Project Plan

Introduction

With the increase in natural gas production and demand throughout the country, shippers continue their search for viable transportation alternatives to get natural gas from source to market. Rail transportation offers the potential to move large quantities of Liquefied Natural Gas (LNG), but the public remains concerned about the safety risks.

To address these concerns, the Pipeline and Hazardous Materials Safety (PHMSA), in collaboration with the Federal Railroad Administration (FRA), is developing and carrying out a comprehensive, multi-action project plan to synthesize the existing data and information regarding LNG-by-Rail, identify gaps, and fill those gaps to ensure that the risks of LNG-by-Rail are understood and mitigated.

Objective & Scope (for the Project)

The objective is to develop and carry out a plan in accordance with eighteen (18) separate tasks identified by PHMSA and FRA leadership within a short period of time – i.e., 45 days – starting January 21, 2020, and ending March 6, 2020. Although diverse, the identified tasks are interrelated and involve, for example, research, outreach, statistical and scenario modeling, risk assessment, cost-benefit analysis, safety evaluation, and physical testing of hazardous materials (hazmat) packaging, including the DOT-113 tank car. The scope of the project is limited to the tasks identified by PHMSA and FRA leadership, as well as the 45-day timeframe.

Given the time constraints, different tasks will achieve different levels of implementation and progress within the 45 days. At the end of the 45 days, some tasks may approach completion, while others might not.

Nevertheless, fulfilling this objective means that **each task** will have its own task plan, including the following elements:

1. An objective statement (e.g., "S.M.A.R.T")
2. Identification and description of all the intermediate and final deliverables (see Roadmap Table)
3. **A specific milestone for progress at the 45-day mark**
4. The required team members and their roles and responsibilities
5. The level of effort (LOE) for the overall task, as well as sub-tasks and lower-level activities ("work packages")
6. Estimated date of completion, based on the LOE
7. At the team's discretion, other elements to manage the task, e.g., Work-Breakdown Structure (WBS), Communication Plan, Task Network ("Activity-on-Node"), Risk Management Plan, Status Reports

Similarly, fulfilling this objective means implementing each task according to its task plan, to the extent feasible given the time constraints, prioritization, and realities of the work involved.

The objective for the overall project can be evaluated using the memory device, "S.M.A.R.T," which stands for **Specific, Measurable, Assignable, Realistic, and Time Related**.

Table XYZ: Evaluating the Objective using S.M.A.R.T.

Objective: *The "Tiger Team" will develop a plan for, and according to that plan carry out, eighteen (18) tasks identified by PHMSA and FRA leadership within 45 calendar days, starting January 21, 2020, and ending March 6, 2020.*	
Specific	The objective is specific because it is limited in time and scope. However, the aspect of the task plan is more specific than task implementation, which will vary task-to-task and team-to-team, making it difficult to be more specific.
Measurable	*Task Plan:* • Number of elements present in the task plan (X / 7) • Number of elements complete in the task plan (X / 7) • Indicator for whether a task has a complete task plan (e.g., Y/N, 1/0) • Percentage of tasks with complete task plan (0-100%) *Task Implementation:* • Percentage of deliverables completed for each task (0-100%) • Indicator for whether a task is complete (e.g., Y/N, 1/0) • Percentage of deliverables completed by the estimated date of completion (0-100%)
Assignable	Each task will have 1 Champion (Executive or Division Director). Each task will have 1 task lead from the Tiger Team. There may be 2 co-leads, as appropriate. The number of team members supporting each task will vary.
Realistic	Given ~15 Tiger Team members working full-time, it seems realistic to complete the creation of 18 task plans in 33 work-days. Since the task plan, and its breakdown of the work and level of effort required, will dictate the expected level of progress at the 45-day mark, it seems realistic to judge the progress of each task according to its plan.
Time Related	33 work-days (45 calendar days), spanning 1/21/20 to 3/6/20

Broader Goal (for the Project & Beyond)

Our objective above contributes to a broader goal: **to ensure the safety of LNG-by-Rail transportation, by understanding the different aspects of LNG-by-Rail risk, reducing that risk, and preparing emergency responders and industry for the materialization of that risk should an incident occur.** This broader goal extends past the duration of this project, but the project and goal are inextricably linked. Future work will build on the foundation laid by this project (just as this project builds on PHMSA and FRA's previous work leading up to this point).

