EARTHJUSTICE

January 13, 2020

VIA www.regulations.gov

Drue Pearce
Deputy Administrator
Pipeline and Hazardous Material Safety Administration
U.S. Department of Transportation, West Building
1200 New Jersey Avenue, SE
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RE: Comments Objecting to the Proposed Rulemaking to Authorize the Transportation of Methane, Refrigerated Liquid by Rail, Docket No. PHMSA-2018-0025 (HM-264).

Dear Deputy Administrator Pearce:

Earthjustice, on behalf of the Center for Biological Diversity, Clean Air Council, Delaware Riverkeeper Network, Environmental Confederation of Southwest Florida, Mountain Watershed Association, and Sierra Club, submits these comments opposing the Department of Transportation's Pipeline and Hazardous Materials Safety Administration's ("PHMSA") proposed rulemaking to authorize transportation of Methane, refrigerated liquid by rail in the DOT-113C120W specification rail tank car ("Proposed Rule"), Docket PHMSA-2018-0025 (HM-264) and the associated Environmental Assessment ("EA"). The Center for Biological Diversity, Clean Air Council, Delaware Riverkeeper Network, Environmental Confederation of Southwest Florida, Mountain Watershed Association, and Sierra Club are nonprofit organizations that are dedicated to protecting the environment and devoted to the general purposes of conservation of natural resources. These organizations also have members who live near railroads along which LNG would be transported under the Proposed Rule. We submit the following comments, attachments, and expert statements to raise concerns about the violations of federal law contained in the Proposed Rule, particularly with respect to public safety risks and significant environmental impacts.

The PHMSA Proposed Rule, and the Environmental Assessment ("EA") on which it depends, unlawfully abdicate mandates under federal law to protect safety and to fully consider the impacts of proposed regulations on humans and the environment. PHMSA cannot rely on the EA assessment to determine the safety of the proposed rule. The rulemaking proposes to authorize the transportation in commerce of methane, refrigerated liquid in DOT specification 113C120W tank cars. The Proposed Rule is unlawful for the following reasons, as further explained throughout these comments and incorporated expert statements and attachments: it violates PHMSA's statutory mandate under the Hazardous Materials Transportation Act to ensure "safe transportation," and violates NEPA given PHMSA's failure to consider the consequences of this action and their failure to conduct and provide an environmental impact statement.

BACKGROUND

The Hazardous Materials Transportation Act of 1975 was created to "protect against the risks to life, property, and the environment that are inherent in the transportation of hazardous material in intrastate, interstate, and foreign commerce." 49 U.S.C. § 5101. The Secretary of Transportation "*shall* prescribe regulations for the *safe* transportation, including security, of hazardous material." *Id.* § 5103(b) (emphasis added). Because transporting designated hazardous material in commerce in a particular amount and form may pose an unreasonable risk to health and safety or property, proceedings to prescribe regulations for safe transportation must be conducted under the Administrative Procedure Act ("APA") rule making process. *Id.* § 5103.

PHMSA is the agency in the United States Department of Transportation that regulates safety standards in transporting hazardous materials. *See* 49 C.F.R. Pts. 100-185. It is responsible for "[a]dministering a national program of safety, including security, in multi-modal hazardous materials transportation including identifying hazardous materials safety concerns, developing uniform safety standards, and promulgating and enforcing safety and security regulations." *Id.* § 1.96. For adding, amending, or deleting regulations, PHMSA uses informal rulemaking procedures under the APA. *Id.* § 106.10. Generally, PHMSA must publish the following rulemaking documents in the Federal Register: (1) an advance notice of proposed rulemaking; (2) a notice of proposed rulemaking; (3) a final rule; (4) an interim final rule; (5) a direct final rule.

On January 1, 2017, the Association of American Railroads ("AAR") submitted to PHMSA a "Petition for Rulemaking to Allow Methane, Refrigerated Liquid to be Transported in Rail Tank Cars" pursuant to 49 C.F.R. § 106.100, which establishes the rulemaking petition process.[1] In this petition for rulemaking, the AAR alleged that there is a commercial interest in transporting LNG-by-rail from Pennsylvania to New England, and between U.S. and Mexico.[2] They argued correctly that the "[a]uthorization of transportation of LNG by rail requires amendment of the Hazardous Materials Table in 49 C.F.R. section 102" and the amendment of "section 173.319 to include specific requirements for DOT-113 cars used for the transportation of LNG."[3]

On February 9, 2017, PHMSA acknowledged the receipt of AAR's petition and assigned the Petition Number P-1697, but did not initiate a rulemaking process.[4] On May 15, 2017, the Center for Biological Diversity submitted a letter to PHMSA to request AAR's petition to be denied, or at the very least, that PHMSA fully comply with the National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4342 *et seq.*, the Hazardous Materials Transportation Act ("HMTA"), 29 U.S.C. § 5101 *et seq.*, and Administrative Procedure Act ("APA"), 5 U.S.C. § 553 *et seq.*[5] It was not until May 7, 2018 that PHMSA answered both letters. While PHMSA responded to the Center for Biological Diversity that their comments "will be considered in the ongoing analysis, as well as any future potential rulemaking action,"[6] PHMSA made a determination under 49 C.F.R. § 106.105, that AAR's petition "merits consideration in a future rulemaking."[7]

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[1] *See* ASS'N AM. R.R., Petition for Rulemaking to Allow Methane, Refrigerated Liquid to be Transported in Rail Tank Cars, (Jan. 17, 2017), https://www.regulations.gov/document?D=PHMSA-2017-0020-0002 [hereinafter AAR Petition].
[2] *Id.* at 2.
[3] *Id.* at 3-4.
[4] *See* PIPELINE & HAZARDOUS MATERIALS SAFETY ADMIN., Acknowledgment Letter, PHMSA Dkt. No. PHMSA-2017-0020 (Feb. 13, 2017), https://www.regulations.gov/document?D=PHMSA-2017-0020-0001.
[5] *See* CENTER OF BIOLOGICAL DIVERSITY, Response Letter, PHMSA Dkt. No. PHMSA-2017-0020 (Jun 12, 2017), https://www.regulations.gov/document?D=PHMSA-2017-0020-0003.
[6] *See* PIPELINE & HAZARDOUS MATERIALS SAFETY ADMIN., Letter of Acknowledgment, PHMSA Dkt. No. PHMSA-2017-0020 (May 7, 2018), https://www.regulations.gov/document?D=PHMSA-2017-0020-0004.
[7] *See* PIPELINE & HAZARDOUS MATERIALS SAFETY ADMIN., Acceptance Letter, PHMSA Dkt. No. PHMSA-2017-0020 (May 7, 2018), https://www.regulations.gov/document?D=PHMSA-2017-0020-0005.

Meanwhile, on August 17, 2017, Energy Transport Solutions, LLC ("ETS") submitted a Special Permit application (SP20534) to PHMSA for the transportation of methane, refrigerated liquid (UN1972), commonly known as Liquefied Natural Gas ("LNG") in DOT-113C120W and DOT 113C140W rail tank cars, even though the applicant acknowledged that LNG is not authorized by law for transport by rail in tank cars.[8] ETS aims to transport LNG in approximately 50-100 cars in two unit trains per day through different regions of the United States that the public does not know since that information was redacted from the application.[9]

ETS ignored the rulemaking process by invoking Special Permits' provisions under 49 U.S.C.A. § 5117 and 9 C.F.R. § 107.105 (d). An application under these provisions must demonstrate that a special permit achieves a level of safety at least equal to that required by regulation, or if a required safety level does not exist, is consistent with the public interest. *See* 49 U.S.C. § 5117; 9 C.F.R. § 107.105(d). A special permit is defined as "a document issued by the Associate Administrator, the Associate Administrator's designee, or as otherwise prescribed in the HMR, under the authority of 49 U.S.C. § 5117 permitting a person to perform a function that is not otherwise permitted under subchapters A or C of this chapter, or other regulations issued under 49 U.S.C. § 5101 *et seq.* (e.g., Federal Motor Carrier Safety routing requirements)." 49 C.F.R. § 107.1. On December 5, 2019, PHMSA granted the ETS special permit, and included several of the documents from that process in this rulemaking docket.[10] In the Notice of Issuance of Special Permit Regarding Liquefied Natural Gas, PHMSA posted

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[8] *See* ENERGY TRANSPORT SOLUTIONS, LLC, Application for a Special Permit, to Transport Methane, Refrigerated Liquid in DOT 113 Tank Cars, Dkt. No. PHMSA-2019-0100 (August 21, 2017), https://www.regulations.gov/document?D=PHMSA-2019-0100-0941 [Hereinafter ETS Application].

[9] *Id.*

[10] *See* PIPELINE & HAZARDOUS MATERIALS ADMIN., Special Permit 20534, (Dec. 6, 2019), https://www.regulations.gov/document?D=PHMSA-2018-0025-0074 [Hereinafter ETS Special Permit]; PIPELINE & HAZARDOUS MATERIALS ADMIN., Special Permit 20534 Final Environmental Assessment (Dec. 6, 2019) https://www.regulations.gov/document?D=PHMSA-2018-0025-0077 [Hereinafter Special Permit EA]; PIPELINE & HAZARDOUS MATERIALS ADMIN., Special Permit Evaluation Form (Dec. 6, 2019), https://www.regulations.gov/document?D=PHMSA-2018-0025-0076.

the special permit and supporting documents to this rulemaking docket to "invite[] comments on these operational controls" included in the special permit."[11]

On October 24, 2019, PHMSA published its Notice of proposed rulemaking in this docket, proposing to add "Methane, refrigerated liquid . . . or Natural gas, refrigerated liquid" to the Hazardous Materials Table to authorize its transport in DOT-113C120W specification rail tank cars with no operational or other safety restriction beyond a maximum permitted filling density and maximum pressure.[12] Given the known dangers of LNG and that LNG has never been transported in tanker cars in the United States, PHMSA must prepare an Environmental Impact Statement to provide an in-depth analysis of the risks and threats to the human environment of moving LNG-by-rail, especially considering the recent history of accidents, explosions, and fatalities from moving fossil fuels that are *less* hazardous than LNG.

I. The proposed rule violates the Hazardous Materials Transportation Act's mandate to PHMSA to ensure "safe transportation" of hazardous materials given the unmitigated known hazards of rail-based LNG transport.

PHMSA, in exercising its authority, must comply with the Hazardous Materials Transportation Act and NEPA, including NEPA's implementing regulations, which require that all federal agencies include an environmental impact statement ("EIS") "in every recommendation or report on . . . major Federal actions significantly affecting the quality of the human environment." 42 U.S.C. § 4332(2)(C); *see also* 40 C.F.R. § 1508.11. To determine whether an EIS is necessary, an agency first prepares an environmental assessment ("EA"), 40 C.F.R. § 1508.9, which must include, among other information, a discussion of "the environmental impacts of the proposed action," *id*. § 1508.9(b). After preparing an EA, an agency may conclude that the proposed action would have no significant impact ("FONSI," for "finding of no significant impact") in lieu of issuing an EIS. *Id*. §§ 1508.9(a)(1), 1508.13. Here, PHMSA generated an EA, which included a finding of no significant impact.

Through this proposed rule, PHMSA would allow an unprecedented, abrupt opening of the United States mainline rail system to long, heavy, hard-to-handle unit

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[11] PIPELINE & HAZARDOUS MATERIALS ADMIN., Notice of Issuance of Special Permit Regarding Liquefied of Natural Gas 6 (Dec. 6, 2019), https://www.regulations.gov/document?D=PHMSA-2018-0025-0075.

[12] 84 Fed. Reg. 56964, 56976-77 (Oct. 24, 2019).

trains of LNG, using a 50-year old rail tank car design (DOT-113C120W), which has never before been authorized for LNG service. A full Environmental Impact Statement (EIS) is needed to address what the United States Federal Railroad Association (FRA) has termed the "unique safety risks" of LNG rail transport in populated areas.[13] The EIS must also address the likely upstream and downstream impacts of LNG-by-rail, including on fracking of natural gas, the new terrorism vulnerabilities posed by urban routing of LNG trains, and the risks of methane leakage and climate change. Millar Aff. ¶ 10.

The current EA and Preliminary Regulatory Impact Analysis (PRIA) lack a compelling supply-demand analysis showing strong demand for near-term rail shipment of LNG. There seems to be no compelling need for PHMSA to be moving so quickly on issuance of a nationwide rule for LNG transport by 100-cars-plus unit trains of rail tank cars, in the absence of reasonably supporting agency research and development actions in the public safety arena. Millar Aff. ¶ 14.

In order for there to be an adequate EIS, the agency research and development actions needed include:

- a new federally-approved LNG-specific tank car design that meets modern safety standards and specifically equipped to handle the heightened volatility and risks associated with moving LNG-by-rail;
- rigorous agency testing of the tank car proposed for LNG service for survivability in derailment conditions, fire impingement, and collision forces;
- evaluation of the railroads' average 100-car-plus unit train business model which has proved highly risky in triggering the recent 2012-2015 North American trauma of numerous crude oil unit train derailments and is now proposed for LNG-by-rail without even the operational controls put in place on crude oil unit trains; and
- adequate consideration of mandating LNG train major safety conditions, including protective urban rerouting, notification mandates to first responders and communities through which trains will run, development of LNG spill event response plans, consideration that rail

[13] Letter from Karl Alexy, Staff Director, Hazardous Materials Division, Fed. R.R. Admin., to James R. Hertwig, President/CEO, Florida East Coast Railway, at 1 (Mar. 3, 2016), [hereinafter Alexy Letter] Attachment 4.

lines carrying LNG be fully insured for worst-case scenarios, odorization[14] of the cargo, and restrictions on train length and speed.

Overall, cryogenic LNG loss-of-containment transportation releases involve serious risks of cold embrittlement of nearby structures and surfaces, fire radiation from high and unquenchable gas cloud fires, and offsite travel downwind of flammable and explosive LNG vapor clouds. *See* 84 Fed. Reg. at 56972-73. Even without serious loss of containment, LNG containment vessels are subject to overheating and consequent BLEVEs (Boiling Liquid Expanding Vapor Explosions), as seen in two recent Spanish LNG truck BLEVE accidents, contradicting claims that such events are physically impossible with LNG. Millar Aff. ¶ 51. As illustrated by the EA and the PRIA (which suffers the same deficiencies and lack of analysis as the EA), to approve the proposed rule would violate PHMSA's mandate to ensure "safe transportation" and would be arbitrary and contrary to law.

A. The Regional Pilot Programs and Recent History of Public Concern for Potential LNG Disasters

As is evident from just the comments in this docket alone, in recent decades worried at-risk residents in many U.S. coastal locations decisively defeated various LNG import facility siting proposals largely because of testimony by gas scientists on protective-distance issues. These scientists, including Dr. James Fay and Dr. Jerry Havens, have underscored the significant transportation LNG risks of release fire

[14] LNG odorization provides particular difficulties as ethyl mercaptan, the odorant typically added to natural gas, cannot be used as it freezes above LNG's boiling point and thus is not carried with the gas. *See* Chris LaFleur et al., SANDIA NAT'L LABORATORIES for U.S. DEPT. TRANSP., FED. R.R. ADMIN., LNG SAFETY ASSESSMENT EVALUATION METHODS 18 (2015), Attachment 32.

radiation in posed to communities within 2-3 miles of LNG transportation (often LNG marine shipping) routes.[15]

Additionally, there has been a lack of public information provided regarding the two LNG-by-rail pilot programs in Alaska and Florida. These pilot programs have been in operation since 2016 as authorized by special permits from the Federal Railroad Administration ("FRA"), allowing transport of LNG in ISO containers.[16] Important Florida East Coast Railroad (FECR) technical documents demanded by FRA have been withheld from residents who filed Freedom of Information Act (FOIA) requests in 2018 and 2019. Of upmost importance to the FOIA requesters is the 2016 Florida East Coast Railroad Quantitative Risk Assessment (QRA) on LNG rail operations in Florida, authored by Exponent consultants. This document was provided but nearly completely redacted. Millar Aff. ¶¶ 157, 223.

These pilot programs were hastily approved. In fact, in an FRA letter dated March 3, 2016, to Florida East Coast Railroad,[17] the FRA expressed concern about transporting LNG over routes that traverse Florida's congested, highly populated coastal areas, with scores of often-traversed highway-rail grade crossings that involve many pedestrian deaths each year. FRA here also noted that any LNG transported along the proposed routes would share the routes with high-speed performance passenger trains, such as the Brightline (now VirginRail), which travel at top speeds of 79 mph and are projected to soon travel at speeds up to 110 mph. The top speed for the LNG transport on this line is 40 mph. Millar Aff. ¶ 225. Best safety practice, of course,

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[15] *See generally* CONGRESSIONAL RESEARCH SERVICE, *Liquefied Natural Gas (LNG) Import Terminals: Siting, Safety, and Regulation*, (Dec. 14, 2019), https://www.everycrsreport.com/files/20091214_RL32205_e95cb50c88dbd56a2c8f706b2d521ef7ae81ee00.pdf, Attachment 8; 60 Jerry Havens, *LNG: Safety in Science*, BULLETIN OF THE ATOMIC SCIENTISTS, 30-31 (Jan./Feb. 2004), https://journals.sagepub.com/doi/full/10.2968/060001010; Jerry Havens, Comment to Coast Guard Dkt. No. USCG-2004-19615 (Aug. 22, 2005), https://www.regulations.gov/document?D=USCG-2004-19615-0091; James A. Fay, *Model of Spills and Fires from LNG and Oil Tankers*, B96 J. OF HAZARDOUS MATERIALS 171-188 (2003); James A. Fay, SPILLS AND FIRES FROM LNG AND OIL TANKERS IN BOSTON HARBOR, (2003). *See also* Millar Aff. ¶ 221.

[16] An ISO container holds significantly less LNG, about one-third the volume of a DOT-113 tank car.

[17] The Florida East Coast Railway is a Class II regional railroad that owns 351 miles of mainline track between Jacksonville and Miami. FLORIDA EAST COAST RAILWAY, *About the Company* (last visited July 15, 2019), https://fecrwy.com.

would be to separate 110 mph passenger trains from 40 mph LNG trains. Natural gas is presently liquefied at the American LNG Hialeah Facility, located on the Northern portion of Hialeah Railyard in Medley, FL, and transported via Florida East Coast rail lines to Port Everglades and Port Miami for export.[18] The FRA, in contrast to PHMSA that argues that LNG risks are similar to other rail transit risks, noted that "the transportation of large quantities of LNG in a single train presents unique safety risks."[19]

Contrary, to long-expressed Congressional, scientific, and public concerns, PHMSA's proposed rule abruptly proposes to bring LNG transportation disaster risks directly by mainline and short line U.S. rail carriers through virtually all major U.S. cities. This effectively *obliterates* the notion of protective distance. Millar Aff. ¶ 227.

B. The "Safety" History of DOT-113 Tank Cars

The EA states that PHMSA analyzed instances of damage to DOT-113 tank cars, and found 14 instances of damage from 1980 to 2017. 84 Fed. Reg. at 56972. This does not inspire confidence in the safety of these cars when there are currently only 405 DOT-113 tank cars in the entire North American railcar fleet.[20] This means that 3.4% of the entire DOT-113 tank car fleet has been damaged. The safety of the DOT-113C120W tank cars (a specific subset of the DOT-113 tank car fleet) is even more concerning. There are only 67 of these tank cars in the entirety of the North American fleet.[21] The EA notes that three of the DOT-113C120 tank cars derailed, and in that derailment, two of the three breached and lost their entire cargoes, while the third car ended up needing to be breached by emergency responders for safety reasons. 84 Fed. Reg. at 56972.

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[18] Ann Henson Feltgen, *Despite 'disaster risk' trains haul highly flammable gas cargo across South Florida*, MIAMI HERALD (Aug. 23, 2018), https://www.miamiherald.com/latest-news/article217176680.html; *see* U.S. DEP'T OF ENERGY OFF. OF FOSSIL ENERGY, *American LNG Hialeah Facility Terminal* (last accessed Jan. 10, 2020), https://www.energy.gov/fe/american-lng-hialeah-facility-terminal; *see also* Letter from John S. Decker, Attorney for American LNG Marketing LLC, to John Anderson, Director, U.S. Dep't of Energy, at 6 (Mar. 8, 2016), https://www.energy.gov/sites/prod/files/2016/03/f30/sales%20contract%20Hialeah%20Facility03_08_16.pdf.

[19] Alexy Letter, Attachment 4, *supra* n. 13, at 1.

[20] NAT'L TRANSP. SAFETY BD., Comment Letter on Proposed Rule: Hazardous Materials: Liquefied Natural Gas by Rail, Docket No. PHMSA-2018-0025, at 3 (Dec. 5, 2019), https://www.regulations.gov/document?D=PHMSA-2018-0025-0078 [hereinafter NTSB Comments], Attachment 2.

[21] *Id.*

Thus, of the three specific derailments of the DOT-113C120 tank car noted by the EA, all three ended up either breaching or needing to be breached and losing their entire cargoes. This represents 4.5% of the entire DOT-113C120 tank car fleet. If the accident rate and loss rate while carrying LNG comes anywhere close to this breach rate, and were it to happen in a populated area as would be allowed by PHMSA, the damage could be enormous.

Of the available data provided by PHMSA, it appears that every DOT-113C120 tank car that derailed ended up being breached. This does not support PHMSA's finding that these cars have an "excellent safety record," nor does PHMSA cite any other evidence to support this unsubstantiated finding. 84 Fed. Reg. at 56967. PHMSA states that the double-hull of the DOT-113C120W tank cars "provides an increased crashworthiness." *Id.* No data is cited to support this finding and three breaches and lading losses for three cars derailed would not support this assertion. The lack of PHMSA data supporting these findings, and all of the other findings in the EA and PRIA, are discussed further in Sections II and III, *infra*.

The Association of American Railroads, in their comments on this proposed rulemaking, admit that a conditional probability of release "cannot be calculated for DOT-113 tank cars because there is insufficient accident and incident data with respect to DOT-113 cars."[22] Attached to their comments is RSI-AAR report RA-19-04, which is an internal railroad industry report that has not been peer-reviewed and does not cite any peer-reviewed national publications.[23] Notably, the report does not contain data on any field tests regarding the crashworthiness and fire survivability of the DOT-113 rail car, nor does it note any data on the test of a new and more robust version of such a tank car, such as a car with thicker shells.[24] While several probabilistic calculations using questionable proxies are included, no actual testing data is included.[25] Despite the many limitations, even AAR's own calculations show that the likelihood of a puncture increases dramatically at higher speeds (probability of puncture calculated to

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[22] ASS'N AM. R.R. & AM. SHORT LINE & REG'L R.R. ASS'N, Comment Letter on Proposed Rule: Hazardous Materials: Liquefied Natural Gas by Rail, Docket No. PHMSA-2018-0025, at 5 (Jan. 7, 2020), https://www.regulations.gov/document?D=PHMSA-2018-0025-0209 [hereinafter AAR Comments].

[23] RSI-AAR RAILROAD TANK CAR SAFETY RESEARCH AND TEST PROJECT, REPORT RA-19-04 (Nov. 24, 2019), https://www.regulations.gov/document?D=PHMSA-2018-0025-0209.

[24] *Id.*

[25] *Id.*

be more than 4 times greater at 50 mph versus 26 mph).[26] Although they used an LNG tender as a proxy to look at inner tank puncture risk, their own calculations show a substantial risk of inner tank puncture in a 30 mph impact and also show that safety is improved by having additional "outage," i.e., empty space at the top of the tank car.[27] Their calculations also show, despite their limitations, that tanker outer tank heads and shells, and full-height head shields, lead to less likely tank punctures than with the existing thickness in the DOT-113 tank cars (indicating the need for a new and more robust tank car before LNG transport by rail can be contemplated).[28]

Other tank cars in the North American fleet, such as those used to transport crude oil, are much more common, and thus, the dangers of their use and of their tendency to breach in train derailments and accidents is well known. For example, a simple track washout can cause "catastrophic loss of hazardous materials" during a derailment of DOT-111 tank cars (a tank car that used to be used to transport crude oil and is of similar design age as the DOT-113 tank car).[29] Many derailments lead to breaches and losses of cargoes.[30] PHMSA has provided no evidence that such consequences would not occur with a train carrying LNG.

C. The Known Dangers of LNG Are Not Comparable to Ethylene

The United States Department of Transportation has noted that Cryogenic hazardous liquids are fundamentally different from other hazardous cargoes, as there is "only a limited period of time exists for which transport may take place before a potentially unsafe condition is automatically created. A loaded cryogenic car, left to its own devices, is 'a car with a guaranteed leak.'"'[31] PHMSA continues to assert that LNG,

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[26] *Id.* at 2.
[27] *Id.* at 7.
[28] *Id.* at 2-3.
[29] NAT'L TRANSP. SAFETY BOARD, RAILROAD ACCIDENT REPORT, DERAILMENT OF CN FREIGHT TRAIN U70691-18 WITH SUBSEQUENT HAZARDOUS MATERIALS RELEASE AND FIRE, NTSB/RAR-12/01, at 101 (2012), Attachment 16.
[30] Of cars the that derailed, most released their contents and caught fire, with events often lasting multiple days until fully extinguished. Brianna Gillespie & Gerard G. Back, FOAM APPLICATION FOR HIGH HAZARD FLAMMABLE TRAIN (HHTF) FIRES, at Appendix B, p. 2 (2017), Attachment 17.
[31] F.A. Vassalo et al., CALSPAN CORP. for FED. R.R. ADMIN., REVIEW OF PROPOSED SPECIFICATIONS RELATING TO THE SHIPMENT OF ETHYLENE IN TANK CARS AT CRYOGENIC TEMPERATURES, FINAL REPORT, at 3-4 (1974), Attachment 18.

from a hazard perspective, is essentially the same as refrigerated ethylene, which is currently authorized for transport in DOT-113 tank cars.[32] The hazards are not the same. As the NTSB notes, ethylene does not even appear on the American Association of Railroad's list of the top 125 hazardous materials that are authorized for rail transport.[33] Of course, the properties of cryogenic ethylene vary substantially from the properties of LNG, including in ignition temperature, flammable limits, storage temperature (minus 155 degrees Fahrenheit for liquid ethylene versus minus 260 for LNG), and reactivity.[34] The CAMEO Chemicals database of NOAA confirms that the heat of combustion for LNG is higher than it is for liquid ethylene.[35] LNG, when turning back into a gas, will expand to 600 times its liquid volume, 84 Fed. Reg. at 59695, which is certainly more than liquid ethylene given the warmer temperatures liquid ethylene is maintained at. Given the warmer temperatures liquid ethylene can be maintained at, it is also easier to maintain ethylene in its liquid form than LNG. PHMSA has not done any analysis on the significance of these differences.

Sandia National Laboratories, in a series of experiments under contract for the United States Department of Energy with LNG pool fires over water, noted that "[d]ue to its unique chemistry, methane fires behave differently compared to other hydrocarbon fuel fires."[36] Sandia concluded that "[f]ire models that capture the [observed] dynamics will be needed to better understand LNG fire physics."[37] Nowhere has PHMSA taken these "unique" and differing LNG characteristics into account. In 1987, the Lawrence Livermore National Laboratory, for the United States Department of Transportation, conducted a series of LNG dispersion tests known as the Falcon Series.[38] The LNG behaved unexpectedly there too, with a "wider than anticipated vapor cloud," which required researches to move sensors further away from

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[32] *See* Attachment 19 for Safety Data Sheet on Liquid Ethylene.
[33] NTSB Comments, attachment 2, at 3.
[34] *Compare* 1974 Review of Proposed Specifications DOT report at 4, attachment 18, *with* U.S. GEN. ACCT. OFF., LIQUEFIED ENERGY GASES SAFETY, at 2-4 (1978), Attachment 24.
[35] *Compare* NAT'L OCEANIC & ATMOS. ADMIN., CAMEO CHEMICALS: LIQUEFIED NATURAL GAS LNG (June 1999) Attachment 20, *with* NAT'L OCEANIC & ATMOS. ADMIN., CAMEO CHEMICALS: ETHYLENE ETL (June 1999), Attachment 21.
[36] Thomas Blanchat et al., SANDIA NAT'L LAB., SUMMARY OF THE PHOENIX SERIES LARGE SCALE LNG POOL FIRE EXPERIMENTS, at 2 (2011), Attachment 22.
[37] *Id.* at 6.
[38] T.C. Brown et al., LAWRENCE LIVERMORE NAT'L LAB., FALCON SERIES DATA REPORT 1987 LNG VAPOR BARRIER VERIFICATION FIELD TRIALS, UCRL- CR--104316 (1990), Attachment 9.

the test site.[39] During test five, "extensive data loss occurred" "due to accidental ignition of the gas cloud."[40]

The Congressional Research Service has issued several publications detailing the unique dangers posed by the transport and storage of LNG. Despite PHMSA's assertions to the contrary, the Congressional Research Service has found that "a major spill would likely result in a . . . serious fire."[41] Their review of the literature noted that a safety zone could require more than 4,000 feet distance from an LNG spill.[42] They note that counterterrorism advisors have "asserted that terrorists have both the desire and capability to attack LNG shipping with the intention of harming the general population."[43] On November 18, 2019, the Congressional Research Service published an update regarding the proposed rule to allow LNG-by-rail. The CRS again noted the danger of "explosion" and cited a 2014 study for the Maritime Administration recommending that "prospective shippers of LNG by rail (to ports) 'perform a detailed study of potential routes for LNG transportation … that avoid densely populated areas and identify emergency response capabilities.'"[44] The CRS further warns that the "proposed rule does not discuss specific tank car features designed to reduce the chances of tank car punctures during derailment, such as those newly required of cars carrying crude oil. The proposed rule also does not specifically indicate whether LNG would be restricted to routes equipped with positive trail control."[45] Unfortunately, CRS researchers have not evaluated the actual safety effectiveness of the railroad industry standard cited – OT-55Q, on overall high-risk hazmat urban routing, as any such urban hazmat re-routing is both secret and voluntary. Millar Aff. ¶ 228.

