Special Permit Evaluation Form

Part I: Application Information

Tracking Number:	2017088295
Special Permit Number:	20534
Date of Application:	August 21, 2017
US DOT Number:	
Project Officer:	Andrew Eckenrode
Summary:	To authorize the transportation in commerce of methane, refrigerated liquid in DOT specification 113C120W tank cars.

Application Type			
☒ New application	☐ Modification application	☐ Renewal application	☐ PT application
☐ GC application	☐ Reconsideration application		

Modes of Transportation Requested:

☐ Motor Vehicle ☒ Rail Freight ☐ Passenger Vessel ☐ Cargo Vessel

☐ Cargo Aircraft ☐ Passenger Aircraft

Company Information				
Company Name	Address	City	State	Postal Code
Energy Transport Solutions Llc	8350 Nw 52nd Ter Ste 300	Doral	FL	331667708

Regulation(s) from which variance is requested:

Regulation Variance	
Section Number	Description
172.101(i)(3)	(3) Bulk packaging. Column (8C) specifies the section in part 173 of this subchapter that prescribes packaging requirements for bulk packagings, subje ...

Materials Requested:

Hazardous Materials Description						
Proper Shipping Name	Class/Div.	UN ID	PG	Pass. air	Cargo air	Air req. (Y/N)
Methane, refrigerated liquid (cryogenic liquid) or Natural gas, refrigerated liquid (cryogenic liquid), with high methane content)	2.1	UN1972		Forbidden	Forbidden	

Is the applicant requesting emergency processing?	☐ Yes	☒ No
Does the special permit meet the requirements for	☐ Yes	☒ No

emergency processing?	
Summarize:	
Does the request involve new issues not addressed through the HMR or previous special permits?	☒ Yes ☐ No
Summarize:	The permit is requesting authorization for transportation of liquefied natural gas (methane, refrigerated liquid) by rail tank car. This material is currently not authorized for transportation by rail tank car although materials with similar properties are authorized for transportation.
Has CONFIDENTIAL or PROPRIETARY information (49 CFR 107.5) been considered in this application?	☒ Yes ☐ No

Part II: Fitness Review

Fit in accordance with § 107.113? ☒ Yes ☐ Safety Profile Review Required

Explain: The available data indicates that the applicant is fit to operate under the terms of this special permit. There are no SMS data; however, these are irrelevant as the applicant is acting as a shipper only.

Name: Donald.Burger Date: November 26, 2019

Part III: Safety Profile Review

Safety Profile Review Required? ☐ Yes ☒ No

Safety Profile Review				
Office	Recommendation	First Reviewer	Second Reviewer	Action

Part IV: Similar Special Permits:

Similar Special Permits	
SP Number	Description
None	

Part V: Pre-Docketing Review:

Does the application contain sufficient information to support docketing?	☒ Yes ☐ No ☐ N/A
If no, the application should be returned for the following reasons:	

Part V: Docket Comments:

Date checked:	November 21, 2019
Comments received:	☒ Yes ☐ No
Summary:	Comments were received in response to publication of the Draft Environmental Assessment. In addition, letters of support were received from the American Short Line and Regional Railroad Association, the Association of American Railroads and Chart, Inc. One letter requesting denial of the application was received from Kristen Edmark, MPH, RD. Her comments addressed concerns similar to those expressed in the comments to the EA including environmental concerns, trains length and weight, train speed and emergency response plans.
Additional review required to address comments received:	☒ Yes ☐ No

Part VI: General:

Special Permits Location Information				
Facility Name	Address	City	State	Postal Code
Company Location				
Confidential per the application				

Proposed duration of the special permit:	24 Months
Estimated number of shipments expected to be made or packaging's manufactured:	100 per Day
Summary:	
Is the special permit being sought related to a compliance review, inspection activity, or enforcement action?	☐ Yes ☒ No
Previous shipping history:	0 Shipments per:
Previous incident history:	0 Incidents per:

Part VII: Radioactive Material:

☐ Yes ☒ No

Packaging Variance(s) Requested:	
Compensatory Measure(s) Required:	
Package Testing Variance(s) Requested:	
Compensatory Measure(s) Required:	
Activity Limit or Material Classification Variance(s) Requested:	

Compensatory Measure(s) Required:	
Radiation, Contamination and/or Criticality Limit Variance(s) Requested:	
Compensatory Measure(s) Required:	
Transport and Operational Controls Required: ☐ Restricted Access (personnel barrier, parking, etc.) ☐ Travel Restriction (route restriction, time of day, weather, speed, etc.) ☐ In-transit monitoring (radiation monitoring, escort by law enforcement and/or HP, etc.) ☐ Other:	
Details:	

Part VIII: Packaging:

☒ Yes ☐ No

Type of packaging variance requested:

☒ Non-authorized specification package ☐ Quantity or size variation ☐ Non-specification package

List the most comparable specification package, if able: The applicant is requesting to use a DOT-113C120W specification tank car for transportation of LNG.

