Exhibit A

154 FERC ¶ 61,190
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: Norman C. Bay, Chairman;
Cheryl A. LaFleur, Tony Clark,
and Colette D. Honorable.

Jordan Cove Energy Project, L.P.	Docket No. CP13-483-000
Pacific Connector Gas Pipeline, LP	Docket No. CP13-492-000

ORDER DENYING APPLICATIONS FOR CERTIFICATE AND SECTION 3 AUTHORIZATION

(Issued March 11, 2016)

1. On May 21, 2013, in Docket No. CP13-483-000, Jordan Cove Energy Project, L.P. (Jordan Cove) filed an application under section 3 of the Natural Gas Act (NGA) and Parts 153 and 380 of the Commission's regulations to site, construct, and operate a liquefied natural gas (LNG) export terminal and associated facilities (Jordan Cove LNG Terminal or LNG Terminal) on the North Spit of Coos Bay in Coos County, Oregon.

2. On June 6, 2013, in Docket No. CP13-492-000, Pacific Connector Gas Pipeline, LP (Pacific Connector) filed an application under NGA section 7(c) and Part 157 of the Commission's regulations for a certificate of public convenience and necessity to construct and operate an approximately 232-mile-long, 36-inch-diameter interstate natural gas pipeline originating near Malin, in Klamath County, Oregon, and terminating at the Jordan Cove LNG Terminal (Pacific Connector Pipeline). The Pacific Connector Pipeline will transport natural gas to the Jordan Cove LNG Terminal for processing, liquefaction, and export. Pacific Connector also requests a blanket certificate under subpart F of Part 157 of the Commission's regulations to perform certain routine construction, operation, and abandonment activities, as well as a blanket certificate under subpart G of Part 284 of the Commission's regulations to provide open-access transportation services.

3. As discussed below, the Commission denies Pacific Connector's and Jordan Cove's proposals.

I. Background

4. Jordan Cove and Pacific Connector are Delaware limited partnerships. Jordan Cove is authorized to do business in the State of Oregon, and has one general partner, the Jordan Cove Energy Project, L.L.C., and one limited partner, Jordan Cove LNG L.P. (a Delaware limited partnership that owns 100 percent of Jordan Cove and Jordan Cove Energy Project, L.L.C.).[1] Pacific Connector is authorized to do business in the states of Oregon, California, and Utah. Pacific Connector has one general partner, Pacific Connector Gas Pipeline, LLC (who owns a one percent interest)[2] and two limited partners, Williams Gas Pipeline Company, LLC[3] and Jordan Cove LNG L.P. (who each own a 49.5 percent interest).

5. Jordan Cove and Pacific Connector are new companies. Upon construction and operation of their proposed facilities, Jordan Cove and Pacific Connector would be subject to the Commission's jurisdiction under the NGA.

II. Proposals

6. The applicants designed the Jordan Cove LNG Terminal and the Pacific Connector Pipeline Projects (referred to collectively as "the projects") to enable the production of up to 6.8 million metric tons per annum (MMTPA) of LNG, using a feed of approximately 1.04 billion standard cubic feet per day (Bcf/d) of natural gas, for export to international or domestic markets in the non-contiguous United States.[4]

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[1] Jordan Cove LNG L.P. is wholly owned and controlled by Veresen Inc., an Alberta, Canada Corporation. *See* Jordan Cove's October 8, 2015 filing at 6 and Exhibit B.

[2] Pacific Connector Gas Pipeline, LLC is a Delaware limited liability company equally owned by Williams Gas Pipeline Company, LLC and Jordan Cove LNG L.P. *See* Jordan Cove's April 23, 2014 filing stating that Fort Chicago LNG II U.S. L.P. (listed in Pacific Connector's application as a part owner of the Pacific Connector Gas Pipeline, LLC) changed its name to Jordan Cove LNG L.P.

[3] Williams Pacific Gas Pipeline Company, LLC is a wholly-owned subsidiary of The Williams Companies, Inc.

[4] We note that while Jordan Cove asserted in its application that there is a need for its project to serve current and future *domestic* needs, stating "the Project will be able to provide access to LNG to meet the demand of isolated markets in Hawaii . . . and the Cook Inlet region of Alaska," Jordan Cove has not filed an application for a certificate of

(continued…)

7. The Pacific Connector Pipeline would carry natural gas to the Jordan Cove LNG Terminal, where the natural gas will be liquefied, stored in cryogenic tanks, and loaded onto ocean-going vessels. The applicants state that the projects will enable natural gas produced in western Canada and the United States' Rocky Mountains to serve markets in Asia, southern Oregon, and, potentially, Hawaii and Alaska.[5]

A. The Jordan Cove LNG Terminal Proposal in Docket No. CP13-483-000

8. Jordan Cove seeks authorization under NGA section 3 to site, construct, and operate an LNG export terminal that would consist of:

- a natural gas conditioning facility with a combined natural gas throughput of approximately 1 Bcf/d;
- four natural gas liquefaction trains that would each process approximately 1.5 MMTPA of LNG;
- a refrigerant storage and resupply system;
- an aerial cooling system;
- two full-containment LNG storage tanks, each with a capacity of 160,000 cubic meters (m^3) (or 1,006,000 barrels), and each equipped with three fully submerged LNG in-tank pumps sized for approximately 11,600 gallons per minute;
- an LNG transfer line consisting of one 2,300-foot-long, 36-inch-diameter line that would connect the shore-based storage system with the LNG loading system;
- an LNG carrier cargo loading system consisting of three 16-inch loading arms and one 16-inch vapor return arm;
- a LNG carrier loading berth capable of accommodating LNG carriers with capacities from 148,000 m^3 to 217,000 m^3;

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public convenience and necessity authorizing it to transport or sell for resale gas in *interstate* commerce. The section 3 authorization it has requested extends only to operations in *foreign* commerce.

[5] *See id.* Jordan Cove would need to apply for and receive authorization under section 7(c) of the NGA prior to processing any gas for transportation in interstate commerce.

- a utility corridor to serve as the primary roadway and utility interconnection between the LNG terminal and the South Dunes Power Plant;
- a boil off gas recovery system;
- electrical, nitrogen, fuel gas, lighting, instrument/plant air and water facility systems;
- an LNG spill containment system, fire water system and other hazard detection, control and prevention systems; and
- utilities, buildings, and support facilities.

9. The Jordan Cove LNG Terminal will be located within about 400 acres of open and industrial land across two contiguous parcels (an eastern and western parcel).[6] The parcels are located on the bay side of the North Spit of Coos Bay in unincorporated Coos County, Oregon, north of the towns of North Bend and Coos Bay.

B. Pacific Connector Gas Pipeline

1. Facilities

10. Pacific Connector requests authorization under NGA section 7(c) to construct and operate a new 232-mile-long interstate natural gas transmission system designed to deliver up to 1.06 Bcf/d of natural gas from interconnects with Ruby Pipeline LLC (Ruby) and Gas Transmission Northwest LLC (GTN) near Malin, Oregon, to the Jordan Cove LNG Terminal. In addition to delivering natural gas to the LNG terminal, Pacific Connector states its pipeline would provide deliveries in southern Oregon through an interconnection with Northwest Pipeline GP's (Northwest) Grants Pass Lateral.[7] The proposed Pacific Connector Pipeline would consist of the following facilities:

- approximately 232 miles of 36-inch-diameter pipeline and appurtenant facilities[8] traversing Klamath, Jackson, Douglas, and Coos counties, Oregon;

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[6] The two parcels are owned by Jordan Cove.

[7] Northwest's Grants Pass Lateral is a 131-mile-long pipeline system extending from Eugene to Grants Pass, Oregon.

[8] Appurtenant facilities include five pig launchers and receivers and 17 block valves spaced along the pipeline route in compliance with U.S. Department of Transportation regulations.

- a natural gas compressor station (Klamath Compressor Station), located on a 31-acre site in Klamath County, Oregon, containing three 20,500 horsepower (HP) compressor units[9] for a total of 41,000 HP of compression;

- appurtenant facilities, including a compressor building, suction/discharge piping, and final discharge coolers, a mainline block valve, and a pig launcher assembly;[10]

- the Jordan Cove Delivery Meter Station, that would have a capacity of approximately 1.020 Bcf/d of natural gas at 850 psig, located at the terminus of the Pacific Connector Pipeline at milepost (MP) 1.47, consisting of multiple large ultrasonic gas flow meters, a gas chromatograph, two gas filter/separators, flow control, electronic flow measurement, communications equipment, a building to house the equipment, a mainline block valve, and a pig receiver;[11]

- the Clarks Branch Delivery Meter Station, with a maximum design capacity of approximately 40 million cubic feet per day (MMcf/d) at 900 psig located at an interconnect with Northwest's existing Grant's Pass Lateral at MP 71.46 in Douglas County, Oregon, consisting of an 8-inch ultrasonic gas flow meter, a gas chromatograph, gas separator, flow control, overpressure protection, electronic flow measurement, communications equipment, a building to house the equipment, a mainline block valve, a pig launcher assembly, and a pig receiver assembly;

- the Klamath-Beaver Receipt Meter Station, with a maximum design capacity of approximately 1.06 Bcf/d at 900 psig located at an interconnect with GTN's mainline in Klamath County, Oregon, within the Klamath Compressor Station site, consisting of multiple large-diameter ultrasonic gas flow meters, gas piping and valves, gas chromatograph, flow control, electronic flow measurement, communications for voice and data transfer, and a building to house the equipment;

[9] The third 20,500 HP compressor unit is proposed for standby purposes; only two units will operate at any given time.

[10] A pig is a tool for cleaning and inspecting the inside of a pipeline.

[11] Pacific Connector states that it would enter into an operational balancing agreement with Jordan Cove prior to the in-service date of these facilities.

- the Klamath-Eagle Receipt Meter Station, with a maximum design capacity of approximately 1.06 Bcf/d at 900 psig located at an interconnect with Ruby's mainline in Klamath County, Oregon, on the Klamath Compressor Station site, consisting of multiple large-diameter ultrasonic gas flow meters, gas piping and valves, gas chromatograph, flow control, electronic flow measurement, communications for voice and data transfer, and a building to house the equipment;[12] and

- communications towers installed at each meter station and at the Klamath Compressor Station to connect Pacific Connector's system to Northwest's existing backbone microwave system, which provides communications with Northwest's gas control center. Additionally, Pacific Connector would utilize Northwest's existing Harness Mountain communications site in Douglas, County, Oregon and would lease space on seven other existing communication towers in Coos, Douglas, Jackson, and Klamath counties, Oregon.

11. Pacific Connector states that the initial firm design capacity of its proposed pipeline system is 1.06 Bcf/d and the maximum allowable operating pressure (MAOP) for the pipeline would be 1,480 psig. Pacific Connector explains that the design assumes 40 MMcf/d would be reserved for the Clark's Branch Delivery Meter Station and 1.02 Bcf/d would be reserved for the Jordan Cove Delivery Meter Station at the terminus of the Pacific Connector Pipeline. Pacific Connector estimates that the cost of the Pacific Connector Pipeline is approximately $1.74 billion.[13]

2. Request for Blanket Certificates

12. Pacific Connector requests a blanket certificate under subpart F of Part 157 to perform routine construction, maintenance, and operational activities related to its proposals. Pacific Connector also requests a blanket certificate under subpart G of Part 284 to provide open-access firm and interruptible transportation services for its customers.

[12] Pacific Connector states that it would provide contributions-in-aid-of-construction for Northwest's, GTN's, and Ruby's construction of the interconnect facilities and would enter into an operational balancing agreement with each company prior to the in-service date of the respective facilities.

[13] The cost estimate is in "as spent" dollars based on a November 1, 2017 in-service date.