The GAO, when it has issued comprehensive reports in the past, has been similarly alarmed by the dangers of liquefied energy gases, summarizing its study by

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[39] *Id.* at 30.

[40] *Id.* at iii, 55.

[41] CONGRESSIONAL RESEARCH SERVICE, *Liquefied Natural Gas (LNG) Import Terminals: Siting, Safety, and Regulation* at 6, (Dec. 14, 2009), https://www.everycrsreport.com/files/20091214_RL32205_e95cb50c88dbd56a2c8f706b2d521ef7ae81ee00.pdf, Attachment 8.

[42] *Id.* at 7.

[43] *Id.* at 23.

[44] CONGRESSIONAL RESEARCH SERVICE, *Liquefied Natural Gas by Rail: Policy Issues*, at 1-2, (Nov. 18, 2019), Attachment 15, (quoting DET NORSKE VERITAS, INC. for U.S DEPT. TRANSP. MARITIME ADMIN., LIQUEFIED NATURAL GAS (LNG) BUNKERING STUDY (2014), Attachment 23).

[45] *Id.* at 2.

noting that "[l]arge quantities of liquefied energy gases should not be transported through densely populated areas unless delivery is otherwise impossible."[46] Although such reports are outdated, their findings are still helpful as being useful today as they discuss the issues with transporting large quantities of liquefied energy gases in vulnerable tank cars through major population centers. The GAO noted an accident involving only 5 rail tank cars loaded with Liquid Propane Gas (LPG) that exploded over an area half a mile by three-quarters of a mile and was felt 45 miles away.[47] Debris from the fire and explosions covered 20 blocks of Decatur, Illinois.[48] Although the GAO only considered LPG because LNG was not authorized by rail due to the danger, their concerns are even more applicable to LNG-by-rail: "If large amounts of LPG or its vapor get into the sewers, subways, and other subterranean ducts in a big city, it could lead to a catastrophe."[49] This is precisely what happened in the Cleveland LNG disaster, where LNG was spilled from a facility and entered the stormwater system, vaporized, and exploded. Temperatures soared to 3,000 degrees Fahrenheit, streets were blown up, and one explosion opened a crater 25 feet deep, 30 feet wide, and 60 feet long, killing 130 people in total.[50] Should LNG spill into a sewage or stormwater systems, as happened in Cleveland, OH with catastrophic consequences, an entire city could easily be destroyed. As noted by the GAO, when less than 15 cubic meters of naphtha was spilled, which is "much less dangerous than LNG," and it entered the sewers of Akron, Ohio, "the incident caused violent explosions more than 8 miles from the point of the spill."[51] PHMSA does not seem to account for the risks of LNG being confined from a spill at all. As the GAO noted, "[t]he 40 cubic meters of LNG from one truck, vaporized and mixed with air in flammable proportions, are enough to fill 110 miles of 6-foot diameter sewer line, or 15 miles of a 16-foot diameter subway system."[52] The LNG from just one rail tank car (which contains about three times as much LNG as a truck), without even considering a unit train, if it spilled in the wrong location, could be enough to destroy a city. The proposed rule does not address any of these concerns.

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[46] Report to the Congress, Liquefied Energy Gases Safety (July 31, 1978) at 2, attachment 24.
[47] *Id.* at p. 8-3.
[48] *Id.*
[49] *Id.* at p. 8-16.
[50] *Id.* at chapter 10.
[51] *Id.* at p. 20-11.
[52] *Id.* at 20-9.

The amount of energy contained in LNG is quite alarming. One gallon of LNG has 0.89975 therms of energy.[53] One DOT-113 tank car has a capacity of approximately 30,000 gallons,[54] meaning that there would be approximately 27,000 therms worth of energy per tank car. With this much LNG per tank car, it would only take 22 tank cars to hold the equivalent energy of the Hiroshima bomb.[55] A unit train of 110 LNG tank cars would thus have five-times the energy of the Hiroshima bomb. PHMSA admits that a cascading failure of cars could occur, by noting that "where multiple DOT-113 specification tank cars are transported in a block or unit train configuration, fire/radiant heat exposure or cryogenic temperature exposure could potentially lead to the release of material or failure of otherwise undamaged tank cars." 84 Fed. Reg. at 56974. However, despite acknowledging such risks, PHMSA does not propose any safety precautions or operational restrictions to prevent 110-car unit trains from travelling through major population centers with the equivalent energy of 5 Hiroshima bombs, nor does PHMSA examine the possible consequences of such a cascading failure.

D. Voluntary and Contemplated Operational Restrictions Fail to Ensure Safe Transport of LNG

PHMSA, in the EA, states that the voluntary industry standard OT-55 is "sufficient to address the risks associated with moving LNG in DOT-113 tank cars," 84 Fed. Reg. at 56973, and in the PRIA, finds that the "safety impacts" are among the "potential benefits and positive impacts from this proposed rulemaking." PRIA at 17. The safety impacts are not beneficial, and the voluntary industry standards, the most notable of which is a voluntary speed limit of 50 mph for trains carrying 20 or more

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[53] *Id.* at 2-2; *see also* U.S. DEPT. ENERGY, LIQUEFIED NATURAL GAS: UNDERSTANDING THE BASIC FACTS, at 9 (noting that one cubic foot of LNG contains 660,000 BTU), Attachment 36.

[54] *See* PRIA at 15. Chart Industries, which is looking at constructing additional DOT-113C120W tank cars for LNG, notes that it has a 34,500 gallon capacity. CHART INDUSTRIES, INC., LNG on the Rails – Precursor to LH2 on the Rails? [Powerpoint Presentation], at 7 (2018), Attachment 25. Chart industries also has a tank specification for a DOT-113C120W car with a 30,680 gallon capacity for LNG. CHART INDUSTRIES, INC., LNG Tank Car SR-603 (2013), Attachment 26.

[55] The Hiroshima Bomb had the equivalent of 15 kilotons of TNT. John Malik, LOS ALAMOS NAT'L LAB. for U.S. DEPT. ENERGY, THE YIELDS OF THE HIROSHIMA AND NAGASAKI NUCLEAR EXPLOSIONS, at 25 (1985), Attachment 27. This is the equivalent of about 595,500 therms.

tank cars of hazardous materials, including LNG, [56] are not sufficient to ensure safe transport of LNG. There is no public reporting nor transparency regarding railroad compliance with these voluntary standards, nor any public assessment of their effectiveness. Millar Aff. ¶ 203-207. DOT has not assessed the effectiveness of these voluntary standards. *Id*. Without any such assessment of the voluntary operational controls, the PHMSA's bald assertions that they are sufficient to ensure safe movement cannot be credited.

The inadequacy of current voluntary standards should be plain given the recent experience with the crude-by-rail disasters throughout the country. On July 6, 2013, one of the worst rail disasters in North American history occurred in Lac Mégantic, Quebec, when a train carrying Bakken crude oil derailed and spilled an estimated 1.6 million gallons of Bakken crude. A series of explosions, and a river of flaming oil flowing downhill from the derailment site, killed 47 people, including children as young as 4, and destroyed a four-block radius in the downtown area.[57] As the quantity of Bakken crude transported by rail skyrocketed, the NTSB documented several other rail-related incidents, involving million gallons of crude oil spilled and massive environmental and property damage.[58] A federal environmental analysis for the Keystone XL pipeline predicted dozens of fatalities and hundreds of injuries every year from the continued use of rail cars to transport large volumes of crude oil.[59] The spate of disasters

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[56] OT-55 will only apply to "Key Trains," which are trains carrying 20 or more car loads of hazardous materials, including LNG. The most notable "safety" feature of such a designation is a voluntary speed limit of 50 mph. ASS'N AM. R.R., Circular No. OT-55-Q, at 1 (Sept. 6, 2018), https://www.aar.org/wp-content/uploads/2018/09/CPC-1337-OT-55-Q-w-AskRail-9-6-18.pdf.

[57] TRANSP. SAFETY BD. CANADA, RAIL RECOMMENDATIONS R14-01, R14-02, R14-03, at 1 (Jan. 24, 2014); Testimony of NTSB Chair Deborah A.P. Hersman, Hearing on Railway Safety, Before the Appropriations Subcomm. on Transp., Hous. and Urban Dev. and Related Agencies, S. Appropr. Comm. at 5 (Apr. 9, 2014).

[58] Paul Stancil, NAT'L TRANSP. SAFETY BD., Rail Accidents Involving Crude Oil and Ethanol Releases, at slides 3-5, from presentation at NTSB Rail Safety Forum: Transportation of Crude Oil and Ethanol (Apr. 22-23, 2014), https://www.ntsb.gov/news/events/Documents/Opening%20Presentation%20Rail%20Accidents%20Involving%20Crude%20Oil%20and%20Ethanol%20Releases.pdf.

[59] U.S. DEPT. STATE, BUREAU OCEANS & INT'L ENVTL. & SCI. AFF., Errata Sheet to Keystone XL Project–Final Supplemental Environmental Impact Statement at 1 (June 2014), https://2012-keystonepipeline-xl.state.gov/documents/organization/227464.pdf; U.S. DEPT. STATE, BUREAU OCEANS & INT'L ENVTL. & SCI. AFF., Keystone XL Project–Final Supplemental Environmental Impact Statement, at ES-35 (Jan. 2014), https://2012-keystonepipeline-xl.state.gov/documents/organization/221135.pdf.

ultimately led to a proposed federal rulemaking to phase in more robust tank car standards and other operational safety protocols. *See, e.g.*, 80 Fed. Reg. at 26,644. Given this history, it should be obvious that PHMSA needs to put in place robust tank car safety standards and operational safety controls, and ensure that such safety requirements are adequate, before proceeding to authorize LNG-by-rail in unlimited quantities across the nation, with no routing restrictions. Neither the EA nor the PRIA address these glaring deficiencies.

Even if PHMSA were to require operational controls, such as those embodied in the High Hazard Flammable Train operational requirements, such as speed restrictions and advanced braking requirements, 49 C.F.R. § 174.310, such operational controls would not be sufficient as derailments and explosions continue to occur for crude trains.[60] Furthermore, although the rule itself does not contemplate any operational controls, PHMSA added into the docket the already-issued Special Permit to invite comment on the operational controls included therein. 84 Fed. Reg. 67768 (Dec. 11, 2019). As stated by the Office of Attorney Generals for New York and Maryland, this late notice does not provide sufficient time to fully evaluate and comment on these controls.[61] Nevertheless, the operational controls embodied in the Special Permit, including remote monitoring and voluntary consensus standard emergency response training,[62] do not ensure operational safety. Millar Aff. ¶¶ 47-48. Simply put, the operational controls fall far short of the safety that would have been provided by Positive Train Control and electronically controlled pneumatic braking, safety requirements that have now been effectively repealed. *Id.*

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[60] Guy Quenneville, *U.S. rail carrier reportedly cracked down on same retrofitted tank type involved in fiery Sask. derailment*, CBC NEWS (Dec. 13, 2019), https://www.cbc.ca/news/canada/saskatoon/saskatchewan-rail-tank-car-cp-1.5395111, Attachment 3; Stephanie Taylor, *'We were very scared:' Woman describes fiery derailment near Lanigan, Sask.*, CALGARY HERALD, (Dec. 9, 2019), https://calgaryherald.com/pmn/news-pmn/canada-news-pmn/cp-rail-train-derails-near-lanigan-sask-sparking-fire-that-closes-highway/wcm/fa6d5820-c7d7-4a13-8ec3-87c6a0497f1b, Attachment 13.

[61] Max Shterngel, N.Y. ST. OFF. ATT'Y GEN. & Steven Goldstein, OFFICE MD. ATT'Y GEN., *Request for Extension of Time to File Comments*, Dkt. No. PHMSA-2018-0025, (Dec. 13, 2019), https://www.regulations.gov/document?D=PHMSA-2018-0025-0085 (request for extension only partially granted, *see* 84 Fed. Reg. 70491 (Dec. 23, 2019) (extending time to comment to January 13, 2020)).

[62] Hazardous Materials: Notice of Issuance of Special Permit Regarding Liquefied Natural Gas, 84 Fed. Reg. 67768, 67769 (Dec. 11, 2019).

Furthermore, the special LNG training for emergency responders required by the Special Permit along unknown rail routes is based on voluntary industry consensus standards. *Id.* Relying on voluntary industry practice does not ensure that emergency responders are properly prepared to respond to an LNG spill. The National Association of State Fire Marshals has come out in opposition to the proposed rule based on the lack of data and that "no additional controls are in place," meaning that "safety may well be compromised."[63] Since the emergency responders themselves feel that they have a lack of information, a voluntary industry consensus standard will not ensure that emergency responders have all of the information they need to respond properly to an LNG disaster.

Finally, although the operational controls that PHMSA has contemplated will not ensure safe transport, the minimal calculations provided in the AAR Comments show that certain operational controls would be *safer* (although *not* safe) than no controls at all. As shown in table 3 of attachment RA-19-04 to the AAR Comments, in calculations of damage to an LNG tender (*not* a DOT-113 tank car, which, due to its design age, is likely even more vulnerable to damage), that in any impact of over 20 mph, the outer jacket would breach and the inner tank could breach too.[64] The calculations also show that the higher the "outage," i.e., the higher the remaining capacity in the tank, the more likely the tender can withstand the impact.[65] Therefore, although we believe that these operational controls would not be sufficient to ensure "safe" transport of LNG as required by the Hazardous Materials Transportation Act, PHMSA would have to limit any trains carrying LNG to a speed limit of 20 mph (or lower) and decrease the maximum filling density of the tank cars in any rule that contemplates LNG transport. To do otherwise would knowingly increase the risk and danger of transport of LNG by rail, which, as noted above, is already known to be unacceptably dangerous and in violation of PHMSA's duty to ensure the safe transport of hazardous materials.

II. The proposed rule violates the Hazardous Materials Transportation Act's mandate to ensure "safe transportation" of hazardous materials given the lack of research and quantification of the hazards of rail-based LNG transport.

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[63] Nat'l Ass'n of State Fire Marshalls, Comment Letter on Proposed Rule: Hazardous Materials: Liquefied Natural Gas by Rail, Docket PHMSA-2018-0025, at 1, (December 17, 2019), https://www.regulations.gov/document?D=PHMSA-2018-0025-0096.

[64] RSI-AAR Report RA-19-04, *supra* n. 23, at 7.

[65] *Id.*

In addition to failing to address the known hazards of rail-based LNG transportation, the proposed rule cannot comply with PHMSA's statutory obligation to ensure "safe transportation" of hazardous materials in light of the numerous, material gaps in scientific research and quantification of other hazards of rail-based LNG transport reflected by the EA and PRIA. There is no specific data on LNG bulk rail shipments because LNG has long been forbidden except by special permit from the FRA. The EA and PRIA does not mention the history of any exceptions granted to the ban. Certainly, LNG has been "forbidden" because of the unique and challenging risks posed by transporting LNG by U.S. railroads. Until December 5, 2019,[66] even the limited Special Permit authorizations for LNG transport had never allowed LNG transportation in tanker cars, instead relying on a much newer and smaller capacity UN portable tank. These limited experiments do not establish a sound record on which to base regulatory action that would permit nationwide LNG transport in 100-car plus unit trains designed decades ago.

It is not a secret that additional information is required for understanding the risks of transporting LNG. PHMSA's own consultant, David Willauer of Cambridge Systematics, conducted a "Risk Assessment of Surface Transport of Liquefied Natural Gas" in May 2018, in which he identified critical federal research and regulatory gaps in assessing the safety risks of rail-based LNG transport.[67] The National Association of State Fire Marshalls similarly comments in this docket emphasizing how untimely and reckless this rulemaking would be given the current lack of scientific basis to safely authorize LNG transport in tanker cars:

> Clearly more research is needed, before the measures approved by the docket are allowed. [. . .] The combination of a lack of information with no increased safety measures is a dangerous proposition. This only serves to put the public and our first responders at even greater risk. We urge you to reconsider your proposed action and offer our opposition to docket PHMSA-2018-0025 (HM-264) as we feel more study on the topic, the tank cars, and the safety systems in place, is needed before such actions are taken.[68]

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[66] DOT-SP 20534, PIPELINE & HAZARDOUS MATERIALS SAFETY ADMIN. (Dec. 5, 2019), https://www.regulations.gov/document?D=PHMSA-2019-0100-3006.

[67] CAMBRIDGE SYSTEMATICS, INC., RISK ASSESSMENT OF SURFACE TRANSPORT OF LIQUID NATURAL GAS, Mar. 20, 2019, https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/research-anddevelopment/hazmat/reports/71651/fr2-phmsa-hmtrns16-oncall-20mar2019-v3.pdf, Attachment 12. *See also* Millar Aff. ¶¶ 160-61.

[68] Nat'l Ass'n of State Fire Marshalls, *supra* n. 63, at 1-2.

A non-exhaustive list of the areas for which research is unavailable or inadequate includes such essential questions as: the suitability of the DOT-113C120W series design for LNG transportation; the threats to populations near rail lines from a release, fire, and/or explosion; the likelihood of a BLEVE or vapor cloud explosion (VCE); the vulnerabilities of rail-based LNG unit trains to targeting in intentional attacks; the training and capacity (or lack thereof) of local first responders to manage an LNG disaster; the behavior and distance LNG vapor clouds could travel in a release; and the true comparative safety of truck-based versus rail-based LNG transport. *See, e.g.,* Millar Aff. ¶ 15. Until these various risks are adequately evaluated, understood, and mitigated, it is inappropriate—and *unsafe*—for PHMSA to finalize the proposed LNG-by-Rail Rule. *See* 49 U.S.C. § 5103(b).

A. The EA and PRIA Reflect the Serious and Dangerous Lack of Scientific Research Related to the Suitability of DOT-113C120W Series Tankers for LNG Carriage.

The EA and PRIA fail to establish any record of the demonstrated safety of the DOT-113C120W specification series for LNG service, particularly with respect to the crashworthiness and resistance to puncture and thermal damage of the tanker. A 2017 PHMSA-ordered review of LNG equipment failure rates found "significant gaps in available failure rate data exist in almost every category" of the Agency's Failure Rate Table (FRT), with the largest gaps including "Cryogenic/LNG pressure vessels" and "Cryogenic/LNG valves, expansion joints and gaskets."[69] Although nearly two years ago this report informed PHMSA that "[t]he last survey of LNG equipment failure rates in the U.S. was conducted 35 years ago,"[70] since that time PHMSA has not updated the FRT.

In April 2019, the Federal Railroad Administration (FRA)—the other agency with which PHMSA shares responsibility for ensuring the safe transportation of any hazardous materials offered for rail shipment—specifically called attention to what it sees as "Major Safety Concerns" regarding the lack of field testing of both portable

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[69] RICH KOOY ET AL., GAS TECHNOLOGY INSTITUTE, STATISTICAL REVIEW AND GAP ANALYSIS OF LNG FAILURE RATE TABLE, PUBLIC FINAL REPORT DTPH5615T00008, 121 (Jan. 11, 2017). Attachment 28. A Failure Rate Table (FRT) catalogs the frequencies with which particular engineered systems or components—in this case, LNG storage and transportation equipment—will reliably fail, expressed per unit of time.

[70] *Id.* at 5.

tanks and tank cars for crashworthiness in an LNG carriage context.[71] In particular, the FRA noted that the performance of "double walled tanks in an engulfing fire is not completely tested or understood."[72] The FRA raised further concerns over the performance of "shut off valves and devices under crash scenarios," as well as other "valves, gaskets and other appurtenances used in cryogenic environments and subject to the fatigue and vibration environment of railroad"—all of which, it notes, "are unknown."[73]

The proposed LNG-by-Rail Rule also fails to show any scientific evidence of the safety of the DOT-113 tankers with respect to the particular hazards raised by the unit train consist and associated speed of travel which PHMSA is contemplating authorizing for rail transportation of LNG. Karl Alexy, Staff Director for the FRA's Office of Safety, has called into question the ability to create hazardous materials tank cars that can survive higher operating speeds, warning "When you begin to look at cars that are derailing at speeds of 30, 40 miles an hour, it's very difficult, it's a big ask, to expect that a tank car get hit [and] not be breached."[74] Given Mr. Alexy's instructive comments, it is particularly troubling that PHMSA proposes to allow the rail industry to follow its own higher and voluntary speed limit of 50 mph.[75] The FRA has separately flagged the risks of multi-container unit train or manifest train shipments of flammable and cryogenic liquids, such as LNG, as "unknown."[76]

The NPRM reflects an unacceptable lack of study around the susceptibility of DOT-113s with LNG lading to undergo a vapor cloud explosion VCE[77] or BLEVE. The

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[71] MARK A MADAY, U.S. DEPT. TRANSP., FED. R.R. ADMIN., LOCOMOTIVE ALTERNATIVE FUELS AND CRYOGENIC COMMODITY TRANSPORTATION (PROJECTS AND REGULATIONS) 13 (Apr. 8, 2019), Attachment 29.

[72] *Id.*

[73] *Id.* The FRA also notes that "Risks of shipments (of Flammable & cryogenic liquids) of multiple containers in unit trains vs. manifest trains are not known," *id.*, another research gap the proposed LNG-by-Rail Rule does not address.

[74] Rebecca Leber, *Oil-Train Spills Are Worse Than Ever, and Obama's New Safety Rules Aren't Enough*, NEW REPUBLIC (Jul. 23, 2014), https://newrepublic.com/article/118824/obama-administrations-oil-train-safety-rules-arent-enough.

[75] *See* Pt. I.D, *supra*.

[76] MADAY, Attachment 29, *supra* n. 71, at Slide 13.

[77] A VCE refers to a release of a flammable gas from a storage vessel "followed by formation, ignition and high-speed combustion of a flammable cloud," which can itself yield "significant blast overpressure." Egidijus Vaidogas et al., *Assessing Risk to Built Roadside Property Posed by Transportation of Liquefied Gasses*, 22(3) J. CIV. ENG'G & MGMT. 442, 443 (Jan. 2013).

international literature on this subject is also lacking, as noted by a recent European study: "Any comprehensive study which compares in detail the risks posed by VCEs . . . and BLEVEs . . . on road or rail is not known to us."[78] More recently, UK Health and Safety Executive report reviewed the unexpected massive forces unleased by four major petrochemical vapor cloud explosions worldwide.[79]

BLEVEs are known to occur where an external fire impinging on a storage vessel containing liquefied gas causes the contents to heat and the internal pressure to rise until the point of failure. However, many relevant variables, such as the length of time that a tank can withstand an external fire, remain unknown. In 1973, a single tank car of comparable capacity to the DOT-113 underwent a BLEVE during unloading operations. The explosion sent flames and scattered pieces of the tank over 2000 feet away, leaving 12 dead and over 100 injured.[80]

Similarly, a BLEVE can occur if a vessel's pressure relief devices (valves that vent off controlled amounts of gas to avoid over-pressurization in the event of a fire or loss of temperature control) fail to timely and effectively vent excess pressure.[81] The efficacy of pressure release devices is insufficiently studied, particularly in the context of a derailment, which could damage or destroy a tanker's relief devices, or could overturn the tanker so that the physical mechanism of the device cannot function. The FRA appears to have suggested this very possibility in a presentation earlier this year.[82]

In addition to the limited data from known explosions considered previously in these comments, the EA also fails to address the significant research gaps on this subject. The AAR attempted a single test of fire survivability in 2017, with an ISO container loaded with nitrogen—*not* a DOT-113 loaded with LNG. Millar Aff. ¶ 23-24.

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[78] Egidijus Vaidogas et al., *Assessing Risk to Built Roadside Property Posed by Transportation of Liquefied Gasses*, 22(3) J. CIV. ENG'G & MGMT. 442, 445 (Jan. 2013), https://www.researchgate.net/publication/269062884_Assessing_Risk_To_Built_Roadside_Property_Posed_By_Transportation_Of_Liquefied_Gasses/link/57556d6808ae0405a5752636/download.
[79] Atkinson, Hall, & McGillivray, REVIEW OF VAPOUR CLOUD EXPLOSION INCIDENTS, HEALTH & SAFETY EXECUTIVE, (2017), https://www.hse.gov.uk/research/rrpdf/rr1113.pdf, Attachment 30.
[80] NAT'L HAZARDOUS MATERIALS FUSION CENTER, *Hazmat History: Kingman, Arizona* 1-2, https://www.iafc.org/topics-and-tools/hazmat/fusion-center/hfc-resource-detail-alt87/rail-tank-car-incident-kingman-az (last visited Dec. 18, 2019). Attachment 31.
[81] *Id.*
[82] *See* MADAY, Attachment 29, n. 70, at Slide 13 ("Performance of shut off valves and devices under crash scenarios is not known.").

During the test, wind blew the propane fire to only one side of the tank, defeating the intended engulfing flame, as could occur in a pool fire scenario. *Id.* Considering the deeply flawed methodologies and execution of this test, involving a different type of tank, loaded with a non-flammable cargo, and not subjected to comparable pool fire conditions, it is difficult to see how this standalone study establishes any support for the fire-resistance of the DOT-113. *Id*.

In contrast, these types of studies have been standard practice for other tankers offered for hazardous materials service, such as with the DOT-105, -111, -112, and -114 series tank cars. Beginning in the 1980s and 1990s, DOT/FRA have subjected those tank car designs to a series of tests, including "full size (actual) tank car impact tests on a railroad track" to determine puncture resistance of tank car heads at various ambient temperatures.[83] With so much unstudied about the hazards of relying on the DOT-113 for LNG service, as well as with particular vulnerabilities posed by unrestricted consists in manifest or unit configuration, PHMSA lacks a "safe" basis to proceed with this rule.

B. The EA and PRIA Make No Attempt to Quantify Urban or Rural Populations' Vulnerabilities to an LNG Release or Explosion.

In failing to adequately address, or in some cases even consider, the release and ignition pathways, potential extent of vapor cloud travel, extents of impacts in a potential release, vulnerability of LNG unit trains to intentional attack, and unpreparedness of local first responders, the EA and PRIA fundamentally ignore the safety of those who live, work, or travel near railways that could carry LNG. A recent Final Report on LNG safety assessment methods prepared for the FRA found that "Scenarios leading to the release and/or ignition of LNG . . . diverse enough to encompass a variety of possible failures, events, and accidents that could lead to harm" still remained to be identified.[84]

Similarly, the United States Government Accountability Office (GAO) found that research gaps on the effects of an LNG spill not only remain but continue to go

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[83] *See* WILLIAM G. LARSON, U.S. DEPT. TRANSP., FED. R.R. ADMIN., ALUMINUM/COLD TEMPERATURE CAR PUNCTURE RESISTANCE TEST: DATA REPORT (DOT/FRA/ORD-92-97) 1-3 (Aug. 1992). The FRA also conducted additional testing of the DOT-111 under simulated crash and pool fire conditions, following the derailment and fires of a crude-by-rail unit train that killed 47 people in Lac-Mégantic, Quebec.

[84] *See* LaFleur et al., Attachment 32, *supra* n. 14, at 18.

unaddressed even in ongoing government research into LNG safety.[85] In that meta-analysis of six other significant LNG release studies, the GAO report concluded that the LNG safety literature was still marked by uncertainties regarding heat impact distances and cascading failures.[86]

The EA and PRIA fail to address the related issue of vapor cloud dispersion modeling, thus declining to quantify the safety hazards of a vapor release in the proposed LNG-by-Rail Rule. In an LNG release, the rate of vapor boil-off, the distance travelled before diluting below the lower flammability limit (LFL), and the proximity of the release site to homes and businesses or to other confining obstructions is essential to evaluating the dangers posed. These omissions seem all the more difficult for PHMSA to justify given the ready existence of LNG vapor cloud dispersion models.[87]

The EA and PRIA also completely ignore the potential that LNG unit trains would create for terrorism, "even while proposing to permit the movement of enormous 100-car LNG unit trains as potential terrorist weapons into and through major U.S. cities." Millar Aff. ¶ 88. The incredible volume of LNG that would be held by a unit train—each tank of which carries threefold the storage of a truck-based container—presents vast potential for death, destruction, and damage to the environment. It has been over 18 years since 9/11, but potential terrorism vulnerabilities still encircle the transport of toxic chemicals.[88] It is in response to

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[85] U.S. GOV. ACCT. OFF., MARITIME SAFETY: PUBLIC SAFETY CONSEQUENCES OF A TERRORIST ATTACK ON A TANKER CARRYING LIQUEFIED NATURAL GAS NEED CLARIFICATION (GAO-07-316) 8, 17 (Feb. 2007), Attachment 33.

[86] *Id.* Although this study was conducted with special attention to LNG tanker ships, the issue of cascading failures is of no less importance to discussions on rail-based LNG transportation.

[87] *See, e.g.*, M.J. Ivings et al., FIRE PROTECTION RESEARCH FOUNDATION, EVALUATING VAPOR DISPERSION MODELS FOR SAFETY ANALYSIS OF LNG FACILITIES, at 15-19 (Sept. 2016), Attachment 34. *See also* Millar Aff. ¶ 35.