Variations from authorized packaging: None

☐ Change in material(s) of construction Material: Not Applicable

Compatible with lading: ☐ Yes ☐ No

☐ Increase in authorized pressure Safety Factor: Not Applicable

☐ Other:

New criteria applied: Not Applicable

If intended for air transportation, does the packaging meet the requirements in §173.27? ☐ Yes ☐ No

Part IX: Package Testing (Part 178 and/or 180):

☐ Yes ☒ No

☐ Manufacture ☐ Periodic Requalification

Deviation Requested:

Part X: Classification Testing:

☐ Yes ☒ No

Test Method Applied:

Criteria Used:

Part XI: Hazard Communication:

☐ Yes ☒ No

☐ Labelling ☐ Marking ☐ Shipping Papers ☐ Placarding

Other:

Alternative measures requested:

Part XII: Segregation/Separation

☐ Yes ☒ No

Alternative measures requested:

Part XIII: Modal Specific Variation

☒ Yes ☐ No

☒ FRA ☐ FMCSA ☐ FAA ☐ USCG

Variation Requested: Transportation in commerce of methane, refrigerated liquid in DOT specification 113C120W tank cars.

Measures Applied: See the section below, Operational Controls

Part XIV: Operational Controls

Special handling/limitations need to offset requested variance(s):

☐ Refrigeration ☐ Additional Segregation/Separation ☐ Time of Day

☒ Limited transportation options ☐ One-time/one-way ☐ Police/LE escort

☐ Disposal/Recycling Only ☐ Avoid Populated Areas ☐ Route specified

☐ Private/Contract Carriage ☒ Other: See below

Details: The operational controls described below have been added to provide for an equivalent level of safety in transportation.

•Each tank car must be operated in accordance with § 173.319 except as specified in paragraph 7.a. above.
•Shipments are authorized between Wyalusing, PA and Gibbstown, NJ, with no intermediate stops.
•Within 90 days after issuance, the grantee shall prepare and submit a plan providing per shipment quantities, timelines, and other actions to be taken for moving from single car shipments to multi-car shipments, and subsequently to unit trains (20 or more tank cars).
•Trains transporting 20 or more tank cars authorized under this special permit must be equipped and operated with a two-way end of train device as defined in 49 CFR § 232.5 or distributed power as defined in 49 CFR § 229.5.
•Prior to the initial shipment of a tank car under this special permit, the grantee must provide training to emergency response agencies that could be affected between the authorized origin and destination. The training shall conform to NFPA-472, including known hazards in emergencies involving the release of LNG, and emergency response methods to address an incident involving a train transporting LNG.
•While in transportation, the grantee must remotely monitor each tank car for pressure, location, and leaks.

Reporting requirements required: ☒ Yes ☐ No

Details: Requirements were added to require reporting - specifics are in the SP.

Part XV: Regulatory Revision

Could the special permit be handled by future regulatory change: ☒ Yes ☐ No

Explain: An NPRM for this topic, Hazardous Materials: Liquefied Natural Gas by Rail, Docket Number PHMSA-2018-0025, was published on 10/24/2019 in the Federal Register.

Part XVI: Evaluation/Recommendation

☒ Approve, as requested	☐ Approve, with partial denial
☐ Deny	☐ Rejection

Based on	Equivalent level of safety
Explain risks and/or benefits if the special permit is granted.	See additional evaluation.
Justification:	See additional evaluation.
Partial denial reasoning:	

First Reviewer Name: Donald.Burger

Date: 2019-11-26

Second Level Review

Name:

Date:

Comments (optional):

Explain risks and/or benefits if the special permit is granted.

Methane, refrigerated liquid or liquefied natural gas (LNG) is an important energy resource for the United States and the rest of world. Increasing the level of exports of LNG to the rest of the world could provide a significant economic benefit to the United States and provide a substantial job growth in the energy sector. Granting DOT-SP 20534 to Energy Transport Solutions will enable LNG to be transported in a manner equivalent to other cryogenic flammable liquids and to help meet the demand for increased LNG exports. Other cryogenic flammable liquids with similar chemical properties such as ethylene have been transported in the US for many years with a documented level of transportation safety.

The primary risk associated with transporting LNG in a DOT specification 113C120W rail tank car is derailment, breach of containment, and possibility of fire. This could range from a relatively small fire from a controlled release to an explosion due to a BLEVE (boiling liquid expanding vapor explosion). However, risk of a BLEVE is very low due to loading requirements and the redundant safety features built into each DOT-113 specification rail tank car.