3. Markets and Services

13. Pacific Connector states that it proposes the Pacific Connector Pipeline, which it has characterized as an integral component of the Jordan Cove LNG Terminal,[14] in response to rising international demand for United States' and Canadian natural gas supplies. Pacific Connector explains that its pipeline will provide market outlets to transport western Canadian and United States' Rocky Mountain natural gas supplies for export through the Jordan Cove LNG Terminal. Pacific Connector states that the pipeline also will be capable of delivering gas to markets in southern Oregon through an interconnection with Northwest's Grants Pass Lateral, but that these markets alone are not sufficient to drive the investment in the pipeline.[15] Therefore, Pacific Connector states that if the pipeline's capacity is not substantially subscribed and if the Jordan Cove LNG Terminal is not contracted, it will not build the pipeline.[16]

14. Pacific Connector has not conducted an open season for its proposed transportation capacity, and has not submitted any precedent agreements or contracts with, or subsequent to, the filing of its application. In its application, Pacific Connector stated that it would keep the Commission apprised of its plans to conduct an open season and enter into precedent agreements for the pipeline's capacity.

15. On May 7, 2014, Commission staff sent Pacific Connector a data request asking it to provide the current status of: (1) Jordan Cove's negotiations for liquefaction contracts for the Jordan Cove LNG Terminal; and (2) Pacific Connector's actions to conduct an open season and enter into precedent agreements for pipeline capacity. On May 15, 2014, Pacific Connector responded and stated that Jordan Cove had entered into non-binding Heads of Agreements with various Asian companies for liquefaction and transportation capacity. Pacific Connector stated that the Heads of Agreements generally provided for pipeline precedent agreements to be executed by October 2014, upon which it would conduct an open season (in October/November 2014).

16. On December 5, 2014, Commission staff sent Pacific Connector another data request asking Pacific Connector to update the Commission on the results of its October/November 2014 open season. On December 10, 2014, Pacific Connector responded, stating that Jordan Cove was still negotiating under the non-binding Heads of Agreements, the terms of which had been extended into early 2015. Pacific Connector

[14] Pacific Connector's June 1, 2015 Data Response at 2.

[15] Pacific Connector's Application at 7.

[16] *Id*. at 9. *See also* Pacific Connector's June 1, 2015 Data Response at 2.

explained that the extended Heads of Agreements generally provided for pipeline precedent agreements to be executed by those shippers choosing to make binding commitments by the first or second quarter of 2015, and that it anticipated holding an open season upon execution of those agreements, in the second quarter of 2015.

17. On May 20, 2015, Commission staff sent Pacific Connector a third data request, explaining that the Commission's Certificate Policy Statement requires the Commission to balance the public benefits of a pipeline proposal against its potential adverse impacts, and that Pacific Connector must show that the public benefits of its proposal outweigh the project's adverse impacts. The data request further explained that while the Commission no longer requires an applicant to present contracts for any specific percentage of proposed new capacity, contracts or precedent agreements always serve as important evidence of project demand. Commission staff then asked Pacific Connector to identify the date it held or will hold an open season and, in the event it does not enter into agreements for service prior to the time the Commission has completed its review of the applications, what evidence in the record Pacific Connector is relying on to show that the benefits of the project outweigh the potential adverse impacts. On June 1, 2015, Pacific Connector responded, stating that would not hold an open season in the second quarter of 2015, but would do so upon the execution of pipeline precedent agreements for at least 90 percent of the pipeline's design capacity, which it anticipated would happen by the end of 2015. Further, Pacific Connector stated that if Jordan Cove does not execute liquefaction agreements for the LNG terminal's capacity, transportation service agreements for service on Pacific Connector will not be executed and it will not build the pipeline. Finally, Pacific Connector stated that the U.S. Department of Energy (DOE) had authorized Jordan Cove's export of LNG to free trade agreement and non-free trade agreement nations, consistent with the public interest. Thus, because the Pacific Connector Pipeline is an integral component of the Jordan Cove LNG Terminal, the pipeline's "public benefits encompass all the public benefits of the Jordan Cove [T]erminal."[17]

18. Finally, on October 14, 2015, Commission staff sent Pacific Connector a fourth data request asking Pacific Connector to discuss: (1) the negotiations between Jordan Cove, Pacific Connector, and any potential liquefaction and transportation customers; (2) whether Pacific Connector entered into any commitments for firm service on the pipeline; and (3) if Pacific Connector entered into precedent agreements, when did or when will it conduct an open season. On November 4, 2015, Pacific Connector replied stating that negotiations between Jordan Cove, Pacific Connector, and prospective customers are "active and ongoing." Pacific Connector stated it "remains confident that

[17] Pacific Connector's June 1, 2015 Data Response at 2.

these customers will enter into binding long-term [agreements]" with both Jordan Cove and Pacific Connector. Pacific Connector again emphasized that given "the significant capital costs associated with this project, Pacific Connector and Jordan Cove must have committed customers with executed agreements in place before making the ultimate decision to move forward on construction of the project" and pledged that it "will adhere to the [C]ommission's standard … condition that service agreements for the pipeline be executed prior to the commencement of construction."[18] Pacific Connector did not provide an estimated date that agreements would be finalized. Pacific Connector also provided information indicating that it had obtained easements for only 5 percent and 3 percent, respectively, of its necessary permanent and construction right of way.

III. Procedural Matters

A. Notice, Interventions, Comments, and Protests

19. Notice of Jordan Cove's application was published in the *Federal Register* on June 6, 2013 (78 Fed. Reg. 34,089), establishing June 20, 2013, as the due date for filing motions to intervene and protests. The parties listed in Appendix A filed timely, unopposed motions to intervene in Docket No. CP13-483-000.[19] Timely notices of intervention in Docket No. CP13-483-000 were filed by the National Marine Fisheries Service (NMFS) and jointly by the Oregon Department of Environmental Quality (Oregon DEQ) and the Oregon Department of Fish and Wildlife (Oregon DFW).[20]

[18] Pacific Connector's November 4, 2015 Data Response at 1.

[19] Timely, unopposed motions to intervene are granted by operation of Rule 214 of the Commission's Rules of Practice and Procedure. *See* 18 C.F.R. § 385.214 (2015).

[20] The timely notices of intervention filed by NMFS and Oregon DEQ and Oregon DFW are granted by operation of Rule 214(a)(2) of the Commission's Rules of Practice and Procedure and are listed as parties in Appendix A. 18 C.F.R. § 385.214(a)(2) (2015). On June 20, 2013, Landowners United and Clarence Adams, jointly, filed a pleading titled "Notice of Intervention" in Docket No. CP13-483-000. Notices of Intervention may only be filed by a State Commission; the Advisory Council on Historic Preservation; the U.S. Departments of Agriculture, Commerce, and the Interior; any state fish and wildlife, water quality certification, or water rights agency; or Indian tribe with authority to issue a water quality certification. 18 C.F.R. § 385.214(a)(2) (2015). However, Landowners United's and Clarence Adams' pleading was timely filed and satisfied all of Rule 214's requirements for filing a motion to intervene. Accordingly, we grant Landowners United and Clarence Adams party status.

20. Notice of Pacific Connector's application was published in the *Federal Register* on June 26, 2013 (78 Fed. Reg. 38,306), establishing July 10, 2013, as the due date for filing motions to intervene and protests. The parties listed in Appendix B filed timely, unopposed motions to intervene in Docket No. CP13-492-000.[21] NMFS and Oregon DEQ and Oregon DFW (jointly) also filed timely notices of intervention in Docket No. CP13-492-000.[22]

21. Late motions to intervene were filed by nine parties in Docket No. CP13-483-000 and by eight parties in Docket No. CP13-492-000.[23] We grant the late motions to intervene. [24]

22. Sierra Club filed a protest in Docket Nos. CP13-483-000 and CP13-492-000. On July 3, 2013, Jordan Cove filed an answer to Sierra Club's protest. The Commission's Rules of Practice and Procedure do not permit answers to protests and we deny Jordan Cove's answer.[25]

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[21] Timely, unopposed motions to intervene are granted by operation of Rule 214 of the Commission's Rules of Practice and Procedure. *See* 18 C.F.R. § 385.214 (2015).

[22] The timely notices of intervention filed by NMFS and the Oregon DEQ and the Oregon DFW are granted by operation of Rule 214(a)(2) of the Commission's Rules of Practice and Procedure and are listed as parties in Appendix B. 18 C.F.R. § 385.214(a)(2) (2015).

[23] In Docket No. CP13-483-000, late motions to intervene were filed by: Clam Diggers Association of Oregon; Clausen Oysters and Lilli Clausen (as an individual); Coos Bay Oyster Company and Jack Hempell (as an individual); Dennis and Karen Henderson (as individuals and as trustees of the Henderson Revocable Intervivos Trust); Evans Shaaf Family LLC and Deborah Evans and Ronald Schaaf (as individuals); Jerry S. Palmer; John M. Roberts, Jr.; Sierra Club; and Waterkeeper Alliance. In Docket No. CP13-492-000, late motions to intervene were filed by: Clam Diggers Association of Oregon; Clausen Oysters and Lilli Clausen (as an individual); Coos Bay Oyster Company and Jack Hempell (as an individual); Dennis and Karen Henderson (as individuals and as trustees of the Henderson Revocable Intervivos Trust); Evans Shaaf Family LLC and Deborah Evans and Ronald Schaaf (as individuals); John F. Caughell and Tammy S. Bray; Stacey and Craig McLaughlin (as individuals); and Waterkeeper Alliance.

[24] 18 C.F.R. § 385.214(d) (2015).

[25] 18 C.F.R. § 385.213(a)(2) (2015).

23. Specifically, Sierra Club argues that the Jordan Cove LNG Terminal is not consistent with the public interest. Contrary to Jordan Cove's economic arguments in support of its proposal, Sierra Club states that LNG export will have adverse and wide-ranging effects on the domestic economy and will not result in job creation. Sierra Club states that the Commission should consider how Jordan Cove's proposal, in addition to all other LNG export proposals, will affect the price of natural gas for domestic customers, as well as how these price increases will harm United States' workers and the economy. In addition, Sierra Club asserts that the projects will induce additional natural gas production in the United States from traditional and non-traditional sources, causing impacts to air and water quality and wildlife habitats. Finally, Sierra Club requests that the Commission evaluate the cumulative impacts of all proposed LNG export terminals in a Programmatic Environmental Impact Statement.

24. Jean Stalcup also filed a protest in Docket No. CP13-492-000. Ms. Stalcup protests Pacific Connector's pipeline application because, as a landowner, she is concerned that the pipeline right-of-way will cause erosion and environmental damage, harm drainage systems and water supplies, and create a safety risk. Additionally, many commenters raise similar concerns regarding potential property devaluation resulting from construction damage and maintenance in the permanent pipeline right-of-way. They also contend that construction and operation of the pipeline will interfere with the use of the lands for farming and timber harvesting operations and the use of waters for oyster farming.

25. Additionally, on December 10, 2015, Thane W. Tienson filed a letter on behalf of six intervening landowners who will be directly impacted by the Pacific Connector Pipeline (Landowner Letter).[26] The Landowner Letter argues that the Commission should deny authorization for the pipeline project given the company's admission "that it does not have a single confirmed customer and has only obtained 4.7 [percent] of the right-of-way easement acreage and 2.8 [percent] of the construction easement acreage." The Landowner Letter states that if the Commission were to authorize the project, Pacific Connector could use the power of eminent domain over approximately 630 landowners; the letter requests that the Commission weigh these impacts against Pacific Connector's failure to execute a single contract for transportation capacity.

[26] Bob Barker, John Clarke, Oregon Women's Land Trust, Evans Schaaf Family LLC, Stacey McLaughlin, and Craig McLaughlin.

B. Request for Formal Hearing

26. Friends of Living Oregon Waters and Columbia Riverkeeper request that the Commission establish a full evidentiary hearing to determine if: (1) the proposed project is in the public interest or required for public convenience and necessity; (2) construction and operation of the project would result in significant impacts to water quality; (3) the project would degrade property values; and (4) the applicants provided adequate information regarding the project's impacts.