[88] *See* Richard A. Falkenrath, *Op-Ed: We Could Breathe Easier: The government must increase the security of toxic chemicals in transit*, WASH. POST. (Mar. 29, 2005) ("Of the all the various remaining civilian vulnerabilities, one stands alone as uniquely deadly, pervasive and susceptible to terrorist attack: industrial chemicals that are toxic when inhaled, such as chlorine, ammonia, phosgene, methyl bromide, and hydrochloric and various other acids. These chemicals, several of which are identical to those used as weapons on the Western Front during World War I, are routinely shipped through and stored near population centers in vast quantities, in many cases with no security . . . . A cleverly designed terrorist attack against such a chemical target would be no more difficult to perpetrate than were the Sept. 11 attacks. The

precisely this underlying threat that the GAO ordered a comprehensive study of the vulnerabilities to terrorism of ship-based LNG transportation after the 9/11 attacks,[89] at a time when rail-based LNG was not even under discussion.

Moreover, PHMSA's proposal for rail-based LNG shipment is all the more dangerous due to the extreme proximity of rail lines to homes, parks, schools, and places of work, which PHMSA notes can be constructed as close to fifty feet from active rail lines. 84 Fed. Reg. at 56974. PHMSA's refusal to include any routing restrictions, leaving LNG authorized for high-density urban transport, needlessly exacerbates this hazard. Despite this, the EA never assesses the potential worst-case scenarios of LNG release impact distances for either LNG tank cars or ISO container trains.

Consider a hypothetical derailment and fire in Philadelphia, PA, a densely populated city which may soon see two daily LNG unit trains of up to 100 cars each as a result of PHMSA's recent approval of the ETS Special Permit.[90] Although the EA endorses the Protective Action Distance guidance of the "Orange Pages" guide, it ignores what carrying out the guide would actually entail. The relevant guide, 115, states: "If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions."[91] This is minimally prudent, considering the heat hazard distance from an LNG fire would be expected to cover roughly a mile radius.[92] Noting that the metro Philadelphia population per square mile *averages* to 11,379.5 people per square mile[93]

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loss of life . . . might even exceed it . . . . [N]o other category of potential terrorist targets presents as great a danger as toxic industrial chemicals.").

[89] *See* GAO MARITIME SAFETY, Attachment 33, *supra* n. 85.

[90] ETS Application, *supra* n. 8, at 14; ETS Special Permit, *supra* n. 10, at 1 (granting ETS Special Permit in Docket No. PHMSA-2019-0100). Unfortunately, the public is left to speculate as to exactly where these extremely hazardous trains will run, as all but the starting and ending location of the Special Permit's routing has been redacted from view of the very people who will be threatened by its operation. *Id.* at 2. *See also* Millar Aff. ¶ 7 (noting the most likely route will pass through Allentown, Reading, and Philadelphia).

[91] PIPELINE & HAZARDOUS MATERIALS SAFETY ADMIN., GUIDE 115, *in* 2016 EMERGENCY RESPONSE GUIDEBOOK 168-69 (2016), https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/ERG2016.pdf.

[92] GAO MARITIME SAFETY, attachment 33 at 7, *supra* n. 85.

[93] U.S. CENSUS BUREAU, *QuickFacts Philadelphia city, Pennsylvania*, https://www.census.gov/quickfacts/philadelphiacitypennsylvania (last accessed Dec. 18, 2019).

(but exceeds that figure in urban cores), thus the Orange Guide would recommend the evacuation of nearly 36,000 people,[94] ideally before an explosion took place.[95]

The EA and PRIA offer no suggestion that local first responders have had the adequate training to respond to the unique risks posed by bulk LNG-by-rail transportation, much less quantify what such capacity development would be needed. Other studies, however, have noted the lack of preparation for emergency responders. A 2019 Norwegian study found that knowledge sharing among emergency responders of the threat LNG represents was very limited, and thus the threat LNG provides varies greatly across municipalities.[96] PHMSA has not provided any information that knowledge sharing of LNG threats is better among United States emergency responders. On the contrary, the U.S. experience has so far seemed to bear out the same lack of training and resource sharing, even after a spate crude oil unit-train disasters from 2012-2016 revealed community vulnerabilities. As the Village of Barrington, IL, has recently noted in this docket:

> Local first responders are just recently being trained on how to respond to crude by rail and ethanol train derailments in their communities. While there are response protocols and evacuation zone parameters that are recommended in PHMSA's 2016 Emergency Response Guidebook for several hazardous materials, there is nothing specific to uncontrolled LNG releases.
>
> After reviewing the literature to respond to this Docket, Barrington has no confidence that emergency responders in any city, town or village could manage an effective response to a bulk LNG derailment incident. To the contrary, the properties of LNG seem to make it an insurmountable

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[94] The population to be evacuated is equal to the recommended area of evacuation of (π) x (radius)^2, or ~3.14 square miles, multiplied by the average area population of 11,379, yielding 35,749 people *on average*.

[95] Notably, this does not take into account the possibility of confinement or travel in a stormwater, sewer, or subway system. Realistically, a major LNG spill in a city like Philadelphia, if the LNG were to enter a confined subterranean system, like that provided by a stormwater system, would call for an evacuation of most of the city.

[96] Maria-Monika Metallinou, *Liquefied Natural Gas as a New Hazard; Learning Processes in Norwegian Fire Brigades*, SAFETY (Feb. 20, 2019). Attachment 35.

challenge for first responders attempting to address a derailment and breach scenario.[97]

In contrast to the hands-off approach of the EA and the PRIA, the EPA "requires that some 12,500 high-risk chemical facilities provide Worst Case Scenario calculations to local emergency responders." Millar Aff. ¶ 88.[98] Unfortunately, none of the congressional and state-level right-to-know laws from 1986-1990 even apply to the highest risk hazmat cargoes in transportation, where the risks to hazardous materials are even greater considering the incidents that can occur to moving transport versus stationary storage. Ultimately, the number and magnitude of material safety questions left open by PHMSA's proposed rule leave the Agency with no responsible and legal basis on which to proceed with the LNG-by-Rail Rule at this time.

C. The EA Asserts That Rail is Safer Than Truck Transportation of LNG While Completely Failing to Establish Comparable and Particular Risks of LNG Unit Trains.

Without merit, and in part due to the lack of research, the EA insists that bulk shipments of LNG-by-rail tank car will be safer and more environmentally sound than by existing tank trucks, asserting that "highway transportation may present a greater risk of accident and release of LNG for each movement." 84 Fed. Reg. at 56971. However, PHMSA cites no evidence to support this claim other than that trucks carrying LNG have been in accidents and had spills. *Id.* at 56972. The EA acknowledges that incidents involving rail tank cars can lead to "considerably larger" releases as compared to hazard areas arising from incidents involving LNG cargo trucks, due to the larger volume of LNG in each tank car compared to that in a truck cargo tank. *Id.* In fact, the EA notes that eight truck-based transportation incidents occurred in the United States in the 12-year period from 2005 to 2017, spilling 11,296 gallons of LNG. *Id.* at 56971-72. Although these truck-based spills cumulatively represent only about one-third of the volume of a single DOT-113 tanker, *see id.* at 56966

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[97] Village of Barrington, Illinois, Comment Letter on Proposed Rule: Hazardous Materials: Liquefied Natural Gas by Rail, Docket PHMSA-2018-0025, at 8, (December 9, 2019), https://www.regulations.gov/document?D=PHMSA-2018-0025-0080. *See also* Millar Aff. ¶ 94 ("Perhaps with the boom in North American LNG infrastructure, the DOT team and consultants drafting the soon-to-be published ERG 2020 may consider adding such a specific focus on ER needs for LNG transportation releases," considering that "[t]his lack of specific guidance has troubled local officials in corridor cities along major US rail routes.").

[98] *See also* U.S. ENVTL. PROT. AGENCY, *Risk Management Plan (RMP) Rule Overview*, https://www.epa.gov/rmp/risk-management-plan-rmp-rule-overview (last visited Jan.8, 2020).

n. 8, and although LNG has never been transported by tanker car, the EA still inexplicably suggests that rail-based LNG is "advantageous" over truck-based transportation when comparing the "miles traveled" *Id.* at 56972. This conclusion is undercut by PHMSA's own admission that "[i]t is difficult to estimate the failure rate of the DOT-113 tank car in derailments because railroads are not required to report incidents to PHMSA or FRA unless they meet a baseline threshold." *Id.*

Worse, the EA reaches this determination without seriously considering other related hazards raised by these comments, particularly the risk of cascading failures posed by the unit train model. The EA offers three scant sentences on the subject, including such specific insights as "the special design of the DOT-113 tank car reduces the probability of cascading failures." 84 Fed. Reg. at 56974. PHMSA offers no support or scientific basis for this conclusion, and in fact subsequently concedes that "where multiple DOT-113 specification tank cars are transported in a block or unit train configuration, fire/radiant heat exposure or cryogenic temperature exposure could potentially lead to the release of material or failure of otherwise undamaged tank cars." *Id.* Unlike PHMSA's proposed LNG-by-Rail rule, which contemplates concentrated routing through population centers, LNG trucks often travel to liquefaction facilities located in remote areas from remote natural gas mining that is not well serviced by pipelines. *See* Millar Aff. ¶ 111. The EA ignores this distinction as well.

PHMSA has demonstrated elsewhere that it is capable of studying an issue, as with its more robust research regarding stationary LNG facilities. It is clear that historically, PHMSA believed that more robust research was needed to assess the potentially high-risk releases from fixed LNG facilities, which have been located at significant distances from populations. Here, PHMSA provides no justification for why it has declined to conduct a similar robust risk research effort when it comes to approving LNG-by-rail transportation, a higher risk undertaking than stationary LNG storage. These trains will potentially carry LNG on over 100-car-plus unit-trains directly through major U.S. cities that are densely populated.

Therefore, the EA acknowledges the potential for either truck or rail transportation of LNG to cause injury, death, property destruction, and environmental harm, and that the scope of potential injury and death is greater for rail travel because of the higher volume of LNG carried in each tank car, but still counsels against truck-based transportation as having a higher propensity for accidents. 84 Fed. Reg. at 56972. PHMSA has studiously declined to consider the advantageous re-routing potentials that LNG truckers have available to them in avoiding major populated areas with their many congestion points in comparison with railroads that have far fewer options for

protective urban re-routing and which, under the proposed rule, would cement their right to impose high risks on even the largest cities.

The record simply does not furnish an adequate basis to reach PHMSA's conclusion that rail transport of LNG is as safe as or safer than truck transport. Until PHMSA has assembled a sound basis to determine that rail-based LNG transportation can be conducted safely—adequately addressing *all* of the numerous vulnerabilities implicated by this proposal—PHMSA cannot proceed with the LNG-by-Rail Rule without violating its mandate to ensure "safe transportation."

III. The proposed rule violates NEPA as the Environmental Assessment included in the NPRM is grossly inadequate and a full Environmental Impact Statement is needed to address public safety and risks of rail transport of LNG in populated areas.

Given all of the admitted unknowns by PHMSA in this rulemaking in the EA and NPRM, the known dangers of LNG that PHMSA chose to ignore, and the cumulative lack of analysis, the need for an EIS would seem to be obvious. Specifically, NEPA requires the preparation of an EIS, as opposed to a mere EA, when an action's "effects on the quality of the human environment are likely to be highly controversial," and/or "are highly uncertain or involve unique or unknown risks." 40 C.F.R. § 1508.27(b)(4)–(5). The D.C. Circuit has found that it is not "sufficient for the agency merely to state that the environmental effects are currently unknown." *Found. on Econ. Trends v. Heckler*, 756 F.2d 143, 155 (D.C. Cir. 1985); *see also W. Watersheds Project v. USDA APHIS Wildlife Servs.*, No. 17-CV-206-BLW, 2018 WL 3097016, at **8-12 (D. Idaho June 22, 2018) (holding that controversy and uncertainty of action warranted an EIS).

The preparation of an EIS is mandated where "uncertainty may be resolved by further collection of data, or where the collection of such data may prevent speculation on potential effects." *National Parks & Conservation Ass'n v. Babbitt*, 241 F.3d 722, 732 (9th Cir. 2001) (abrogated on other grounds); *see also Blue Mountains Biodiversity Project v. Blackwood*, 161 F.3d 1208, 1213-14 (9th Cir. 1998); *Sierra Club v. United States Forest Service*, 843 F.2d 1190, 1193 (9th Cir. 1988). Furthermore, the assertion that gathering the appropriate data and analyzing it would be too difficult is an impermissible basis for foregoing an EIS. *See, e.g.*, *Seattle Audubon Soc'y v. Moseley*, 798 F. Supp. 1494, 1497 (W.D. Wash. 1992) ("Difficulty of compliance will not permit an agency to avoid its duties under NEPA"); *Calvert Cliffs' Coordinating Comm., Inc. v. U.S. Atomic Energy Comm'n*, 449 F.2d 1109, 1115 (1971) ("Considerations of administrative difficulty, delay or economic cost will not suffice to strip [NEPA] of its fundamental importance"); *Laurel Heights*

Improvements Ass'n v. Regents of Univ. of Cal., 47 Cal. 3d 376, 399 (1988) ("We find no authority that exempts an agency from complying with the law, environmental or otherwise, merely because the agency's task may be difficult").

There is good reason for this clear line of case law requiring an EIS where there is a certain degree of uncertainty regarding the environmental consequences of a federal action. The Council on Environmental Quality ("CEQ") regulations, 40 C.F.R. §§ 1500.1–1518.4, promulgated with the "purpose [of] tell[ing] federal agencies what they must do to comply with [NEPA] procedures and achieve the goals of [NEPA]," have been interpreted by the Supreme Court as "entitled to substantial deference." *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 355 (1989) (citing *Andrus v. Sierra Club*, 442 U.S. 347, 358 (1979)). These regulations mandated worst-case analyses until 1986, when CEQ replaced the former 40 C.F.R. § 1502.22, which required an agency to include a "worst-case analysis and an indication of the probability or improbability of its occurrence" in the EIS any time relevant information was either unavailable or too costly to obtain. Now, when an agency is faced with incomplete or unavailable information, the EIS must include "a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and . . . the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community." 40 C.F.R. §§ 1502.22(b)(3), (4) (2007). The regulation therefore prudently "requires disclosure and analysis of the 'costs of uncertainty -- i.e., the costs of proceeding without more and better information."' *Southern Oregon Citizens Against Toxic Sprays, Inc. v. Clark*, 720 F.2d 1475, 1478 (9th Cir. 1983) (quoting *Sierra Club v. Sigler*, 695 F.2d 957, 970 (9th Cir. 1983)).

Here, PHMSA makes numerous unsupported statements and statements asserting a great deal of uncertainty due, in part, to a lack of available LNG-related risk information and in part to the agency's failure in information gathering in the environmental assessment. For example, PHMSA "decided not to propose operational controls because there is not sufficient data about the potential movements of LNG by tank car." 84 Fed. Reg. at 56969. PHMSA does not note any effort that it made to gather such information from the railroads or anyone else. PHMSA also fails to "estimate the failure rate of the DOT-113 tank car in derailments because railroads are not required to report incidents to PHMSA or FRA," and yet again, PHMSA decided to proceed with rulemaking with no apparent attempts to request such data. *Id.* at 56972. Similarly, PHMSA found that the "hazard distance of a vapor cloud dispersion of LNG is difficult to predict," *id.* at 56974, despite the availability of models that could predict such action. Millar Aff. ¶¶ 18, 42. Nor does PHMSA attempt to quantify the risk of a cascading

failure of multiple DOT-113 tank cars carrying LNG, nor the damage that would be caused should such a failure occur. 84 Fed. Reg. at 56974. PHMSA argues that "[i]t is not possible to state with certainty whether a BLEVE is possible in the case of a LNG tank car derailment, and what conditions need to be present for such an event to occur." *Id.* However, two recent Spanish trucks carrying LNG experienced a BLEVE, so such an accident is certainly possible. Millar Aff. ¶ 51. PHMSA does not state what study it undertook nor what data it considered in reaching the opposite conclusion.

PHMSA also ignored the many known dangers about LNG. PHMSA failed to analyze the risks of LNG spilling into a confined system (such as a stormwater, subway, or sewage system) and the possible damage that could occur. PHMSA mentions the possibility of a cascading failure of an LNG unit-train, but fails to look at any of the possible consequences or attempt to calculate the potential area surrounding such a disaster that could be destroyed. 84 Fed. Reg. at 56974. Finally, given the opposition and concern of emergency responders, communities, safety agencies like the NTSB, and environmental groups, this action is certainly controversial and warrants an EIS. A finding of no significant impact cannot be allowed to stand due to PHMSA's choice to ignore and downplay the known potential consequences.

In short, PHMSA's finding of no significant environmental impact is not supported by PHMSA's environmental assessment. PHMSA's lack of knowledge or curiosity about possible impacts is no excuse for it to fail to carry out its fundamental duties under NEPA. PHMSA's failure to evaluate these impacts in its NEPA document render the rule change arbitrary, capricious, or otherwise not in accordance with law. Furthermore, even if the agency cannot specifically quantify the likelihood of various risks from the transport of LNG, that does not excuse them from this duty under Section 1502.22. *See San Luis Obispo Mothers for Peace v. Nuclear Regulatory Comm'n*, 449 F.3d 1016, 1032 (9th Cir. 2006) (rejecting arguments that a risk must be quantifiable to trigger a NEPA analysis pursuant to 40 C.F.R. § 1502.22).

IV. The PRIA's cost and benefits analysis is inadequate and cannot be relied on for the basis of rulemaking.

As highlighted in sections I-II, *supra*, the PRIA lacks any meaningful analysis as to the expected costs and benefits of the proposed rule. The PRIA asserts that the proposed rule "would allow for expanded production opportunities," PRIA at 27, without any analysis as to what those opportunities are. It admits that "[i]t is difficult to adequately forecast the future volume of shipments of LNG-by-rail," *id.*, and so does not even attempt to make such a forecast. As no forecast is made, the PRIA's

predictions regarding market impacts, potential economic gains, the use of LNG as fuel, home heating fuel switching, emissions, and safety impacts, are all equally speculative without any analysis or study. Pure speculation as to possible market impacts, without citation, is not adequate when PHMSA could have taken the time to investigate the potential market. PHMSA has a statutory duty to seek out the relevant information.[99] For example, PHMSA, rather than simply relying on the AAR petition that there is a " 'commercial interest' in LNG by rail," PRIA at 19 (quoting AAR Petition, could have approached suppliers and consumers of LNG and requested information on the market potential. Willfully choosing to remain ignorant about the potential market size is not an excuse to proceed with rulemaking on the justification that PHMSA does not have better information on which to base its rulemaking in its possession. PHMSA does not have the discretion to finalize the rule on the basis of the PRIA presented in this docket due to these deficiencies.

V. The Environmental Assessment fails to analyze greenhouse gas emissions and climate impacts of the proposed NPRM and thus violates PHMSA's duty under the National Environmental Policy Act.

PHMSA's environmental review pursuant to NEPA must also address the likely upstream and downstream impacts of transporting LNG-by-rail, including on fracking of natural gas and climate change. The most significant long-term environmental impact of all would be the prolonging of the fossil fuel era with huge LNG investments in North America and worldwide instead of directing those investments to renewable energy resources.

For either an EA or an EIS, the purposes of NEPA require the agency to "consider and disclose" the environmental effects of the actions it certifies. *Baltimore Gas & Elec. Co. v. Nat. Res. Def. Council, Inc.*, 462 U.S. 87, 96 (1983). So long as the agency takes a "hard look" at the environmental consequences, NEPA "does not mandate particular results." *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989). NEPA's "hard look" requires "discussion of the 'significance' of [an] indirect effect, *see* 40 C.F.R. § 1502.16(b) (2018), as well as 'the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions.'" *Sierra Club v. Fed. Energy Regulatory Comm'n*, 867 F.3d 1357, 1374 (D.C. Cir. 2017) (internal citation omitted).

[99] *See* Section V.B., *infra*.

Indirect effects "are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable." 40 C.F.R. § 1508.8(b); *see New York v. Nuclear Regulatory Comm'n*, 681 F.3d 471, 476 (D.C. Cir. 2012). An environmental impact is reasonably foreseeable "if it is 'sufficiently likely to occur that a person of ordinary prudence would take it into account in reaching a decision.'" *Mid States Coal. for Progress v. Surface Transp. Bd.*, 345 F.3d 520, 549 (8th Cir. 2003) (internal citation omitted). Implicit in this requirement to analyze foreseeable effects is a duty to engage in "reasonable forecasting." *Scientists' Inst. for Pub. Info., Inc. v. Atomic Energy Comm'n*, 481 F.2d 1079, 1092 (D.C. Cir. 1973). However, here, PHMSA failed to account for the context and intensity of the upstream and downstream emissions impacts resulting from the NPRM. *See* 40 C.F.R. § 1508.27; *see also Anderson v. Evans,* 314 F.3d 1006, 1021 (9th Cir. 2002) (holding that substantial questions about one of the intensity factors was sufficient to require an EIS).

The indirect effects inquiry is wide-ranging. Specifically, under this standard, courts have required federal agencies to consider the indirect effects of energy-related transportation projects. In *Mid States*, for example, because a new rail line provided a more direct route from coal mines to power plants, the court held that NEPA required the Surface Transportation Board to consider the downstream impacts of burning the coal. *Mid States*, 345 F.3d at 549 ("[I]t is reasonably foreseeable – indeed, it is almost certainly true – that the proposed project will increase the long-term demand for coal and any adverse effects that result from burning coal."); *see also Border Power Plant Working Grp. v. Dep't of Energy*, 260 F. Supp. 2d 997, 1030 (S.D. Cal. 2003) (holding air quality impacts of Mexican power plant that would export electricity to the United States over new transmission line were reasonably foreseeable result of constructing transmission line).

Accordingly, "[t]he impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impacts analysis that NEPA requires agencies to conduct." *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1217 (9th Cir. 2008), citing 40 C.F.R. § 1508.7 (cumulative impact is "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency . . . or person undertakes such other actions"); *see also id*. at 1216 (cumulative impacts analysis inadequate where agency failed to "discuss the actual environmental effects resulting from [greenhouse gas] emissions") (emphasis in original).

The D.C. Circuit recently ruled in *Sierra Club*, 867 F.3d at 1371-1372, that NEPA required the Federal Energy Regulatory Commission to consider the indirect but

reasonably foreseeable impacts of natural gas pipelines which included the downstream greenhouse gas emissions ("GHG") resulting from burning of gas transported by the pipeline in its NEPA review. Although the Commission had claimed that it lacked information regarding the amount of gas that would be burned downstream, the Court found that the agency could "make educated assumptions" about use of gas based on its knowledge of the general capacity of the pipeline. *Id.* at 1374.

Applying *Sierra Club*, federal district courts in other jurisdictions reached similar results. For example, in *San Juan Citizens All. v. U.S. Bureau of Land Mgmt.*, 326 F. Supp. 3d 1227 (D.N.M. 2018), the court rejected BLM's claim that "consumption is not 'an indirect effect of oil and gas production because production is not a proximate cause of GHG emissions resulting from consumption.'" *Id.* at 1242. Instead, the court ruled that BLM's "statement is circular and worded as though it is a legal conclusion…[and] it is contrary to the reasoning in several persuasive cases that have determined that combustion emissions are an indirect effect of an agency's decision to extract those natural resources*." Id.; see also W. Org. of Res. Councils v. U.S. Bureau of Land Mgmt.*, No. CV 16-21-GF-BMM, 2018 WL 1475470, *13 (D. Mont. Mar. 26, 2018), *appeal dismissed*, No. 18-35836, 2019 WL 141346 (9th Cir. Jan. 2, 2019) (finding that NEPA requires consideration of environmental consequences of the downstream combustion of the coal, oil and gas resources potentially open to development under agency plan within the NEPA document).

In *San Juan*, the court continued that "it is erroneous to fail to consider, at the earliest feasible stage, 'the environmental consequences of the downstream combustion of the coal, oil and gas resources potentially open to development' under the proposed agency action." *San Juan*, 326 F. Supp. 3d at 1244. Accordingly, the court found that BLM's action was "arbitrary" due to its failure to estimate the amount of GHG emissions which will result from consumption of the oil and gas produced as a result of the development of wells in the leased areas*. Id.; see also Montana Envtl. Info. Ctr. v. U.S. Office of Surface Mining*, 274 F. Supp. 3d 1074, 1097-99 (D. Mont. 2017), *amended in part, adhered to in part sub nom. Montana Envtl. Info. Ctr. v. U.S. Office of Surface Mining*, No. CV 15-106-M-DWM, 2017 WL 5047901 (D. Mont. Nov. 3, 2017); *Dine Citizens Against Ruining Our Env't v. U.S. Office of Surface Mine Reclamation and Enforcement*, 82 F. Supp. 3d 1201, 1213 (D. Colo. 2015), *Dine Citzens Against Ruining our Env't v. U.S. Office of Surface Mining Reclamation & Env't*, 643 F. App'x 799 (10th Cir. 2016).

PHMSA's obligations under NEPA extend beyond its jurisdiction under the Natural Gas Act. For example, in *Save our Sonoran v. Flowers*, 408 F.3d 1113 (9th Cir. 2005), the court explained:

> Although the Corps' permitting authority [under the Clean Water Act] is limited to those aspects of a development that directly affect jurisdictional waters, it has responsibility under NEPA to analyze all of the environmental consequences of a project. Put another way, while it is the development's impact on jurisdictional waters that determines the scope of the Corps' permitting authority, it is the impact of the permit on the environment at large that determines the Corps' NEPA responsibility. The Corps' responsibility under NEPA to consider the environmental consequences of a permit extends even to environmental effects with no impact on jurisdictional waters at all.

Id. at 1122. Therefore, PHMSA cannot shirk its duty to examine the upstream or downstream climate change impacts resulting from its action by claiming the causes of the alleged environmental impacts fall outside of its jurisdiction. The NEPA requirement to consider direct, indirect, and cumulative effects, 40 C.F.R. §§ 1508.7, 1508.8, "calls for the disclosure of the full range of effects that flow from the action*, regardless of the ability to control or regulate those effects*." *See also Mid States Coal. for Progress v. Surface Transp. Bd.*, 345 F.3d 520, 550 (8th Cir. 2003) (requiring evaluation of indirect effects of railway, although other agencies regulate downstream sources that would burn coal).

PHMSA's analysis – or utter lack thereof – of GHG emissions violates NEPA in at least three ways. First, PHMSA violated NEPA by failing to analyze the impact of GHG emissions and climate change despite the clear connection between the activities authorized in the proposed rule change and the release of greenhouse gases. Second, PHMSA violated NEPA by failing to request any information from the applicant or other parties with relevant data regarding downstream and upstream GHG emissions. Third, PHMSA violated NEPA by failing to account for, or otherwise examine, the induced development of additional production, transportation, and combustion of natural gas liquids ("NGLs") as a result of the NPRM.

A. PHMSA Violated NEPA By Failing To Account For Or Analyze Greenhouse Gas Emissions Resulting From The Fugitive Emissions and Combustion Of LNG Transported in DOT-113 Tank Cars.

There is no doubt that the activities authorized in the NPRM will result in the fugitive release or combustion of LNGs that will emit significant quantities of GHGs into the atmosphere. Indeed, the eventual combustion of LNG is one of the purposes

behind the Association of American Railroad's petition, and the fugitive release of GHGs during transportation is a recognized and inevitable consequence of authorizing this type of transportation method. The U.S. Court of Appeals for the District of Columbia Circuit has now multiple times instructed the Federal Energy Regulatory Commission that the GHG emissions caused by the reasonably foreseeable release or combustion of natural gas transported through a pipeline is an indirect effect that must be considered pursuant to NEPA. *Birckhead v. FERC*, 925 F.3d 510, 518-19(D.C. Cir. 2019); *see also Sierra Club*, 867 F.3d at 1371-72. The same must true for LNG transported via rail.

However, PHMSA failed to analyze the GHG emission and climate impacts resulting from the activities authorized in the NPRM. PHMSA does not even attempt to quantify the emissions, let alone examine their context and intensity as required by NEPA. Instead of collecting the data and performing the appropriate modeling, PHMSA fleetingly mentions GHG emissions a single time with regard to a comparison of train versus truck engine emissions. Even in that context the emissions were neither quantified nor meaningfully examined. *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1223 (9th Cir. 2008) (agency's conclusion that a reduction "in the growth of carbon emissions would not have a significant impact . . . was unaccompanied by any analysis or supporting data").

Furthermore, a recent study from the Massachusetts Institute of Technology published in *Environmental Research Letters* warns that current methods of controlling methane leaks must improve 30% to 90% over the next decade for natural gas to be an effective part of U.S. efforts to meet GHG reduction goals.[100]

The study considered multiple scenarios to look at the scale of methane mitigation needed if natural gas is relied on to cut carbon dioxide-equivalent emissions 32% by 2030 relative to 2005 levels, which is meant to represent a power sector goal that would help enable the US to meet its economy-wide commitments to the Paris Agreement.[101] There is no question that leaks occur at every stage of the supply chain at storage tanks, production wells, and pipelines, and the study surveys leakage estimates

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[100] *See* Magdalena M. Klemun & Jessika E. Trancik, TIMELINES FOR MITIGATING THE METHANE IMPACTS OF USING NATURAL GAS FOR CARBON DIOXIDE ABATEMENT, INSTITUTE FOR DATA, SYSTEMS, AND SOCIETY, MASS. INST. OF TECH., *Environmental Research Letters* (December 16, 2019), at 1.