As such, this goal can be expressed for both the 45-day period that demarcates this project, and beyond:

- ***At the 45-day mark***, with a plan in hand for all the identified tasks, and some tasks underway or complete, PHMSA and FRA leadership will be as prepared as possible to address public concerns about the safety risks of LNG-by-Rail. **A likely arena for addressing public concerns is a Congressional hearing.**
- ***Beyond 45 days***, the implementation of the tasks will continue according to plan and further reinforce the U.S. Department of Transportation's (DOT) understanding of LNG-by-Rail risk and ability to mitigate that risk.

Strategy

Looking closely at the broader goal, it implies three approaches that, taken together, create a cohesive strategy for dealing with the risk of LNG-by-Rail. We simplify this strategy and refer to it here as (1) "know the risk," (2) "cut the risk," and (3) "prepare for risk."

Efforts to "know the risk" expand DOT's knowledge of the types of risk posed by LNG-by-Rail, and their extent. Efforts to "cut the risk" relate the possible strategies and technologies that reduce the risk of transporting LNG by rail, especially through track inspection, tank car design, and operational factors. Efforts to "prepare for risk" are focused on the emergency response community, and ensure that, should an incident occur and the risks of LNG materialize, emergency responders have the awareness, training, and resources to keep themselves and the public safe.

Naturally, these efforts are interdependent and synergistic, but the following table presents one way to categorize them with respect to "knowing," "cutting," and "preparing" for the risk of LNG-by-Rail. Each of the bullet-points in the table represent a project task.

Table XYZ: Strategy for Addressing LNG-by-Rail Risk

Know the Risk	Cut the Risk	Prepare for Risk
• Evaluate CPR & Sharma Model • Conduct Full-Scale Impact Test on DOT-113	• Conduct automatic track inspection • Evaluate train operational controls	• Validate emergency responder needs • Develop LNG educational and outreach material

• Perform dynamic train simulation • Conduct qualitative risk assessment • Conduct safety/security route risk assessment • Conduct LNG-laden UN portable tank fire-testing • Conduct modal conversion (truck vs. rail) risk assessment • Conduct loading/unloading safety assessment • Perform empirical review of international LNG-by-Rail transport	• Re-evaluate ECP brake requirements for LNG trains	• Develop worst-case scenario model

Project Tasks

Table XYZ: Summary of Project Tasks

#	Task Summary	Know-Cut-Prepare (Risk)	Four Questions: *(1) 113, (2) Unit Trains, (3) Community Consequences, (4) Emergency Response*
1	Validate emergency responder opinion and needs Through the coordination of town hall meetings and direct engagement of the emergency response community, DOT will collaborate with emergency responders to share information and gauge the level of awareness, training, and planning to protect the public should an incident occur.	Prepare for Risk	4, 3, 2
2	Develop LNG educational and outreach materials DOT will develop requisite materials, such as LNG fact sheets, flow maps, infographics, or display materials, that can be used in various events to educate and present data and information in a visual manner. This activity includes ensuring ERG-related materials are available as well.	Prepare for Risk	4, 3

3	**Evaluate conditional probability of release (CPR) models** DOT will evaluate the conditional probability of an LNG release in derailment scenarios, as developed by the AAR-RSI Railroad Tank Car Safety Research and Test Project. This information will then be used to run various accident simulations, building upon previous modeling conducted for the High-Hazard Flammable Train (HHFT) rule. This ensures that DOT understands at a quantitative level the probability of release, a key component to understanding the overall risk of transporting LNG by rail, and how that probability varies based on factors of design and operational controls.	Know the Risk	1, 2
4	**Conduct full-scale impact test on DOT-113 tank cars** DOT will conduct full-scale impact testing on different DOT-113 tank cars or representative configurations, to collect data when they are physically struck by a "ram car" (impactor). The data from impact testing will validate and provide fidelity to finite element analysis models that support the train accident models in item #3.	Know the Risk	1
5	**Train dynamic simulation** FRA will develop the route data and operate its train simulator over the planned route for the special permit movement of LNG tank cars. The simulation will consider unit-train quantities to determine if any specific areas or operational concerns require further consideration.	Know the Risk	2, 1
6	**Automatic track inspection of designated LNG route** The FRA Automated Track Inspection Program (ATIP) deploys inspection vehicles that collect track geometry data and determine compliance with the Federal Track Safety Standards (FTSS), which can be used to assess the effectiveness of railroads' track maintenance, inspection, and repair while focusing on the LNG route designated in the ETS special permit (DOT-SP 20534). This effort enables DOT and the regulated community to ensure track quality and minimization of derailment risk while transporting LNG by rail.	Cut the Risk	4, 3, 2
7	**Qualitative risk assessment (QRA) of designated LNG route** With the assistance of an expert Federal contractor, DOT will conduct a QRA of the movement of unit trains focused on the LNG route designated in the ETS special permit (DOT-SP 20534) between Wyalusing, PA, and Gibbstown, NJ. The QRA will supplement efforts to measure risk quantitatively, and inform operational controls to apply on the designated and anticipated LNG	Know the Risk	4, 3, 2