The risks associated with transporting LNG in a DOT specification 113C120W rail tank car and the determination of an equivalent level of safety for transportation have been addressed in the pre-decisional Special Permit Evaluation Forms prepared by the Federal Railroad Administration and by various Divisions within the Pipeline and Hazardous Materials Safety Administration which were used to develop this final evaluation.

There was additional evaluation work performed in conjunction with development of the draft and Environmental Assessments for the special permit.

Justification

After review and evaluation of the application for special permit and all other materials applicable to the request to authorize transportation in commerce of methane, refrigerated liquid in DOT specification 113C120W rail tank cars, it was determined that an equivalent level of safety will be provided if the materials are transported in accordance with the provisions of the proposed special permit. Therefore, it is recommended that the special permit be approved.

Hazardous Material

The applicant has requested authorization to transport the following material in DOT specification 113C120W rail tank cars.

Methane, refrigerated liquid or Natural gas, refrigerated liquid, Division 2.1, UN1972

This material is commonly referred to as LNG and will be described as such for the rest of this evaluation. Under the Hazardous Materials Regulations (HMR) LNG is not authorized for transportation in DOT specification 113C120W rail tank cars. However, ethylene refrigerated liquid, Division 2.1, UN1038 is currently authorized for transportation in DOT specification 113C120W rail tank cars. A comparison of the physical properties of the materials are shown below.

Physical properties comparisons

Liquified Gas Properties	LNG	Ethylene
Molecular Formula	CH4	C2H4
Mass	16.04	28.05
Density (g/L)	422.36	567.65
Boiling Point (°C)	-162	-103.7
Auto Ignition Temp. (K)	810.00	815.90
Lower Explosive Limit (air)	5%	3%
Upper Explosive Limit (air)	15%	36%
Liquid/Gas Equivalent (mol/mol)	588.82	450.23
Heat Capacity J/(mol•K) (constant volume)	0.94	3.35
Heat of Vap. (kJ/mol)	8.20	13.5
Heat Capacity J/(mol•K) (constant pressure)	34.97	40.96
Heat Capacity J/(mol•K) (constant volume)	26.64	32.26

The hazardous properties (flammability and pressure build up) of LNG and ethylene if transported in a DOT specification 113C120W rail tank car are virtually identical when the parameters for filling the tank car are adjusted for the specific physical properties of LNG vs liquid ethylene. The parameters that need to be adjusted for each material include:

- Maximum start to discharge pressure (psig)
- Maximum permitted filling density (percent by weight)
- Maximum pressure when offered for transportation (psig)
- Design service temperature of the tank (°F)

These parameters vary for each specific material authorized for transportation in a cryogenic state in a tank car and are necessary to ensure that movement of these materials is completed safely. For LNG in a DOT specification 113C120W rail tank car, the parameters should be as follows:

- Maximum start to discharge pressure: 75 psig
- Maximum permitted filling density (percent by weight): 32.5*
- Maximum pressure when offered for transportation: 15 psig
- Design service temperature of the tank: Minus 260 °F
  *this factors in a maximum filling capacity of 85% of the tank

With these calculated parameters, the transportation of LNG in a DOT specification 113C120W rail tank car would be equivalent to liquid ethylene in single tank car movements. This analysis does not consider potential increased risks associated with multiple tank cars containing LNG within a single train consist. Currently, there are no restrictions on the number of tank cars within a train consist for any cryogenic flammable gas (ethylene or hydrogen).

Authorized Tank Car

The applicant has requested that a DOT specification 113C120W rail tank car be authorized for transportation of LNG by rail. The HMR currently authorize the DOT specification 113C120W rail tank car for other flammable cryogenic liquids sharing similar chemical and physical characteristics as LNG (i.e., ethylene and hydrogen). (See the comparison with ethylene above.) Therefore, the applicant proposed that the DOT specification 113C120W rail tank car design is suitable for transporting LNG by rail.

Due to its design requirements, the DOT specification 113C120W rail tank car is inherently a more robust tank car when compared to other tank cars used for the transportation of other flammable liquids or liquefied gases and is safer from the perspective of a hazardous materials release resulting from a tank breach during a derailment or other type of rail incident.

Under the HMR, a DOT specification 113C120W rail tank car is required to be fabricated as a double pressure vessel design with the commodity tank (inner vessel) constructed of ASTM A 240/A 240M, Type 304 or 304L stainless steel, and the outer jacket shell (outer vessel) typically constructed of carbon steel. The inner vessel is designed and constructed with a minimum thickness of 3/16 inch and the outer shell thickness is 7/16 inch. The rail tank car is manufactured with an insulated annular space holding a vacuum between the two pressure vessels. Along with the vacuum, a high tech multi-layer insulation (MLI) is used in the annular space that significantly reduces heat transfer from the atmosphere to the tank and also provides thermal (fire) protection to the inner tank. This minimizes the heating of the cryogenic (i.e., refrigerated) material in the tank car while being transported.