IV. Discussion

A. Pacific Connector's Proposed Pacific Connector Gas Pipeline

27. Since Pacific Connector's proposed pipeline facilities will be used to transport natural gas in interstate commerce subject to the jurisdiction of the Commission, the construction and operation of the facilities are subject to the requirements of NGA sections 7(c) and (e).[27]

1. Certificate Policy Statement

28. The Certificate Policy Statement provides guidance for evaluating proposals to certificate new construction.[28] The Certificate Policy Statement establishes criteria for determining whether there is a need for a proposed project and whether the proposed project will serve the public interest. The Certificate Policy Statement explains that in deciding whether to authorize the construction of major new pipeline facilities, the Commission balances the public benefits against the potential adverse consequences. The Commission's goal is to give appropriate consideration to the enhancement of competitive transportation alternatives, the possibility of overbuilding, subsidization by existing customers, the applicant's responsibility for unsubscribed capacity, the avoidance of unnecessary disruptions of the environment, and the unneeded exercise of eminent domain in evaluating new pipeline construction.

29. Under this policy, the threshold requirement for pipelines proposing new projects is that the pipeline must be prepared to financially support the project without relying on subsidization from its existing customers. The next step is to determine whether the

[27] 15 U.S.C. §§ 717f(c) and 717f(e) (2012).

[28] *Certification of New Interstate Natural Gas Pipeline Facilities*, 88 FERC ¶ 61,227 (1999), *order on clarification*, 90 FERC ¶ 61,128, *order on clarification*, 92 FERC ¶ 61,094 (2000) (Certificate Policy Statement).

applicant has made efforts to eliminate or minimize any adverse effects the project might have on the applicant's existing customers, existing pipelines in the market and their captive customers, or landowners and communities affected by the route of the new pipeline. If residual adverse effects on these interest groups are identified after efforts have been made to minimize them, the Commission will evaluate the project by balancing the evidence of public benefits to be achieved against the residual adverse effects. This is essentially an economic test. Only when the benefits outweigh the adverse effects on economic interests will the Commission proceed to complete the environmental analysis where other interests are considered.

a. Threshold Requirement – No Subsidization

30. As noted above, the threshold requirement is that the applicant must be prepared to financially support the project without relying on subsidization from existing customers. Pacific Connector is a new natural gas company and does not have existing customers. Therefore, there will be no subsidization. The Commission finds that Pacific Connector satisfies the threshold requirement of the Certificate Policy Statement.

b. Impact on Existing Customers and Pipelines

31. Once an applicant has satisfied the threshold requirement that its project is financially viable without subsidies, the Commission will consider the effects of the project on three major interests identified in the Certificate Policy Statement as having the potential to be adversely affected by approval of a major certificate project: the interests of the applicant's existing customers, the interests of competing existing facilities and their captive customers, and the interests of landowners and surrounding communities.[29] As stated above, Pacific Connector is a new company proposing to construct and operate a new pipeline; thus, it has no existing customers or services that would be impacted by its current proposal. Additionally, the proposal will not replace firm transportation service on any other pipelines in the market. Therefore, we find that Pacific Connector will not adversely impact existing pipelines in the market or their captive customers.

c. Impact on Landowners and Communities

32. Pacific Connector has made efforts to minimize the adverse effects its project might have on landowners and communities by proposing to locate approximately 95 of the total 232 miles (41 percent) of proposed pipeline adjacent to existing powerlines, roads, and other pipelines. The remaining 59 percent of the route would be constructed

[29] Certificate Policy Statement, 88 FERC at 61,747.

within newly created right-of-way on land that is primarily forest, with agricultural and rangeland being the next two most predominant land uses. Approximately 32.1 percent of the pipeline (or 74.5 miles) would cross federal and state lands, while the remaining 67.9 percent of the pipeline (or 157.3 miles) would cross private lands.[30]

33. Many intervenors and commenters express concern regarding the Pacific Connector Pipeline's potential to adversely impact land valuation, tax revenue, and business operations in the area. In the Landowner Letter, several intervenors request that the Commission balance Pacific Connector's failure to provide evidence of market demand for the proposed pipeline and its failure to acquire easements along the proposed right-of-way[31] against the impacts to landowners who would face eminent domain actions if the Commission issues a certificate for the pipeline.

34. The Commission will approve an application for a certificate of public convenience and necessity only if the public benefits from a proposed project outweigh any adverse effects.[32] The focus of the Commission's analysis under the Certificate Policy Statement is on the impact of a proposed project on the relevant interests balanced against the benefits to be gained from the project. This is a proportional approach, where the amount of evidence required to establish need will depend on the potential adverse effects of the proposed project.[33] The more interests adversely affected, or the more adverse impact a project would have on a particular interest, the greater the showing of need and public benefits required to balance the adverse impact.[34]

35. The Certificate Policy Statement describes a situation where sponsors of a new company proposing to serve a new, previously unserved market "are able to acquire all, or substantially all, of the necessary right-of-way by negotiation prior to filing the application" and explains that "[s]uch a project would not need any additional indicators

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[30] *See* Final Environmental Impact Statement at 2-32 and 4-12.

[31] Pacific Connector has not submitted evidence that it has obtained any easement or right-of-way agreements for the necessary use of private lands.

[32] Certificate Policy Statement, 90 FERC at 61,389, 61,396.

[33] *Arlington Storage Co., LLC*, 128 FERC ¶ 61,261, at P 7 (2009); *Transcontinental Gas Pipe Line Corp.*, 120 FERC ¶ 61,181, at P 90 (2007); *Midwestern Gas Transmission Co.*, 116 FERC ¶ 61,182, at P 37 (2006).

[34] Certificate Policy Statement, 88 FERC at 61,749.

of need . . . [since] landowners would not be subject to eminent domain proceedings."[35] The Certificate Policy Statement goes on to recognize that it may not be possible for a sponsor to acquire all the necessary right-of-way by negotiation, stating that:

> [T]he company might minimize the effect of the project on landowners by acquiring as much right-of-way as possible. In that case, the applicant may be called upon to present some evidence of market demand, but under this sliding scale approach the benefits needed to be shown would be less than in a case where no land rights had been previously acquired by negotiation.[36]

36. The Certificate Policy Statement allows an applicant to rely on a variety of relevant factors to demonstrate need, rather than requiring evidence that a specific percentage of the proposed capacity is subscribed under long-term precedent or service agreements.[37] These other factors might include, but are not limited to, precedent agreements, demand projections, potential cost savings to consumers, or a comparison of projected demand with the amount of capacity currently serving the market.[38] The Commission stated that it will consider all such evidence submitted by the applicant reflecting on the need for the project. Nonetheless, the Certificate Policy Statement made clear that, although submittal of precedent agreements is no longer required, they are still significant evidence of need or demand for a project.[39]

37. In *Turtle Bayou Gas Storage Company, LLC* (*Turtle Bayou*),[40] the Commission denied Turtle Bayou's application to construct and operate a natural gas storage facility, finding that it failed to meet the criteria of the Certificate Policy Statement. As a new company with no existing customers, Turtle Bayou met the threshold requirement of no subsidization. However, as evidence of public benefits, Turtle Bayou presented only general assertions of a need for natural gas storage at the regional and national level. There was no evidence that any of the proposed capacity had been subscribed under

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[35] *Id.* at 61,748.

[36] *Id.* at 61,749.

[37] *Id.* at 61,747.

[38] *Id.*

[39] *Id.*

[40] 135 FERC ¶ 61,233 (2011).

precedent agreements. At the same time, the record showed that Turtle Bayou owned virtually none of the property rights which would be necessary to develop its project. Having been unable to acquire those rights through negotiation with the single landowner, it appeared that Turtle Bayou would have to obtain them through exercise of the right of eminent domain provided by a Commission certificate. Given these circumstances, the Commission found that "[t]he generalized showing [of project need] made by Turtle Bayou does not outweigh the impact on the landowner that holds the majority of property rights needed to develop the proposed project ... Therefore, we cannot find that Turtle Bayou's proposed project is required by the public convenience and necessity, and we deny its request for certificate authority to construct and operate its project."[41]

38. In this case, the Pacific Connector Pipeline will impact 157.3 miles of privately-owned lands, held by approximately 630 landowners (54 of which have intervened). As stated above, the landowners contend that the pipeline will have negative economic impacts, such as land devaluation, loss of tax revenue, and economic harm to business operations (e.g., oyster and timber harvesting and farming). While we cannot predict the outcome of the eventual negotiations, it currently appears that at least some portion of the necessary property rights will need to be obtained through the exercise of eminent domain.[42] The Certificate Policy Statement makes clear that holdout landowners cannot veto a project that the Commission finds is required by the public convenience and necessity after balancing all relevant factors and considerations.[43] However, "the strength of the benefit showing will need to be proportional to the applicant's proposed exercise of eminent domain procedures."[44]

39. Here, Pacific Connector has presented little or no evidence of need for the Pacific Connector Pipeline. Pacific Connector has neither entered into any precedent agreements for its project, nor conducted an open season, which might (or might not) have resulted in "expressions of interest" the company could have claimed as indicia of demand. As it stands, Pacific Connector states that the pipeline will benefit the public by delivering gas supply from the Rocky Mountains and Canada to the Jordan Cove LNG Terminal and by providing an additional source of gas supply to communities in southern Oregon (though,

[41] *Id*. at 34.

[42] Pacific Connector has not filed any negotiated agreements to access private property along the pipeline's route.

[43] Certificate Policy Statement, 88 FERC at 61,749.

[44] *Id.*

again, it has presented no evidence of demand for such service). Pacific Connector also contends that construction of the pipeline and LNG terminal will create temporary construction jobs and full-time operation jobs and millions of dollars in property, sales, and use taxes to state and local governments. Finally, Pacific Connector contends that the Commission has previously found that the benefits provided by pipelines that deliver feed gas to export terminals outweigh the minimal adverse impacts and such projects are required by the public convenience and necessity.[45]

40. Pacific Connector is essentially asking the Commission to rely on DOE's finding that authorization of the commodity export is consistent with the public interest as sufficient to support a finding by the Commission that the Pacific Connector pipeline is required by the public convenience and necessity, as there is no other proposed way for gas to be delivered to the Jordan Cove LNG Terminal for export. Additionally, Pacific Connector emphasizes that neither the pipeline nor the terminal will be constructed unless and until customers ultimately subscribe to a significant portion of the capacity of the facilities. The Commission has not previously found a proposed pipeline to be required by the public convenience and necessity under NGA section 7 on the basis of a DOE finding under NGA section 3 that the importation or exportation of the commodity natural gas by an entity proposing to use the services of an associated LNG facility is consistent with the public interest.[46] Nor has the Commission relied solely on the fact

[45] Pacific Connector's statement is misleading because the facts presented in its cited cases differ greatly from the facts here. In *Dominion Cove Point LNG, LP*, 148 FERC ¶ 61,244 (2014), *reh'g denied*, 151 FERC ¶ 61,095 (2015), the proposed pipeline was fully contracted and would be constructed entirely on Dominion-owned land and/or right-of-ways. *Dominion Cove Point LNG, LP*, 148 FERC ¶ 61,244 at P 58. Similarly, in *Cheniere Creole Trail Pipeline, L.P.*, 142 FERC ¶ 61,137 (2013), the proposed pipeline was fully subscribed and did not need new right-of-way or easements for construction. *Id*. at PP 13 and 31.

[46] DOE's order did not purport to consider any issues related to the Pacific Connector Pipeline. While the regulatory functions of section 3 of the NGA (relating to the import and export of natural gas) were transferred to the Secretary of Energy (Secretary) in 1977 pursuant to section 301(b) of the Department of Energy Organization Act, 42 U.S.C. § 7151(b) (2006), the regulatory functions of section 7 (relating to the sale for resale and transportation of natural gas in interstate commerce) were transferred to and vested in the Commission pursuant to section 402(a)(1)(D) of that Act. 42 U.S.C. § 7172(a)(1)(D) (2006). Further, while the Secretary retained authority to authorize imports and exports of the commodity natural gas under section 3, the Secretary subsequently delegated to the Commission the authority to approve or disapprove the construction and operation of particular facilities, the site at which facilities shall be

(continued…)

that a company is not likely to proceed with construction of facilities in the absence of a market for a project's services – particularly in the face of significant opposition from directly-impacted landowners. Further, while the Commission could ensure avoidance of unnecessary environmental impacts by including a certificate condition providing that authorization for the commencement of construction would not be granted until Pacific Connector has successfully executed contracts for a certain level of service, the right to eminent domain is inherent in a certificate issued under NGA section 7. Thus, the Commission's issuance of a certificate would allow Pacific Connector to proceed with eminent domain proceedings in what we find to be the absence of a demonstrated need for the pipeline.