	routes that mitigate the risk of incident occurrence and severity.		
8	Develop worst-case scenario model Integrating inputs from emergency responders, impact testing, probability of release modeling and other findings, DOT will develop worst-case scenarios for an LNG-by-Rail incident, relating potential consequences to human life, the environment, and property. This effort enables DOT and the emergency response community to determine appropriate actions, analyze preparedness along proposed routes, and develop appropriate mitigation strategies.	Prepare for Risk	4, 3, 2, 1
9	Conduct safety and security route risk assessment Using existing requirements in the HMR, DOT will employ the Rail Corridor Risk Management System (RCRMS) software to qualify and quantify the risk of the most likely ETS special permit route and viable alternatives. This enables DOT to identify the most critical, route risk factors and the stakeholders, including emergency responders and the public, who are most likely to be affected should a LNG-by-Rail incident occur.	Know the Risk	4, 3, 2
10	Evaluate train operational controls DOT will evaluate existing HMR requirements and industry standards (such as AAR OT-55) to determine current compliance and identify any operational controls that should be considered.	Cut the Risk	2, 3
11	Re-evaluate ECP brake requirements for LNG unit trains Since LNG-by-Rail will effectively require a new DOT-113 tank car fleet, DOT will re-evaluate the ECP braking analysis for HHFTs to determine whether ECP braking systems are cost-justified and feasible relative to LNG-by-Rail.	Cut the Risk	2
12	LNG-laden UN portable tank fire-testing DOT has initiated fire-testing of LNG-laden UN T75 portable tanks to evaluate the survivability of these tanks in a pool fire, which enables the collection of data that informs modeling of worst-case and other accident scenarios applicable to potential LNG-by-Rail incidents.	Know the Risk	1, 2, 3, 4
13	Modal conversion (truck vs. rail) risk assessment A modal conversion risk assessment enables DOT to qualify and quantify the different types and extent of risks between the two modes.	Know the Risk	2, 3, 4
14	Conduct loading and un-loading safety evaluation DOT will analyze the loading, un-loading, and trans-loading of LNG to determine if any additional	Know the Risk	3, 4, 2

	considerations exist and any identified concerns for tank car fittings. This safety evaluation will identify and describe the specific risks involved and enable tailoring of training and dissemination of best practices to ensure workplace safety and minimize the risks incidental to transportation of LNG.		
15	Perform empirical review of international LNG rail transportation LNG has been transported by rail with a safe track record in Japan for nearly two decades and in Europe. DOT will review the existing literature and information available and prepare a white paper and report on the international experience with LNG-by-Rail to gain lessons learned and best practices and understand the state-of-the-art and science of transporting LNG by rail.	Know the Risk	2, 1, 3, 4
16	Stand-up TRB Collaboration for LNG Research		