The DOT specification 113C120W rail tank car is the authorized packaging for the transport of flammable cryogenic materials (e.g., Ethylene, Hydrogen) by rail and has been in service for over 58 years transporting flammable cryogenic materials safely. Methane, refrigerated liquid (LNG) has similar characteristics to these other cryogenic materials (specifically Ethylene). Therefore, based on the characteristics of LNG and the cryogenic tank car specification requirements in the HMR (49 CFR 179, Subpart F), we have determined the DOT specification 113C120W rail tank car is an acceptable packaging to transport LNG by rail.

Operational Controls

Based on information that was provided in the application for special permit, the risk analysis provided by the applicant, the evaluation of the risk analysis by FRA, the draft Environmental Assessment (EA) and the comments to the EA, it was determined that certain operational controls should be added to the special permit. The operational controls include:

- Shipments are authorized between Wyalusing, PA and Gibbstown, NJ, with no intermediate stops.
- Within 90 days after issuance, the grantee shall prepare and submit a plan providing per shipment quantities, timelines, and other actions to be taken for moving from single car shipments to multi-car shipments, and subsequently to unit trains (20 or more tank cars).
- Trains transporting 20 or more tank cars authorized under this special permit must be equipped and operated with a two-way end of train device or distributed power.
- Prior to the initial shipment of a tank car under this special permit, the grantee must provide training to emergency response agencies that could be affected between the authorized origin and destination. The training shall conform to NFPA-472, including known hazards in emergencies involving the release of LNG, and emergency response methods to address an incident involving a train transporting LNG.
- While in transportation, the grantee must remotely monitor each tank car for pressure, location, and leaks.

Origin – Destination Pair

Given that the special permit applicant only needs to transport LNG between Wyalusing, Pennsylvania and Gibbstown, New Jersey, PHMSA has limited the scope of the special permit to only allow transportation of LNG in DOT specification 113C120W rail tank cars to and from these two locations , with no intermediate stops. PHMSA is considering allowing the transportation of LNG more broadly in a separate rulemaking. However, there was no rationale to broaden the scope of the special permit when the applicant's proposal only involved the above-described locations. The routing restrictions are not the result of current safety concerns about the risks LNG tank cars could pose outside of the listed origin and destination. While the exact route has not been specified, there is a requirement in the special permit to:

> *"provide training to emergency response agencies that could be affected between the authorized origin and destination. The training shall conform to NFPA-472, including known hazards in emergencies involving the release of LNG, and emergency response methods to address an incident involving a train transporting LNG."*

Based upon the requirement imposed in the permit, local emergency response agencies will receive training from the applicant and so should be prepared to respond to an incident to a train transporting

LNG. PHMSA does not anticipate a situation where an emergency response agency will be unaware of how to respond to an incident involving a train transporting LNG subject to this special permit.

Preparation for Increases in LNG Transportation Volume
The special permit requires the grantee to submit a plan that describes how they intend to handle the anticipated increase in volume of LNG transported by rail. It is anticipated that under the special permit the grantee will transition from moving rail tank cars as part of a larger train consist to moving unit trains (20 or more cars) of LNG. To enable this to be done safely, the special permit imposes two requirements on the grantee. The first requires submission of a plan providing per shipment quantities, timelines, and other actions to be taken for moving from single car shipments to multi-car shipments, and subsequently to unit trains (20 or more tank cars). Second, the operational controls require a train with 20 or more cars of LNG to be equipped and operated with a two-way end of train device or distributed power. This will enable the train operator to have enhanced control over the train by being able to reduce speed more effectively.

Leak Detection
To determine if there are any issues with the cars while en route, the special permit specifies that the DOT specification 113C120W rail tank cars must be equipped with devices that allow the grantee to monitor the cars and identify and locate any car experiencing an unexpected increase or decrease in pressure. This will allow the grantee to ensure that all the cars are operating as intended.

Conclusion
LNG is currently authorized for transportation in the HMR in DOT specification MC-338 cargo tank motor vehicles which have a significantly higher incident rate than that of DOT specification 113C120W rail tank cars. For each DOT specification 113C120W rail tank car which would be used to transport LNG it would require three DOT specification MC-338 cargo tank motor vehicles to transport a similar quantity of LNG. Increased use of DOT specification MC-338 cargo tank motor vehicles could lead to an increase of LNG related incidents on the roadways between Wyalusing, PA to Gibbstown, NJ. This can be mitigated by use of DOT specification 113C120W rail tank cars and transporting the LNG by rail.

Based upon the relevant information presented to PHMSA regarding the application and the terms and conditions of the special permit, including imposition of certain operational controls, PHMSA's technical evaluators have determined that the special permit provides an equivalent level of safety to what is required under the HMR and recommend the permit be granted.