41. We find the generalized allegations of need proffered by Pacific Connector do not outweigh the potential for adverse impact on landowners and communities.

d. Certificate Policy Statement Conclusion

42. Because the record does not support a finding that the public benefits of the Pacific Connector Pipeline outweigh the adverse effects on landowners, we deny Pacific Connector's request for certificate authority to construct and operate its project, as well as the related blanket construction and transportation certificate applications.

B. Jordan Cove's Proposed LNG Terminal

43. The Jordan Cove LNG Terminal and the Pacific Connector Pipeline, though requiring authorization under different sections of the NGA, have been proposed as two segments of a single, integrated project. As described above, Pacific Connector has stated that although its pipeline will be capable of delivering gas to markets in southern Oregon through an interconnection with Northwest's Grant Pass Lateral, it will not build the project unless the Jordan Cove LNG Terminal Project goes forward.[47] Similarly, without a source of natural gas, proposed here to be delivered by the Pacific Connector Pipeline, it will be impossible for Jordan Cove's liquefaction facility to function.

---

located, and with respect to natural gas that involves the construction of new domestic facilities, the place of entry for imports or exit for exports. The Secretary's current delegation of authority to the Commission relating to import and export facilities was renewed by the Secretary's DOE Delegation Order No. 00-044.00A, effective May 16, 2006.

[47] *See* Pacific Connector's Application at 7 and 9, and Pacific Connector's June 1, 2015 Data Response at 2.

44. As discussed above, in determining whether a proposed project will serve the public interest under the Certificate Policy Statement, the Commission balances the public benefits of a proposed project against the potential adverse consequences. While the Certificate Policy Statement does not specifically apply to facilities authorized under NGA section 3, the Commission is still required to conclude that authorization of such facilities will not be inconsistent with the public interest.[48] We find that without a pipeline connecting it to a source of gas to be liquefied and exported, the proposed Jordan Cove LNG Terminal can provide no benefit to the public to counterbalance any of the impacts which would be associated with its construction.

45. The Commission has not previously authorized LNG export terminal facilities without a known transportation source of natural gas.[49] Here, the Pacific Connector

[48] *See AES Sparrows Point LNG, LLC*, 126 FERC ¶ 61,019, at n.21 (2009), where the Commission noted that the rationale of balancing benefits against burdens to determine the public interest is the same in both types of proceedings.

[49] *Corpus Christi Liquefaction, LLC and Cheniere Corpus Christi Pipeline, L.P.*, 149 FERC ¶ 61,283 (2014), *reh'g denied*, 151 FERC ¶ 61,098 (2015) (order granting authorization under NGA section 3 to construct and operate import and export facilities located in San Patricio and Nueces Counties, Texas, and issuing a certificate to construct and operate a 23-mile-long pipeline in San Patricio County, Texas to transport natural gas bi-directionally between the liquefaction project and existing interstate and intrastate natural gas pipeline systems); *Dominion Cove Point LNG, LP*, 148 FERC ¶ 61,244 (2014), *reh'g denied*, 151 FERC ¶ 61,095 (2015) (order granting authorization under NGA section 3 to construct and operate liquefaction facilities at the company's existing LNG terminal in Calvert County, Maryland, to export domestically-produced natural gas supplied by the company's pipeline facilities); *Freeport LNG Development, L.P., FLNG Liquefaction, LLC, FLNG Liquefaction 2, LLC, and FLNG Liquefaction 3, LLC*, 148 FERC ¶ 61,076 (2014), *reh'g and clarification denied*, 149 FERC ¶ 61,119 (2014) (order granting authorization under NGA section 3 to construct and operate natural gas pretreatment facilities and several interconnecting pipelines to support liquefaction and export operations at the company's existing LNG terminal in Freeport, Texas); *Cameron LNG, LLC and Cameron Interstate Pipeline, LLC*, 147 FERC ¶ 61,230 (2014), *reh'g rejected*, 148 FERC ¶ 61,073 (2014), *reh'g denied*, 148 FERC ¶ 61,237 (2014) (order granting authorization under NGA section 3 to construct and operate export facilities at the company's existing LNG import terminal in Cameron, Louisiana, and issuing a certificate to construct and operate a pipeline and compression facilities to transport domestically-produced gas to the LNG terminal for liquefaction and export); *Sabine Pass Liquefaction, LLC and Sabine Pass LNG, L.P.*, 139 FERC ¶ 61,039 (2012) (order granting NGA section 3 authorization to construct and operate liquefaction facilities to

(continued…)

Pipeline is the only proposed transportation path for natural gas to reach the Jordan Cove LNG Terminal.

46. Because the record does not support a finding that the Jordan Cove LNG Terminal can operate to liquefy and export LNG absent the Pacific Connector Pipeline, we find that authorizing its construction would be inconsistent with the public interest. Therefore, we also deny Jordan Cove's request for authorization to site, construct and operate the Jordan Cove LNG Terminal.[50]

V. Conclusion

47. Given this action, we dismiss as moot the environmental concerns raised by Sierra Club in its protest.[51] Likewise, Friends of Living Oregon Waters' and Columbia Riverkeeper's requests for a formal hearing on the application are moot.

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export domestically-produced natural gas received from two interstate pipeline interconnected with the company's existing LNG terminal); and *Sabine Pass LNG, L.P.*, 127 FERC ¶ 61,200 (2012), *reh'g denied*, 140 FERC ¶ 61,076 (2012) (order amending authorization under NGA section 3 to allow Sabine Pass LNG, L.P. to export LNG that had been previously imported and stored in its liquid form at its existing Sabine Pass Liquefied Natural Gas Terminal located in Cameron Parish, Louisiana).

[50] We acknowledge that pursuant to its authority under NGA section 3, DOE's Office of Fossil Energy (DOE/FE) issued Jordan Cove authorization to export 15 MPTA, or 2.0 Bcf/d, of domestically produced natural gas by vessel to all free trade agreement (FTA) and non-FTA nations, finding that the potential export of such volumes to not be inconsistent with the public interest. *See* DOE/FE Order No. 3041 (December 7, 2011) (authorizing Jordan Cove to export 9 MMTA or 1.2 Bcf/d of natural gas to FTA nations for a 30-year term) and DOE/FE Order No. 3413 (March 24, 2014) (conditionally authorizing Jordan Cove to export 6 MMTA or 0.8 Bcf/d of natural gas to non-FTA nations for a 20-year term). In granting Jordan Cove long-term authorization to export LNG, DOE/FE found that there was substantial evidence of economic and other public benefits such that the authorization was not inconsistent with the public interest. However, as stated, we view the Jordan Cove Project as an integrated project, comprising both the terminal and the pipeline. Accordingly, since we are denying authorization for the Pacific Connector Pipeline as proposed, we are also denying our authorization for the Jordan Cove LNG Terminal.

[51] Additionally, we dismiss as moot the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians' February 22, 2016 request for an additional 30 days to comment on the Pacific Connector Pipeline Project Cultural Resources Survey.

48. Our actions here are without prejudice to Jordan Cove and/or Pacific Connector submitting a new application to construct and/or operate LNG export facilities or natural gas transportation facilities should the companies show a market need for these services in the future.

49. The Commission, on its own motion, received and made part of the record in these proceedings all evidence, including the applications and exhibits thereto, submitted in support of the authorizations sought herein, and upon consideration of the record,

The Commission orders:

(A) In Docket No. CP13-492-000, Pacific Connector's request for a certificate of public convenience and necessity under section 7(c) of the NGA to construct and operate an approximately 232-mile-long, 36-inch-diameter pipeline is denied.

(B) In Docket No. CP13-483-000, Jordan Cove's request for authorization under section 3 of the NGA to site, construct, and operate its LNG terminal in Coos Bay County, Oregon is denied.

(C) The untimely motions to intervene are granted as discussed herein.

(D) Jordan Cove's July 3, 2013 answer is denied.

(E) The Friends of Living Oregon Waters' and Columbia River Clean Energy Coalition's requests for an evidentiary hearing are dismissed as moot.

By the Commission.

(S E A L)

Nathaniel J. Davis, Sr.,
Deputy Secretary.

Appendix A

Interventions in Docket No. CP13-483-000

*out of time

Blue Ridge Alternate Route 2013
Bob Barker
C-2 Cattle Company
Cascadia Wildlands and Oregon Wild
Center for Biological Diversity
Citizens Against LNG, Inc; Citizens Against LNG; & Jody McCaffree (as an individual)
Clam Diggers Association of Oregon*
Clausen Oysters and Lilli Clausen (as an individual)*
Columbia Riverkeeper
Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians
Coos Bay Oyster Company and Jack Hempell (as an individual)*
Coos County Sheep Company and Dustin A Clarke (as an individual)
David McGriff
Dennis and Karen Henderson (as individuals and as trustees of the Henderson Revocable Intervivos Trust)*
Evans Schaaf Family LLC and Deborah Evans and Ronald Schaaf (as individuals)*
Food & Water Watch
Fred Messerle & Sons, Inc.
Friends of Living Oregon Waters
Holly Hall Stamper
James R. Davenport
Jean Stalcup
Jerry S. Palmer*
Jonathan M. Hanson
John M. Roberts, Jr.*
Klamath-Siskiyou Wildlands Center
Landowners United and Clarence Adams (as an individual)
LNG Development Company, LLC (d/b/a/ Oregon LNG) and Oregon Pipeline Company, LLC
Marcella and Alan Laudani
Mark Sheldon
National Marine Fisheries Service
Northwest Industrial Gas Users
Nova Lovell
Oregon Coast Alliance
Oregon Department of Energy
Oregon Department of Environmental Quality and the Oregon Department of Fish and

Wildlife (jointly)
Oregon Department of Land Conservation and Development
Oregon Shores Conservation Coalition
Oregon Women's Land Trust
Pacific Coast Federation of Fisherman's Associations and the Institute for Fisheries Resources (jointly)
Richard F. Knablin
Rogue Riverkeeper
Sherry M Church
Sierra Club*
State of Wyoming
Waterkeeper Alliance*
Western Environmental Law Center
Wyoming Pipeline Authority

Appendix B

Interventions in Docket No. CP13-492-000

*out of time

Bill Gow
Blue Ridge Alternate Route 2013
Bob Barker
C-2 Cattle Company
Cascadia Wildlands and Oregon Wild
Center for Biological Diversity
Citizens Against LNG, Inc.; Citizens Against LNG; and Jody McCaffree (as an individual)
Clam Diggers Association of Oregon*
Clausen Oysters and Lilli Clausen (as an individual)*
Columbia Riverkeeper
Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians
Coos Bay Oyster Company and Jack Hempell (as an individual)*
Coos County Sheep Company and Dustin A Clarke (as an individual)
Curtis Pallin
Daniel Fox
David McGriff
David Messerle
Dee Willis
Dennis and Karen Henderson (as individuals and as trustees of the Henderson Revocable Intervivos Trust)*
Evans Schaaf Family LLC and Deborah Evans and Ronald Schaaf (as individuals)*
Food & Water Watch
Fred Messerle & Sons, Inc.
Friends of Living Oregon Waters
Gary Gunnell
Gas Transmission Northwest LLC
Jake Robinson
James R. Davenport
Jason Messerle
Jean Stalcup
Jeff Messerle
Jennifer LM Barrows and Richard A Barrows
John Caughell
John Clarke
John F. Caughell and Tammy S Bray*
John M. Roberts, Jr.