Team

Table XYZ: Team Members and Contact

Team Member	OA	E-mail	Work Phone	Tiger Team (Y / N)
Ballengee, Lily	PHMSA	<lily.ballengee@dot.gov>		Y
Braxton, Yolanda	PHMSA	<yolanda.braxton@dot.gov>		Y
Gale, Tony	PHMSA	<tony.gale@dot.gov>		Y
González, III, Francisco	FRA	<francisco.gonzalez@dot.gov>		Y
Klem, Michael	PHMSA	<michael.klem@dot.gov>		Y
Ledbetter, Titus	PHMSA	<titus.ledbetter.ctr@dot.gov>		Y
Lesko, Jonathan	PHMSA	<jonathan.lesko@dot.gov>		Y
Lucas, Adam	PHMSA	<Adam.Lucas@dot.gov>		Y
Maday, Mark	FRA	<mark.maday@dot.gov>		Y
Majors, Leonard	PHMSA	<leonard.majors@dot.gov>		Y
Mirza, Shaukat	PHMSA	<shaukat.mirza@dot.gov>		Y
Nixon, Shamia	PHMSA	<shamia.nixon.ctr@dot.gov>		Y
Quade, William	PHMSA	<william.quade@dot.gov>		N
Raj, Phani	FRA	<phani.raj@dot.gov>		Y
Rivera, Jordan	PHMSA	<jordan.rivera@dot.gov>		Y

Rohlck, Gabriela	PHMSA	<gabriela.rohlck@dot.gov>		Y
Schoonover, William	PHMSA	<william.schoonover@dot.gov>		N
Sheppard, Carla	PHMSA	<carla.sheppard@dot.gov>		Y
Starin, Robert	PHMSA	<robert.starin@dot.gov>		Y

Table XYZ: Project Teams

#	Tasks	Champion	Project Lead	Supporting Team
1	Validate emergency responder opinion and needs	Aaron Mitchell (PHMSA)	Carla Shephard (PHMSA)	
2	Develop LNG educational and outreach materials	Aaron Mitchell (PHMSA)	Jordan Rivera (PHMSA)	
3	Evaluate conditional probability of release (CPR) and Sharma models		Leonard Majors (PHMSA); Michael Klem (PHMSA)	
4	Conduct full-scale impact test on DOT-113 tank cars		Leonard Majors (PHMSA); Michael Klem (PHMSA)	Francisco Gonzalez (FRA)
5	Perform train dynamic simulation	Mark Maday (FRA)	Jonathan Lesko (PHMSA)	Chris Holt (FRA)
6	Conduct automatic track inspection of designated LNG route	Mark Maday (FRA)	Lily Ballengee (PHMSA)	Mark Patterson (FRA)
7	Conduct qualitative risk assessment (QRA) of designated LNG route		Gabriela Rohlck (PHMSA)	Phani Raj (FRA)
8	Develop worst-case scenario model		Gabriela Rohlck (PHMSA)	Phani Raj (FRA); Jonathan Lesko (PHMSA)
9	Conduct safety and security route risk assessment	Mark Maday (FRA)	Jonathan Lesko (PHMSA)	Lisa Mattsinger (FRA); Nicole Anderson (PHMSA)
10	Evaluate train operational controls		Tony Gale (PHMSA)	Adam Lucas (PHMSA)
11	Re-evaluate ECP brake requirements for LNG unit trains		Bob Starin (PHMSA)	Marc Fuller (FRA)
12	Conduct LNG-laden UN portable tank fire-testing		Leonard Majors (PHMSA); Michael Klem (PHMSA)	Francisco Gonzalez (FRA)
13	Conduct modal conversion (truck vs. rail) risk assessment		Bob Starin (PHMSA)	

14	Conduct loading and un-loading safety evaluation		Shaukat Mirza (PHMSA)	
15	Perform empirical review of international LNG rail transportation		Jonathan Lesko (PHMSA)	Lindsey Constantino (PHMSA); Titus Ledbetter (PHMSA)
16	Stand-up TRB Collaboration for LNG Research	Bob Starin (PHMSA)	Michael Klem (PHMSA)	Shaukat Mirza (PHMSA)

PHMSA will develop and execute a project plan that clearly establishes and describes the activities to be performed under this initiative, with responsible parties assigned to each activity. This project plan is outlined below, organized by project and activity with links to eight (8) focus areas:

1. **Agency Approach & Messaging**
2. **Performance Management**
3. **Regulatory Solutions**
4. **Special Permits & Approvals**
5. **Compliance**
6. **Partnerships & Alliances**
7. **Data / Risk / R&D**
8. **Professional Development**