[101] *Id*. at 7.

that range from 1.5% to 4.9%.[102] Leaks occur at any place where two surfaces meet in a non-welded or otherwise non-bonded manner, which include through valve stems, flanges, threaded connections, pump or compressor shaft seals, or related equipment. Ultimately, the study concluded that existing and new infrastructure "would require substantial reductions in the natural gas leakage rate from today's levels" in order to meet the climate goals identified above.[103] Efforts to effectuate reductions in these leakage levels will "depend on the costs of monitoring, mitigating, and preventing leaks, particularly if aiming for the lowest leakage rates suggested by the dynamic metrics."[104]

Here, PHMSA makes no determination as to whether the leakage rate for the DOT-113 tank car is higher or lower compared to current modes of transportation. Furthermore, PHMSA does not even acknowledge GHG fugitive emissions necessarily occur when using DOT-113 rail cars to transport LNG. There is no question that leakage will occur, the question is how much? This is precisely the type of question NEPA was designed to answer.

Indeed, even the American Petroleum Institute ("API") acknowledges that, "[t]ransportation GHG emissions associated with motor vehicles, vessels, barges, tank trucks, *rail cars or tankers*, should be accounted for in an overall GHG emissions inventory when they are germane to company operations."[105] As API makes clear, not only does leakage occur without fail in this context, but there are recognized methods to estimate the expected GHG leakage.[106] And while commenters do not necessarily endorse this methodology, commenters recognize that API has at least identified a methodology "in order to enable consistent and comprehensive internationally-accepted methodologies to estimate GHG emissions from the liquefied natural gas (LNG) operations segment including its specialized facilities, processing techniques, and associated infrastructure."[107] Here, there is no question that PHMSA never took an inventory of GHG emissions, or even attempted to make an estimate on leakage rates

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[102] *Id*. at 2.
[103] *Id*. at 10.
[104] *Id*. at 9.
[105] AM. PETROLEUM INST., LIQUEFIED NATURAL GAS (LNG) OPERATIONS: CONSISTENT METHODOLOGY FOR ESTIMATING GREENHOUSE GAS EMISSIONS, (May 2015), https://www.api.org/~/media/Files/EHS/climate-change/api-lng-ghg-emissions-guidelines-05-2015.pdf (emphasis added).
[106] *Id*. at 1.
[107] *Id*.

based on API's methodology or any other methodology. This failure is a violation of PHMSA's responsibilities under NEPA.

B. PHMSA Failed To Attempt To Seek Out The Necessary Information To Determine Upstream and Downstream GHG Emissions and Environmental Impacts.

In addition to PHMSA's failure to analyze GHG emissions and their impacts, PHMSA also failed to perform an even more fundamental task required under NEPA, which is to seek out the necessary information to better inform its decision-making. PHMSA's duty to collect this information would include, but is not limited to, requesting the relevant data from interested parties. This is particularly true where the agency does not have a wealth of institutional knowledge in a particular area.

PHMSA's failure to seek out all the appropriate information is a separate but equally dispositive violation of NEPA. Specifically, PHMSA must at least request information regarding the extent of potential increased domestic production and consumption of methane gas that would result under the Proposed Rule in order to comply with NEPA, and as noted above information regarding GHG fugitive emission leakage rates. NEPA "requires the [agency] to at least *attempt* to obtain the information necessary to fulfill its statutory responsibilities." *Birckhead*, 925 F.3d at 520 (emphasis added*); see also Delaware Riverkeeper Network v. FERC*, 753 F.3d 1304, 1310 (D.C. Cir. 2014) ("an agency must fulfill its duties to the fullest extent possible") (citations omitted). Even if the relevant information is unavailable, the reviewing agency has an affirmative duty to seek it out. *See Barnes v. U.S. Dep't of Transp.*, 655 F.3d 1124, 1136 (9th Cir. 2011) ("an agency must use its best efforts to find out all that it reasonably can") (citations omitted); *see also* 40 C.F.R. § 1502.16(b).

Here, PHMSA throws its hands up in the air, and contends that because it is "regulator of hazardous materials packaging safety [it] lacks the expertise to perform a quantitative prediction of how this rulemaking could affect GHG emissions." 84 Fed. Reg. at 569675. This response does not comply with NEPA.

Where a federal agency contended that it was too speculative to reach any conclusions regarding the upstream and downstream emission of GHGs the D.C. Circuit stated it was:

> . . .skeptical of any suggestion that a[n] [] applicant would be unwilling or unable to obtain it if the [agency] were to ask for such data as part of the . . . application process.

Birckhead, 925 F.3d at 520 (D.C. Cir. 2019). Here, PHMSA failed to request or otherwise collect the relevant information from the two most obvious interested parties—the petitioner Association of American Railroads and Energy Transport Solutions, LLC ("ETS"). PHMSA has also failed to request information from API regarding rail tank car leakage rates.

The petitioner for the NPRM is an industry trade group who has a focus on increasing the "productivity of the U.S. freight rail industry."[108] Therefore, the petitioner has a direct interest in the proposed rule change, and could provide useful information with regard to the environmental review of the NPRM. However, PHMSA has yet to request any additional information from the petitioner. PHMSA could also request additional information from ETS, who submitted a special permit application for the transportation of LNG in DOT-113 rail tank cars in 2017.[109] However, PHMSA inexplicably has not asked for information from ETS either. PHMSA's failure to carry out this basic requirement of seeking germane information regarding the proposed regulatory changes violates NEPA. *See Barnes*, 655 F.3d at 1136.

C. PHMSA Failed To Account For Induced Upstream Development And Downstream Emissions Resulting From the Authorization To Transport LNG Using DOT-113 Rail Cars.

In a third violation of NEPA, PHMSA failed to review or even acknowledge the impact of the induced upstream development, and increased consumption of natural gas that will result from the NPRM. The NPRM is the legally relevant cause of new upstream development and downstream emissions. Courts have held that where a project will increase an activity by enabling it to occur or by making the activity more economically attractive, NEPA requires analysis of the effects of the activity's increase. *See e.g.*, *Barnes v. U.S. Dep't of Transp.*, 655 F.3d 1124, 1138-9 (9th Cir. 2011) (requiring study of increased air traffic spurred by new airport runway); *Sierra Club v. Marsh*, 769 F.2d 868, 877-79 (1st Cir. 1985) (requiring consideration of effects of "industrial development" of previously undeveloped and inaccessible island that would be enabled by new port and causeway).

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[108] *See* ASS'N AM. R.R., *About Us*, https://www.aar.org/about-us/ (last visited Jan. 13, 2020).
[109] *See* ETS Application, *supra* n. 8.

Here, there is no doubt that at least the NPRM will make the upstream development more economically attractive. Where "[t]he growth-inducing effects of . . . [a] project are its raison d'etre," that growth must be considered in the NEPA analysis, regardless of whether it is uncertain or depends on further "local and private action." *City of Davis v. Coleman*, 521 F.2d 661, 675, 677 (9th Cir. 1975) (requiring consideration of development enabled by highway project); *see also Friends of the Earth v. U.S. Army Corps of Eng'rs,* 109 F. Supp. 2d 30, 41 (D. D.C. 2000) ("Since the economic development of these areas is an announced goal and anticipated consequence of the casino projects, the Corps cannot claim that the prospect of secondary development is 'highly speculative'"). In *High Country Conservation Advocates v. U.S. Forest Service,* where the Forest Service action at issue would "increase the supply of cheap, low-sulfur coal," the court followed *Mid States* to require the Forest Service to evaluate how "this additional supply will impact the demand for coal relative to other fuel sources, [causing] coal that otherwise would have been left in the ground [to] be burned." 52 F. Supp. 3d 1174, 1198 (D. Colo. 2014). On remand, the Forest Service used a private model comparable to the National Energy Modeling System, concluding that as a result of the project, "the mix of energy sources used to generate the electricity will change," and that these shifts would create quantifiable changes in carbon dioxide emissions. 80 Fed. Reg. 72,665, 72,668 (Nov. 20, 2015).

It is clear that this rulemaking will not merely result in the substitution of one transportation method of LNG for another; rather, PHMSA makes numerous statements throughout its NPRM and supporting documents conceding that the rule change would induce development. For example, PHMSA explicitly states that the rule change is "expected to *expand production opportunities* to the industry . . ." PRIA at 3 (emphasis added). PHMSA further asserts that the "benefits and positive impacts from this proposed rulemaking, include[e] . . . expanded fuel usage . . ." *Id*. at 17. The NPRM concludes that "[a]uthorizing the transport of LNG by tank car via rulemaking has the potential to allow shippers to move a *greater quantity of LNG* more efficiently." 84 Fed. Reg. at 56971 (emphasis added). PHMSA has also stated that using DOT-113 rail cars "will . . . help meet the demand for *increased* LNG exports."[110] Therefore, by PHMSA's own admission increased upstream development and production is casually connected to the NPRM.

[110] Special Permit Evaluation Form, *supra* n. 10, at 7 (emphasis added).

ETS's application to PHMSA for the related Special Permit further supports the conclusion that the NPRM will result in increased upstream development and production. For example, ETS states that approving the Special Permit for the use of DOT-113 rail tank cars will result in "[b]ringing *additional amounts* of LNG to market."[111] ETS further contends that "transporting LNG by rail as authorized by this Special Permit would result in an *increase* in U.S. exports."[112] The only way to "increase exports" and bring "additional" LNG to market is to induce increased production, which of course also results in increased consumption. PHMSA ultimately agreed with ETS on this very point, where PHMSA stated that authorizing the use of DOT-113 rail tank cars may "result in *additional business opportunities* to be realized as a result of the efficiencies of transporting LNG-by-rail and thereby *further incentivize domestic production*."[113]

The comments of the Railway Supply Institute's ("RSI") Committee on Tank Cars ("RSI-CTC") in the special permit docket also states that the authorization of the use of DOT-113 rail cars will support the "growth of the natural gas market in the U.S. and may further incentivize domestic production by enabling natural gas producers to access foreign and domestic markets more efficiently."[114] PHMSA notes that "[s]uch business opportunities could include end-use applications (such as power plants), export facilities, and the associated loading/unloading facilities that would accommodate such developments."[115] That induced upstream production would occur is not surprising considering that PHMSA contends that such increased production "would serve important policy goals of promoting domestic energy production and consumption." PRIA at 18.

Additionally, PHMSA's underlying economic conclusions related to the authorization of the NPRM demonstrate that the rule change will cause increased upstream development and downstream emissions. Indeed, PHMSA notes that "[t]he proposed rule would be expected to result in transportation efficiencies." *Id*. at 17. These transportation efficiencies are created by the fact that "[o]n average, railroads are

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[111] ETS Application, *supra* n. 8, at 9 (emphasis added).
[112] *Id.* (emphasis added).
[113] Special Permit EA, *supra* n. 10, at 21 (emphasis added).
[114] Railway Supply Inst., Comment Letter on Hazardous Materials Safety: Notice of Availability of the Draft Environmental Assessment for a Special Permit Request for Liquefied Natural Gas by Rail, Dkt. No. PHMSA-2019-0100, at 3 (July 8, 2019), https://www.regulations.gov/document?D=PHMSA-2019-0100-1013.
[115] Special Permit EA, *supra* n. 10, at 24.

four times more fuel efficient than trucks." 84 Fed. Reg. at 56971. PHMSA has found that moving "one ton of freight by train would result in 70% less fuel than moving the same freight by truck,"[116]and that "[o]ne tank car can replace almost three truck cargo tank trailers." PRIA at 17. PHMSA also found that there are "also cost savings to be gained from larger capacity and less handling and hence less potential for commodity damage." *Id*.

Consistent with the comments of PHMSA and various interested parties, expert review of the rule change concludes that the "outward shift in [the] supply curve from reduced cost" will result in an "increased quantity of production." ECONorthwest Expert Statement, attached, at 1, 3, 6. Specifically, the report identifies that:

> The mechanism for the increase in quantity due to reduced costs of production would be attributable to lowering costs of production on the margin sufficient that some sources which would be unprofitable to exploit before the cost reduction would become profitable to exploit at the newly reduced costs of production.

Id. at 3. The report notes that this increase in production would be the result of an "expansion of the geography that can profitably be utilized for LNG production, as well as an increase in the well sites that can profitably be operated." *Id.* Furthermore, the report notes that the "proposed rule and associated reductions in the cost of supply will not provide direct benefits to U.S. consumers," because "production ha[s] not been a critical constraint on the supply of natural gas" and therefore lower prices are unlikely. *Id.* at 5.

These increased efficiencies will open or otherwise expand new markets, allowing the distribution of the LNG to "new regions, particularly stranded regions, which lack pipeline service; or emerging regions, such as near chemical plants or feedstock sites, where rail may offer a comparative advantage due to terrain manageability." PRIA at 18. For example, domestically, PHMSA notes that:

> New England, which is a 'stranded' gas market that currently is served by truck delivery of LNG or by waterborne imports . . . could be a candidate for LNG delivery by rail. It is a market with high demand and limited access to the pipeline network. In New England, LNG provides about 8 percent of its total annual gas supply. The nearby states of Pennsylvania,

[116] *Id.* at 15.

> Ohio, and West Virginia currently account for 30 percent of U.S. gas production, which could be more efficiently transported to New England by rail . . . .

PRIA at 20. In other words, but-for the approval of the proposed method of transportation, these markets would not be served with LNG, or remain constrained. Statements from Energy Transfer Solutions provide further evidence of the way in which allowing the broad use of these rail cars will necessarily unlock new markets, thereby spurring more production. For example, ETS states that it "has already received *numerous inquiries* from local distribution companies and other suppliers in natural gas constrained areas of the mid-Atlantic and New England regarding the availability of off-take agreements for quantities of LNG that ETS would ship by rail out of the Liquefaction Facility."[117] The letter further provides that "[a]s is well known, many areas of the mid-Atlantic and New England are severely gas constrained and are facing real challenges in meeting supply requirements."[118] The Association of American Railroads' petition reinforces this point, where the association notes that "customers have expressed interest in shipping LNG by rail from Pennsylvania to New England."[119]

In this context, identifying the location of likely upstream development is well within the capability of PHMSA. For example, historical drilling and permitting activity is an accurate and reasonable indicator for new well-pad development. Prime candidates for new drilling activity are those well-pads that are already permitted by the state, but have not yet been developed. Pennsylvania meticulously tracks such sites, and in Pennsylvania alone there are well over 3,500 undeveloped but permitted well-pads that could feed new markets in New England and abroad.[120]

Furthermore, these permitted well-pads are located in precisely those counties that have been prolific producers of gas, including: Bradford, Lycoming, Susquehanna,

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[117] Energy Transport Solutions, LLC, Comment Letter on Hazardous Materials Safety: Notice of Availability of the Draft Environmental Assessment for a Special Permit Request for Liquefied Natural Gas by Rail, Dkt. No. PHMSA-2019-0100, at 2 (Nov. 1, 2019), https://www.regulations.gov/document?D=PHMSA-2019-0100-3003.

[118] *Id*.

[119] AAR Petition, *supra* n. 1, at 1.

[120] *See* PA. DEPT. ENVTL. PROT., *PA Oil and Gas Mapping*, http://www.depgis.state.pa.us/PaOilAndGasMapping/OilGasWellsStrayGasMap.html (last visited Jan. 13, 2020).

and Tioga Counties.[121] Therefore, not only does PHMSA have information regarding the general region where well-pads would likely be located, the agency has access to localized data on the specific locations of the well-pads.[122] In this light, PHMSA cannot claim that such facts are unknowable.

Transportation efficiencies could also facilitate the access of new international markets that would further drive upstream development activities. Specifically, PHMSA states that:

> There are also many new potential economic gains for the U.S. energy industry, including export opportunities to Europe, Japan, Caribbean, Central American and South American countries. European efforts to import more LNG in the coming years could create another potential opportunity for U.S. producers, as the increased adoption of LNG in smaller economies—such as Poland, Greece, Italy and Lithuania—has opened up new opportunities of U.S. exporters. Japan, being the largest LNG importer in the world, is an additional potential trade partner of the U.S. Industry analysts believe there are commercial opportunities for the U.S. through exports by major Japanese electric and gas utilities and Japanese investment in U.S. LNG infrastructure, mainly U.S. power plants and gas liquefaction export facilities.

PRIA at 19. Therefore, there are both domestic and international markets that are prime candidates to drive an increase in production as facilitated by decreased transportation costs. The potential fuel savings – assuming they are accurate – combined with the fact that one of the constraints on production is the limited or otherwise costly nature of other transportation methods, leads to the inevitable conclusion that allowing the use the DOT-113 rail tank cars will increase production upstream, and result in the burning of more LNG downstream. However, none of this is accounted for in the NPRM.

Furthermore, to the extent that PHMSA contends that expected GHG emissions, or upstream/downstream development are unknowable or too uncertain to reasonably predict, that is yet another NEPA violation. *Robertson v. Methow Valley Citizens Council,* 490 U.S. 332, 349 (1989) ("Simply by focusing the agency's attention on the

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[121] *See* FRACTRACKER ALLIANCE, *12 Month Unconventional Production in PA*, http://ft.maps.arcgis.com/apps/Minimalist/index.html?appid=13601c1dc3f944a88e91fad65ab108ec, (last visited Jan. 13, 2020).
[122] *Id*.

environmental consequences of a proposed project, NEPA ensures that important effects will not be overlooked or underestimated only to be discovered after resources have been committed or the die otherwise cast"). This "well-settled rule" of NEPA demands "that an agency must evaluate foreseeable environmental impacts *even if they are the result of the yet-unknown actions of third parties*." *Brady Campaign to Prevent Gun Violence v. Salazar*, 612 F. Supp. 2d 1, 22 (D.D.C. 2009) (emphasis added).

Specifically, NEPA requires the preparation of an EIS, as opposed to an EA, when an action's "effects on the quality of the human environment are likely to be highly controversial," and/or "are highly uncertain or involve unique or unknown risks." 40 C.F.R. § 1508.27(b)(4)–(5). The D.C. Circuit has found that it is not "sufficient for the agency merely to state that the environmental effects are currently unknown." *Found. on Econ. Trends v. Heckler*, 756 F.2d 143, 155 (D.C. Cir. 1985); *see also W. Watersheds Project v. USDA APHIS Wildlife Servs.*, No. 17-CV-206-BLW, 2018 WL 3097016, at **8-12 (D. Idaho June 22, 2018) (holding that controversy and uncertainty of action warranted an EIS).

The preparation of an EIS is mandated where "uncertainty may be resolved by further collection of data, or where the collection of such data may prevent speculation on potential effects." *National Parks & Conservation Ass'n v. Babbitt*, 241 F.3d 722, 732 (9th Cir. 2001) (abrogated on other grounds); *see also Blue Mountains Biodiversity Project v. Blackwood*, 161 F.3d 1208, 1213-14 (9th Cir. 1998); *Sierra Club v. United States Forest Service*, 843 F.2d 1190, 1193 (9th Cir. 1988). The assertion that gathering the appropriate data and analyzing it would be too difficult is an impermissible basis for foregoing an EIS. *See, e.g.*, *Seattle Audubon Soc'y v. Moseley*, 798 F.Supp. 1494, 1497 (W.D. Wash. 1992) ("Difficulty of compliance will not permit an agency to avoid its duties under NEPA"); *Calvert Cliffs' Coordinating Comm., Inc. v. U.S. Atomic Energy Comm'n*, 449 F.2d 1109, 1115 (1971) ("Considerations of administrative difficulty, delay or economic cost will not suffice to strip [NEPA] of its fundamental importance"); *Laurel Heights Improvements Ass'n v. Regents of Univ. of Cal.*, 47 Cal. 3d 376, 399 (1988) ("We find no authority that exempts an agency from complying with the law, environmental or otherwise, merely because the agency's task may be difficult").

There is good reason for this clear line of case law requiring an EIS where there is a certain degree of uncertainty regarding the environmental consequences of a federal action. The Council on Environmental Quality ("CEQ") regulations, 40 C.F.R. §§ 1500.1–1518.4, promulgated with the "purpose [of] tell[ing] federal agencies what they must do to comply with [NEPA] procedures and achieve the goals of [NEPA]," have been interpreted by the Supreme Court as "entitled to substantial deference." *Robertson v.*

Methow Valley Citizens Council, 490 U.S. at 355 (citing *Andrus v. Sierra Club*, 442 U.S. 347, 358 (1979)). These regulations mandated worst-case analyses until 1986, when CEQ replaced the former 40 C.F.R. § 1502.22, requiring an agency, when relevant information was either unavailable or too costly to obtain, to include in the EIS a "worst-case analysis and an indication of the probability or improbability of its occurrence."

Now, when an agency is faced with incomplete or unavailable information, the EIS must include "a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and ... the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community." 40 C.F.R. §§ 1502.22(b)(3), (4)(2007). The regulation therefore prudently "requires disclosure and analysis of the 'costs of uncertainty - i.e., the costs of proceeding without more and better information."' *Southern Oregon Citizens Against Toxic Sprays, Inc. v. Clark*, 720 F.2d 1475, 1478 (9th Cir. 1983) (quoting *Sierra Club v. Sigler*, 695 F.2d 957, 970 (9th Cir. 1983)).

Here, PHMSA's flimsy statement that it "lacks the expertise to perform a quantitative prediction of how this rulemaking could affect GHG emissions" is no excuse for it to avoid its fundamental duties under NEPA. A combination of statements made by PHMSA, ETS, the Association of American Railroads, and independent experts make clear that the rule change will result in increased upstream development, downstream combustion, and the additional emission of GHGs. PHMSA's failure to evaluate these impacts in its NEPA document render the rule change arbitrary, capricious, or otherwise not in accordance with law. Furthermore, even if the agency cannot specifically quantify the emissions, that does not excuse them from this duty under Section 1502.22. *See San Luis Obispo Mothers for Peace v. Nuclear Regulatory Comm'n*, 449 F.3d 1016, 1032 (9th Cir. 2006) (where the Court rejected arguments that a risk must be quantifiable to trigger a NEPA analysis pursuant to 40 C.F.R. § 1502.22).

Lastly, there exist tools that PHMSA has not deployed to determine the incremental impacts of downstream GHG emissions, including but not limited to the Social Cost of Carbon and ecosystem valuation analysis. PHMSA's failure to use or even mention these tools is a further violation of NEPA.

The Social Cost of Carbon is a scientifically-derived metric to translate tonnage of carbon dioxide or other GHGs to the cost of long-term climate harm and remains generally accepted in the scientific community. *See also* 40 C.F.R. § 1502.22(b)(4) (2018). Cost monetization, as provided by this tool, is appropriate and required when

"alternative mode[s] of [NEPA] evaluation [are] insufficiently detailed to aid the decision-makers in deciding whether to proceed, or to provide the information the public needs to evaluate the project effectively." *Columbia Basin Land Prot. Ass'n v. Schlesinger*, 643 F.2d 585, 594 (9th Cir. 1981). Additionally, several courts and two of the five Federal Energy Regulatory Commissioners have provided full-throated support for using the Social Cost of Carbon. *See, e.g., Mont. Envtl. Info. Ctr. v. U.S. Office of Surface Mining*, 274 F. Supp. 3d 1074, 1097-98 (D. Mont. 2017); *High Country Conservation Advocates v. U.S. Forest Serv.*, 52 F. Supp. 3d 1174, 1190-91 (D. Colo. 2014); *NEXUS Gas Transmission, LLC*, 164 F.E.R.C. ¶ 61,054 at P 61,340 (2018) (Glick, Comm'r, dissenting) ("[T]he Social Cost of Carbon provides a meaningful approach for considering the effects that the Commission's certificate decisions have on climate change."); Rehearing Order (LaFleur, Comm'r, dissenting) at 6 ("[T]he Social Cost of Carbon can meaningfully inform the Commission's decision-making to reflect the climate change impacts of an individual project."). Federal agencies have recognized the use of this tool on project-level basis. *See, e.g., Fla. Se. Connection, LLC,* 162 FERC ¶ 61,233 (2018), at ¶ 37 & n. 76.

Here, the proposed rule change would result in additional emissions of GHGs that must be reviewed and contextualized using the appropriate available tools, including, but not limited to, the social cost of carbon. PHMSA's failure to use or event acknowledge the social cost of carbon is itself an additional violation of NEPA.

VI. The proposed rule fails to analyze impacts to endangered or threatened species and thus violates PHMSA's duty under the Endangered Species Act.

PHMSA must consult with the expert wildlife agencies to ensure the proposed LNG-by-rail regulations are not likely to jeopardize any species protected by the Endangered Species Act (ESA) or adversely affect any designated critical habitat.

In enacting the ESA, Congress recognized that certain species "have been so depleted in numbers that they are in danger of or threatened with extinction." 16 U.S.C. §1531(a)(2). Accordingly, the ESA seeks "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, [and] to provide a program for the conservation of such . . . species." 16 U.S.C. § 1531(b).

Section 7(a)(2) requires federal agencies to consult with the with the National Marine Fisheries Service and the Fish and Wildlife Service ("Services") whenever their discretionary actions "may affect" a listed species or designated critical habitat. 16

U.S.C. § 1536(a); *see also Babbitt v. Sweet Home Chapter of Cmtys. for a Great Or.*, 515 U.S. 687, 692, 115 S. Ct. 2407, 132 L. Ed. 2d 597 (1995); *Karuk Tribe*, 681 F.3d at 1020. The ESA's implementing regulations broadly construe "agency action" to include licensing and permitting programs, 50 C.F.R. § 402.02(c), as well as "actions directly or indirectly causing modifications to the land, water, or air." Id. § 402.02(d).

The regulations governing Section 7 compliance require federal agencies to review their actions at the "earliest possible time" to determine whether they "may affect" listed species or critical habitat. 50 C.F.R. § 402.14. If the determination is made, "formal consultation" is generally required. *Id.* Formal consultation allows agencies to draw on the expertise of "wildlife agencies to determine whether [an] action is likely to jeopardize a listed species" or its habitat, and "to identify reasonable and prudent alternatives" to avoid those harmful impacts. *Karuk Tribe*, 681 F.3d at 1020 (citing *Turtle Island Restoration Network v. Nat'l Marine Fisheries Serv.*, 340 F.3d 969, 974 (9th Cir. 2003)).

The rulemaking at issue constitutes "agency action" within the meaning of Section 7. Under established case law, there is "agency action" whenever an agency makes an affirmative, discretionary decision about whether, or under what conditions, to allow private activity to proceed. Here PHMSA, in coordination with the Federal Railroad Administration (FRA), is proposing changes to the Hazardous Materials Regulations to allow for the bulk transport of LNG in rail tank cars. This rulemaking proposes to authorize the transportation of LNG in the DOT-113C120W specification rail tank car. PHMSA has discretion to influence or change the proposed authorization for the benefit of a protected species – first of all, it is not in any way obligated or required to allow the transportation of LNG-by-rail. And if it were to authorize the activity, it could put constraints on it for the benefit of protected species – for example, by prohibiting LNG-by-rail within particularly sensitive critical habitat, or placing safety requirements on the rail cars in order to ensure an accident could not endanger imperiled species.

The proposed activity undoubtedly "may affect" an ESA-listed species or designated critical habitat. The "may affect" determination is a low threshold for triggering consultation. *Cal. ex rel. Lockyer v. U.S. Dep't of Agric.*, 575 F.3d 999, 1018 (9th Cir. 2009). "'Any possible effect, whether beneficial, benign, adverse or of an undetermined character,'" triggers the requirement. *Id.* at 1018-19 (quoting 51 Fed. Reg. 19,926, 19,949 (June 3, 1986)) (emphasis in *Lockyer*). The Secretaries of Commerce and the Interior have explained that "[t]he threshold for formal consultation must be set sufficiently low to allow Federal agencies to satisfy their duty to 'insure'" that their actions do not jeopardize listed species or adversely modify critical habitat. 51 Fed. Reg.

at 19,949. An agency may avoid the consultation requirement only if it determines that its action will have "no effect" on a listed species or critical habitat. *Sw. Ctr. for Biological Diversity v. U.S. Forest Serv.*, 100 F.3d 1443, 1447-48 (9th Cir. 1996).

Here, the proposed activity would allow LNG in rail cars to pass through critical habitat of numerous species throughout the country, and an accident is any of those areas could have catastrophic consequences. PHMSA must consult with the expert wildlife agencies to ensure the proposed LNG-by-rail regulations are not likely to jeopardize any listed species or adversely modify any designated critical habitat.

CONCLUSION

For these reasons, PHMSA's proposed rule does not comply with NEPA or PHMSA's obligations to ensure the safe transport of hazardous materials under the Hazardous Materials Transportation Act.

We therefore respectfully request PHMSA to withdraw the proposed rule or, at the least, conduct a full Environmental Impact Assessment ("EIS") to correct these inadequacies and legal errors and reconsider its conclusions on the basis of the corrected information. Please contact us with any questions.

Sincerely,

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Affidavit of Fred Millar

Before me, the undersigned Notary Public, personally appeared Fred Millar, who, after being by me duly sworn, upon his oath stated and deposed as follows:

QUALIFICATIONS & INTRODUCTION

1. My name is Fred Millar, I am over 18 years old, and I make this affidavit based on my personal knowledge, professional skills, and education. I have worked on nuclear waste transportation, industrial chemical transportation, crude oil trains, LNG transportation, accident prevention, emergency planning and homeland security.[1]

2. Additionally, I served as consultant to major U.S. chemical and oil worker unions, environmental groups, insurance companies, and university and governmental bodies.

3. I have analyzed safety problems and advocated for national and grassroots action strategies for chemical hazard assessment, emergency planning, accident prevention, and public access to information.

4. I have worked with citizens, workers, and public officials in scores of petrochemical communities on generic industrial safety issues and on existing risk documents such as worst-case accident scenarios. I have pressed for many specific safety improvement activities by companies and governments, commented on many federal rulemakings, and testified in Congress and local city councils.