John Muenchrath
John Szymik
Jonathan M. Hanson
Joseph P Quinn
Karen Solomon
Klamath-Siskiyou Wildlands Center
Landowners United and Clarence Adams (as an individual)
LNG Development Company, LLC (d/b/a Oregon LNG)
Marcella and Alan Laudani
Mark Sheldon
National Marine Fisheries Service
Northwest Industrial Gas Users
Nova Lovell
Oregon Coast Alliance
Oregon Department of Energy
Oregon Department of Environmental Quality and the Oregon Department of Fish and Wildlife (jointly)
Oregon Department of Land Conservation and Development
Oregon Shores Conservation Coalition
Oregon Women's Land Trust
Pacific Coast Federation of Fisherman's Associations and the Institute for Fisheries Resources (jointly)
Paul M Washburn
Process Gas Consumers Group
Rogue Riverkeeper
Ronald L Foord
Ruby Pipeline
Seneca Jones Timber Company, LLC
Shane Johnson
Sierra Club
Stacey and Craig McLaughlin (as individuals)*
State of Wyoming
Southwest Gas Corporation
Victor Elam
Waterkeeper Alliance*
Western Environmental Law Center
Will Wright
Wyoming Pipeline Authority

Exhibit B

Exhibit B-1

Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
2601 Meacham Boulevard
Fort Worth, TX 76193

Aeronautical Study No.
2013-ANM-1907-OE
Prior Study No.
2013-ANM-1747-OE

Issued Date: 07/24/2014

Jerzy Kichner
Jordan Cove Energy Project
125 Central Ave
Suite 380
Coos Bay, OR 97420

**** NOTICE OF PRESUMED HAZARD ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	LNG TANK - NORTH
Location:	North Bend and Coos Bay, OR
Latitude:	43-25-55.32N NAD 83
Longitude:	124-16-01.37W
Heights:	30 feet site elevation (SE)
	225 feet above ground level (AGL)
	255 feet above mean sea level (AMSL)

Initial findings of this study indicate that the structure as described exceeds obstruction standards and/or would have an adverse physical or electromagnetic interference effect upon navigable airspace or air navigation facilities. Pending resolution of the issues described below, the structure is presumed to be a hazard to air navigation.

If the structure were reduced in height so as not to exceed 137 feet above ground level (167 feet above mean sea level), it would not exceed obstruction standards and a favorable determination could subsequently be issued.

Any height exceeding 183 feet above ground level (213 feet above mean sea level), will result in a substantial adverse effect and would warrant a Determination of Hazard to Air Navigation.

See Attachment for Additional information.

NOTE: PENDING RESOLUTION OF THE ISSUE(S) DESCRIBED ABOVE, THE STRUCTURE IS PRESUMED TO BE A HAZARD TO AIR NAVIGATION. THIS LETTER DOES NOT AUTHORIZE CONSTRUCTION OF THE STRUCTURE EVEN AT A REDUCED HEIGHT. ANY RESOLUTION OF THE ISSUE(S) DESCRIBED ABOVE MUST BE COMMUNICATED TO THE FAA SO THAT A FAVORABLE DETERMINATION CAN SUBSEQUENTLY BE ISSUED.

IF MORE THAN 60 DAYS FROM THE DATE OF THIS LETTER HAS ELAPSED WITHOUT ATTEMPTED RESOLUTION, IT WILL BE NECESSARY FOR YOU TO REACTIVATE THE STUDY BY FILING A NEW FAA FORM 7460-1, NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION.

If we can be of further assistance, please contact our office at (907) 271-5863. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-ANM-1907-OE.

Signature Control No: 195630983-224866817 (NPH)
Robert van Haastert
Specialist

Attachment(s)
Additional Information

ASN 2013-ANM-1907-OE

Abbreviations

VFR - Visual Flight Rules	AGL - Above Ground Level	RWY - runway
IFR - Instrument Flight Rules	MSL - Mean Sea Level	nm - nautical mile
DA - Decision Altitude	MDA - Minimum Decent Altitude	
NEH - No Effect Height	ICA - Initial Climb Area	CAT - aircraft category

Part 77 - Title 14 CFR Part 77, Safe, Efficient Use and Preservation of the Navigable Airspace

Our study has disclosed that this proposed 225 AGL/255 MSL LNG tank, designated LNG TANK- North, is within the protected surfaces at Southwest Oregon Regional (OTH), North Bend, OR. The OTH elevation: 17 MSL.

At the proposed 225 AGL/255 MSL height, this structure would penetrate these protected airport surfaces:

Section 77.17(a)(2) -- The transitional surface area designated to protect Category C and Category D aircraft traffic patterns and VFR aircraft transitioning to/from the enroute phase of flight. These tanks would exceed this transitional surface area by 25 feet.

Section 77.19(a) - A height exceeding a horizontal plane 150 feet above the established airport elevation. This tank would exceed the VFR maneuvering areas for Category A and Category B aircraft (horizontal surface) at OTH by 88 feet.

This proposed tank would exceed the traffic pattern airspace by 42 feet for the OTH RWY 04/22 as defined in FAA JO 7400.2J, 6-3-8, Evaluating Effect on VFR Operations.

d. AIRPORT AREAS - Consider the following when determining the effect of structures on VFR operations near airports:

1. Traffic Pattern Airspace - There are many variables that influence the establishment of airport arrival and departure traffic flows. Structures in the traffic pattern airspace may adversely affect air navigation by being a physical obstruction to air navigation or by distracting a pilot's attention during a critical phase of flight. The categories of aircraft using the airport determine airport traffic pattern airspace dimensions.

(a) Traffic Pattern Airspace dimensions (See FIG 6-3-11).

(b) Within Traffic Pattern Airspace - A structure that exceeds a 14 CFR, part 77 obstruction standard and that exceeds any of the following heights is considered to have an adverse effect and would have a substantial adverse effect if a significant volume of VFR aeronautical operations are affected except as noted in paragraph 6-3-8 d.1.(f) and (g) (see FIG 6-3-12).

(c) The height of the transition surface (other than abeam the runway), the approach slope (up to the height of the horizontal surface), the horizontal surface, and the conical surface (as applied to visual approach runways, Section 77.25).

The OTH Airport Master Record can be viewed at http://www.gcr1.com/5010web/airport.cfm?Site=OTH. It states that there are 36 single engine, eight (8) multi engine, and one (1) jet aircraft based at OTH. For the 12 months ending 31 July 2012 (latest information) there were 18,277 reported operations.

A favorable FAA Determination can be issued at a revised height of 137 AGL/157 MSL.

Further FAA study is not available for this proposal for any height greater than 183 AGL/203 MSL, as an internal FAA study identified a substantial adverse effect exists for any height greater than 183 AGL/203 MSL

Please email Dan Shoemaker at Dan.Shoemaker@faa.gov or Robert.van.Haastert@faa.gov, with your intentions for this aeronautical study.

Exhibit B-2

Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
2601 Meacham Boulevard
Fort Worth, TX 76193

Aeronautical Study No.
2013-ANM-1747-OE

Issued Date: 07/24/2014

Jerzy Kichner
Jordan Cove Energy Project
125 Central Ave
Suite 380
Coos Bay, OR 97420

**** NOTICE OF PRESUMED HAZARD ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	LNG TANKS (two)
Location:	North Bend and Coos Bay, OR
Latitude:	43-25-50.58N NAD 83
Longitude:	124-16-01.08W
Heights:	30 feet site elevation (SE)
	225 feet above ground level (AGL)
	255 feet above mean sea level (AMSL)

Initial findings of this study indicate that the structure as described exceeds obstruction standards and/or would have an adverse physical or electromagnetic interference effect upon navigable airspace or air navigation facilities. Pending resolution of the issues described below, the structure is presumed to be a hazard to air navigation.

If the structure were reduced in height so as not to exceed 137 feet above ground level (167 feet above mean sea level), it would not exceed obstruction standards and a favorable determination could subsequently be issued.

Any height exceeding 183 feet above ground level (213 feet above mean sea level), will result in a substantial adverse effect and would warrant a Determination of Hazard to Air Navigation.

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If we can be of further assistance, please contact our office at (907) 271-5863. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-ANM-1747-OE.

Signature Control No: 194337946-224825690 (NPH)
Robert van Haastert
Specialist

Attachment(s)
Additional Information

ASN 2013-ANM-1747-OE

Abbreviations

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IFR - Instrument Flight Rules	MSL - Mean Sea Level	nm - nautical mile
DA - Decision Altitude	MDA - Minimum Decent Altitude	
NEH - No Effect Height	ICA - Initial Climb Area	CAT - aircraft category

Part 77 - Title 14 CFR Part 77, Safe, Efficient Use and Preservation of the Navigable Airspace

Our study has disclosed that these two proposed 225 AGL/255 MSL LNG tanks are within the protected surfaces at Southwest Oregon Regional (OTH), North Bend, OR. The OTH elevation: 17 MSL.

At the proposed 225 AGL/255 MSL height, the proposed structures would penetrate these protected airport surfaces:

Section 77.17(a)(2) -- The transitional surface area designated to protect Category C and Category D aircraft traffic patterns and VFR aircraft transitioning to/from the enroute phase of flight. These tanks would exceed this transitional surface area by 25 feet.

Section 77.19(a) - A height exceeding a horizontal plane 150 feet above the established airport elevation. These tanks would exceed the VFR maneuvering areas for Category A and Category B aircraft (horizontal surface) at OTH by 88 feet.

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1. Traffic Pattern Airspace - There are many variables that influence the establishment of airport arrival and departure traffic flows. Structures in the traffic pattern airspace may adversely affect air navigation by being a physical obstruction to air navigation or by distracting a pilot's attention during a critical phase of flight. The categories of aircraft using the airport determine airport traffic pattern airspace dimensions.

(a) Traffic Pattern Airspace dimensions (See FIG 6-3-11).

(b) Within Traffic Pattern Airspace - A structure that exceeds a 14 CFR, part 77 obstruction standard and that exceeds any of the following heights is considered to have an adverse effect and would have a substantial adverse effect if a significant volume of VFR aeronautical operations are affected except as noted in paragraph 6-3-8 d.1.(f) and (g) (see FIG 6-3-12).

(c) The height of the transition surface (other than abeam the runway), the approach slope (up to the height of the horizontal surface), the horizontal surface, and the conical surface (as applied to visual approach runways, Section 77.25).

The OTH Airport Master Record can be viewed at http://www.gcr1.com/5010web/airport.cfm?Site=OTH. It states that there are 36 single engine, eight (8) multi engine, and one (1) jet aircraft based at OTH. For the 12 months ending 31 July 2012 (latest information) there were 18,277 reported operations.

A favorable FAA Determination can be issued at a revised height of 137 AGL/157 MSL.

Further FAA study is not available for this proposal for any height greater than 183 AGL/203 MSL, as an internal FAA study identified a substantial adverse effect exists for any height greater than 183 AGL/203 MSL

Please email Dan Shoemaker at Dan.Shoemaker@faa.gov or Robert.van.Haastert@faa.gov, with your intentions for this aeronautical study.

Exhibit B-3

Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
2601 Meacham Boulevard
Fort Worth, TX 76193

Aeronautical Study No.
2013-ANM-1766-OE

Issued Date: 07/24/2014

Jerzy Kichner
Jordan Cove Energy Project
125 Central Ave
Suite 380
Coos Bay, OR 97420

**** NOTICE OF PRESUMED HAZARD ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Tower AMINE TOWER 1 - W
Location:	North Bend and Coos Bay, OR
Latitude:	43-26-06.42N NAD 83
Longitude:	124-14-43.33W
Heights:	46 feet site elevation (SE)
	142 feet above ground level (AGL)
	188 feet above mean sea level (AMSL)

Initial findings of this study indicate that the structure as described exceeds obstruction standards and/or would have an adverse physical or electromagnetic interference effect upon navigable airspace or air navigation facilities. Pending resolution of the issues described below, the structure is presumed to be a hazard to air navigation.

If the structure were reduced in height so as not to exceed 121 feet above ground level (167 feet above mean sea level), it would not exceed obstruction standards and a favorable determination could subsequently be issued.

Any height exceeding 121 feet above ground level (167 feet above mean sea level), will result in a substantial adverse effect and would warrant a Determination of Hazard to Air Navigation.

See Attachment for Additional information.