Table XYZ: Project Plan for the LNG-by-Rail Strategic Initiative

◆ = Key Deliverable

Activity	Responsible Party	Due Date (or) Schedule	Focus Area
(0) Develop Plan for Strategic Initiative for LNG by Rail			
Complete Draft of Strategic Initiative Plan	Yolanda Braxton, Bob Starin, Jonathan Lesko	1/15/2020	1, 2
Review Draft of Strategic Initiative Plan	Bill Schoonover, Skip Elliott	1/15/2020	1, 2
Review / Comment on Strategic Initiative Plan	FRA / PHMSA	1/22/2020	1, 2
Present and Brief Strategic Initiative to PHMSA Leadership	Yolanda Braxton, Bob Starin, Jonathan Lesko, Lily Ballengee	Weekly	1, 2, 8
◆ Final Strategic Plan	Yolanda Braxton, Bob Starin, Jonathan Lesko	1/24/2020	1, 2, 8
(1) Validate Emergency Responder Opinions and Needs			
Lancaster Town Hall with U.S. Fire Administration	PHMSA / FEMA	10/14/2019	4, 6
Final Report from Lancaster Town Hall		11/22/2019	4, 6

Activity	Responsible Party	Due Date (or) Schedule	Focus Area
Decision and Plan for Location of Next Town Hall	Aaron Mitchell, Mark Maday	12/1/2019	6
New York / New Jersey (NY /NJ) Town Hall		April 2020	4, 6
◆ Final Report from NY / NJ Town Hall		TBD	4, 6
Conduct Outreach to Philadelphia Fire Department		April 2020	4, 6
Conduct LNG Session at IAFC Annual Meeting		June 2020	6, 8
Plan for other locations in the United States	Aaron Mitchell, Mark Maday	TBD	6
Lessons learned from FCA UN Tank Approval	Aaron Mitchell, Mark Maday	TBD	6
Conduct LNG Session at IAFC Annual Meeting	Aaron Mitchell, Mark Maday	June 2020	6,8
(2) Develop LNG Educational and Outreach Materials			
Engage Center for Liquefied Natural Gas (CLNG) and TRANSCAER	PHMSA / FRA / CLNG / TRANSCAER	TBD	6
◆ Develop LNG Fact Sheet	Aaron Mitchell, Mark Maday	TBD	6
◆ Develop LNG Flow GIS and Infographics		TBD	6
◆ Develop LNG Emergency Response Guide		TBD	6
◆ Develop Shippers' LNG Guide		TBD	6
◆ Develop Package Difference	Aaron Mitchell, Mark Maday	TBD	6
◆ Development of Cutaways	Aaron Mitchell, Mark Maday	TBD	6
Distribute Educational and Outreach Materials	Aaron Mitchell	TBD	6
(3) Re-examine Conditional Probability of Release (CPR) and Sharma Model			
Evaluate Data Quality for CPR	PHMSA / FRA / AAR-RSI	TBD	7
Update the TWP-17 Data Set	Francisco González, III		
Identify Design Factors Affecting CPR and Release	PHMSA / FRA	TBD	7
Update the Sharma Model	PHMSA / FRA / Sharma & Associates		7
◆ Final Report for derailment simulation model Findings	PHMSA / FRA / Sharma & Associates	TBD	7
Determine Design Factors for Rulemaking or Other Implementation	PHMSA / FRA	TBD	3

Activity	Responsible Party	Due Date (or) Schedule	Focus Area
Determine Operational Controls Factors for Rulemaking or Other Implementation		TBD	3
(4) Conduct Full-Scale Impact Test on DOT-113 Tank Car			
Conduct Full-Scale Impact Testing of the Legacy DOT-113 Tank Car	Francisco González, III, Lad Falat	11/19/2019	7
Analyze Video and Test Data		2/28/2020	7
◆ Final Report for 1st Impact Testing		TBD	7
Bid on New Tank Car		TBD	7
Alternate Test Design/Surrogate if we cannot get DOT 113 Tank Car		TBD	7
Conduct 2nd Full-Scale Impact Testing of New DOT-113		May 2020	7
◆ Final Report for 2nd Impact Testing		TBD	7
Conduct 3rd Full-Scale Impact Testing of Enhanced DOT-113		Spring 2021	7
◆ Final Report for 3rd Impact Testing		TBD	7
(5) Perform Train Dynamic Modeling			
Determine Parameters for FRA Train Energy and Dynamics Simulator (TEDS)	Francisco González, III, Chris Holt	01/15/2020	7
Perform TEDS Modeling on LNG in DOT-113		Feb 2020	7
◆ Final Report for TEDS Modeling		March 2020	7
(6) Conduct Automatic Track Inspection of Designated LNG Route			
Identify Designated LNG Route	Mark Patterson, Mark Maday	1/9/2020	5, 7
Review previous ATIP reports for route segments		Feb 2020	5, 7
Conduct ATIP over designated route		May 2020	5,7
◆ Final Report for ATIP		June 2020	5, 7
(7) Qualitative Risk Assessment (QRA) of Designated LNG Route			
◆ SOW for QRA	Phani Raj, Bob Starin	TBD	6, 7
Issue Contract for QRA		TBD	6, 7
◆ Final QRA		TBD	6, 7
(8) Develop Worst-Case Scenarios (WCS)			
Develop Initial WCS (Surrogate Case)	Lad Falat, Mark Maday	12/1/2019	7
Integrate derailment simulation model and Impact Testing Findings into WCS (Task 4 & 5)	Lad Falat, Mark Maday, Phani Raj, Francisco González, III	TBD	7