5. In the post-Bhopal disaster period,[2] while working with allies, I worked to develop new legislation enacting a major new federal regulatory program on prevention of chemical facility accidents. The resulting 1990 legislation, the Clean Air Act Amendments of 1990, Section 112 r, even until now requires the provision to US EPA of several types of important chemical safety risk information from the 12,500 most dangerous US chemical facilities (the EPA regulations do not cover LNG facilities nor transportation). The legislation also established the US Chemical Safety and Hazard Investigation Board, modeled on the longstanding and respected independent National Transportation Safety Board (NTSB). The latter NTSB, on Dec 5, 2019, submitted an incisive 5-page comment on this proposed rule docket that strongly raises many of the same key public safety issues that this Statement addresses and the NTSB comment adds safety recommendations from the Board's professional staff research.[3]

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[1] Fred Millar Curriculum Vitae, Attachment 1.

[2] *See generally* Alan Taylor, *Bhopal: The World's Worst Industrial Disaster, 30 Years Later*, THE ATLANTIC (Dec. 2, 2014), https://www.theatlantic.com/photo/2014/12/bhopal-the-worlds-worstindustrial-disaster-30-years-later/100864/.

[3] NAT'L TRANSP. SAFETY BOARD, Comment Letter on Proposed Rule: Hazardous Materials: Liquefied Natural Gas by Rail, Docket No. PHMSA-2018-0025, at 3 (Dec. 5, 2019), https://www.regulations.gov/document?D=PHMSA-2018-0025-0078 [hereinafter NTSB Comments], Attachment 2.

6. I have written this Expert Statement in the context of the Notice of Proposed Rulemaking (NPRM) dated October 24, 2019 from the Pipeline and Hazardous Materials Safety Administration (PHMSA) to permit bulk transportation of Liquefied Natural Gas (LNG) in rail tank cars in the US rail system, as well as of the closely related supporting documents such as the 24-page PHMSA Preliminary Regulatory Impact Analysis, dated October 2019. The context also includes documents from the previous PHMSA Docket No. PHMSA-2019-0100 ("special permit docket"), on the ETS Petition for Special Permit 20534, two of which documents PHMSA has included as official documents in the instant NPRM Docket No. PHMSA-2018-0025. Accordingly, this expert statement shall also refer to key assertions from the previous docket, especially from the 32-page Final Environmental Assessment (EA) from that Special Permit docket which has been included in the rulemaking docket with ID PHMSA-2018-0025-0077, which, as here, included a declaration that no full Environmental Impact Statement was necessary for bulk transport of LNG by rail tank cars in the US. In DOT regulatory history, Special Permits are often precursors on the way to full NPRMs.

7. Despite some 2,900 mostly negative comments on the special permit docket, PHMSA issued on December 5, 2019 a two-year Special Permit 20534 to ETS that permits up to 100 LNG rail cars per day, only between Wyalusing PA and Gibbstown NJ. The Permit requires from ETS a plan for potential growth into unit train operations. No route is specified, and only minimal operating restrictions are included. Notably, the High Hazard Flammable Train operating restrictions mandated for crude oil trains are not included, although emergency response training of train crews and emergency responders along the route is. Even if the High Hazard Flammable Train operating restrictions were included, there is good reason to think that they would not be protective against tank car breaches. In a recent rural Saskatchewan derailment, of 33 derailed flammable crude oil tank cars (reportedly all of them the new DOT-117 design and CPC-1232s rail cars which have been improved as a result of more stringent regulation), 19 of them released their whole cargoes.[4] The 2004 Professional Railroad Atlas of North America shows the most likely route for trains subject to the special permit includes a Class I railroad (Norfolk Southern) and at least one short line (RBMN), and routing through major population centers, including Allentown, Reading, and Philadelphia.

8. A full Environmental Impact Statement (EIS) is needed in this rulemaking to address what the United States Federal Railroad Association (FRA) has termed the "unique safety risks" of LNG rail transport in populated areas.[5]

9. The proposed rule would allow an unprecedented and abrupt opening of the U.S. mainline rail system to long, heavy, hard-to-handle (possibly more than 100 car) unit trains of LNG, using a 50-year-old rail tank car design, which has never before been authorized for LNG service.

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[4] Guy Quenneville, *U.S. rail carrier reportedly cracked down on same retrofitted tank type involved in fiery Sask. derailment*, CBC NEWS (Dec. 13, 2019), https://www.cbc.ca/news/canada/saskatoon/saskatchewan-rail-tank-car-cp-1.5395111, Attachment 3.

[5] Letter from Karl Alexy, Staff Director, Hazardous Materials Division, Fed. R.R. Admin., to James R. Hertwig, President, Florida East Coast Railway (Mar. 3, 2016), [hereinafter Alexy Letter] Attachment 4.

10. The EIS must also address the likely upstream and downstream impacts of LNG by rail, including the fracking of natural gas, the new terrorism vulnerabilities posed by urban routing of LNG trains, and the risks of methane leakage and climate change.

11. Another catastrophic environmental impact, of course, would be the prolonging of the fossil fuel era with huge LNG investments in North America and worldwide instead of directing those investments to renewable energy resources.

12. The public safety impacts of the current worldwide boom in the LNG industry worldwide have yet to become fully evident.[6]

13. These public safety impacts may become evident relatively soon. As happened very quickly in the abrupt growth of crude oil unit trains across North America during 2012-2015, when there were several highly flammable derailment disasters soon after the introduction of that rail transportation practice. This bears strong similarities to the LNG rail tank and unit train operations which PHMSA proposes to approve with the instant rulemaking.

14. The EA included in this rulemaking lacks a compelling supply-demand analysis showing strong demand for near-term rail shipment of LNG. There seems to be no compelling need for PHMSA to be moving so quickly on issuance of a nationwide rule for LNG transport by 70-cars-plus unit trains of rail tank cars, in the absence of reasonably supporting agency research and development reports in the public safety arena. PHMSA's dangerous haste to permit LNG by rail does seem especially arbitrary given what the EA itself admits is the considerable time the shippers and rail industry will need to build out an LNG market and provide a new fleet of DOT-113s for LNG service. 84 Fed. Reg. 56964, 56967.

15. The agency research and development actions needed before this rulemaking should even proceed include:

    a. a new federally-approved LNG-specific tank car design that meets modern safety standards;

    b. rigorous agency testing of either the existing 50-year-old DOT-113 tank car and/or a proposed new design tank car [as the AAR Tank Car Committee is currently discussing] for survivability in derailment conditions, fire impingement, and collision forces;

    c. evaluation of the railroads' (40 to 100-car-plus) unit train business model, which has proved highly risky in triggering the recent 2012-2015 North American trauma of numerous crude oil unit train derailments and is now proposed for LNG by rail;

[6] *See* Nace, Plante, & Browning, *The New Energy Boom: Tracking Global LNG Infrastructure*, GLOBAL ENERGY MONITOR (June 2019), https://globalenergymonitor.org/new-gas-boom/.

d. adequate consideration of mandating LNG train major safety conditions, including protective urban rerouting, odorization of the cargo, and restrictions on train length and speed; and

e. mandates for adequate railroad-funded emergency response training and equipment for railroad crews and local community emergency responders, including accurate information on potential LNG release consequences and on evacuation needs based on estimates of the distances that LNG rail release vapor clouds can travel downwind into a community before either ignition into an unquenchable hot fire or confined-cloud spontaneous explosions.

NPRM IS UNSUPPORTED BY ROBUST SCIENTIFIC FOUNDATION/LACK OF RESEARCH OF RISKS

16. The EA displays a seriously deficient effort to gather relevant data needed for rational agency action on LNG rail transportation.

17. Because of the large costs and risks of conducting large-scale LNG field research, however, LNG experts have periodically indicated that there has been only limited progress in understanding even some of the most basic factors in the behavior of serious potential LNG releases.

18. Therefore, scientists, companies and agencies have to rely on various competing gas release and dispersion models, each with its own assumptions, limitations and uncertainties, to design, regulate, and provide industry best practice voluntary guidance for the siting and operation of LNG facilities worldwide. Many experts suggest that these models need more field-testing for their validation. They also recognize the important data gaps in the historical record of relevant LNG-specific operations and accidental releases real-world data needed to build valid models. Four dense gas models have been approved for LNG facility siting use by the federal agencies, none specifically for assessing LNG transportation release risks.

19. Based on virtually no data or relevant research, the Preliminary Regulatory Impact Analysis (PRIA) asserts that LNG Rail would not be significantly more dangerous than other flammable cryogenic cargoes already allowed on rail, PRIA at 21, while admitting only that perhaps the new rule could unleash onto the US rail system a large increase over the current volumes of US transportation of cryogenic rail cars carrying LNG.[7] PRIA at 18.

20. Field research is especially needed on both the fire survivability and impact crashworthiness of the 50-year-old design DOT-113 cryogenic tank cars which the rule proposes to authorize for nationwide use.[8] Contrary to DOT assertions that the DOT-113

[7] U.S. DEPT. TRANSP., PIPELINE & HAZARDOUS MATERIALS SAFETY ADMIN., HAZARDOUS MATERIALS: LIQUEFIED NATURAL GAS BY RAIL NOTICE OF PROPOSED RULEMAKING PRELIMINARY REGULATORY IMPACT ANALYSIS, Docket No. PHMSA-2018-0025 (HMR 264), at 21 (Oct. 2019) [hereinafter PRIA].

[8] "Even sturdier trains traveling at speeds of 30 m.p.h. may not be able to withstand punctures. 'When you begin to look at cars that are derailing at speeds of 30, 40 miles an hour, it's very difficult, it's a big ask, to expect that a tank

provides adequate safety, the double-shelled design of the DOT-113 has apparently never been rigorously field tested in rigorous agency field research (which research the current federal documents suggest is only beginning).

21. The EA cites no crash testing or fire testing at all, much less with LNG cargo specifically, of the 50-year-old DOT-113 design tank car proposed for this permit.

22. PHMSA's NPRM cites the 50-year history of all types of cryogenic rail shipments in the DOT-113 tank cars as an adequate basis for rulemaking. 84 Fed. Reg. 56973. But the NPRM does not provide the historical rail traffic volumes data cited elsewhere by DOT, which data is very thin. So the non-LNG cryogenics research provides a very weak statistical basis and is dubiously relevant for assessing future LNG rail risks.

23. The existing nascent federal field research involved the 2017 testing of the shells and Pressure Release Valves (PRVs) only on a jury-rigged ISO container—not tank car—containing nitrogen—not LNG. LNG ISOs have been used for years on trucks and more recently in the FL and AK rail experiments.

24. But that FRA 2017 field test was botched, when the wind blew the underlying propane fire onto only one side of the ISO container instead of "engulfing" it as planned, and FRA's 2018 request for a do-over test was reportedly unfunded. A new do-over ISO container survivability test is reportedly underway, this time with LNG itself as the cargo, and will be followed up, FRA hopes, with some DOT-113 tank car survivability field tests with simulated fire or collision. However, no intermediate test results or firm research program have been available on request.

25. Presumably FRA will be collaborating with AAR in whatever plans that organization, with more accessible industry research funding, may have for survivability testing of the DOT-113. It seems just as likely that AAR will not expend the considerable cost—in light of the dubious market demand for rail tank car shipments—to field test the 50-year-old DOT-113 design. Instead, AAR could choose to focus on the efforts of its Tank Car Committee LNG Task Force to design—and perhaps test—a more robust version with some marginally safer tank car features, such as those on the post-2015 crude oil tank car DOT-117. Of course, these updated features have notoriously failed to contain cargo in recent events, such as the multi-car derailment and fire/explosion only weeks ago in rural Saskatchewan, in which 19 cars lost their entire loads, spilling roughly 400,000 gallons of crude oil.[9] A key cost/benefit and safety consideration in designing safer tank cars, is that mandating more steel in the tank shell will increase the weight of the tank car, and therefore necessarily

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car get hit [and] not be breached,' Karl Alexy, staff director of the Federal Railroad Administration's Office of Safety, said in the National Transportation Safety Board's April forum." Rebecca Leber, *Oil-Train Spills Are Worse Than Ever, and Obama's New Safety Rules Aren't Enough*, NEW REPUBLIC (Jul. 23, 2014), https://newrepublic.com/article/118824/obama-administrations-oil-train-safety-rules-arent-enough.

[9] *See, e.g.*, Guy Quenneville, *Derailed Sask. CP train leaked more than 6 times the amount of oil than 2016 Husky pipeline spill*, CBC NEWS (Dec. 13, 2019), https://www.cbc.ca/news/canada/saskatoon/cp-train-crude-oil-derailment-saskatchewan-1.5393622; David Shield, *'All I could see was flames': Sask. crude oil train derailment fills sky with smoke, fire*, CBC NEWS (Dec. 10, 2019), https://www.cbc.ca/news/canada/saskatoon/cp-rail-derailment-sask-plunkett-guernsey-1.5389011.

reduces the volume of LNG that may be transported per car, due to total maximum weight limitations.

26. By useful historical analogy, in the midst of the 2012-2016 High Hazard Flammable Trains (HHFT) crisis—featuring 16 or so highly publicized North American crude oil and ethanol unit train derailments and fire events, including Lac-Mégantic in which 47 died—the FRA in 2014 did belatedly conduct some survivability testing of the relevant DOT-111 rail cars under simulated crash and pool fire conditions. The rather skimpy research, consisting of six field tests, was nonetheless sobering, as the later statement from FRA's Karl Alexy suggested publicly that building an HHFT tank car to withstand puncture at normal unit train speeds was impossible.[10]

27. By analogy, the 2018 NTSB Accident Report RAR-18/02 on the recent 2017 derailment of an ethanol unit train in rural Iowa, stated that 14 of the 20 derailed tank cars released 322,000 gallons and burned, with a total cost estimated at $4 million. These were the old and notoriously inadequate DOT-111 design tank cars, of approximately the same vintage as the 50-year-old design DOT-113s now hauling a small number of non-LNG cryogenic liquids and proposed for hauling unit trains of LNG. The ethanol (agriculture) industry, unlike the crude oil industry, had prevailed upon Congress to grant it a hugely delayed deadline of 2023/2025 for phase-out of DOT-111 and CPC-1232 tank cars, and NTSB found that by April 2017 only 1/3 of the ethanol fleet was of the newer mandated (although still inadequate) DOT-117 design.[11]

28. The PRIA reveals significant data and safety research gaps in the under-resourced DOT safety agencies (PHMSA and FRA).

29. The DOT agencies do not collect nor provide any historical data on volumes of LNG shipments by truck, and thus there is no way to calculate an accident rate that might be useful—if only by analogy—to LNG rail safety.

30. In any case, PHMSA's classic and comprehensive Kowalewski report from 2009 bluntly concluded that, due in part to industry under-reporting, all the agency's modal accident reporting databases, including for the rail mode, were too deficient to support respectable agency rulemaking.[12]

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[10] Leber, *supra* n. 8.

[11] *See* NAT'L TRANSP. SAFETY BD., DERAILMENT AND HAZARDOUS MATERIALS RELEASE OF UNION PACIFIC RAILROAD UNIT ETHANOL TRAIN, GRAETTINGER, IOWA, MARCH 10, 2017, NTSB/RAR-18/02, at 53 (Oct. 2018), https://www.ntsb.gov/investigations/accidentreports/reports/rar1802.pdf. *See also* Karl Alexy, OFF. SAFETY, FED. R.R. ADMIN., Comparative Analysis of Documented Damage to Tank Cars Containing Denatured Alcohol or Crude Oil Exposed to Pool Fire Conditions (date unknown).

[12] *See, e.g.*, Rick Kowalewski, PIPELINE & HAZARDOUS MATERIALS SAFETY ADMIN., A Data Quality Assessment: Evaluating the major safety data programs for pipeline and hazardous materials safety, at G-2 (NOV. 10, 2009), Attachment 5 ("We rely on industry reporting for our incident data. But the regulated industry has an institutional bias in determining the causes, circumstances, and consequences of failures. . . . Reports from companies also reflect large numbers of blanks and "unknown" data, particularly in the most serious cases—exactly where it is most critical that we have good data. . . . We don't know what our rules cost or what benefit the public gets . . . .").

31. The agencies cite no substantial body of academic research, either, on LNG rail or truck accident consequences or probabilities. *See* PRIA at 13.

32. The agencies have no substantial federal research on LNG transportation safety, as PHMSA admits. *Id.* at 12. FRA research on LNG tank car crashworthiness and on unit trains is said to be "underway." *Id.* at 13. Whatever FRA LNG-related field test results there may be from 2019 work have not been released.

33. For another example, from another DOT transportation safety agency, of lack of substantial DOT agency research on LNG Rail, the DOT Office of Hazardous Materials Safety (OHMS) recently reported an annual R&D budget of some $7.5 million, paltry for oversight of a gigantic national industry presenting significant disaster risks. OHMS staff and some funded research firm staff report that none of the currently funded Broad Area Announcements research projects ongoing include LNG risks in any mode of transportation.

34. The DOT agencies have reportedly not commissioned any full Quantitative Risk Assessment (QRA) (likely to take two years at best) that would be designed to support a future assertion of adequate safety in LNG rail transportation.

35. And despite the availability of gas models and the example of earlier federal field research, the agencies have apparently hired no dense gas dispersion expert modelers to calculate the fire radiation, vapor cloud overland travel or explosion consequences of any set of selected potential LNG by rail releases, begging off in recent documents by saying the calculations would be too "difficult."

36. The recent federal documents and industry consultant studies do concede that an LNG released vapor cloud can travel great distances, hugging the ground, pushed by the wind.[13]

37. PHMSA, in the NPRM and PRIA, asserts that Rail LNG would be safer than the US truck LNG already allowed. However, the agencies rest their comparative conclusions on data from reported LNG and other cryogenic truck accidents in a small selection of recent years.

38. Neither the NPRM nor the PRIA cites any specific agency, academic, consultant or industry association comparison of the disaster risks of LNG by Rail and by truck. They almost never try to estimate the kinds of special hazards for public safety posed by potential rail routing of LNG trains through populated cities, except in one suggestion that LNG Rail releases could engulf buildings near the tracks. 84 Fed. Reg. at 56974.

39. Industry and DOT assert that DOT's AK and FL LNG Rail experiments on small regional rail lines—both by Special Permit from FRA—provide additional safety assurance to support a national rulemaking on LNG by rail tank cars. This argument, provided without details (which are being withheld from public view), cannot be taken seriously. Questions

[13] EXPONENT, ETS MOVEMENT OF LNG IN DOT-113 TANK CARS BY RAIL QUANTITATIVE RISK ANALYSIS (QRA) CONSIDERING DOT-113 TANK CAR POSITION IN TRAIN AND TRAIN SPEED, at 6 (2017), [hereinafter ETS QRA] Attachment 6.

unanswered include amounts being transported, how they are being transported, where they are being transported, and what operational controls are in place.

40. The EA maintains only in a string of weakly supported low-risk assertions that the DOT-113 cryogenics tank car is "robust" without citing any crash or fire test research; that accidental rail LNG releases though potentially serious will be "rare;" that a BLEVE is "highly unlikely;" and that the probabilities of inner tank and outer tank damage are "low." *Id.* at 56972-74.

41. PHMSA and the DOT model safety agencies have historically crafted their safety regulations by relying centrally on PHMSA's own directly relevant data on historical operations and accidents that indicate what kinds of hazmat releases can be expected. PHMSA based its dubious safety assertions in the EA on LNG by rail on a very slim historical data basis of non-LNG rail releases from a rather small U.S. cryogenics industry overall.

42. In order to undergird a set of federal actions (permits, rulemaking, etc.) PHMSA could easily adapt and use—with relatively respectable assumptions, but without performing a full probabilistic QRA—one of the long-approved LNG gas dispersion models (or other models if arguably more adequate) for a set of representative potential LNG rail car releases and publish in an EIS the impact distance results for a selected set of potential LNG rail car releases: pool fires, vapor cloud travel and explosions, and BLEVEs.

NPRM AND EA ERRONEOUSLY DOWNPLAY THE EXTRAORDINARY RISKS OF LNG BY RAIL, INCLUDING KNOWN DEFECTS OF THE DOT-113 TANK CARS

43. The most crucial deficiency in the federal documents, illustrated in the EA throughout, is that while briefly outlining some potential LNG rail release potentials, they severely downplay the unique safety challenges of LNG by rail in general, as well as the significant risks of unit trains in particular.

44. This flies in the face of longstanding concerns from Congress, public officials and the public, about LNG facilities and disaster risk potentials inherent in the transportation of large quantities of LNG. Congress has long mandated that several federal safety agencies share responsibilities in regulating LNG operations, and specifically has advised that LNG facility proponents should seek remote siting. As one former Director of the Energy and Minerals Division of the General Accounting Office put it: "We believe remote siting is the primary factor in safety. Because of the inevitable uncertainties inherent in large-scale use of new technologies and the vulnerability of the facilities to natural phenomena and sabotage, the public can be best protected by placing these facilities away from densely populated areas."[14]

[14] CONGRESSIONAL RESEARCH SERVICE, *Liquefied Natural Gas (LNG) Import Terminals: Siting, Safety, and Regulation* at 19, (Dec. 14, 2009), https://www.everycrsreport.com/files/20091214_RL32205_e95cb50c88dbd56a2c8f706b2d521ef7ae81ee00.pdf, Attachment 8.

45. Most important to underscore, the key is protective distance between the LNG facility and potentially impacted residents or resources.

46. The proposed rule has no mandate for protective re-routing using the multitude of standing railroad interchange agreements, which can allow joint railroad re-routing to avoid in many cases urban areas and sensitive establishments. This rule as it stands would effectively obliterate any principle of protective distance in LNG rail operations.

47. Furthermore, although the rule itself does not contemplate any operational controls, the add-on operational controls included in the already issued Special Permits fall far short of what is required to ensure safe operations. These Special Permit operational control provisions have severe limitations, especially in the context of the overall Trump Administration's vigorous rail safety de-regulation program which has in effect gutted several major rail safety regulations promulgated in recent years. The Special Permit's train control devices required are not as good as Positive Train Control (PTC) would be, nor are the Special Permit's required braking systems as good as electronically controlled pneumatic ("ECP") braking would be (both PTC and ECP requirements have been separately gutted by the current Administration).

48. The content of the LNG training which the Special Permit requires for emergency responders along the rail route is not specified by federal regulation, and instead rests on industry consensus standards. In practice, many LNG training programs seem to use the relatively recent PHMSA-funded training shaped by the National Association of State Fire Marshals. This training is unfortunately very dangerous, since it suggests: a) that LNG rail releases can be "managed" and b) that the fire service should participate in all phases of LNG public discussions as an informed cadre to calm down the irrational citizens worried about LNG disaster risks. The training that is offered does not adequately address the threats that emergency responders would face, nor does it adequately address all of the possible causes of LNG disasters, including terrorism.

49. The significant public safety risks of LNG facilities and transportation have been of concern to the at-risk public, public officials, and scientists for several decades. The highest concern for decades was for the potential miles-long fire radiation impact disasters from imported LNG ship carriers. Now, in this current era, US LNG export facility- and transportation-related risks are of paramount concern.

50. Overall, cryogenic LNG loss-of-containment transportation releases involve serious risks of cold embrittlement of nearby structures and surfaces, fire radiation from high and unquenchable gas cloud fires, and offsite travel downwind of flammable and explosive LNG vapor clouds. *See* EA, 84 Fed. Reg. at 56972-73.

51. Even without serious loss of containment, experts now estimate that LNG containment vessels are subject to overheating and consequent Boiling Liquid Expanding Vapor Explosions (BLEVEs), as seen in two recent Spanish LNG truck BLEVE accidents, which had surprised many LNG experts who had thought such events physically impossible.

52. The DOT agencies' position lists but fails to take into account seriously the combination of all the major features of an LNG Rail release, which presents, in FRA official Karl Alexy's words, "unique safety risks."[15]

53. In what seems arguably the Worst-Case Scenario LNG Rail release, the risk is from a dense cold ground-hugging vapor cloud that can travel far downwind, and then explode spontaneously if "confined." The most recent DOT documents now do admit that a derailment disaster with cryogenics "can result in large quantities of hazardous materials released," 84 Fed. Reg. at 56972, but downplay the risk of the disaster by simply declining to calculate either its consequences (using available gas release/dispersion models) or its probability (using much more controversial QRA models, discussed later).

54. The agencies' own historical data, moreover, showed a high percentage of DOT-113 tank cars with non-LNG cryogenics in fact released their cargoes in derailments. *Id.*

55. The limited data presented by DOT, moreover, suggests sobering tank car release risk issues with non-LNG cryogenic cargoes by rail. Of the 14 instances of DOT-113 railcar damage reported to DOT between 1980 and 2017, a significant percentage—3 of the 14 (21%)—"lost lading from breach of both the outer and inner tanks. This is the most serious type of damage . . . ." *Id.*

56. This high release rate and high volumes of cargo released by the DOT-113 cars are presumably due to the often-high rates of speed of freight trains en route and the subsequent large crush and puncture forces generated in derailments.

57. The PRIA briefly concedes, but bluntly declines to evaluate, the potential for an LNG rail release vapor cloud—which will be 620 times larger than the liquid volumes from releasing tank car(s)—traveling downwind as a ground-hugging, cold, dense cloud that either ignites or becomes confined by entering a stormwater or sewage system and spontaneously explodes, as occurred in the Cleveland LNG storage tank release disaster in 1944 that killed 128.

58. The NPRM and PRIA do not mention or cite explicitly any of the recent science underscoring the potential increased danger of spontaneous explosion resulting from "confining" an unignited LNG vapor cloud, but the documents do not dispute what now appears to be a widespread assumption.

59. The 1987 federal Falcon field test LNG vapor cloud release series provided important information, but it was abruptly aborted when the release in Test 5 unexpectedly blew up the whole test facility.

60. The PRIA, like the NPRM, explicitly avoids the "difficult" detailed discussion of LNG rail release downwind vapor cloud consequences almost completely, and simply asserts that current safety features of the DOT-113 cryogenic rail car and the AAR voluntary guidance

[15] Alexy Letter, Attachment 4, *supra* n. 5.

to member railroads mean that the probability of an LNG release disaster is remote. PRIA at 22.

61. This seems, like several other DOT risk-minimizing assertions, a subjective "engineering judgment" by regulators in the absence of any rigorous risk assessment, a gap which PHMSA consultant David Willauer's March 20, 2019 report underscores by forcefully recommending a full QRA in the immediate future.

62. What little safety-related data the PRIA does present actually highlights the high risks of potential LNG releases in transportation.

63. The PRIA admits that alternative authorizing LNG rail tank car transportation, especially in LNG block train shipment or unit trains, poses the potential for much larger LNG release disasters than do smaller tank truck or ISO truck shipments. PRIA at 22.

64. The most important evasion in the agencies' regulatory risk evaluation is that the PRIA has no discussion of the availability of, or implementation of protective urban hazmat routing, either for rail or for truck shipments of LNG or any other high-risk cargoes. Current federal law and regulations on urban rail hazmat protective routing, promulgated in 2007 following widespread protective routing measures by major US cities including Washington D.C., do not require that railroads prioritize public safety over economic considerations and in fact allows each railroad in its urban route selection to weight 27 new federal "routing factors" as it chooses, with an appallingly minimal federal oversight.

65. Thus, the agency ignores the fact that fatally undermines the agencies' overall assertions that for ultra-hazardous cargoes, truck is less safe than rail: LNG truck shippers and carriers inherently have much more route flexibility and options for avoiding major urban population concentrations than LNG rail shipments will have.

66. Neither DOT nor industry nor state/local entities have systematically tracked—much less reported—the truck routing of LNG, other cryogenic trucks and other high-hazard cargoes, except for high-level nuclear waste, which has long had national Nuclear Regulatory Commission (NRC) packaging and routing restrictions, and mandating armed escorts if travel through cities is unavoidable, e.g., by mainline rail.[16]

67. The NRC has relatively robust safety and security regulations for high level radioactive material transportation containers and routing approvals (the route approvals are kept secret for counter-terrorism reasons) for rail, truck and airplane are robust, and require armed escorts for shipments through high-density populated areas, as well as prior notification of government officials.[17]

68. The 9/11 attacks-related Congressional actions in 2007 included mandates to DOT to evaluate and improve the already established federal system to encourage states to designate approved truck routes for radioactive and non-radioactive hazmat cargoes. A

[16] U.S. NUCLEAR REG. COMM'N, *Frequently Asked Questions and Answers: Spent Nuclear Fuel Transportation* 4, https://www.nrc.gov/waste/spent-fuel-transp-faq.html (last accessed Jan. 8, 2020), Attachment 7.
[17] *Id.* at 3-4.

federal contractor Battelle monitors the state programs and maintains a GIS-based National Hazardous Materials Route Registry for state-designated hazmat routing.

69. The national website for the American Trucking Research Institute (ATRI) reveals that the trucking industry overall, in which speed of delivery means higher profits, is appropriately obsessed with avoiding congestion points across the US. ATRI regularly surveys in detail and publishes the Top 100 Bottlenecks by state in the US.

70. Railroads also have pressures for speedier delivery given their overall comparative record of longer delivery times and more potential long delays than trucking. Incidentally, this implicates safety and terrorism-related factors that are unmentioned in the NPRM, EA, and PRIA.

71. Each railroad owns its rail corridors, moreover, so each strives to maximize its profits mainly by infrastructure improvement spending on those routes and by various schemes for major management efficiencies (recently and notoriously including a push for one-person freight train crews), and by keeping cargoes on its own lines as long as possible in cross-country shipments.

72. No federal or industry report has evaluated the safety, security, and cost-benefit outcomes of the post-2007 federal urban rail hazmat routing law. In any case, LNG would not have been included, as it would not then have been authorized for US rail transport.