NOTE: PENDING RESOLUTION OF THE ISSUE(S) DESCRIBED ABOVE, THE STRUCTURE IS PRESUMED TO BE A HAZARD TO AIR NAVIGATION. THIS LETTER DOES NOT AUTHORIZE CONSTRUCTION OF THE STRUCTURE EVEN AT A REDUCED HEIGHT. ANY RESOLUTION OF THE ISSUE(S) DESCRIBED ABOVE MUST BE COMMUNICATED TO THE FAA SO THAT A FAVORABLE DETERMINATION CAN SUBSEQUENTLY BE ISSUED.

IF MORE THAN 60 DAYS FROM THE DATE OF THIS LETTER HAS ELAPSED WITHOUT ATTEMPTED RESOLUTION, IT WILL BE NECESSARY FOR YOU TO REACTIVATE THE STUDY BY FILING A NEW FAA FORM 7460-1, NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION.

If we can be of further assistance, please contact our office at (907) 271-5863. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2013-ANM-1766-OE.

Signature Control No: 194338102-224858559 (NPH)
Robert van Haastert
Specialist

Attachment(s)
Additional Information

ASN 2013-ANM-1766-OE

Abbreviations

VFR - Visual Flight Rules	AGL - Above Ground Level	RWY - runway
IFR - Instrument Flight Rules	MSL - Mean Sea Level	nm - nautical mile
DA - Decision Altitude	MDA - Minimum Decent Altitude	
NEH - No Effect Height	ICA - Initial Climb Area	CAT - aircraft category

Part 77 - Title 14 CFR Part 77, Safe, Efficient Use and Preservation of the Navigable Airspace

Our study has disclosed that this proposed 142 AGL/188 MSL tower, designated AMINE Tower-1, is within the protected surfaces at Southwest Oregon Regional (OTH), North Bend, OR. The OTH elevation: 17 MSL.

At the proposed 142 AGL/188 MSL height, this structure would penetrate these protected airport surfaces:

Section 77.19(a) - A height exceeding a horizontal plane 150 feet above the established airport elevation. This building would exceed the VFR maneuvering areas for Category A and Category B aircraft (horizontal surface) at OTH by21 feet

This proposed tower would exceed the traffic pattern airspace by 21 feet for the OTH RWY 04/22 as defined in FAA JO 7400.2J, 6-3-8, Evaluating Effect on VFR Operations.

d. AIRPORT AREAS - Consider the following when determining the effect of structures on VFR operations near airports:

1. Traffic Pattern Airspace - There are many variables that influence the establishment of airport arrival and departure traffic flows. Structures in the traffic pattern airspace may adversely affect air navigation by being a physical obstruction to air navigation or by distracting a pilot's attention during a critical phase of flight. The categories of aircraft using the airport determine airport traffic pattern airspace dimensions.

(a) Traffic Pattern Airspace dimensions (See FIG 6-3-11).

(b) Within Traffic Pattern Airspace - A structure that exceeds a 14 CFR, part 77 obstruction standard and that exceeds any of the following heights is considered to have an adverse effect and would have a substantial adverse effect if a significant volume of VFR aeronautical operations are affected except as noted in paragraph 6-3-8 d.1.(f) and (g) (see FIG 6-3-12).

(c) The height of the transition surface (other than abeam the runway), the approach slope (up to the height of the horizontal surface), the horizontal surface, and the conical surface (as applied to visual approach runways, Section 77.25).

The OTH Airport Master Record can be viewed at http://www.gcr1.com/5010web/airport.cfm?Site=OTH. It states that there are 36 single engine, eight (8) multi engine, and one (1) jet aircraft based at OTH. For the 12 months ending 31 July 2012 (latest information) there were 18,277 reported operations.

A favorable FAA Determination can be issued at a revised height of 121 AGL/167 MSL.

Further FAA study is not available for this proposal for any height greater than 121 AGL/167 MSL, as an internal FAA study identified a substantial adverse effect exists for any height greater than 121 AGL/167 MSL.

Please email Dan Shoemaker at Dan.Shoemaker@faa.gov or Robert.van.Haastert@faa.gov, with your intentions for this aeronautical study.

Exhibit B-4

Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
2601 Meacham Boulevard
Fort Worth, TX 76193

Aeronautical Study No.
2013-ANM-1767-OE

Issued Date: 07/24/2014

Jerzy Kichner
Jordan Cove Energy Project
125 Central Ave
Suite 380
Coos Bay, OR 97420

**** NOTICE OF PRESUMED HAZARD ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Tower AMINE TOWER 2 - E
Location:	North Bend and Coos Bay, OR
Latitude:	43-26-05.54N NAD 83
Longitude:	124-14-40.16W
Heights:	46 feet site elevation (SE)
	142 feet above ground level (AGL)
	188 feet above mean sea level (AMSL)

Initial findings of this study indicate that the structure as described exceeds obstruction standards and/or would have an adverse physical or electromagnetic interference effect upon navigable airspace or air navigation facilities. Pending resolution of the issues described below, the structure is presumed to be a hazard to air navigation.

If the structure were reduced in height so as not to exceed 121 feet above ground level (167 feet above mean sea level), it would not exceed obstruction standards and a favorable determination could subsequently be issued.

Any height exceeding 121 feet above ground level (167 feet above mean sea level), will result in a substantial adverse effect and would warrant a Determination of Hazard to Air Navigation.

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Signature Control No: 194338105-224859952 (NPH)
Robert van Haastert
Specialist

Attachment(s)
Additional Information

ASN 2013-ANM-1767-OE

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Our study has disclosed that this proposed 142 AGL/188 MSL tower, designated AMINE Tower-2, is within the protected surfaces at Southwest Oregon Regional (OTH), North Bend, OR. The OTH elevation: 17 MSL.

At the proposed 142 AGL/188 MSL height, this structure would penetrate these protected airport surfaces:

Section 77.19(a) - A height exceeding a horizontal plane 150 feet above the established airport elevation. This building would exceed the VFR maneuvering areas for Category A and Category B aircraft (horizontal surface) at OTH by 21 feet

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Please email Dan Shoemaker at Dan.Shoemaker@faa.gov or Robert.van.Haastert@faa.gov, with your intentions for this aeronautical study.

Exhibit C

Submitted by

Jerry Havens
Distinguished Professor of Chemical Engineering
University of Arkansas

James Venart
Professor Emeritus of Mechanical Engineering
University of New Brunswick

Regarding the
Jordan Cove Export Terminal
Draft Environmental Impact Statement
Docket No. CP13-483

January 14, 2015

UNITED STATES LNG TERMINAL SAFE-SITING POLICY IS FAULTY

We have commented repeatedly to the Federal Energy Regulatory Commission (FERC) and the Department of Transportation (DOT) that we believe FERC is approving variances to the requirements of 49 CFR 193, Liquefied Natural Gas Facilities: Federal Safety Standards, that have not been subjected to adequate science based review and appear to provide inadequate fire and explosion exclusion zones to protect the public.

This submission focuses on the Draft Environmental Impact Statement (DEIS) for the Jordan Cove Export (JCE) Terminal Project. We believe the JCE DEIS fails to provide for protection of the public from credible fire and explosion hazards. The conversion of the Jordan Cove facility for export, including provision of gas treatment technology utilizing mixed hydrocarbon refrigerants for liquefaction and removal of heavy hydrocarbons from the natural gas feed to the plant, presents hazards to the project more serious (on a unit weight basis) than with LNG. We believe these additional hazards have been discounted without sufficient scientific justification in spite of multiple international reports during the last decade of catastrophic accidents involving unconfined (hydrocarbon) vapor cloud explosions. It is clear that the increased hazards due to the presence of significant amounts of heavier-than-methane hydrocarbons, for which there is considerably more extensive research and accident experience than for LNG-ONLY projects, and which are "game-changing" in importance, have been seriously under-estimated in this DEIS. We believe the hazards attending the proposed operations at the Jordan Cove export facility could have the potential to rise, as a result of cascading events, to catastrophic levels that could cause the near-total and possibly total loss of the facility, including any LNG ship berthed there. Such an event could present serious hazards to the public well beyond the facility boundaries.

We also believe there remains significant potential for cascading fire and explosion events attending "LNG only" storage and handling that have not been sufficiently addressed, particularly regarding the worst-possible case events that should be considered on the shore side storage tanks and marine side (ship related), either by accident or terrorist activity. Instead of considering the findings of extensive LNG Safety research conducted at the direction of Congress during the last decade that might influence the judgment of the acceptability (to the public) of the worst case

events that should be considered for this proposed terminal, the present JCE DEIS appears to largely ignore those findings.

The JCE DEIS focuses principally on arguments directed to meeting the "letter" of the federal regulations governing a single index of public safety - mathematical modeled exclusion zones (safe separation distances) intended to keep the public out of harm's way. But this DEIS relies, for prediction of exclusion zone distances, on the use of mathematical models which have not been subjected to adequate (open for public inspection) validation requirements either by comparison with experimental data or independent scientific peer review. Furthermore, the calculations of the exclusion distances for vapor dispersion and vapor-cloud-explosion hazards do not provide any evidence of applicability in near calm conditions coupled with reliance on impermeable (concrete) vapor fences designed to retard vapor cloud travel. Until there is produced by the applicant meaningful evidence of the accuracy and applicability-for-purpose of these modeling techniques, and that information is made available for public evaluation and oversight, it must be considered that the potential hazards of storage, handling, and shipping of such massive quantities of energy as are involved in this project could have been seriously underestimated.

The Jordan Cove Export Terminal DEIS Section 4 (Environmental Analysis), which contains the section on Reliability and Safety, comes to nearly twelve hundred pages, much of which is technically complex and therefore unlikely to be very helpful to the public. In view of shortcomings in the DEIS that we will identify, we believe it is particularly timely to summarize the hazards that require careful address for the proposed export terminal, as well as provide DOT and FERC with our independent assessment of the current state of scientific knowledge, including limitations thereof, upon which proper quantification of the risks and consequences of credible accidental or intentional events should be based.

We believe the present methodology of regulating LNG Terminal (import and export) hazards-to-the-public are overdue for careful review and assessment. During the brief (six-decade) history of LNG trans-ocean transport, LNG Storage and Handling Facilities have increased in size by an order of magnitude (factor 10). At the same time, it appears that the regulatory guidelines have not been continually reviewed and updated in consideration of extensive research programs required by Congress to better provide for public safety from LNG import terminals or the ships that service them. Most importantly, the regulations that are being applied to the proposed JCE Terminal appear to give only cursory attention to the additional hazards that will be involved by the proposed expansion of the terminal for export service. For this reason alone, we believe it is important for the public to consider "how we got here". We have prepared a short history of the development of the current LNG Facility Siting-for-Safety regulations which we believe would be helpful for all involved (public and regulators alike) to consider. However, in order to focus on the concerns that we believe require immediate address in the JCE Terminal DEIS, we have placed that historical appendix at the end of our comments. We recommend it to the reader.

There is a rich history of experience with the hazards of hydrocarbon fuels and chemicals heavier than methane (the principal component of LNG). That history describes numerous catastrophic accidents involving complete destruction of plant facilities due to fire and explosion. In the present JCE DEIS, FERC appears to have accepted extensions of arguments previously prepared for the application to build the facility as an import terminal. However, as our history (appendix) shows, the regulations regarding approval of import terminals have in the past been guided by the premise that LNG, as methane, poses significantly lesser hazards than heavier hydrocarbons routinely handled in the petroleum industry. We do not disagree with this characterization. What we find disconcerting is the extent to which the "safety" characteristics of

methane have been misunderstood (and misrepresented) as the industry has expanded; today involving extremely large volumes of LNG (energy) concentrated in storage and handling facilities. After all, methane is the prize fuel that it is in that it ignites easily and burns hotly and cleanly, and those attributes entail hazards that multiply with the amounts of fuel involved. Therefore, we believe that insufficient attention has been given to the potential magnitude of the hazards that accompany the large scale storage-and-handling LNG-ONLY operations now operating and planned. But, we want to make it clear that our more serious concerns relating to the JCE Terminal result from the combined storage and handling, in gaseous and liquid forms, of methane and heavier hydrocarbons including ethylene, propane, pentane, and amines in such large amounts.