Activity	Responsible Party	Due Date (or) Schedule	Focus Area
Accident (Sq Ft Area Info)	Leonard Majors	TBD	7
Run Part 193 model (Heat flux)		TBD	7
Incorporate Emergency Response Input into WCS	Aaron Mitchell, Mark Maday	TBD	6, 7
◆ Final Report for Refined WCS	Lad Falat, Mark Maday	TBD	7
(9) Assess Safety / Security Route Risk			
Route Identification	Lisa Matsinger	12/19/2019	7
Preliminary Route Risk Assessment (RCRMS) (27 Factors)	Lisa Matsinger, Mark Maday	1/9/2020	7
Route Assessment: Crossing Inventory		TBD	
Route Assessment: Safety Culture Survey	Tom Murta	TBS	
Perform On-Site Route and Carrier Assessment	FRA	Feb/Mar 2020	4, 5, 7
◆ Final Report for Route Risk Assessment	FRA / Norfolk Southern	April 2020	4, 5, 6, 7
(10) Evaluate Operational Controls			
Review Operational Controls in DOT-SP 20534, OT-55, and HHFT Final Rule	Shane Kelley	2/5/2020	3, 4
Evaluate Reporting Requirements for Information Sharing with SERCs / TERCs for LNG Trains	Shane Kelley	2/5/2020	3, 4, 5
Determine OT-55 Compliance	Mark Maday	TBD	
◆ Options Paper for Operational Controls for Rulemaking	Shane Kelley	2/17/2020	3, 7
Determine Operational Controls for Rulemaking	Shane Kelley, Bill Schoonover, Mark Maday, Chris Holt	2/24/2020	3
Analyze Shipping Plan Reporting from DOT-SP 20534	FRA / PHMSA / ETS	April 2020	4, 5, 6
Remote Monitoring of Tank Cars	Leonard Majors		
◆ Response to Shipping Plan from DOT-SP 20534	FRA / PHMSA / ETS	May 2020	4, 5, 6
(11) Re-Evaluation of ECP Brake Requirements with LNG			

Activity	Responsible Party	Due Date (or) Schedule	Focus Area
Review Previous Cost-Benefit Analysis of ECP Braking (HHFTs)	Bob Starin, Mark Johnson, Gary Fairbanks, Marc Fuller, Mark Anderson	1/22/2020	3, 7
Revise Cost-Benefit Analysis of ECP Braking for LNG Trains		1/29/2020	3, 7
◆ Final Analysis for ECP Braking		2/5/2020	3, 7
(12) LNG-Laden UN Portable Tank Fire-Testing			
Conduct Phases I and II Fire-Testing of a UN T75 LNG tank	Mark Maday, Francisco González, III, Phani Raj	March 2020	7
Model Performance of UN T75 LNG tank		TBD	7
◆ Final Report for Fire-Testing		September 2020	7