73. PHMSA's brief summary displays significant caveats on the adequacy of its data but nonetheless asserts the agency's "belief" that LNG by rail will be safer than LNG by truck:

> Though rare, derailments involving DOT-113 tank cars can result in large quantities of hazardous materials released, which can result from venting or breach of the inner tank shell. These releases can be considerably larger than releases from a CTMV [truck] that travels by highway. Nonetheless, considering that the DOT-113 tank car has a 50-year service history and with the understanding it is possible there are unreported incidents from years past, the safety history is noteworthy. It is difficult to estimate the failure rate of the DOT-113 tank car in derailments because railroads are not required to report incidents to PHMSA or FRA unless they meet a baseline threshold. 49 CFR 171.16 and 225.19. Incident data suggests that incidents involving rail tank cars can lead to higher consequence incidents; however, PHMSA believes that rail transportation is advantageous considering the quantity transported compared to miles traveled.

84 Fed. Reg. at 56972.

74. Perhaps the most illuminating safety-related statements in the EA feature sobering risk analysis results from PHMSA's efforts to cobble together for this EA some kind of respectable transportation history that could be used to make reasonable estimates of future LNG rail accident scenarios and impacts. *See* 84 Fed. Reg. at 56972. PHMSA had to reach far back and try to make conclusions based incorrectly on data from US DOT-113 tank car refrigerated gas shipments of all refrigerated chemicals by rail.

75. A big problem evident in the EA's analysis is that there is a very limited history of incidents with the DOT-113 rail car with any kind of refrigerated liquids. This reflects the very limited number annually of all such cryogenic rail tank car shipments nationally. The EA leaves this important overall data unmentioned. In 2015, only some 12,770 rail cryogenic shipments occurred, according to U.S. Energy Information Administration (EIA) data, a tiny proportion of the 2.5 million railcars annually the AAR estimates for all hazmat rail cargoes. And of those 12,770 annual cryogenic shipments, only 356 were with ethylene cargo; the rest were for carbon dioxide, argon, etc.—and none were with the "forbidden" LNG.

76. However, only 67 of the DOT-113C120W railcars are in service today.

77. Therefore, making statistically respectable estimates, from the skimpy historical record, of the DOT-113 rail cars' likely performance in future derailments is virtually impossible. One can only note bluntly, as the EA does, that releases can occur and that there is no reason to doubt that in a serious puncture the whole refrigerated LNG cargo is likely to be released and promptly vaporize into a cold, dense vapor cloud subject to wind and terrain.

78. No specific data on LNG bulk rail shipments were available because LNG had long been "forbidden" except by special permit from FRA. The EA does not mention the history of any exceptions granted to the ban. The federal safety agencies would no doubt explain this agency ban as a reasonable reaction to LNG's uniquely challenging risks in the U.S. rail environment. The LNG industry maintains it was simply because of no strong demand for bulk LNG by rail.

79. According to the EA, the first derailment that resulted in the breach of an inner tank of a DOT-113 occurred in May 2011 in Moran, Kansas. Three DOT-113C120 specification tank cars containing liquid ethylene sustained damage. Two of the cars were breached in the derailment and initially caught fire, and the other car was mechanically breached with explosives and burned due to the damages it sustained from the derailment. The total quantity of refrigerated ethylene spilled was 44,306 gallons and the total damage estimate was calculated at approximately $231,000 in 2017. The other derailment that caused tank failure occurred in October 2014 in Mer Rouge, Louisiana. The rail tank cars were filled with refrigerated liquid argon. One car was a DOT-113A90W specification tank car authorized by Special Permit and the other was an AAR204W tank car. The total quantity of refrigerated argon spilled was 47,233 gallons and the total damage estimate is calculated at approximately $228,000 (in 2017 dollars). No injuries or fatalities were reported as a result of the release of hazardous materials from either incident. The average quantity spilled per derailment involving the analyzed cryogenic liquids, 45,769 gallons, is approximately ten times greater than the average quantity spilled for all rail incidents involving hazardous materials from 2005 to 2017, at 4,807 gallons.[18]

[18] Letter from Peter DeFazio, Chair, H. Comm. on Transp. & Infrastructure, and Tom Malinowski, Member of Congress, to Howard Elliot, Administrator, Pipeline & Hazardous Materials Safety Admin., at 2 (Dec. 18, 2019), https://transportation.house.gov/imo/media/doc/2019-12-18%20LNG%20by%20Rail%20NPRM%20Comment%20Letter.pdf; 84 Fed. Reg. at 56972.

80. Two accidents hardly provide a respectable database for federal action, and given the limited number of DOT-113C120 cars, having at least 3 of the 67 total cars in existence in a derailment, and of those 3, having 2 of them breach on their own, and having to mechanically breach the third car for safety, is a bad safety record (almost 5% of all DOT-113C120 cars have thus experienced a breach, including all of those involved in derailments). *Id.* (although there are 14 instances of damage to DOT-113 cars identified in the EA, only 3 are directly linked to the DOT-113C120).

81. By contrast to evaluation of transportation risks, PHMSA has conducted robust research on LNG facility risks. PHMSA has undertaken to improve its data collection and analysis methodologies for regulating LNG facilities, when compared to its lack of research for LNG rail transportation.

82. It is also clear that historically, PHMSA believed that more robust research was needed to assess the potentially high-risk releases from fixed LNG facilities, which have historically been located at significant distances from populations. There is no justification for how PHMSA has declined to conduct a similarly robust risk research effort when it comes to approving LNG by rail, which is arguably a similar, if not more dangerous, activity than LNG fixed facilities. These unit trains will potentially carry LNG in trains up to 100-cars each directly through major U.S. cities that are densely populated.

83. In addition to the LNG risk research gaps displayed in the 2019 NPRM and PRIA and in PHMSA's 2019 Willauer Report, LNG-related documents indicating keen awareness of these gaps are prominent in PHMSA's periodic Research and Development national forums, and from the railroad industry trade press, and from the AAR's LNG-related slide presentations beginning in 2016.

84. PHMSA reported in one such forum on April 16, 2015 the $1.4 million budget that had been made available for "LNG Rail Transportation Initiatives," and outlined a list of key agency research projects to begin in early 2016. "Expected Deliverables," with no estimated date shown, were explicitly directed towards producing the key information needed for supporting new LNG rail transportation (i.e., LNG tank car) regulations. This needed research has not been completed, especially not for LNG in rail tank cars.

85. Arguably the most important evidence of the weakness of the railroads' own safety case for LNG Rail using the current DOT-113 cryogenic rail tank car, however, is AAR's brief and breezy comment in the special permit docket. These comments indicate that the rail industry itself along with DOT has significant basic issues with the safety provided by the 50-year-old design of the DOT-113 rail car and have mounted quietly a focused, but decidedly incomplete and possibly derailed, effort to remedy its deficiencies:

> Finally, AAR's Tank Car Committee (TCC) currently has a task force evaluating the DOT-113 specification for LNG at the request of DOT. The task force is discussing potential opportunities for improvement of puncture resistance, thermal protection, insulation, tank thickness, location and types of valves/fittings and protective housing, and other items. Further, the task force is reviewing the work done by the AAR Locomotive Committee (with

> support from the TCC) that developed the LNG tender standards for natural gas as a locomotive fuel. PHMSA and the Federal Railroad Administration are participating on the LNG DOT-113 task force. The TCC will report the results of that review to PHMSA as soon as recommendations are available.

Robert Fronczak, Association of American Railroads, Comment Letter on Notice: Hazardous Materials Safety: Draft Environmental Assessment for a Special Permit Request for Liquefied Natural Gas by Rail, Docket No. PHMSA-2019-0100, at 2 (July 8, 2019).

86. AAR safety assertions, aimed at undermining perceived needs for more LNG Rail safety research, rest essentially on repeated denials of any "unique safety risks" that LNG by rail would present in the US. This term is used forcefully, however, in FRA's Karl Alexy approval letter dated March 3, 2016 to FECR granting agency approval for the Florida LNG rail experiment to begin—using ISO containers on flat cars—only with FRA-specified extra safety conditions:

> The proposed transportation of LNG by rail is a new opportunity for railroads, and a new challenge for safety regulators. No railroad in the Unites States currently transports LNG. LNG is a hazardous material, with temperatures of -260 degrees Fahrenheit at atmospheric pressure. We know any release of LNG in a non-controlled environment is dangerous, but the transportation of large quantities of LNG in a single train present unique safety risks.[19]

87. A key weakness in the PHMSA NPRM/PRIA safety case for LNG-by-rail is that it provides no model calculations or historical data for the dire consequences it suggests could result from releases of either LNG or other cryogenic cargoes, only suggesting in several places briefly (and like the AAR comment, without citing comparative detailed evidence of hazardous cloud distances for LNG and other cryogenic cargoes) that LNG "is as safe or safer than" other cryogenic cargoes. PRIA at 10.

88. The EA never assesses the potential worst-case scenarios of LNG release impact distances for either LNG tank car or ISO container trains. The EA completely ignores this potential, even while proposing to permit the movement of enormous 100-car LNG unit trains as potential terrorist weapons into and through major U.S. cities. EPA, by contrast, requires that some 12,500 high-risk chemical facilities provide Worst Case Scenario calculations to local emergency responders.[20]

89. The EA ultimately underscores the flaws of its public safety argument by compromising weakly, but perhaps usefully on the LNG potential release impact distance question. 84 Fed. Reg. at 56974. The EA very briefly endorses (with no analysis) the Protective Action Distance guidance for flammable cargoes in the DOT Emergency Response Guidebook (ERG), which is highly revered by the North American fire and emergency services. In its generic, simplified "Orange Pages" guides for highly flammable gases (including its Guide

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[19] Alexy Letter, Attachment 4, *supra* n. 5, at 1.

[20] U.S. ENVTL. PROT. AGENCY, *Risk Management Plan (RMP) Rule Overview*, https://www.epa.gov/rmp/risk-management-plan-rmp-rule-overview (last visited Jan.8, 2020).

115 for refrigerated liquids such as LNG), the current 2016 ERG—and previous editions produced by PHMSA every 4 years—provides a widely-used "bible" intended to be used by first responders explicitly only for their initial decisions in the first 20 minutes of a "large spill" of various high-risk chemical cargoes in a transportation emergency.

90. The ERG's Guide 115 has long advised first responders to "consider initial downwind evacuation" of half a mile if there is even a single breached refrigerated liquids transportation container with no fire. But if the container is involved in a fire, emergency responders should isolate the scene (prevent entry) for one mile in all directions and also "consider initial evacuation for one mile in all directions."

91. Notably, this EA does not consider the public safety implications of this advice regarding some potential need for appropriate safety precautions in the proposed LNG nationwide rail transportation.

92. The EA leaves unexamined, moreover, the question of whether and how this generic ERG guidance is adequate for LNG cargoes specifically. For large nighttime spills from rail tank cars and low wind conditions, the 2016 ERG's Initial Isolation and Protective Action recommendations for toxic chemicals in Table 3 vary from 2.7 miles (ammonia) to 7-plus miles (chlorine, sulfur dioxide).

93. The ERG has not, up until now, singled out LNG rail transportation risks specifically for similarly targeted advice for first responders, perhaps because LNG has long previously been "forbidden" for U.S. rail transportation and with only a relatively small history of LNG truck shipments.

94. Perhaps with the boom in North American LNG infrastructure, the DOT team and consultants drafting the soon-to-be published ERG 2020 may consider adding such a specific focus on ER needs for LNG transportation releases. This lack of specific guidance has troubled local officials in corridor cities along major US rail routes, such as those from the Village of Barrington, IL, which submitted comments opposing the instant NPRM, focusing on the risks to local emergency responders and communities:

> Local first responders are just recently being trained on how to respond to crude by rail and ethanol train derailments in their communities. While there are response protocols and evacuation zone parameters that are recommended in PHMSA's 2016 Emergency Response Guidebook for several hazardous materials, there is nothing specific to uncontrolled LNG releases.
>
> After reviewing the literature to respond to this Docket, Barrington has no confidence that emergency responders in any city, town or village could manage an effective response to a bulk LNG derailment incident. To the contrary, the properties of LNG seem to make it an insurmountable

challenge for first responders attempting to address a derailment and breach scenario.[21]

95. National associations of emergency responders and some corridor cities and counties have opposed the fast-racked new DOT proposed rule on allowing LNG on US rails, citing especially the lack of any historical safety record to assure public safety and the lack of local emergency response capabilities in case of disaster.

96. The EA repeatedly downplays the potential disaster consequences (employing implicitly the traditional formula Risk = Consequence x Probability) by asserting that there is an arguably low LNG release probability and that the likelihood of accidents and releases and resulting fires/explosions/BLEVEs is low.

97. The EA does indicate some potential LNG rail car release scenarios, but omits key consequence factors which need explicit consideration, such as:

    a. The EA omits mentioning the huge volume of even a single LNG rail car flammable gas cloud release. The released gas cloud that could move into a nearby community is 620 times larger than the rail car liquid volume released.

    b. The EA omits discussing in detail the most severe offsite LNG release Worst Case Scenario: an LNG flammable cloud if not immediately ignited can travel far downwind, and if it gets "confined" in any number of ways, can explode. Such a release occurred in the 1944 Cleveland, Ohio, LNG storage tank disaster that released LNG vapor clouds which entered the sewer system and caused explosions over a 1 square mile area, killing 128 people.

98. The risks of LNG releases with vapor clouds becoming "confined" and exploding even without ignition has long been discussed by gas scientists and experts. It is suggested as a potential outcome of an LNG pool fire in the instant NPRM Docket, but with the confused and seemingly misleading implication that ignition and confinement in a confined space is needed. This description seems to conflate an unignited travelling dense vapor cloud with the flashback fire from an ignited cloud. *See* 84 Fed Reg. at 56973. No literature on the subject elsewhere discusses the confinement of a "traveling flame."

99. As early as the substantial 2009 Congressional Research Service (CRS) report on LNG terminal siting risks, confined LNG gas explosion was cited as a possible outcome of an uncontrolled release: "Natural gas is combustible, so an uncontrolled release of LNG poses a hazard of fire or, in confined spaces, explosion."[22]

100. In the few sections in which the EA even mentions the worst case scenario question of "how far will the harmful impacts of various LNG releases extend," the EA unapologetically declines to answer:

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[21] Village of Barrington, Illinois, Comment Letter on Proposed Rule: Hazardous Materials: Liquefied Natural Gas by Rail, Docket PHMSA-2018-0025-0080, at 8, (December 9, 2019), https://www.regulations.gov/document?D=PHMSA-2018-0025-0080.

[22] CONGRESSIONAL RESEARCH SERVICE, Attachment 8, *supra* n. 14, at 5.

> The distance over which an LNG vapor cloud remains flammable is difficult to predict; local weather conditions (wind speed, atmospheric stability or turbulence), terrain, surface cover (i.e., vegetation, trees, and buildings) will influence how a vapor cloud disperses, and how rapidly it dilutes.
>
> If an LNG vapor cloud is ignited before the cloud has been dispersed or diluted to below its lower flammability limit, a flash fire may occur. Unlike other flammable liquids and gases, a LNG vapor cloud will not entirely ignite at once. If ignited, the methane in LNG has a flame temperature of about 1,330 °C (2,426 °F). The resulting ignition leads to a relatively slow (subsonic) burning vapor fire which travels back to the release point producing either a pool fire or a jet fire.

84 Fed. Reg. at 56973.

101. And the EA mentions, but dismisses in three short sentences, the real LNG release worst case scenario, is that of possible "confined" LNG cloud explosions.

> The slow burning vapor fire will not generate damaging overpressures (i.e. explosions), if unconfined. To produce an overpressure event, the LNG vapors need to be within the flammability range and ignited, and either be confined within a structure or the travelling flame in the open encounters structural obstructions (e.g., houses, trees, bushes, pipe racks, etc.) that can increase the flame turbulence significantly when the flash fire reaches the source of vapor (boiling LNG), if there is still a liquid pool of LNG evaporating at that time, a pool fire will result.

Id. at 56973.

102. Many gas scientists and agency experts now would agree that LNG cloud "confinement," leading to a possible spontaneous explosion, does not depend on the cloud being in a "structure," but could occur by the cloud's being "confined" under a rail car, between two homes, in a ditch or ravine, or being held up by a wall or even dense vegetation. The EA does suggest awareness of this potential danger with LNG. *Id.*. However, the EA does not try to estimate:

    a. the distances that a large, dense, ground-hugging LNG vapor cloud can travel into a community if unconfined; nor

    b. what extraordinary confinement risks are posed in a rail and especially an urban rail environment where trackside obstacles such as the EA-cited examples of "houses, trees, bushes…" exist, along with many other potential obstacles such as tunnels, overpasses, and buildings that often overlook train tracks.

103. As the EA underscores, there is a paucity of federal research on LNG releases over-land, whereas there are decades of research pertaining to potential LNG releases over-water from

ships. However, the EA selectively ignores some arguably relevant and useful LNG flammable vapor cloud research and misuses irrelevant toxic gas cloud research.

104. Puzzlingly, the EA does not discuss the one classic 1987 federally-sponsored Falcon series of four LNG over-land gas release tests. Five tests had been planned, but the fourth unexpectedly blew up the whole federal test apparatus and ended the test series.

105. The 1987 Falcon tests had been designed to show industry and government agencies how effective facility-provided LNG vapor barrier enclosures could be. The primary purpose of the test was not to measure downwind, and therefore only a few gas concentration sensor arrays were erected downwind, and only out to 100 meters and 250 meters distance. The Falcon researchers did not in the later tests add more sensors downwind, although the gas clouds from the two largest of the 4 releases (Falcon-1 and Falcon-3, equivalent to the release of approximately one and a half DOT-113 tank cars worth of LNG)[23] were recorded going beyond the 250 m sensors at levels above the dangerous Lower Flammable Limit (LFL) for LNG of 2.5% (LNG to air ratio). The farther distances went unrecorded.

106. The completed Falcon field research trials showed the released dense LNG cloud temporarily held up by, then rapidly filling up and overtopping the four-sided, 9-meters tall fiberglass cloth vapor barrier enclosure, and continuing downwind. Some industry observers reportedly expressed keen disappointment at the minimal success of the barriers in preventing downwind travel of the gas cloud.

107. The released clouds traveled at a dangerous level beyond 250 meters. This is the most important solid federal field test research result that can be cited for assessing how far an LNG release can travel over-land, which is 250 meters-plus. But the research itself underscores the lack of interest in the distance a released LNG cloud might travel, seemingly because of a research community assumption that LNG facility onsite loss of containment will almost never be allowed to result in huge vapor cloud releases. No gas monitors were set out beyond 250 meters, so no data is available on the LNG vapor cloud distances reached at various concentrations.

108. The EA does not even attempt to grapple with the implications of the Falcon research for the formidable issues of how many kinds of real world obstacles exist in the U.S. rail transportation environment, especially in urban rail corridors, where various obstacles could provide numerous kinds of “vapor barriers” (and potential confined cloud explosions) for an accidental or terrorism-released LNG vapor cloud.

109. Beyond its assertions of insurmountable difficulties in LNG consequence calculations, the EA asserts further it cannot even make robust calculations of the probabilities of LNG rail releases because of the same cited gaps in LNG rail transportation data and research. Respectable professional probability analysis, it is true, demands robust and relevant

[23] T.C. Brown et al., LAWRENCE LIVERMORE NAT’L LAB., FALCON SERIES DATA REPORT 1987 LNG VAPOR BARRIER VERIFICATION FIELD TRIALS, UCRL- CR--104316 (1990), Attachment 9.

historical data and prior calculations of consequence as the basis for arriving at the final calculations of probabilities of given releases.

110. Notably, the EA fails to seriously consider historical LNG stationary facility releases, such as the Cleveland[24] and Skikda[25] disasters.

111. Rather astonishingly, the EA asserts that LNG by rail tank car will be safer than the existing LNG by tank truck. The current US LNG trucks shipments often travel from remotely located liquefaction facilities to remote natural gas mining and greenhouse operations that are not well served by natural gas pipelines.

112. The EA does concede that a unit train possibly with 100 tank cars of LNG will carry a huge quantity, much more than a single MC-338 truck LNG vehicle or an ISO container on a single flat car.

113. The EA refrains from mentioning that it was the U.S. chemical shippers and rail industry that post-9/11 had to expend political capital fighting major cities worried about potential hazmat train terrorism. Osama bin Laden, it was discovered upon his death, had advised his cadres to attack US energy infrastructure.[26]

114. The EA needs to show whatever data it may have to support a comparison of which mode is preferable from a disaster prevention perspective.

115. The EA's minimizing of rail LNG accidental release risks and its complete neglect of rail LNG terrorist potentials are both facilitated by this EA characterization of low risks, without any data provided other than volumes of cargoes of rail transport of ultra-hazardous cargoes as safer than truck transportation. The terrorist threat to the U.S. freight rail systems has not evaporated.

116. One can hardly tout LNG as a major new essential element in U.S. energy security and simultaneously decline to address the potential for long and visible LNG trains moving relatively slowly through major cities to be very attractive targets for terrorism.[27]

117. Historically, and of key relevance, in the post-9/11 period, keen public and official recognition of rail urban hazmat safety and security vulnerabilities prompted strong efforts

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[24] *See e.g.*, *The Day Cleveland Exploded: 70 Years Later, the Unthinkable Disaster of the East Ohio Gas Co. Explosion*, CLEVELAND SCENE (Oct. 15, 2014), https://www.clevescene.com/cleveland/the-day-cleveland-exploded-70-years-later-theunthinkable-disaster-of-the-east-ohio-gas-co-explosion/Content?oid=4391878.

[25] *See e.g.*, Simon Romero, *Algerian Explosion Stirs Foes of U.S. Gas Projects*, N.Y. TIMES (Feb. 12, 2004), https://www.nytimes.com/2004/02/12/business/algerian-explosion-stirs-foes-of-us-gasprojects.html.

[26] Jeanne Meserve & Carol Cratty, *U.S.: Al Qaeda Has Interest in Strikes on Energy Infrastructure*, CNN (May 20, 2011), http://www.cnn.com/2011/US/05/20/terror.alert/index.html.

[27] Bridget Johnson, *How the Terror Threat to Rail Has Evolved 15 Years After Madrid*, HOMELAND SECURITY TODAY, Mar. 12, 2019, https://www.hstoday.us/subject-matterareas/terrorism-study/how-the-terror-threat-to-rail-has-evolved-15-years-after-madrid/.

to get national protective hazmat urban rail routing regulations. Major media attention found urban rail hazmat terrorism risks very credible.[28]

118. Unfortunately, Congressional urban rail hazmat re-routing proposals were soundly defeated in 2007 by the railroads and chemical shippers, in favor of Public Law 110-53, which reportedly has led to virtually no protective urban rail re-routing.

119. In 2015, CEO of Canadian Pacific, Hunter Harrison, lamented in the media that he was uncomfortable that his rail line was still routing very dangerous cargoes through Chicago—and other major North American cities.[29]

120. The international hazmat risk literature (none of which is even mentioned by DOT) also seems sparse on the risks posed by rail versus truck transportation, as if it is generally assumed that truck transportation is ubiquitous. As commented by one Lithuanian QRA study focused on the probability of roadside damage posed by the two most serious types of fire and explosion transportation releases from liquefied gases: "Any comprehensive study which compares in detail the risks posed by VCEs (Vapor Cloud Explosions) and BLEVEs (Boiling Liquid Expanding Vapor Explosions) on road or rail is not known to us."[30]

121. This Lithuanian study cites U.S. data on reported accidents from 2003 to 2013, including "a very large number of which little or no damage" that indicate that "hazmat transportation by rail causes a substantially smaller number of accidents and incidents than moving such materials by truck." In the 2003-2013 period the totals reported were 478 fires and 375 explosions by road, versus 36 fires and 9 explosions by rail.[31] But the study cites no reports of comparative damage to structures or people from road or rail incidents, or of accidents relative to total mileage of road versus rail, or relative to mileages through populated areas.

122. The final Special Permit EA changed its earlier draft estimation—with no explanation—of the probability, which the EA elsewhere asserted was unknowable, of an LNG rail release high consequence scenario involving "inner tank damage resulting in large release." Instead of earlier estimations of PHMSA of "very low" probability, the EA for the rule now asserts, citing no evidence, "low." 84 Fed. Reg. at 56974. This would seem to be contradicted by the only specific accident data cited in the EA involving DOT-113C120

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[28] *See* Richard A Falkenrath, *Op-Ed: We Could Breathe Easier: The government must increase the security of toxic chemicals in transit*, WASH. POST, (Mar. 29, 2005).

[29] Eric Atkins, *CP Rail CEO Says Terrorists a Greater Threat than Derailments*, GLOBE & MAIL (Mar. 2, 2015) (updated May 12, 2018), https://www.theglobeandmail.com/report-on-business/cp-rail-ceo-says-terrorists-a-greater-threat-than-derailment-to-oil-tank-cars/article23254667/.

[30] Egidijus Vaidogas et al., *Assessing Risk to Built Roadside Property Posed by Transportation of Liquefied Gasses*, 22(3) J. CIV. ENG'G & MGMT. 442, 445 (Jan. 2013), https://www.researchgate.net/publication/269062884_Assessing_Risk_To_Built_Roadside_Property_Posed_By_Transportation_Of_Liquefied_Gasses/link/57556d6808ae0405a5752636/download.

[31] *Id.* at 443.

tank cars where three cars were involved in a derailment, and all three tank cars ultimately had inner tank damage resulting in large releases. *Id.* at 56972.

123. EA repeatedly makes unsupported assertions minimizing LNG rail transportation risks. Again with no evidence cited from any relevant testing, EA asserts "highway transportation may present a greater risk of accident and release of LNG for each movement, which creates a danger for both humans and the environment." *Id.* at 56971. However, no evidence is cited to support this claim, other than that trucks carrying LNG have been in accidents and had spills.

NPRM FAILS TO MEANINGFULLY ADDRESS RELEASE SCENARIOS AND RELATED COMMUNITY EMERGENCY RESPONSE ISSUES

124. A major LNG-related risk issue which PHMSA's EA does highlight is that "offensive" (fire quenching or event containment from close to the release source) emergency response (ER) is essentially impossible for a transportation-related LNG release that can result in an unquenchably hot LNG fire or a huge flammable LNG gas cloud formation 620 times as large as the tank car volume released.

125. Response and mitigation techniques (defensive ER) beyond evacuation for breaches in cryogenic tank cars do not exist or are impractical during a derailment scenario. Breach of a cryogenic tank car will result in the loss of the entire volume of material in the tank car. Incidents are relatively rare, though rail impacts can have tremendous consequences, given the quantity of hazardous materials in transportation. *See* 84 Fed. Reg. at 56972.

126. In order to assess the overall risks to public safety from the proposed issuance of this rule, one significant question is whether local fire and emergency services are both prepared and equipped to prepare for and to deal effectively with potential LNG rail release emergencies. Some 80% of all fire service members in North America are in poorly funded volunteer fire departments, and full time employed as bank tellers, lawyers, etc.—hardly able to take major time off work to attend serious drills or classes on hazmat risks.

127. The U.S. fire service and local officials nearby LNG stationary facilities reportedly are uneducated about the risks of LNG transportation. The bluntest example of this came from Chief Lonnie Click, who responded to, and was Incident Commander, at the March 31, 2014, Plymouth, Washington LNG release accident. Chief Click shared his experience in a Washington D.C. DOT PHMSA and National Association of Pipeline Safety Regulators (NAPSR) LNG Workshop held on May 19, 2016. He emphasized that first responders did "Not know[] what we were getting into until we were closer" and that responding to the incident put him "on a crash course of learning all about LNG [that] morning . . . because I really didn't know a thing about it."[32]

128. It seems in fact very likely that local emergency responders along the few small regional rail lines (in AK and FL) recently used for LNG rail transportation are getting dangerously

[32] Lonnie Click, presentation for PIPELINE & HAZARDOUS MATERIALS SAFETY ADMIN., *Public Workshop on LNG Regulations - May 19 - Morning Session*, at 1:02:06-1:02:59, YOUTUBE (May 19, 2016), https://www.youtube.com/watch?v=yCTIJaElAlw&list=PL4wHDsuQuKleTf4Z3ca6vJgpiRVTkSZ2&index=3.

pro-LNG, complacent ER training for LNG release emergencies. PHMSA has funded the National Association of State Fire Marshals to provide training materials which, while providing some accurate information on the characteristics of LNG, alarmingly induce complacency. The materials provided suggest LNG is an inevitable feature of progress and that LNG releases can be "managed." Worse, the materials unabashedly seek to enlist the fire service to engage in all LNG-related community proceedings on siting and emergency planning as a newly "informed" cadre to counter what the NFSFM training condescendingly portrays as the presumably irrational concerns of the citizens at risk from serious potential LNG release.

TO THE EXTENT THE NPRM RELIES ON ANY QUANTITATIVE RISK ASSESSMENT, THIS RELIANCE IS UNJUSTIFIED DUE TO THE NUMEROUS FLAWS OF SUCH STUDIES

129. Chemical industry and government hazmat safety officials have in recent years been suggesting a relatively new way to support governmental hazmat rulemakings, by using a study methodology called Quantitative Risk Assessment (QRA). QRA methodology is now being employed by the companies promoting the spread of LNG facilities and carriage (as with the QRAs commissioned by the rail carrier FECR and by shipper ETS), as well as by DOT safety regulators (as in the current and possible future contracts between PHMSA and Cambridge Systematics).

