to transport LNG by rail in the US
- The Alaska Railroad currently has a SP to transport LNG in tank trucks in an intermodal move
- There was never a demand to transport LNG by rail in the past
- LNG has been allowed in tank cars in Canada since July 2014
- Canadian Containers for Transport of Dangerous Goods by Rail standard TP14877 revised section 8.6.24 includes the specifications for the TC-113C120W and TC-113C140W class cars

The Alaska Railroad is the first railroad permitted to transport LNG by Rail

Alaska Railroad Project

- FRA granted approval in October 2015
  - Expires in December 2017
  - Three round trips per week
  - 12 tanks per train – 7,024 gallons per container
- Intermodal shipment from Port Mackenzie to Fairbanks (350 miles)
- First shipment occurred in October 2016

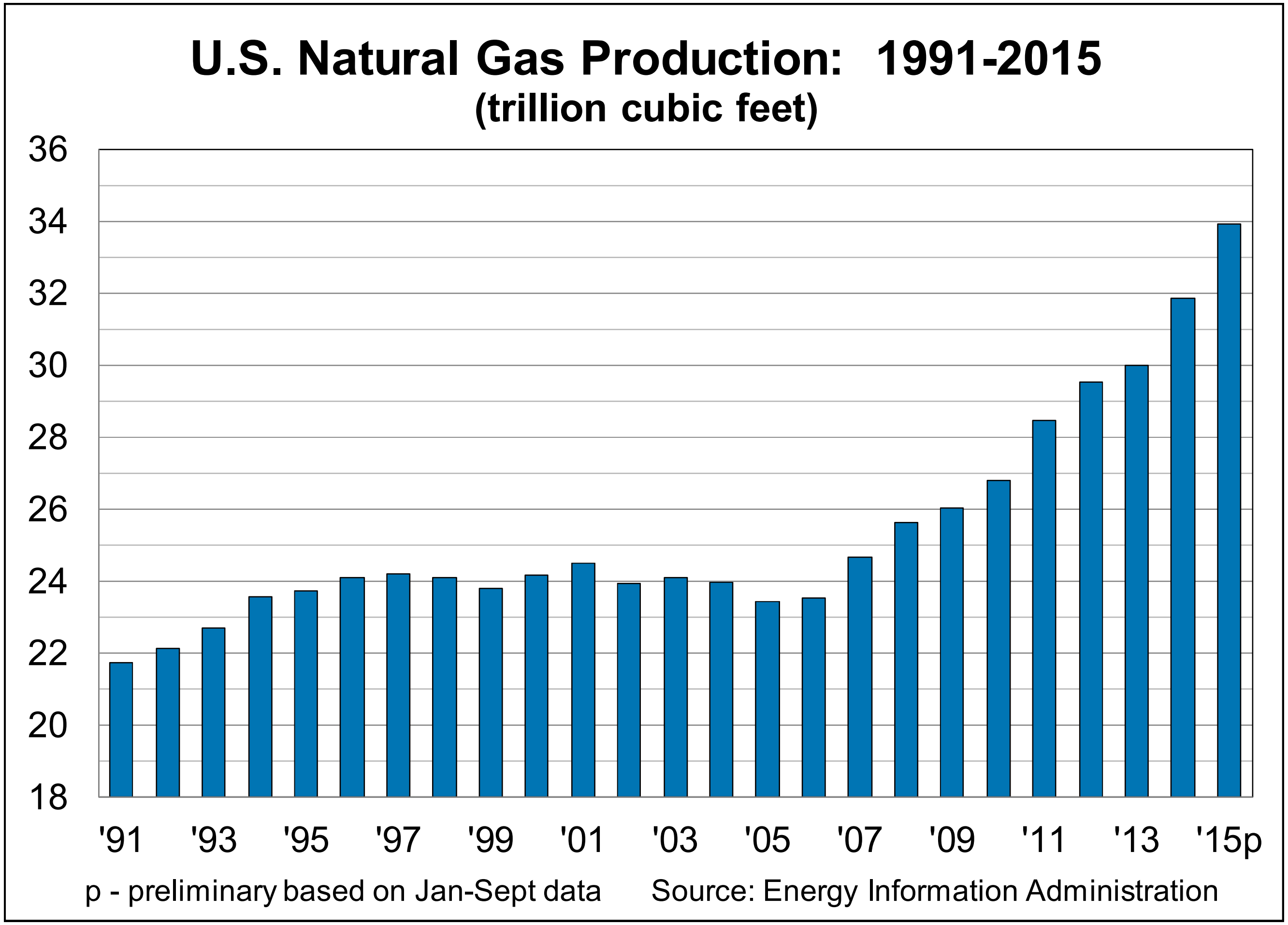
LNG Engineering Parameters

Parameter	LNG Tank Car Value	40-Foot LNG ISO Container
Inner tank material	ASTM A240 304L	ASME SA 240-304
Inner tank thickness	0.6 inch	0.264 inch
Outer tank material	AAR TC128B	ASTM A 572-60
Outer head thickness	0.5 inch	0.315 inch
Outer shell thickness	0.4375 inch	0.236 inch
Shell standoff	6 inches	4 inches
Head standoff	6 inches	6 inches
Inner tank diameter	104 inches	88 inches
Inner tank length	~900 inches	456 inches
Inner tank pressure	75 psi	70 -100 psi
Capacity	30,000 gallons	10,000 gallons
Outage	13%	13%