13. Modal Conversion (Truck v. Rail)		
◆ SOW for Analysis	TBD	TBD
14. Conduct Loading and Un-Loading Safety Evaluation		
◆ SOW for Analysis	TBD	TBD
Discussion with EPA on Joint Research	TBD	TBD
Analysis of DOT 5800.1 incidents on connecting/unconnecting	TBD	TBD
15. Perform Empirical Review of International LNG Rail Transportation		
◆ White Paper on LNG by Rail for Japan	TBD	TBD
◆ White Paper on LNG by Rail for Europe	TBD	TBD
16. TRB Research Projects LNG		
Study on train length as a risk factor	TBD	TBD
Modal study of LNG Transport	TBD	TBD
Study on highway congestion	TBD	TBD

Project Narration

(1) Validate Emergency Responder Opinions and Needs

PHMSA wants to have a high level of confidence that emergency responders have the requisite training and planning to protect the public if an incident were to occur. Thus, PHMSA provided funding to FEMA's U.S. Fire Administration to hold a town hall in Lancaster County, PA, on October 14, 2019. The town hall included representatives of the emergency response and preparedness community in the mid-Atlantic region and specifically Pennsylvania and New Jersey. There was no heightened concern

expressed regarding the potential rail transport of LNG because the preparedness community was already well oriented to the challenges of LNG incident response in other transportation modes and fixed facility environments.

PHMSA plans to fund another town hall in the NY/NJ area and directly engage the Philadelphia Fire Department (as well as Philadelphia County emergency planning) because of the route proposed in the special permit application.

(2) Develop LNG Educational and Outreach Materials

PHMSA wants to have a high level of confidence that emergency responders have the requisite training and planning to protect the public if an incident were to occur. Educational and outreach materials will be produced to reach emergency responders and other public officials to and make them aware of the hazards posed by LNG.

(3) Evaluate CPR and Derailment Simulation Models

The RSI-AAR Railroad Tank Car Safety Research and Test Project has conducted research and published data that estimates for the probability of lading loss for most configurations of tank cars in the fleet, and for their individual features such as tank heads, tank shells, and top and bottom fittings, given that the tank car in question is derailed in an FRA-reportable accident. These estimates are commonly referred to as conditional probabilities of release (CPR).

This data provides a crucial source of quantitative performance data for potential changes to tank car design standards. Recent research in this area included more recently accident data that may have different inherent damage resistance properties than earlier cars did, and changed accident environments because of the increased gross weight on rail. CPR offers the best data to identify how design changes can prevent future releases of hazardous materials.

(4) Conduct Full-Scale Impact Test on DOT-113 Tank Car

Following previous FRA research to evaluate the performance and crashworthiness of tank cars, this research will include developing finite element analysis models followed by full-scale puncture testing of DOT specification 113 tank cars. The actual tests will be used to validate and focus puncture models. The result is car behavior data and a validated model to perform real-time analysis of proposed design enhancements and unit train dynamics.

On November 19, 2019, a full-scale puncture test of a DOT-113 specification tank car was performed at DOT's Transportation Technology Center (TCC) in Pueblo, CO. The results of this test and future tests of DOT 113's will be used to validate the structural integrity of the DOT-113 design and develop/validate computer models and simulations used to evaluate crashworthiness.

(5) Perform Train Dynamic Modeling

FRA developed Train Energy and Dynamics Simulator (TEDS) based upon a longitudinal train dynamics and operations simulation model. This high-fidelity model allows users to conduct safety and risk evaluations by realistically predicting longitudinal train behavior under a variety of operating conditions, including acceleration, braking, steady state running, hilly terrain operation, and certain emergency conditions.

FRA will perform TEDS modeling on the transportation of LNG in DOT Specification 113 tank cars under various conditions.

(6) Conduct Automatic Track Inspection of Designated LNG Route

FRA Automated Track Inspection Program (ATIP) helps America's railroads improve railroad quality and safety under statutes mandated by Congress. ATIP cars conduct operational surveys of the U.S. rail transportation network determining railroad compliance with Federal Track Safety Standards (FTSS). The Operations and Planning Division schedules ATIP inspections, manages and distribute track geometry condition data, and provides contractual oversight for the program.

In addition, the ATIP data is used to assess the effectiveness of railroads' track maintenance and inspection processes, provides data to assess track safety trends, and provides data to railroads to assist in making repairs and improving safety and maintenance quality. The ATIP program also supports the development and demonstration of FRA's Research and Development's research products for the advancement of track inspection technologies and improvement of railroad safety.