130. Recently the Trump Administration's April 10, 2019, Executive Orders to speed up the federal agencies' promotion of small scale LNG facilities, LNG export, and opening up LNG-by-rail bulk transportation, also included a mandate to employ "risk-based" methodologies—a code word for QRA.

131. However, QRA methodologies have long been controversial in the US and elsewhere. This widespread lack of acceptance also has led to the QRA being incorporated in very few regulatory standards. As Professor Robert Kuehn's classic essay[33] develops at length, the designed aim of a QRA is to keep public in the dark about imposed chemical risks, befuddled with complex calculations which require an expensive consultant to critique. QRA methodologies are also by design highly costly, and very technically complex, with very few practitioners worldwide (none to my knowledge in the US agencies). These qualities of QRA further removes decisions about acceptable risk to beyond the ken of the public and even most public officials.

132. The QRA approach is inherently problematic, utilized for last few decades by high-risk industries for its success in submerging and disguising calculations of potential—typically very significant—consequences of a chemical release underneath layers of complex probabilistic calculations designed to produce vanishingly small likelihoods of such outcomes.

133. All QRAs are ultimately based on reliance on hundreds of "engineering judgments" regarding the universal QRA employment of less-than-optimal data and necessary technical

[33] Robert R. Kuehn, *The Environmental Justice Implications of Quantitative Risk Assessment*, 1996 U. ILL. L. REV. 103 (1996).

assumptions. Consequently, a QRA is therefore highly subject to manipulation towards analytical conclusions which are consistent with the aims of its authors or sponsors.

134. The unreliability of the QRA has been confirmed through at least one major scientific meta-study. The classic major European Union "ASSURANCE" report (also called the "Benchmark" study), decisively underscored this manipulability of QRA methodology.[34] In this study, the EU directed seven different prominent QRA practitioners to use their varied methodologies to focus on a simple ammonia storage facility in Thessalonica, Greece. The risk estimate results differed by a factor of 10,000, no doubt resulting from their multitude of differing assumptions, models and calculation operations. Such variability can hardly qualify QRA methodologies for being considered a reliable science. The recent Exponent and Willauer reports on LNG rail risks concede the limitations of QRA methodologies.

135. The degree to which the QRA is subject to manipulation is one stated reason US safety and environmental regulators have declined to adopt it for US hazmat rail regulations. For example, expert Exponent consultants who provided FECR's QRA suggested that both their client FECR as well as "the FRA team" closely overseeing the FRA-mandated effort directed their methodological choices.[35]

136. Even within the problematic framework of the QRA, one prerequisite for a QRA with any utility for informed decision making is the existence of an applicable "risk tolerability" or "acceptable risk" standard,[36] against which to weigh the numerical risk values of a QRA. Because the US has no formal national risk tolerability standards or "acceptable risk criteria" there are no real world acceptability standards or cut-off values to compare to the arbitrary numeric outputs of a QRA. Each acceptable risk decision for LNG facilities or transportation in a democratic society is essentially a local political decision, sometimes hard-fought, ideally made by those most at risk.

137. A key aim of any QRA—keeping the public in the dark—is most vividly seen by its treatment of distance questions. In the context of LNG, based on whatever assumptions and calculations are provided of the sizes of potential LNG releases, whether accidental or by terrorism, at-risk communities will ask what are the document's model-predicted distances for harmful release impacts, and how many people and structures could be

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[34] Kurt Lauridsen et al., ASSESSMENT OF UNCERTAINTIES IN RISK ANALYSIS OF CHEMICAL ESTABLISHMENTS. THE ASSURANCE PROJECT. FINAL SUMMARY REPORT, Risø-R-1344(EN), RISØ NATIONAL LABORATORY (May 2002), https://backend.orbit.dtu.dk/ws/portalfiles/portal/7712279/ris_r_1344.pdf, Attachment 10.

[35] EXPONENT, FLORIDA EAST COAST RAILWAY FECR MOVEMENT BY LNG ISO CONTAINERS BY RAIL, QUANTITATIVE RISK ANALYSIS (QRA) CONSIDERING LNG POSITION IN TRAIN AND TRAIN SPEED (redacted), at 25 (2016), [hereinafter FECR QRA] Attachment 11.

[36] As stated in the Willauer Report, *infra* n. 37, at 63, Exponent points out in their report that FRA has not codified quantitative risk criteria for LNG hazardous materials transportation scenarios. Additionally, QRA analyses are not common regulatory requirements in the U.S. and no broadly accepted risk criteria are employed by domestic communities or industries. Therefore, Exponent used LPG instead of LNG as a benchmark for calculated risk since accident rates and hole size probabilities in accidents are considered independent of the hazmat commodity shipped. *Cf.* Baruch Fischhoff et al., OAK RIDGE NAT'L LAB. for U.S. NUCLEAR REG. COMM'N, APPROACHES TO ACCEPTABLE RISK: A CRITICAL GUIDE (Dec. 1980), https://www.nrc.gov/docs/ML0716/ML071650351.pdf.

impacted? Why do risk-imposing industries and some government agencies promote use of QRAs? In short, to change the subject on public discussions regarding potential serious chemical releases from the catastrophic possible hazard consequences to the arguably very low probabilities of occurrence.

138. Although the instant NPRM and PRIA do not explicitly rely on any QRA methodology, this problematic methodology lurks in the background of the agency's recent decision-making. PHMSA consultant David Willauer, in his March 20, 2018, Report to PHMSA, which this statement will later discuss fully, has forcefully recommended a full QRA as the next step in the PHMSA Rail LNG regulatory process.[37] In the context of the Trump Administration Orders to promote LNG development, such a course seems likely.

139. Moreover, in connection with ETS' recent special permit application, Docket No. PHMSA-2019-0100, ETS submitted a QRA (ETS QRA).[38] While the ETS QRA has not (as yet) been included in the current rulemaking docket, the final Special Permit—which was approved on a record that included the ETS QRA—has been filed under supporting and related material. Thus, it is necessary here to address the particular deficiencies of the ETS QRA, to the extent that PHMSA is implicitly considering their results.

140. The ETS QRA embodies the general deficiencies outlined above. ETS has manipulated this QRA to artificially minimize the risks presented by rail transport of LNG, deeply slashing its credibility and utility. In particular, this QRA:

    a. Presents ample evidence of the lack of key data to support a robust and respectable QRA, and instead nonetheless proceeds with what QRA practitioners term "the best available data," very thin "proxy" historical data and on assumptions and methodologies developed for similar "proxy" industrial operations.

    b. Ignores key risk-minimizing features of possible alternatives, for instance, truck-based transportation of LNG that can benefit from protective urban re-routing.

    c. Entirely fails to consider terrorism risks—the QRA deals only with accident risk, *see id.* at 12, thus expressly ignores any terrorism risks regarding LNG rail transportation in any setting (whether urban, iconic locations, critical infrastructure locations, sensitive establishments, etc.).

    d. Ignores potential Worst Case Scenarios—such as long distance travel by LNG vapor clouds that can explode even without ignition—and assumes rail LNG releases will ignite nearby on tracks, minimizing potential harms.

[37] *See* David Willauer, CAMBRIDGE SYSTEMATICS for U.S. PIPELINE & HAZARDOUS MATERIALS SAFETY ADMIN., RISK ASSESSMENT OF SURFACE TRANSPORT OF LIQUID NATURAL GAS (2019), [hereinafter Willauer Report], Attachment 12.
[38] ETS QRA, Attachment 6, *supra* n. 13.

e. Presents abstract hypothetical case studies instead considering concrete real world conditions in the transportation environment.

f. Relies upon highly biased industry sources for modeling, and upon assumptions that are outdated and/or from foreign sources.

g. Hides the geographical impact distances of the consequences of a serious LNG release, instead presenting data only in probability "contours" based on compiling many dubious assumed and calculated probabilities of factors. As a result, emergency responders get no information on how far to evacuate at-risk citizens in various representative scenarios of LNG rail releases.

141. Exponent, author of the report, explicitly outlined some of the major "Limitations" of the QRA documents, including the "uncertainties … inherent" in the QRA methodologies.[39] It also discusses candidly the lack of US support for regulating on the basis of QRAs, and the lack of a national governmental standard for risk tolerability.[40] The QRA indicates how it has borrowed from US industry standards—in a nod to the increasingly pro-QRA industry consensus—LNG standard NFPA 59A—on acceptable risk and as well from international standards such as the Dutch Purple Book. Its reliance on industry and international standards is apparent also in its References section.

142. The ETS QRA also candidly lays out throughout the manifold ways in which the authors found a serious deficiency in adequate data on LNG rail transportation. They therefore have subsequently relied heavily on various patchwork methodological workarounds, which even these authors realize and subtly admit can be seen as dubiously valid.

143. Throughout, however, the ETS QRA conveys the message that in the QRA community reliance on less-than-robust data and use of many unexamined "engineering" assumptions is normal or at least inevitable. ETS QRA also outlines in various sections its reliance on proprietary industry data, models and standards and on manifold "engineering judgments" which are non-transparent. For instance, the report:

a. Relies on "industry-accepted population impact models to calculate IR [individual risk] and SR [societal risk] for facility and transportation," *id.* at 9;

b. Notes that "several variables were approximated or estimated," *id.* at 10, notably, without always making these transparent. It used somewhat "similar" data on rail operations and accidents, since LNG transportation has been "sparse" in the US and agencies have not collected LNG rail accident data. It also used admittedly dubious data from stationary facilities on levels of acceptable risk, instead of directly relevant levels of risk for LNG transportation. Much of these approached have been borrowed from the industry consensus LNG standard, NFPA 59A;

[39] ETS QRA at 47.
[40] *Id.* at ix.

c. Uses substitute federal accident data instead of DOT-113 accidents, data for which was nearly entirely lacking, *id.* at 12;

d. Relies, "as an analog," on accident data covering accidents involving all trains or data regarding the entire US fleet of pressurized rail cars that carry certain toxic and flammable gases—which are not readily analogous to the specialized DOT-113s, *id.* at 19;

e. Relies in part on non-transparent industry "proprietary" data, *id.* at 20.

144. There are a number of additional troubling aspects of the ETS QRA:

a. The existing DOT-113 cryogenic rail car (a 50-year-old design) is briefly described only as "capable of LNG service," *id.* at 7, hardly a ringing endorsement. ETS QRA provides no data on the tank car's sparse historical US usage with other cryogenics (in 2015, for instance, only 12,770 shipments).

b. The report makes no mention of any kind of survivability testing in the past or planned for the near future of the DOT-113 design car as other tank car designs have sometimes endured (e.g., fire testing, crash testing).

c. The non-transparent probability calculations resulted in estimations that in a serious event, the combined leakage from the unknown number of cars which suffered a Catastrophic Release (CR), would amount to no more than the equivalent of 3 DOT-113s. *Id.* at 22.

d. ETS QRA uses the PHAST model, which is very old, and the sub-model UDM which is a 20-year old model. *Id.* at 27. The prominent expert Dr. Jerry Havens has over the years presented several substantial critiques of the federal LNG safety regulatory agencies' reliance on outmoded models and assumptions.

e. Though the QRA calculated some consequence estimates of "the size and downwind distance of the flammable clouds" and the "populations that may be affected are estimated using US Census data" for unignited LNG vapor cloud travel with PHAST modeling, only a few, potentially cherry-picked, results are shown. *Id.* at 10.

f. The QRA claims the PHAST model assumes a perfectly flat terrain with no obstacles, which does result in far downwind distances. *Id.* at 27. But it is unclear how under such a flat terrain assumption the model can consider an unignited LNG cloud confinement-caused explosion.

g. These PHAST downwind vapor-modeling calculations include modeled results from selected sizes of small release openings and an instantaneous "catastrophic release" ("CR" in the charts provided). Unsurprisingly, the ETS QRA does not disclose the extent of the release cloud distances nor the numbers of estimated citizens potentially killed (e.g., at the fatality levels assumed of $35kW/m^2$ fire

radiation exposure or by 4.35 psig overpressure from explosion) or injured in such releases. *Id.* at 31.

h. The QRA assumes from "experience," *id.* at 39, that the Worst Case Scenario (WCS) for downwind release travel is the lowest category of wind speed. Recent research with dense toxic gas clouds suggests that higher wind speeds may produce the estimated WCS.

i. The QRA deals with mainline rail traffic only, not with the kinds of sometimes less well-maintained short line railroad tracks that LNG transportation will likely often take at the beginnings and/or ends of long rail journeys.

145. Ultimately, the ETS QRA's quantitative results are presented, as in virtually all QRAs, in complexly calculated probabilities that are vanishingly small. Their calculations of a worst-case scenario catastrophic release of at least one car in derailments involving DOT-113s tank cars ranges from a 1-in-100,000 chance at high speeds to a 5-in-a-million chance at low speeds.[41]

146. Unsurprisingly the ETS QRA announces a risk-minimizing bottom line result: Societal risk is "one fatality approximately once every 200 years for high speed mainline transport and approximately once every 350 years for low speed mainline transport." *Id.* at xii.

147. The more concrete consequence numbers, essential in the early phases of the full QRA, were not shown in the ETS QRA. The closest the ETS QRA got was to show a few "representative hazard distances," assuming the flammable clouds "reach their maximum extent" outside the rail car(s), with 757 feet presented as the worst-case scenario distance result for explosion overpressure fatalities. *Id.* at 31. Presumably, this distance would have to be a radius of a circle around the potentially far downwind point of explosion, however the ETS QRA declines to elaborate or explain further.

148. The ETS QRA calculates the probability of a "delayed ignition" (not immediately ignited) cloud causing a flash fire (60%) or explosion (40%), *id.* at 33, but discloses no estimation of the downwind distance an unignited released LNG vapor cloud could reach. The ETS QRA states up front that it will address "confinement-caused explosions," *id.* at 1, so presumably the PHAST Risk model does consider an unignited cloud reaching far distance downwind and then being "confined" and exploding. The word "confinement" never seems to appear in the text again.

149. Unlike the information provided by the prior Exponent 2016 FECR QRA, the 2017 ETS QRA includes no estimation of kinds of populations or sensitive establishments (e.g., schools, hospitals, churches) along the Eastern Pennsylvania 227-mile sample route studied

[41] At low speeds: their calculation for a full cargo release is 5.09×10^{-6} (i.e., 5.09 chances in one million) for one car; 3.07×10^{-8} for 2 cars; and 9.22×10^{-11} for 3 cars(in an five-car scenario). At high speed, the QRA calculates a CR probability of 1.08×10^{-5} for one car, 1.63×10^{-7} for two cars, or 1.47×10^{-9} for three cars (in an event involving 11 cars). *Id.* at 36-37.

by the 2017 QRA within any of the flash fire, fireball, or explosion hazard distances given in Table 22.

150. The 227-mile long rail route sampled in the ETS QRA may be representative of much of rural and small-town America, but only one of the 227 one-mile-long segments studied has a population density of 20,000 or more per square mile, and only ten of the 227 track segments have population densities of greater than 9,000 per square mile. Of the remaining 215 one-mile track segments, fully 103 have population densities of less than 500 persons per square mile.

151. Exponent's ETS QRA PHAST modeling predicts that the worst case scenario for individual risk in the one segment with 20,000 population density per square mile would only reach a maximum of 512 feet, roughly a tenth of a mile, through the extent of the Zone 3 hazard tolerance zone, with only 3 in 10 million chance (a $3x10^{-7}$) probability of harm. There is no indication in the ETS QRA of how many people might be killed or injured by this scenario in this most populous of zones.

152. This is a seemingly modest hazard prediction result, given the estimations for precautionary evacuations of one mile in flammable cargo fire events, for example, in the widely used DOT Emergency Response Guidebook, Guide 115. But drawing even a 512-foot zone on each side of an urban rail track could nevertheless seem to pose a significant threat in some cities.

153. It may be useful to note here that in the most recent US LNG facility release (2014), which injured three employees, the Incident Commander of the response, local fire chief Lonnie Click, took the ERG guidance advice of a one mile precautionary evacuation and doubled it to a two-mile radius evacuation. He did so to allow a margin of safety given the uncertainties of risk calculations for a chemical that is largely unfamiliar to the emergency response community.

154. The EA itself does not cite the support of any kind of QRA (neither the ETS, FECR, or other) as having demonstrated an "acceptable risk" for LNG rail transportation. Both the nationally focused ETS QRA and the regionally focused FECR QRA do assert acceptable risk for rail LNG, using international standards incorporated into the US industry's consensus LNG safety standard NFPA 59A. The US, however, does not have any official national standard for acceptable hazmat transportation risks (see discussion in paragraphs 141-143 regarding NFPA 59A).

155. Notably, even if PHMSA in its EA has been unwilling to estimate distance potentials for an LNG tank car rail release, a multitude of others in government and industry have been using well-known available and approved gas science modeling for estimating the distance consequences of various hypothetical LNG facility and rail car releases.[42]

[42] For fixed LNG facilities, the U.S. Federal Energy Regulatory Commission (FERC) has for at least three decades required facility staff to model (using four officially FERC-approved standard gas models, at least one of which is proprietary) the regulatory proposed facility Exclusion Zone for potential LNG release impact distance calculations,

156. A prominent example of agency and researcher use of gas modeling to assess LNG rail transportation risk exists in the FRA-permitted LNG rail transportation experiment along Florida's East Coast Rail. Although the FRA, another DOT subagency, has apparently had in its possession the seemingly relevant 2016 FECR QRA document, it is unmentioned by this EA, and has been kept essentially secret so far by FRA.[43]

157. This 2016 FECR QRA is perhaps the most illustrative indication of the industry and government determined consensus that the public needs to be kept in the dark, by various means, on potential LNG release impact distances:

    a. The QRA methodology itself has been utilized by disaster risk-imposing industries, such as nuclear power and toxic chemicals, as it is designed to obscure the consequence distance estimates, which are nonetheless a necessary step for the overall risk calculations; and

    b. FRA has not released the 2016 FECR QRA document to FOIA requests, except with every single data point redacted.

158. PHMSA consultant Cambridge Systematics, Inc., recently provided a simplified risk analysis without any details of potential release scenarios or distances.[44] The report recommended strongly that PHMSA commission a full-scale QRA to underpin future agency safety actions on LNG rail safety. This is estimated to be very costly and take at least a full year. It is unknown whether PHMSA has begun such an effort. The abrupt proposal for this rule and earlier for Special Permit 20534 and previous PHMSA R&D summary presentations seem to imply that it has not.

159. I do not call uncritically for PHMSA to conduct a full-blown QRA of the proposed nationwide LNG by rail, since QRAs are by design efforts to obscure the potential chemical release consequence impact distances under layers of complex probabilistic calculations. The FECR QRA on LNG rail in Florida is a notable example of this, as can be glimpsed—as through a glass darkly—even in its redacted version. It would be useful, however, if PHMSA and FRA as part of this permit proceeding would release the 2016 FECR QRA in its currently withheld unredacted version.

NPRM IGNORES THE LESSONS AND WEAKNESSES OF THE WILLAUER REPORT

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which is an essential factor in winning FERC approvals of LNG siting. These calculations are not of worst case scenarios, but of less severe, credible facility releases based on "Design Basis Accidents" and modeling of their consequences. After working through the required distance calculations, FERC and the facility experts then delve into the non-well-defined and non-regulated areas when they consider various additional probabilistic release factors such as onsite facility-promised mitigations (e.g., the effectiveness of proposed facility-promised vapor barriers to "hold up" a released LNG cloud). FERC staff makes its own (un-transparent and significantly subjective) final overall assessments of the likelihood of the facility's potential LNG release impacts on the public, and eventually (almost always) assesses the approved proposed sites as "adequately safe." The LNG industry is constantly working to inject even more probabilistic elements into FERC regulation.

[43] FECR QRA, Attachment 11, *supra* n. 35.

[44] Willauer Report, Attachment 12, *supra* n. 37.

160. The Willauer Report, which PHMSA only very recently commissioned, and finally published on March 20, 2019, actually provides key indications of how little DOT knows about the risks of LNG truck and rail transportation. *See generally*, Willauer Report, Attachment 12.

161. The nuanced and carefully modest Willauer Report details extensive and authoritative information that overall underscores the weakness of the hurried-up federal rulemaking effort. The Willauer Report draws from an extensive array of data sources and interviews to present first an "LNG Demand" case, presenting a substantial set of US natural gas and LNG current and potential future US market analyses, but without indicating any concrete LNG industry business plans, industry final investment decisions, or even any plausible expected global or US market demands that could necessitate the large volumes of LNG that using freight rail instead of trucking could provide. And second, it presents a safety case for the rulemaking—a "Risk Assessment" (not a full QRA) including voluminous information useful as the foundational underpinnings of a fuller hoped-for DOT-funded QRA.

162. The Willauer Report's safety case aims to advocate and lay the initial research groundwork for a future separate full scale QRA for LNG shipment by both rail and truck.

163. The Report begins with candid caveats regarding the use, value and limitations of QRA methodology and the difficulty in reaching "acceptable risk" determinations for LNG transportation.

164. The Report nonetheless expresses a willingness to lean on QRA techniques and risk acceptability standards borrowed from a few industry sources, and from a few other nations' agencies and on the frequent use of proxy data when more relevant LNG data are not available. *Id.* at 62.

165. The Willauer Report over-hypes QRA while admitting flaws leading to uncertainties concerning its results and the reluctance of many government agencies to accept the use of QRA methodologies. *Id.* at 64.

166. While exaggerating the usage of QRA in US government agencies, the Report usefully outlines the types of transportation data needed for the typical traditional risk assessments performed by FRA and PHMSA, respectively. Note here that the railroad industry and federal DOT agencies keep secret the exact methodologies, the extent, and the results of any (reportedly woefully understaffed) FRA oversight of the US railroads' current individual rail routing choices under the regulations from the 2007 Congressional law for their most hazardous cargoes.

167. The Report usefully details the steps involved in a respectable QRA, and "the proposed methods for developing a rail LNG QRA." *Id.* at 66, 69. None of these steps are attempted by the current relatively short Report, but left to the later follow-up QRA recommended in the Report. Notably, the Report underscores that a QRA's calculation of hazmat release consequences precedes the calculation of release probabilities.

168. The Report describes the typical features of the DOT-113 cryogenic tank car, and states that even the most basic data for assessing the risk of the proposed DOT-113 rail cryogenics tank car are lacking, necessitating subjective "engineering assumptions" and use of proxy data in early QRA calculations of overall accident release behavior. *Id.* at 83-84.

169. The Report indicates that some very basic crashworthiness testing for LNG rail containers is ongoing and being planned for mid-2018, but not with the DOT-113 tank car, only with the much smaller "ISO tank on a rail [flat] car." *Id.* at 84. The Report does not indicate that the May 2017 field test it mentions was botched, nor that the planned 2018 re-do test did not receive funding.

170. The Report recounts some beginning efforts to calculate probabilities of release from LNG rail transportation containers, using arguably very inadequate proxy container data. *Id.* at 85.

171. This same Report discussion indicates that the data available even in AAR tank car safety research is very sparse, possibly outdated, and offers only dubious value for researchers on LNG safety issues. The Report suggests that a researcher would have to torture the data, for example, using "average values estimated using hazardous materials cars in the PHMSA database" and then "filtered for pressure cars only" (DOT-113 cryogenic cars are not in this data, since the LNG tank cars are insulated, non-pressurized). *Id.*

172. The Report briefly discusses the main kinds of potential LNG release consequences, first the flammable ones. In this discussion, the Report cites one of the major gas dispersion consequence tools, PHAST Risk v. 6.7, as having been used in the FECR QRA, and as a model approved by PHMSA, but does not provide any specific data on LNG-by-rail release consequences calculated by any entity with the use of PHAST. *Id.* at 86, 88.

173. The Report also downplays the threat of a long downwind LNG release cold vapor cloud, using often value-laden LNG risk-minimizing phrases like "rapidly disperse" and "short period of time"—without citing any real or even hypothetical examples. The Report echoes the NPRM/PRIA documents in suggesting that calculating the cloud travel hazard distances would be difficult, and it also replicates their decision *not* to make such calculations. It does not provide a single example of any expert group that has done so, e.g., by using PHAST or any other respectable model.

174. The Report does explicitly mention, as if hurriedly, the potential for cloud "confinement," but without any detailed discussion.

175. The Report usefully provides, moreover, one important caveat for the use of PHAST modeling in LNG release consequence contexts, noting that PHAST cannot be used to model the behavior of LNG clouds moving over obstacles, only over perfectly flat terrain. *Id.* at 87. This seems to imply that the behavior of released LNG dense gas clouds cannot be calculated by PHAST for either the "vapor barriers" used on many LNG facility sites, or the "confinement" of an unignited LNG cloud from a rail release after traveling some

distance into the community, then being held up by a ditch, wall or other obstacle, which can lead to spontaneous explosion(s).

176. The Report's Figure 6.10 at page 89 seems to leave out any potential for an unignited LNG release vapor cloud "confinement" explosion. Confinement is mentioned on page 86, and hinted at on page 87.

177. The Report repeats LNG Rail proponents' (including FRA's Dr. Phani Raj) lowballing of the disaster risk, saying of LNG that "*typically* . . . it will warm up, rise and dissipate." *Id.* at 87 (emphasis added). This seems willfully blind, given what factors might be "typical" in a trackside railroad environment with scores of ignition sources and near-track community release environment potentials for an LNG vapor cloud being confined.

178. Contrary to the quick dissipation scenario presented, the Report does outline the much more sobering vapor cloud release potentials and states that models are available to calculate the consequences, but focuses on delayed *ignition* only, versus confinement.

179. At page 91, the Report usefully highlights the importance of calculating the exposures to affected populations of an LNG release, but gives no suggestion as to potential distances and exposures for such releases:

    a. which have been calculated anywhere ever before, or

    b. which might be calculated in a potential LNG transportation release by any transportation mode (e.g., the FECR QRA of which Willauer got a somewhat redacted version), or

    c. even in calculations from some federal agency EA or EIS positing a hypothetical LNG fixed facility or transportation release.

180. In this same passage, the Report suggests that the PHAST model limits calculated release consequences only to the physical release scenarios, with no discussion of estimated human health impacts to the exposed populations. *Id.*

181. The Willauer Report has a short section on Truck Risk Factors, including driver fatigue, *see, e.g., id.* at 95, but notably no corresponding discussion of the well-known risks of railroad engineer fatigue due in large part to risky railroad personnel assignment practices. This has been a longtime key issue in hazmat rail stakeholder forums, such as the ongoing federal Rail Safety Advisory Committee with multiple stakeholders represented—and long crippled by the RSAC ground rule of reaching only consensus agreements from all participants.

182. The Willauer Report cites a slim QRA 2015 report from "researchers" Hart and Morrison, "Bulk Transport by Road and Rail" regarding LNG risks versus LPG risks, *id.* at 97 (for which no url or source is cited or can be found).

183. Notably, despite underscoring the value of "separation" as a vital safety factor in the multiple layers of protection sought for safety in LNG operations, the 2019 Willauer

Report's discussion on the LNG truck industry ignores completely the question of potentials for protective urban rail re-routing versus. truck re-routing.

184. The Willauer Report's Appendix F on cryogenic containers provided valuable information regarding the reportedly ongoing intensive AAR review of the safety deficiencies of the DOT-113 tank car and AAR's leadership in the current deregulation effort. *Id.* at F-1.

185. The Report presents the main topics needing intensive study in the next phase of the PHMSA-funded effort on LNG risk in surface transportation.

186. The Willauer Report underscores key historical context issues underlying the current LNG Rail rulemaking.

187. The Report's Appendix F discussion of the history of LNG rail tank car experience in Europe reveals that it is just beginning.

188. None of the federal or industry documents reviewed in this Expert Statement have cited any European usage of LNG transportation by rail tank cars, and only a few media articles have cited only a few experiments even to demonstrate potential viability of such usage.

189. The Canadian experience with LNG Rail in tank cars, though allowed by regulation, is in fact non-existent, as the Report concedes. *Id.*

190. The Report takes pains to elaborate on the real-world commercial attractiveness of the ISO container for many LNG markets and transportation needs. *Id.*

191. The Report usefully includes some indications that AAR and FRA are taking much more seriously the need to test the crashworthiness of the ISOs. But most notably, at the time of the publication of the Report, there was no ongoing or planned fire or crash testing of the current 50-year-old design DOT-113s, perhaps because the railroads figure that, given the various uncertainties in LNG markets and regulation, it is more important as a priority to push ahead with designing and getting ASAP some new and improved version of the DOT-113.

192. The Willauer Report "Bibliography" shows an impressive comprehensiveness regarding the hazardous materials transportation literature, and includes some LNG-specific references, but very few on the surface transportation of LNG by any mode. *See id.* at B-1 to B-8. This further underscores the dearth of actual research on the subject.

193. The Report's references list many more references related to general hazmat transportation documents, including those on overall rail hazmat transportation by UIUC, led by Dr. Chris P. Barkan, and including several substantial rail hazmat studies by his colleagues Drs. Saat and Liu, often funded by BNSF railroad, and several on QRA-oriented research. The Report mentions without elaboration the apparently ongoing DOT Volpe Center research on LNG locomotive tender crashworthiness—without any indication that this research might or will involve corresponding crashworthiness study of LNG tank cars.

194. The Willauer report does not cite any previous substantial industry- or DOT-funded risk agency research reports, if there indeed are any (including crashworthiness testing), that had credibly supported the earlier DOT longstanding allowances for US LNG transport by truck (including tank trucks and ISO intermodal containers), nor for the recent post-2016 agency Special Permit approvals for the two experimental LNG rail pilots by ISO containers.

195. In the absence of such research, these latter agency Special Permits had authorized small LNG-by-rail ISO movements on the Alaska Railroad Corporation (ARRC) largely rural line and on the more populated Florida East Coast Railway (FECR) line between Miami and Florida coastal seaports.