We believe the proposed JCE Terminal DEIS is a signal example of the (unwarranted) extent to which regulations designed for LNG-only handling facilities are being used as the basis for regulating large-scale projects involving heavier-than-methane hydrocarbon chemicals and fuels in volumes, particularly in combination, that involve significantly greater hazard potential than do import-only LNG terminals. With the current concerns for terrorist activity, and in view of the recent international experience of catastrophic accidental unconfined vapor cloud explosions of hydrocarbon fuels, it is time for a careful review.

Volume of Hazardous Hydrocarbons Stored at the Proposed JCE Terminal

- Hazardous Materials Tank (s) Storage Volumes, gallons
  - LNG (2) – 89,662,000
  - Ethylene (1) – 14,000
  - Propane (1) – 15,670
  - Isopentane (1) – 31,030
  - Amine (1) – 17,205
- Hazardous Materials Design Spill Volumes and Spill Impoundment Volumes, gallons
  - LNG (2) – 89,662,000 – 112,338,200 (outer tank concrete wall)
  - 36-inch Ship Load Header (at dock) – 784,600 – 785,170 (concrete sump)
  - 36-inch Ship Load Header (at tanks) – 827,740 – 833,400 (concrete sump, shared)
  - 24-inch LNG Rundown Line – 71,980 – 833,400 (concrete sump, shared)
  - 6-inch Mixed Refrigerant Line – 61,060 – 833,400 (concrete sump, shared)
  - Ethylene Storage Tank – 14,000 – 43,935 (concrete sump, shared)
  - Propane Storage Tank – 15,670 – 43,935 (concrete sump, shared)
  - Isopentane Storage Tank – 31,030 – 43,395 (concrete sump, shared)
  - Amine Makeup Tank – 17,205 – 17,245 (concrete sump)

We focus on these large hazardous materials inventories, the "design" spills that are considered, and the estimation of potential consequences which determine the safety exclusion distances for fire and explosion hazards - to provide our summary assessment of the JCE DEIS.

FAILURE TO ADEQUATELY PROVIDE FOR PUBLIC SAFETY

The JCE Terminal DEIS issued by FERC concludes that the principal regulatory requirements of 49 CFR 193: *Liquefied Natural Gas Facilities: Federal Safety Standards* providing exclusion zones to protect the public from liquid pool fire, vapor cloud dispersion, and vapor cloud explosion hazards have been met satisfactorily (with FERC-stated actions required) by the applicant's submitted mathematical-model calculated exclusion distances.

In our opinion, the DEIS-proposed approval of the JCE Terminal, in the absence of careful address of the concerns we describe below, will not provide for sufficient separation distances (exclusion zones) to protect the public from credible events, whether by accident or intentional act. However, our principal intent is not to engage in argument regarding the details of the methodology or the accuracy of the predictions submitted by Jordan Cove to calculate the exclusion distances (we do believe there are deficiencies in that regard because sufficient evidence of the accuracy and applicability of the mathematical models and model-inputs thereto has not been presented). Most importantly, we believe that the JCE DEIS has developed too rapidly, we suspect partly due to its evolvement from the DEIS previously submitted for approval as an import (only) terminal at the Coos Bay site, and as a result has become mired in the details of exclusion zone determination using theoretical models without proper recognition of the overall potential for catastrophic hazards that must be considered for operation as an export terminal.

Our primary purpose in these comments is to state the following serious concerns which we believe require science-based adjudication prior to approval of this application-for-siting:

1. The current consequence-driven regulatory process (see appendix on history), which decides the acceptability of an LNG siting process by ensuring that the consequences of accidents will not extend offsite to affect the public), has developed similarly to that which forms the basis for nuclear plant siting approval – reliance on determination of so-called credible "design accidents" (here called "design spills") to determine the required exclusion distances (from the accident (spill) location) to the applicant's property line. The determination of these design accidents is a complex process which has developed *ad hoc*. Initially the design accident (release) was taken as the catastrophic release of the entire contents of the largest storage vessel on the site. It later was changed to the "guillotine" severance of the largest transfer line in the facility, with the release duration assumed to be ten minutes, or a shorter time if the applicant could demonstrate the ability to limit the spill duration (such as by incorporation of emergency shutdown procedures). There followed the adoption of a provision by which an alternative release rate and total amount (termed an "accidental leakage rate (ACR) spill") can be submitted by the applicant for approval. Such ACR spills are typically spills from smaller lines (such as branch or instrument lines) rather than the largest lines carrying the hazardous material. The regulation provisions now allow consideration of even smaller releases from "holes" in the selected lines. In our opinion these developments can only be understood as resulting from pressures on the applicants to seek approval of smaller and smaller required exclusion distance determinations. But the requirements placed on the applicant to demonstrate the probability or lack thereof of the different kinds of releases assumed for designation as an ACR are not sufficiently quantified – the process appears to be largely a "good-faith" decision reached jointly by the applicant and the DOT/FERC staffs. In our judgment this is not good science or engineering; it is indicative of regulation that facilitates facility approval – potentially at the expense of public safety.
2. Further compromising the effectiveness of the current regulations for public safety, the system has become dependent upon modeling methods using

complex mathematical calculations (computer programs) that are not available to the public for independent evaluation of their applicability-for-purpose; we believe this prevents a basic public right-to-know.

3. The calculations supporting the exclusion zone distance for the LNG "tanktop" fire chosen by the applicant as the controlling "design spill" fire do not consider potential cascading failure hazards to the public that could follow such a fire. We believe such failures have the potential to lead to structural failures of the LNG tank(s) which could lead to catastrophe.

4. There are numerous potential hazards from fires and explosions that could result in cascading events involving the liquefaction trains at the facility as well as LNG ships berthed at the facility. We realize the ship is not FERC's responsibility; however, the worst-case hazard potential for the marine side of the proposed terminal should be considered before approval in view of the public concerns recently addressed in research required by Congress.

5. The methods used to determine vapor-cloud exclusion zones, particularly the use of "mitigation" methods such as gas-impervious concrete fences to prevent advance of vapor clouds beyond the applicant's property lines, could increase the potential for serious, even catastrophic, vapor cloud explosions. The JCE Terminal DEIS appears to ignore international experiences of catastrophic unconfined vapor cloud explosions (UVCE), at least four of which occurred in the last decade, destroying the facilities involved as a result of cascading events.

- **Design Spill Accident Selection**

The design spill specified for the ship's cargo unloading line for the Jordan Cove Export facility has been designated as a guillotine break of a 36 inch line with a ten minute duration spill of 827,740 gallons. Havens' 2009 review[1]of eleven LNG import terminal environmental impact statements indicates approvals for ship unloading line design spills ranging from 28,900 gallons (Keyspan, not approved) to 812,000 gallons (Trunkline, approved). FERC provided no quantitative justification for approving such large variations for these eleven spills, which resulted in large variations in the extent of vapor cloud exclusion zones. Since the vapor cloud zone determinations are directly related to the amount of LNG spilled, this lack of consistency in the design spills selected for analysis by the various applicants has the appearance of simply determining the size of the spill that the applicant's property line distance will allow. None of these widely varying approvals appear to have been supported by quantitative science-based analysis.

The Jordan Cove Export (JCE) DEIS illustrates the potential for misunderstanding in the current design-spill-selection process. The JCE DEIS specifies a ship unloading line (SUL) spill of more than 827,000 gallons into a concrete impoundment basin. To our knowledge this JCE SUL spill is the largest specified by any terminal applicant to date. To the reader uninitiated in the complexities of this process, this choice of design spill might be viewed as conservative (assuming a worst case spill of nearly a million gallons of LNG). However, current scientific knowledge concerning such events ensures that the applicant would have no hope of guaranteeing that the vapor cloud from such a large spill could be maintained within their property boundary *without incorporating extreme*

[1]Havens, J., Consequence Analyses for Credible LNG Hazards, Second Annual AICHE/CSCHE Topical Conference, Montreal, Quebec, August 2009

measures. The extreme measures proposed to contain the cloud on the JCE's property are vapor-impervious concrete fences, some forty feet tall, which prevent the advance of a vapor cloud in selected directions. We believe this provision could result in defeating the purpose of the exclusion zones for ensuring public safety - by introducing additional severe hazards of vapor cloud explosion.

There are other serious problems with the design spill quantities and vapor dispersion (vapor cloud formation) predictions. The vapor dispersion model predictions presented assume maximum wind speeds (presumably at 10 meters elevation) of 1-2 m/s. Near the ground (one to five meters elevation) the wind direction fluctuation (as well as the speed) is very uncertain in near-calm wind conditions. There are proven scientific reasons to expect that low-wind speed (near-calm) conditions combined with the high density stratification of the cold LNG vapor cloud near the spill can increase the potential for damaging vapor cloud explosions. In such conditions the advance of the LNG vapor cloud is determined primarily by gravity forces on the cloud; typical cloud advance speeds would be around one (or even a fraction of one) meter per second. As a consequence, mixing of LNG vapor with air would be exceptionally "slow", and some degree of partial "containment of the cloud" would result due to the vapor fences' holdup effect. Finally, we expect that since the fences do not surround the property (there are gaps where the gas could get through) it is likely that simulations of the vapor dispersion, even with the presently specified fences, might not predict containment of the flammable gas cloud boundaries at higher wind speeds.

- **<u>Vapor Dispersion Models are Proprietary and are not Available for Public Vetting</u>**

The vapor dispersion models (also used for the damaging explosion-overpressure predictions) are not available for independent inspection or evaluation. While the models are presumably available to anyone requesting such services, the cost would probably be prohibitive to the public. This is a very significant development in government regulation policy; previously such models (DEGADIS and FEM3A) were available to the public at no cost. We believe this situation should be reviewed; it has the potential to undermine confidence in the entire process.

At least two new vapor dispersion models have been approved, for a total of four; DEGADIS, FEM3A, and two new ones, PHAST and FLACS. In contrast to DEGADIS and FEM3A, the development of which were paid for with public funds and which were (and still are) freely available for use and independent evaluation, the new models are privately held (proprietary), prohibitively expensive to the public, and they are not freely available for evaluation of applicability and accuracy. To our knowledge PHAST and FLACS are the only models which have been used since they were approved, and they are the only (vapor dispersion) models used for the preparation of the JCE Terminal DEIS.

- **<u>The Fire Radiation Design Spill Ignores the Potential for Severe Cascading Effects</u>**

The controlling fire radiation exclusion zone distance calculated using LNGFIRE3 and presented in the JCE DEIS barely falls within the applicant's property boundaries. We believe that the application of the LNGFIRE3 model to such a tank-top scenario requires assumptions which are erroneous to describe the wind speed and flow patterns at the top of the tank and that these deficiencies could result in non-conservative predictions of exclusion zones. However, as we want to prioritize our concerns regarding hazards with severe (catastrophe) potential, we focus here on our concern that such a fire (tank-top), if it were to occur in a nearly full LNG tank, could burn for a protracted time period, perhaps twenty to thirty hours, and there would be no practicable way to extinguish it.

Professor Venart's study of this fire scenario raises serious questions regarding the possibility of massive failure of a full-containment LNG tank due to severe, long-term, fire heat exposure to the tank with such a fire atop it. We believe that if this Design Spill Fire is to be used to determine the fire-radiation exclusion zone, there must also be considered the potential for such a fire to cause catastrophic failure of the tank (or tanks), resulting in the rapid release (spill) of perhaps half a million gallons of burning LNG. Should that occur, the fire radiation distances from the earthen-berm tertiary containment provided would surely extend the estimated fire radiation exclusion zone requirements to provide for public safety well beyond the facility property lines, to say nothing of the potential for catastrophic damage to the entire facility. We present below excerpts from Venart's presentation to DOT's Pipeline and Hazardous Materials Safety Administration (PHMSA)[2] that illustrate our concerns for cascading failures following such a tank-top-fire-scenario.