(7) Qualitative Risk Assessment (QRA) of Designated LNG Route

With contractor support, PHMSA will conduct a qualitative risk assessment (QRA) of the movement of unit trains of LNG along the planned route between Wyalusing, PA, and Gibbstown, NJ.

(8) Develop Worst-Case Scenarios (WCS) Model

Identifying the potential worst-case scenario for surface transport of LNG is an essential task for developing mitigation strategies, emergency response, and operation controls necessary to ensure an adequate level of safety to the regulations is maintained. The identification of a worst-case scenario will allow PHMSA to develop conservative initial operational controls that can be refined as additional data is obtained.

A review of the information obtained directly from the first responder community, conditional probability of release calculations, and full-scale testing and modeling of LNG tenders will be utilized to provide a worst-case scenario (conservative estimate at first followed by more refined data) that can be leveraged to determine effective response considerations and tactics for first responders.

(9) Safety and Security Risk Assessment

The HMR requires railroads that transport certain hazmat commodities to perform a comprehensive safety and security risk analysis to determine and select routes which pose the least overall risk. These analyses must include a minimum of 27 specific risk factors including input provided by state and local governments. While LNG is not included in the regulation, evaluating the rail transport of LNG over the identified route provided by the permit applicant will enable PHMSA to have information that will help validate the quantitative risk analysis conducted separately by the applicant. This analysis will include a similar analysis of alternative viable routes. A safety and security analysis shall be carried out on the planned transportation route as well as viable alternatives.

(10) Evaluate Operational Controls

Effective operational controls are essential for ensuring that an adequate level of safety, notification, and emergency response preparedness is maintained regardless of the hazardous material(s) being transported. While initial conservative controls are appropriately installed, these are subject to periodic review to validate that these controls are providing a positive safety benefit.

As a minimal baseline, incorporation of the Recommended Railroad Operating Practices for Transportation of Hazardous Materials (OT-55) for cryogenic liquids as operational controls are proposed. In addition, reporting requirements like those in HM-251B (Oil Spill Response Plans and Information Sharing for High-Hazard Flammable Trains) to make sure appropriate information is shared with State and tribal emergency response commissions to improve community preparedness will be adopted.

(11) Re-Evaluate of ECP Brake Requirements with LNG

ECP brakes offer many benefits over traditional air brakes. ECP braking systems, allow for a train engineer to apply the brakes simultaneously on all train cars, allowing for quicker stops than traditional air brakes. ECP brakes also provide for enhanced control and lower risks of derailment. PHMSA plans to undertake a cost-benefit analysis on requiring the installation of ECP brakes on newly construct DOT-113 tank cars.

(12) LNG-Laden UN Portable Tank Fire-Testing

Modeling and a full-scale fire testing of a UN T-75 portable tank filled with LNG has been initiated to analyze its performance of in a total fire engulfment scenario, which could occur in train derailment accidents.

The UN T-75 portable tank is built to International Standards Organization (ISO) specifications, and incorporate the same design principles and materials of construction used to build DOT-113 cryogenic tank cars.

A finalized report detailing the fire test results, models developed and fire performance characterization will be developed. These results could also be used in risks assessments associated with transportation of LNG by rail in portable tanks. The models developed could be useful in assessing the performance of DOT-113 tank cars in similar fire engulfment scenarios.

(13) Modal Conversion (Truck v. Rail) Risk Assessment

DOT has initiated fire-testing of LNG-laden UN T75 portable tanks to evaluate the survivability of these tanks in a pool fire, which enables the collection of data that informs modeling of worst-case and other accident scenarios applicable to potential LNG-by-Rail incidents.

(14) Loading and Un-Loading Safety Evaluation

DOT will analyze the loading, un-loading, and trans-loading of LNG to determine if any additional considerations exist and any identified concerns for tank car fittings. This safety evaluation will identify and describe the specific risks involved and enable tailoring of training and dissemination of best practices to ensure workplace safety and minimize risks incidental to transportation of LNG.

(15) Perform Empirical Review of International LNG Rail Transportation

LNG has been transported by rail with a safe track record in Japan for nearly two decades and in Europe. DOT will review the existing literature and information available and prepare a white paper and report on the international experience with LNG-by-Rail to gain lessons learned and best practices and understand the state-of-the-art and science of transporting LNG-by-rail.

(16) Stand-up TRB Collaboration for LNG Research

TBD