NPRM DELEGATES CRUCIAL SAFETY RESTRICTIONS TO NON-BINDING INDUSTRY PRACTICES

196. The EA has added in—without substantial analysis or even discussion—the voluntary consensus railroad industry minimum standard high-risk hazmat operating practices guidance in AAR Circular OT-55Q. This is the latest version of industry's Directive OT-55, which was introduced many years ago for AAR member railroad guidance on handling the most dangerous toxic and radioactive rail cargoes, with no consideration of flammable cargo risks.

197. PHMSA and DOT cannot rely on these measures to ensure operational safety. There is no public reporting nor transparency regarding railroad compliance with these AAR voluntary standards, and no public assessment of their effectiveness.

198. The AAR retorted publicly that they would not slow down their crude oil unit trains below their already-announced voluntary limit of 50 mph in the country, 40 mph in cities. AAR noted that their OT-55 voluntary operational controls would cover crude oil and ethanol unit train shipments (involving AAR's definitions of "Key Trains" and "Key Routes").

199. The FRA's belated 2014 crashworthiness research on the DOT-113 proved important in stimulating, moving forward, and shaping the later (although certainly still inadequate) 2015 DOT national High Hazard Flammable Trains (HHFT) safety regulations.

200. Notably the belated new 2015 HHFT regulations also did not even include significant restrictions on train speed, instead, they basically only included what the railroads had already announced they would implement.

201. The new regulations did not deal with key flammable release risk factors such as crude oil cargo volatility (the regulation of which was left to North Dakota state officials) and train length. And protective urban re-routing was left completely unaddressed.

202. The North American railroads successfully insisted with the Obama Administration DOT that they needed to continue to route all hazmat trains through major cities, and railroads had won on this issue in the national debate that resulted in the railroad-friendly 2007 Congressional urban rail hazmat routing law. Each railroad's routing decisions are secret.

203. The instant proposed rule, by contrast with the ETS Special Permit, shows PHMSA simply explicitly relying on the existing regulations for cryogenic rail cars and the railroads' consensus Interchange Rules and voluntary industry standard AAR Circular OT-55Q as "sufficient to address the risks associated with moving LNG in DOT-113 tank cars." 84 Fed. Reg. at 56973.

204. The NPRM and PRIA do not propose any limitation even in the number of LNG tank cars to be carried in a single train consist in a mixed freight train or in a unit train (possibly over 100 cars long), leaving that for a possible separate rulemaking.

205. To my knowledge, DOT has never rigorously assessed the effectiveness of its own regulations on cryogenic rail cargoes (which after all are not a large sector of the hazmat transportation in the US—only some 12,700 total shipments in 2015). The cryogenics cargo accident record, as discussed in the NPRM, 94 Fed. Reg. 56972, demonstrates the existing DOT regulations manifestly do not prevent a high percentage of loss of containment releases in serious DOT-113 accidents.

206. Nor has DOT assessed the effectiveness of the implementation of AAR voluntary standards by the US railroads—either by the seven Class I major railroads or by the short line railroads that often carry hazmat cargoes at the beginnings and/or ends of many long freight rail journeys.

207. The agencies simply assert the adequacy of current agency operational control regulations on LNG and the DOT-113 railcar and of the AAR's voluntary guidance Directive OT-55Q, while citing no substantial agency assessment of the scope of various railroads' implementation or of the effectiveness of either regime.

208. The most recent vivid evidence of the deficiencies in both the current HHFT operational requirements and in the new HHFT tank car designs mandated in 2015 in containing HHFT cargoes in derailments comes from the Dec. 9, 2019 multi-car disaster in rural Canada.[45] There is no reason to assume that similar safeguards for LNG by rail will be any more protective.

209. In national industry slide presentations[46] beginning at least in 2016, the American Association of Railroads (AAR) presented its more elaborated safety arguments for supporting the reversal of the existing ban on LNG bulk transportation by rail tank car.

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[45] Stephanie Taylor, *'We were very scared:' Woman describes fiery derailment near Lanigan, Sask.*, CALGARY HERALD, (Dec. 9, 2019), https://calgaryherald.com/pmn/news-pmn/canada-news-pmn/cp-rail-train-derails-near-lanigan-sask-sparking-fire-that-closes-highway/wcm/fa6d5820-c7d7-4a13-8ec3-87c6a0497f1b, Attachment 13.

[46] Robert Fronczak, *Getting LNG Onto the Rails* at slide 14, ASSOC. AM. R.R., ENERGY BY RAIL CONFERENCE (Oct. 27, 2016), https://www.desmogblog.com/sites/beta.desmogblog.com/files/Fronczak_Presentation.pdf
("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

210. Perhaps the clearest evidence for agency willingness to cut corners on needed LNG research is found in the AAR's presentation in which AAR's Robert Fronczak vaguely summarizes information reportedly from a Federal Railroads Administration (FRA) source, safety official Francisco Gonzales, on FRA's 2016 LNG research priorities. The slide relates that the federal safety agencies are just beginning to plan what is to be significant research into crashworthiness of the DOT-113 tank car design—including four types of crash scenarios. However, the same slide also suggests that the agency may be willing to consider a more hurried "simplified engineering analysis" program based on "extrapolation."

211. The industry has pushed such abbreviated and generic studies in order to ram LNG-by-rail into federal regulations, without the requisite research that PHMSA and the other agencies involved need to have in order to evaluate the safety of LNG by rail as outlined in the proposed rule.

NPRM IGNORES HISTORIC CONCERNS REGARDING RAIL TRANSPORT OF HAZMAT

212. As illustrated in the US historical experience with nuclear waste transportation planning, the at-risk public has historically had little confidence that US corporate railroads will route even their most dangerous hazmat cargoes in the safest way.

213. The plans that US Department of Energy (DOE) and the nuclear power industry (with some 100 reactors operating) were jointly making in the 1990s to transport the nuclear reactors' high level radioactive wastes and spent nuclear fuel across the nation, by trucks and trains converging on DOE's selected interim storage site underground at Yucca Mountain NV, stirred great public anxiety.

214. The leaked National Academy of Sciences map of likely routes through many major cities was widely published in the media, and the resulting public uproar eventually forced cancellation of the DOE/industry transportation plans in favor of mandated on-site dry storage of the radioactive wastes.

215. In comparison to the rail situation, there *are* longstanding national regulations that mandate protective re-routing of radioactive cargo trucks to avoid urban areas (based on safety/mitigating possibility of terrorist attacks/etc.).[47]—

• Step 3: Analyze crashworthiness performance
  • Assess using extrapolation
  • Simplified engineering analysis
  • Detailed engineering analysis will be considered").

[47] U.S. DEPT. ENERGY, TRANSPORTATION EXTERNAL COORDINATION WORKING GROUP, RAIL ROUTING – CURRENT PRACTICES FOR SPENT NUCLEAR FUEL AND HIGH-LEVEL WASTE SHIPMENTS, AND A COMPARATIVE ANALYSIS OF HIGHWAY REGULATORY GUIDELINES APPLIED TO RAIL (Jul. 30, 2004), https://www.csgmidwest.org/About/MRMTP/PublicInformation/Issue%20Archive/References/TEC_Rail_TG_Rail_Routing.pdf ("The Nuclear Regulatory Commission (NRC) has established a system of physical protection requirements for shipments of spent nuclear fuel and high-level radioactive waste . . . designed to reduce the risk of radiological sabotage or diversion of weapons-grade nuclear materials. Shippers that are NRC licensees are required

216. Despite much longstanding US public interest, however, in regulating the rail routing of large quantity radioactive materials, in ways similar to the long-existing regulation of truck shipments of such materials, US DOE's nuclear waste transportation stakeholders in the DOE Transportation External Coordination Working Group noted glumly that "regulations like those for highway shipments do not exist for rail transport."[48]

217. Although the FRA did produce limited rail transportation safety compliance guidance in 1998 for such radioactive shipments that included monitoring the route selections made jointly by shippers and rail carriers, it is ultimately unclear how much protective urban radioactive cargo rail re-routing actually occurs, since these decisions are between corporations. And the federal agencies use the potential for terrorism to keep routing information from at-risk populations.

218. Both on safety and terrorism grounds, any future PHMSA rulemaking should assess the risks of LNG Rail to urban populations versus the use of LNG by truck, and the dubious prospects for public acceptance of the risks of urban LNG Rail.

219. In historical context, the EA is falling in line with the posture of the AAR, which in 2017 petitioned PHMSA for new regulations to open the whole U.S. rail system to LNG using the DOT-113 tank cars.[49]

220. Both AAR and PHMSA have deliberately downplayed the 2012-2015 national trauma caused by the railroad industry's new crude oil unit train business model that railroads imposed, on a manifestly unprepared North American rail physical and regulatory infrastructure. That analogous abrupt high-risk industry hazmat experiment situation produced fifteen fiery crude oil unit train derailments with the old puncture-prone DOT-111 railcars, including arguably the worst-case scenario imaginable, the 47 fatalities at Lac-Mégantic. Even worse case disasters are imaginable, such as the 1944 Cleveland disaster, with an equivalent unit train derailment of LNG given how much more energy is contained in a tank car of LNG compared to crude oil.[50]

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to send the rail route plan to the NRC, which (as it does for highway) examines physical security considerations in accordance with 10 CFR 73.37. The NRC has identified five types of route characteristics, within the context of physical security, that receive special consideration when NRC staff review routes (highway or rail) for approval pursuant to 10 CFR 73: (1) routes through highly populated areas; (2) routes that would place the shipment or escort vehicle in a significantly disadvantageous position; (3) routes with marginal safety design features; (4) routes with limited rest and refueling locations; and (5) routes where responses by local law enforcement agencies, when requested, would not be swift or timely.").

[48] Rail routing of large quantity radioactive materials such as spent nuclear fuel is treated differently from highway routing from a regulatory standpoint. Regulations like those for highway shipments do not exist for rail transport; instead, a shipper and rail carrier normally jointly plan the route considering factors important to service and operational requirements. *Id.* at 2.

[49] Robert E. Fronczak, ASSOC. AM. R.R., PETITION FOR RULEMAKING TO ALLOW METHANE, REFRIGERATED LIQUID TO BE TRANSPORTED IN RAIL TANK CARS (Feb. 21, 2017), https://www.regulations.gov/document?D=PHMSA-2017-0020-0002.

[50] *See* Justin Mikulka, *Trump Order to Allow LNG by Rail Would Expand Bomb Train Risks*, DESMOG BLOG, (Apr. 17, 2019), https://www.desmogblog.com/2019/04/17/trump-executive-orderlng-rail-bomb-train-risks.

221. In recent decades, worried at-risk residents in many U.S. coastal locations decisively defeated various LNG import facility siting proposals largely because of testimony by gas scientists on distance issues. These scientists, including Dr. James Fay and Dr. Jerry Havens, have underscored the significant LNG release fire radiation risks posed to communities within 2-3 miles of LNG transportation (often LNG marine shipping) routes.[51]

222. Most relevant to the current EA, is that the modal safety agencies, including the Federal Railroad Administration (FRA),which share regulatory jurisdiction over LNG transportation with PHMSA, have long designated bulk transportation of LNG by rail tank car as "Forbidden" under the federal Hazardous Materials Table, allowed only under special permit from FRA, and rarely granted. 49 CFR § 172.101.

223. Since 2016, in the context of the current and new growth of the North American LNG industry, FRA has approved two recent regional LNG transport programs via Alaska and Florida railroads,[52] but only with many FRA demands for technical risk evaluations and data reports from the carriers. These small-scale Special Permit LNG regional experiments are not useful for assessing LNG tank car risks on the mainline US rail system, as they were with ISO containers, not tank cars and with small numbers of shipments and no long unit trains. In any case, for both projects, the documents containing the critical lessons learned for safety and risk are being withheld from public view.

224. Many of FRA's own statements suggest the recklessness of the recent federal rail LNG regional pilot experiments.

225. In an FRA letter dated March 3, 2016, to Florida East Coast Rail, the FRA expressed concern about transporting LNG over routes that traverse Florida's congested, highly populated coastal areas, with scores of often-traversed highway-rail grade crossings that involve many pedestrian deaths each year. FRA here also noted that "Any LNG transported along the proposed routes would eventually share the routes with high-speed performance passenger trains [formerly Brightline, now VirginRail] traveling at speeds up to 110 mph."[53] The top speed for the LNG transport on this line, with scores of grade crossings, is 40 mph. *Id.*

226. FRA itself has apparently not produced for public consumption a worst-case scenario for either of the high-risk Alaska and Florida regional pilot experiments with bulk LNG, nor any substantial safety evaluation of the pilots, nor any risk assessments for LNG by rail operations in the larger US rail system overall.

227. Contrary to long-expressed Congressional, scientific, and public concerns, PHMSA's EA abruptly proposes to bring LNG transportation disaster risks directly by mainline and short

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[51] *See* James A. Fay, SPILLS AND FIRES FROM LNG AND OIL TANKERS IN BOSTON HARBOR, (2003), Attachment 14.
[52] The pilot programs use ISO cargo containers, one-third the volume of the DOT-113 cryogenic rail tank cars proposed under Special Permit 20534.
[53] Alexy Letter, Attachment 4, *supra* n. 5, at 2.

line U.S. rail carriers through virtually all major U.S. cities. This effectively *obliterates* the notion of protective distance.

228. The Congressional Research Service recently outlined some of these concerns, citing a 2014 study by the Maritime Administration that recommended that prospective shippers of LNG by rail "perform a detailed study of potential routes for LNG transportation … that avoid densely populated areas and identify emergency response capabilities."[54] Unfortunately CRS researchers have not evaluated the actual safety effectiveness of either: the overall 2015-era Congressional law and DOT's routing implementing regulation, (perhaps impossible to assess, since it is so railroad-friendly and involves each railroad's extremely flexible and secret corporate decisions on urban hazmat routing), or the railroad industry standard cited—presumably OT-55Q, also on overall high-risk hazmat urban routing.

CONCLUSION

229. A reasonable overall conclusion, therefore, from PHMSA's own identified research gaps, is that basic research and studies must be conducted before proceeding to national rulemaking. PHMSA cannot rationally grant nationwide LNG rail transportation permits, much less national regulations, for LNG rail transportation until robust and necessary agency research is completed and analyzed, to inform an adequate EIS.

FURTHER, AFFIANT SAYETH NOT.

EDMUND FREDRIK MILLAR Fred Millar
Expert's Name

STATE OF VIRGINIA
COUNTY OF ARLINGTON

I, the undersigned Notary Public, in and for said State and County, hereby certify that Fred Millar, whose name is signed to the foregoing Affidavit, and who is known to me, acknowledged before me on this day that, being informed of the contents of said Affidavit, he executed same voluntarily on the day the same bears date.

Given under my hand and seal this 10th day of January, 2020.
Cristian Flores Notary Public

CRISTHIAN JENIT FLORES
NOTARY PUBLIC
REG. #7641442
MY COMMISSION EXPIRES
01/31/2023
COMMONWEALTH OF VIRGINIA

My Commission Expires: 1/31/2023

[54] CONGRESSIONAL RESEARCH SERVICE, *Liquefied Natural Gas by Rail: Policy Issues*, at 2, (Nov. 18, 2019), Attachment 15.

ECONorthwest
ECONOMICS • FINANCE • PLANNING

DATE: January 9, 2020
TO: Aaron Stemplewicz, Earthjustice
FROM: Mark Buckley, ECONorthwest
SUBJECT: LNG RAIL TRANSPORT RULEMAKING COMMENT

Overview

I am submitting these comments specific to the issue of the likely consequences of legalizing the transport of liquified natural gas (LNG) by rail in terms of reducing transportation costs. These cost-savings to producers are likely to contribute to increases in the geographic extent and intensity of gas drilling and extraction activities. This increased activity will have negative consequences for public health and environmental quality due to increased release and dispersal of pollutants. Prices for natural gas have steadily declined over the past decade within the U.S., suggesting plentiful supply. These low domestic prices also suggest increases in production would likely primarily be used for export. And the shift from truck to rail would reduce the labor supply associated with transport, reducing the jobs and wages per volume. On net, these transportation cost reductions will likely lead to increased costs for the public via reduced health and a degraded environment, fewer domestic jobs transporting LNG per volume, and increased LNG exports.

Qualifications

My name is Mark Buckley. I hold a B.A. in economics from Davidson College and a Ph.D. in environmental studies from the University of California, Santa Cruz, with a focus in economics. I am currently a partner, project director, and senior economist at ECONorthwest, a Northwest-based economic consulting firm. In these

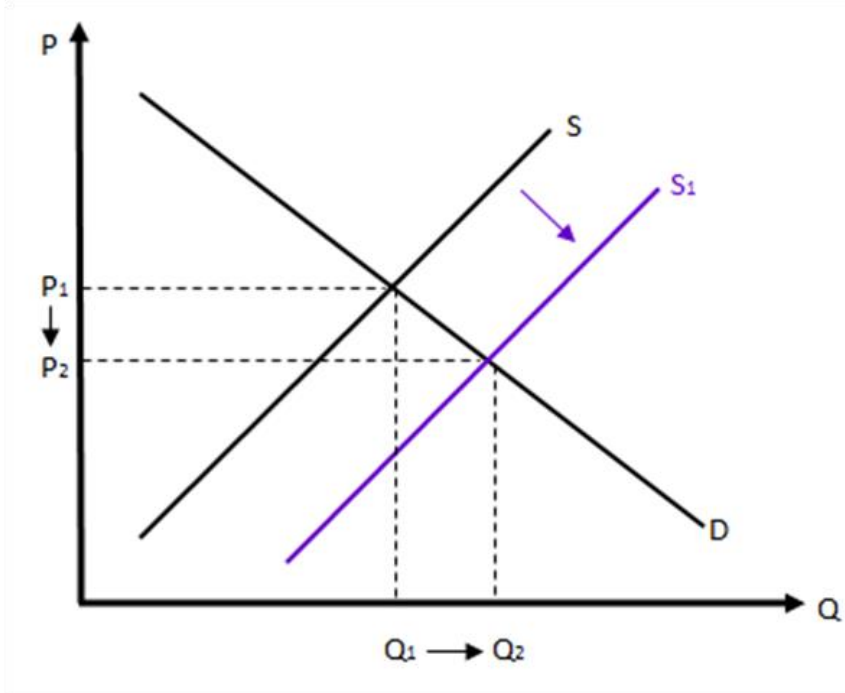
roles I lead the firm's natural resource practice area, designing and managing economic analyses typically involving water resources and land management. Most of my work involves designing and leading benefit-cost analyses for federal, state, and local government agencies managing natural resources. In these contexts, my role is to provide economic analysis and information necessary to make decisions regarding resource management and the expenditure of funds. I focus on decision-making and context-specific scarcities. I have served as an adjunct economics professor at Portland State University and published research involving economic analysis of natural resources issues in peer-reviewed journals and edited volumes. In addition to my public policy research, I have also served as an expert economist in litigation-related cases involving natural resources, the calculation of the value of damages, and the calculation of economic benefits gained by defendants as a result of noncompliance with law. This includes the preparation of expert reports and testimony applying economics and finance to Clean Water Act penalty determinations for the U.S. Department of Justice ("USDOJ") and the U.S. Environmental Protection Agency ("USEPA").

I. Transportation of LNG by rail will likely reduce the costs of LNG production.

The transportation efficiencies made available by the proposed rule would be the result of reduced transportation costs for LNG production. This reduction in transportation costs lowers the overall cost to supply, which can lead to lower market prices for LNG, increased quantities of LNG production, and an increase in

profit to LNG producers. The basic relationship and effect of this reduction in the cost of supply is an outward shift in the supply curve (S to S_1), as illustrated in Figure 1.

Figure 1. Outward Shift in Supply Curve from Reduced Costs



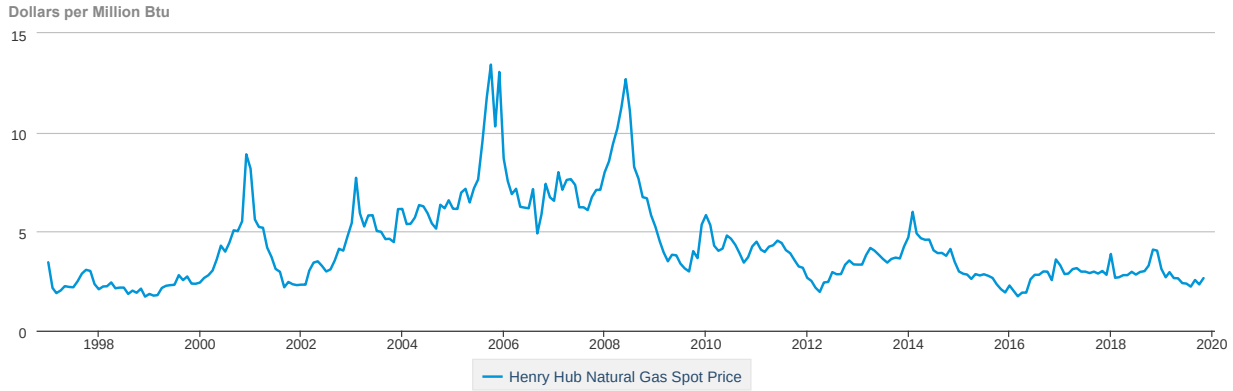
The more widespread the cost reduction, the greater the decrease in market price (P_1 to P_2), whereas a more limited set of benefiting producers would equate to less influence on the overall market but more of a potential increase in quantity produced (Q_1 to Q_2), and/or profit enjoyed, by those benefiting producers.

The mechanism for the increase in quantity due to reduced costs of production would be attributable to lowering costs of production on the margin sufficient that some sources which would be unprofitable to exploit before the cost reduction would become profitable to exploit at the newly reduced costs of production. This phenomenon would be manifested as reported in the Preliminary

Regulatory Impact Analysis in an expansion of the geography that can profitably be utilized for LNG production, as well as an increase in the well sites that can profitably be operated.

This is a long-standing and well-recognized phenomenon in the field of economics, going back to the origins of marginal analysis and David Ricardo's definition of rent from the nineteenth century which is still used by economists and referenced in textbooks today.[1] The concept of Ricardian rent is that producers capture additional profit via rent due to no added investment other than having access to operate on land that is more profitable than the marginal site where revenue just equals costs. In this case the new rule pushes out the extent of the marginal extraction site (geographically and in terms of marginal cost of production to operate), and the outcome is more profit for producers and more total quantity produced, while the marginal site drives price, so price doesn't necessarily decline.

Figure 2. U.S. Spot Market Prices for Natural Gas

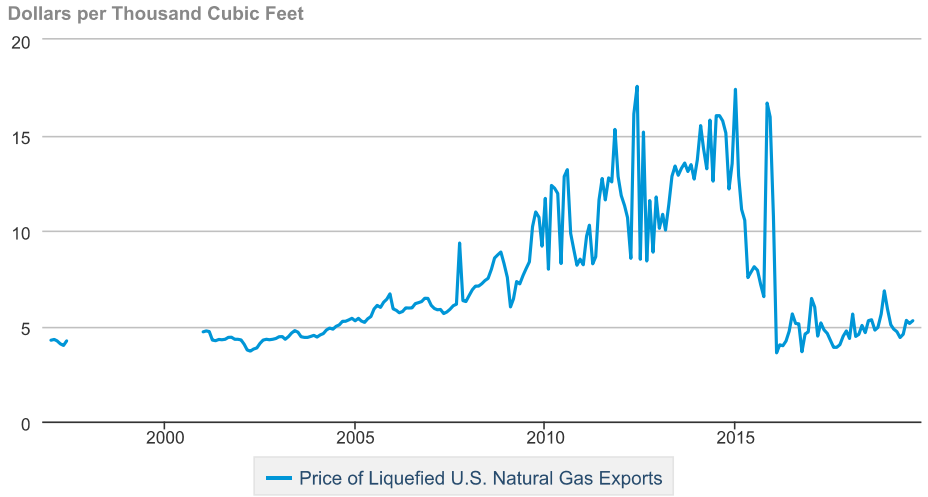


Source: U.S. Energy Information Administration

[1] See for example "Ricardian Rent", (pp. 417-418) in Nicholson, W., & Snyder, C.M. (2008). *Microeconomic Theory: Basic Principles and Extensions. 10th ed.* Mason, OH: Thomson South-Western.

Under some circumstances the proposed rule has the potential to further lower market prices for natural gas, this is even less likely as the prices have steadily declined for the last decade. As Figure 2 and Figure 3 illustrate, domestic market prices for natural gas have been in decline since a peak in 2005, dropping from $13.42 per million BTU to below $2 in recent years and holding near $2, and export prices have seen similar dramatic declines. These market prices strongly suggest that costs of production have not been a critical constraint on the supply of natural gas, nor has the supply been unable to meet demand. These price trends suggest that if anything, the supply of natural gas is currently quite plentiful in the United States. These price trends explain as well why the increased interest in export, to potentially access markets that are not as well-supplied as the United States. This also suggests that the proposed rule and associated reductions in the cost of supply will not provide direct benefits to U.S. consumers (e.g. lower prices), but rather primarily increased profits to producers and exporters in particular.

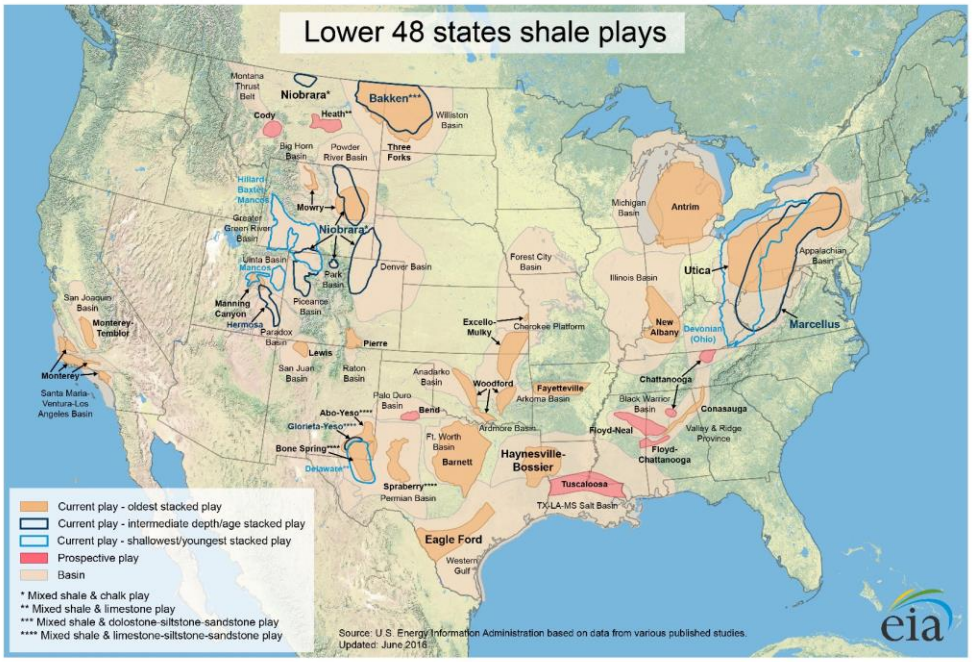
Figure 3. U.S. Export Market Prices for Natural Gas



Source: U.S. Energy Information Administration

II. Transportation of LNG by rail will likely have consequences for the geographic extent and intensity of fossil fuel drilling and extraction.

Figure 4. U.S. Natural Gas Resources Map



Source: U.S. Energy Information Administration

If the primary effect of a reduced cost of production is increased profit for producers and increased quantity of production, the primary effects U.S. residents are likely to experience are the increased geographic expanse of natural gas production and the increased intensity of operations. While only current as of 2016, the U.S. Energy Information Administration provides a map of natural gas resources (Figure 4). Natural gas is distributed throughout the country, particularly in the East near major population centers. Therefore increases in natural gas production are more likely to increase the detrimental effects of drilling activity

such as water supply contamination and public health problems than a decrease in energy costs.

III. Transportation of LNG by rail will likely lead to reduced workforce and reduced total wages associated with shipping activity.

A shift in transportation from truck to rail would likely reduce employment and wages among the labor force. An important reason that truck transport is more costly than rail is the higher amount of labor required per unit of transport. The number of people employed for an equivalent volume of LNG transported by truck vs. rail can differ by orders of magnitude. Trucks each need a driver, whereas currently freight trains only require a two member crew each, and in fact the Association of American Railroads has been actively campaigning to allow freight trains to operate with a one member crew.[2] This labor relation is also evidenced by the U.S. Department of Transportation's Bureau of Transportation Statistics, which shows the much higher and increasing productivity of rail labor, particularly relative to truck labor.[3]

This outcome again directly follows from core economic theory. A profit-maximizing firm will substitute from labor to capital as the cost of capital declines. Effectively the rule-making drives up the cost of labor relative to capital, and business can generate more profit by investing proportionately more into capital, in

[2] Association of American Railroads. Freight Rail and Crew Size Regulations. https://www.aar.org/article/freight-rail-crew-size-regulations/.

[3] U.S. Bureau of Transportation Statistics. 2018. Transportation Economic Trends. https://www.bts.gov/product/transportation-economic-trends. December.

this case trains and rail cars (not necessarily through purchase but also rental use) and reducing investment in labor, in this case truck drivers.[4]

[4] See for example "Production Functions" and discussion of technical substitution between capital and labor (pp. 295-306) in Nicholson, W., & Snyder, C.M. (2008). *Microeconomic Theory: Basic Principles and Extensions. 10th ed.* Mason, OH: Thomson South-Western.