The Need

- There is a huge increase in the production of methane in the US as a result of fracking
- The price of natural gas is low
- Shippers are starting to pursue transportation of LNG by rail
- Car builders are receiving requests for quotes to build new cars to transport LNG
- There is a shortage of pipeline capacity in certain areas of the country
- As a result, the need to transport

Production in 2016 will be approximately 33.9 trillion cubic feet, or 44 percent higher than the 1990 to 2006 average



LNG as a Possible Fuel Source

- Railroads are exploring the use of LNG as a locomotive fuel
- Until infrastructure can be built, there will be a need to get LNG to railroad fueling points
- Tank car transportation is a good alternative to the movement of that LNG
  - Safe 99.997% of all hazardous materials reach destination without an accident-caused release

12,770 Other Cryogenic Liquids were Transported by Tank Car in 2015

Proper Shipping Name	U.S. DOT Hazard Class	UN/NA Number	2015 US Tank Car Originations
CARBON DIOXIDE, REFRIGERATED LIQUID	2.2	UN2187	10,708
ARGON, REFRIGERATED LIQUID	2.2	UN1951	1,588
ETHYLENE, REFRIGERATED LIQUID	2.1	UN1038	356
HYDROGEN CHLORIDE, REFRIGERATED LIQUID	2.3	UN2186	118
Total			12,770

Transportation of Ethylene Refrigerated Liquid

- Ethylene, refrigerated liquid has been shipped in rail tank cars for 50 years
- The properties of methane, refrigerated liquid are very similar to ethylene, refrigerated liquid (UN 1038, hazard class 2.1)
- The differences are minor:
  - Methane has a normal boiling point of –260F where ethylene's is –160F
  - Methane weighs ~3.6 lbs/gal where ethylene weighs 4.7 lbs/gal.
  - Both products are lighter than air at ambient temperatures and thus any spilled or vented liquid or gas disperses in the air as soon as it warms up to ambient temperature

Other Cryogenic Materials Historically Transported by Rail

- Hydrogen refrigerated liquid and oxygen, refrigerated liquid
- Both commodities are currently authorized for transportation by tank car
- Hydrogen refrigerated liquid has a boiling point of -423°F and is classified as a flammable gas
- Oxygen refrigerated liquid has a boiling point of -297°F
- When DOT-113 tank cars were developed for the transportation of cryogenic liquids, there was no contemplated demand for the transportation of LNG, and as a result it was not included in the list of authorized commodities

What DOT Should Do?

- Authorize transportation of methane, refrigerated liquid in DOT-113C120W and DOT-113C140W tank cars
- These tank cars meet essentially the same requirements as tank cars used for ethylene, refrigerated liquid, and are essentially identical to the requirements for those cars
- Cars should be allowed for 286,000 pounds gross rail load (GRL) for the complete car

49 CFR §173.319(d)(2) Should Be Modified as Follows

2) Air, argon, helium, nitrogen**, methane** and oxygen, ethylene, and hydrogen (minimum 95 percent parahydrogen), cryogenic liquids must be loaded and shipped in accordance with the following table:

Pressure Control Valve Setting or Relief Valve Setting

Maximum Set-to-discharge Pressure (psig)	Maximum permitted filling density (percent by weight)				
	Ethylene	Ethylene	Ethylene	Hydrogen	Methane
17				6.60	
45	52.8				**38.4**
70					**37.5**
75		51.1	51.1		
Maximum pressure when offered for transportation	10 psig	10 psig	20 psig		
Design service temperature	Minus 260 °F	Minus 260 °F	Minus 155 °F	Minus 423 °F	**Minus 260 °F**
Specification (see 180.507(b)(3)of this subchapter	113D60W 113C60W	113C120W	113S120W	113A175W 113A60W	**113C120W** **113C140W**

FRA is Planning Testing

- Step 1: Equipment Description
  - Gathered information in in sufficient detail for evaluations
- Step 2: Accident scenarios
  - Four scenarios: head, shell top and bottom impacts
- Step 3: Analyze crashworthiness performance
  - Assess using extrapolation
  - Simplified engineering analysis
  - Detailed engineering analysis will be considered

Source: Presentation by Francisco Gonzales III at the October 19, 2016 Tank Car Committee Meeting

Questions

Robert E. Fronczak
Assistant Vice President Environment & Hazmat
Association of American Railroads
425 Third Street, S.W., Suite 1000
Washington, DC 20024
Phone: 202-639-2839
Email: RFronczak@aar.org