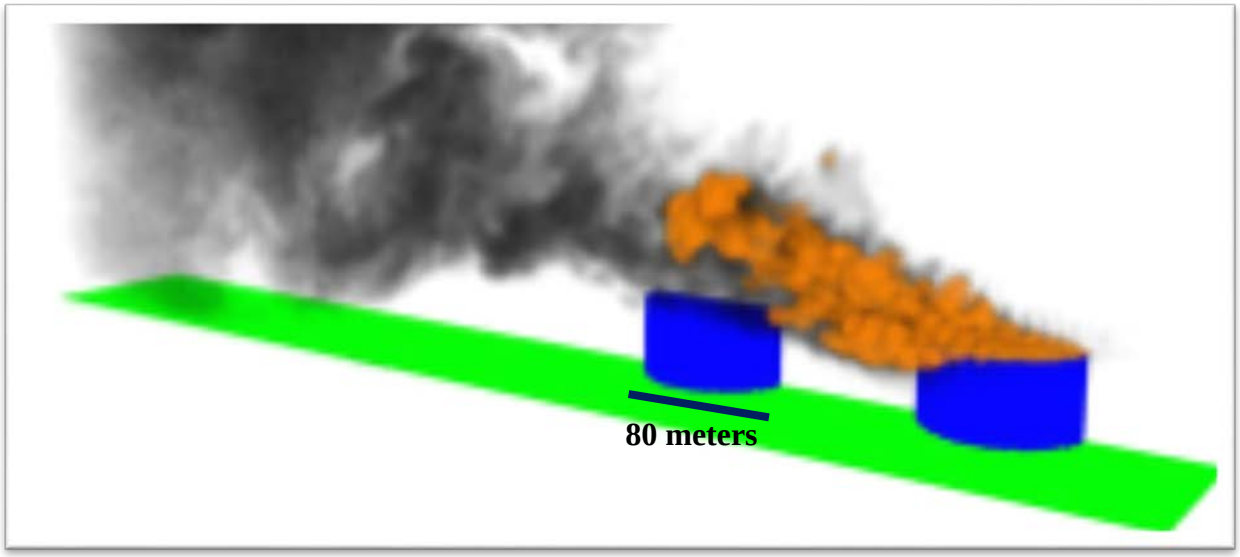
Description of full-containment LNG tanks

- Very large – 80 > 90 meters diameter, 40 > 50 meters tall
- Post tensioned reinforced concrete, walls 0.7 m thick, roof 0.5 m thick
- Post tension; steel, vertical and circumferential through buttresses and tendons
- Concrete shell outer layer, inner layers, vapor barrier (steel), insulation (perlite) Nickel-steel LNG containment
- Plumbing, in and out, through the tank top

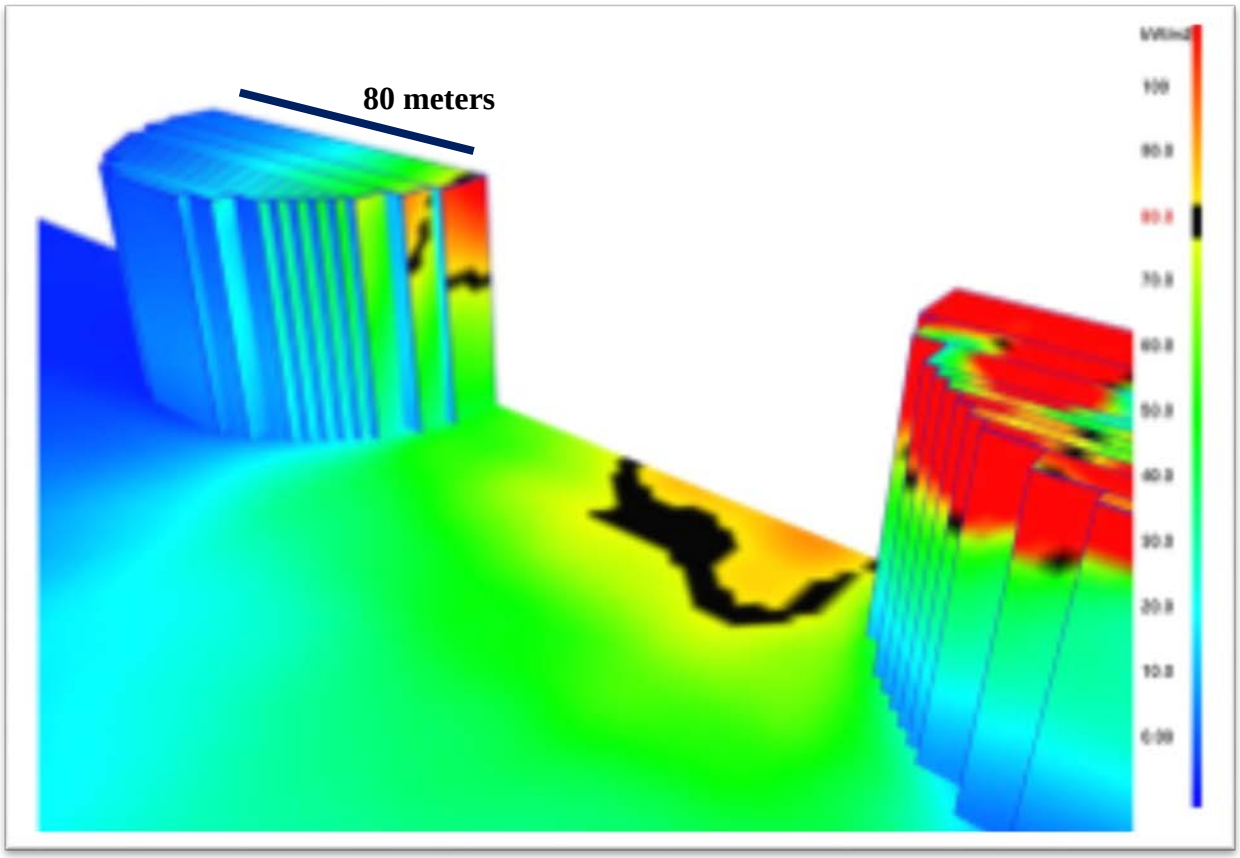
Typical Tank(s)

[2] Venart, J., LNG Tank-top Fires: Radiation Exclusion Zones, Presented to DOT PHMSA, Washington, DC, May 30, 2013.

LNG tank-top fire (high wind speed) FDS model results by Venart



Smoke and Fire Development for Two Tanks



Down-wind tank being exposed to an up-wind tank-top fire
Boundary heat flux for two tanks at 1 minute after fire initiation.
Incident heat flux exposures to both tanks in excess of 80 kW/m^2, wind 7.5 m/s.

Conclusions regarding tank-top fire and cascading failure scenario

- LNGFIRE3 has NOT been validated for the size of LNG fires anticipated for tank-top fires. Its use to establish conservative thermal exclusion zones is suspect.
- If not extinguished such a tank-top fire could possibly burn for 20-30 hours.
- NIST FDS CFD and experimental studies establish that the wind flowing around the sides of the tank tends to drag the flame down over the edge of the tank towards the ground. This exposes the concrete containment to high temperatures, radiant fluxes greater-than-design and thus thermal stresses with a potential for spalling, cracking, and other failure modes, thus loss of support to the interior mild steel moisture barrier and the insulating perlite.
- Thermal stresses to this complex system over the many hours of fire exposure could possibly cause collapse of the downwind edges of the Nickel steel primary containment and loss of LNG into the Perlite, a situation perhaps sufficient to result in total collapse of the containment system due to thermal stress. Under such conditions escalation of the event would be inevitable.
- The extent of the pool fire could now increase to the edges of any berm-impoundment surrounding the tank area, if provided, and a very much larger pool fire could result (of shorter duration).
- With two tanks, if one tank did not collapse, its adjacent neighbor would be exposed to heat fluxes greater than 80 kW/m^2 should the prevailing wind result in its flame exposure. Due to the increased fire size, plant processing areas could be adversely affected and the public radiation exclusion zone substantially increased.

- **<u>Potential for Cascading Events Increases with Heavier-than-Methane Hydrocarbons</u>**

The JCE DEIS pays little attention to the potential for boiling liquid expanding vapor explosions (BLEVEs) and UVCEs involving the liquefaction facilities. There appears to be a lack of coordination between the federal agencies (FERC and EPA[3] in this instance) in consideration of hydrocarbon explosion potential. We suspect that this is due to past emphasis of the regulations on LNG-only facilities. We quote from the Executive Summary of EPA 744-R-94-002:

This report assesses the potential consequences of accidents involving flammable chemicals to support the evaluation of whether such chemicals may warrant addition to the list of extremely hazardous substances (EHSs) under section 302 of Title III of the Superfund Amendments and Reauthorization Act (SARA). EPA's analysis included identification and evaluation of existing listing and classification systems, along with any applicable criteria; review of existing regulations and codes dealing with flammable materials; analysis of histories of accidents involving flammable substances; and modeling potential consequences of fires and explosions of flammable substances. …

A review of accident history indicates that flammable substances have been involved in many accidents, and, in many cases, fires and explosions of flammable

[3] Flammable Gases And Liquids And Their Hazards, United States Environmental Protection Agency, EPA 744-R-94-002, February 1994

substances have caused deaths and injuries. Accidents involving flammable substances may lead to vapor cloud explosions, vapor cloud fires, boiling liquid expanding vapor explosions (BLEVEs), pool fires, and jet fires, depending on the type of substance involved and the circumstances of the accident.

Vapor cloud explosions produce blast waves that can potentially cause offsite damage and kill or injure people. EPA reviewed the effects of blast wave overpressures to determine the level that has the potential to cause death or injury. High overpressure levels can cause death or injury as a direct result of an explosion; such effects generally occur close to the site of an explosion. EPA's analysis of the literature indicates that people also could be killed or injured because of indirect effects of the blast (e.g., collapse of buildings, flying glass or debris); these effects could occur farther from the site of the blast. A vapor cloud may burn without exploding; the effects of such a vapor cloud fire are limited primarily to the area covered by the burning cloud. The primary hazard of BLEVEs, pool fires and jet fires is thermal radiation; the potential effects of thermal radiation generally do not extend for as great a distance as those of blast waves. In addition, the effects of thermal radiation are related to duration of exposure; people exposed at some distance from a fire would likely be able to escape. BLEVEs, which generally involve rupture of a container, can cause container fragments to be thrown substantial distances; such fragments have the potential to cause damage and injury. Fragments and debris may also be thrown out as a result of the blast from a vapor cloud explosion.

The probability of occurrence of vapor cloud explosions appears to be rather low, based on analysis of the literature. EPA reviewed factors that may affect the probability of occurrence of a vapor cloud explosion, including the quantity of flammable vapor in a cloud, the presence of obstacles or partial confinement, and the type of ignition source. *Analysis of accidents indicates that vapor cloud explosions are less likely when the quantity in the cloud is less than 10,000 pounds. (emphasis added)* It is generally thought that some type of obstruction or confinement enhances the probability that a vapor cloud explosion, rather than a vapor cloud fire, will occur. A high energy ignition source also contributes to the probability of occurrence of a vapor cloud explosion. …

Based on modeling and analysis of the literature, flammable gases and volatile flammable liquids appear to be the flammable substances of most concern, because they may readily form vapor clouds, with the potential for damaging vapor cloud explosions. EPA identified a number of such substances of concern. The analysis carried out by EPA for this report was intended to provide a general background on the hazards of flammable gases and liquids. The modeling results and accident data illustrate and compare the consequences of vapor cloud explosions, vapor cloud fires, BLEVEs, and pool fires. …

There have been a large number of devastating hydrocarbon explosions, particularly BLEVEs, since 1994. Finally, we note that the design spills considered in the JCE DEIS exceed the 10,000

pound figure suggested by EPA as demarcating the size below which UVCEs are "improbable" (see emphasis added text in the EPA report quoted above) by at least a factor of 10, and in the case of LNG spills, by a factor of perhaps 300.

- **<u>The Vapor Clouds Formed from the Design Spills Pose Severe Explosion Hazards</u>**

The vapor dispersion distances calculated using PHAST and FLACS, while extending in some cases slightly past the applicant's property boundaries, obviously could not have been determined by the (dispersion) models used without the applicant's provision of gas-impermeable vapor fences to retain the flammable cloud boundaries within the property boundary. The Figure below indicates the position of the proposed vapor fences; gas-impermeable concrete fences as tall as forty feet.

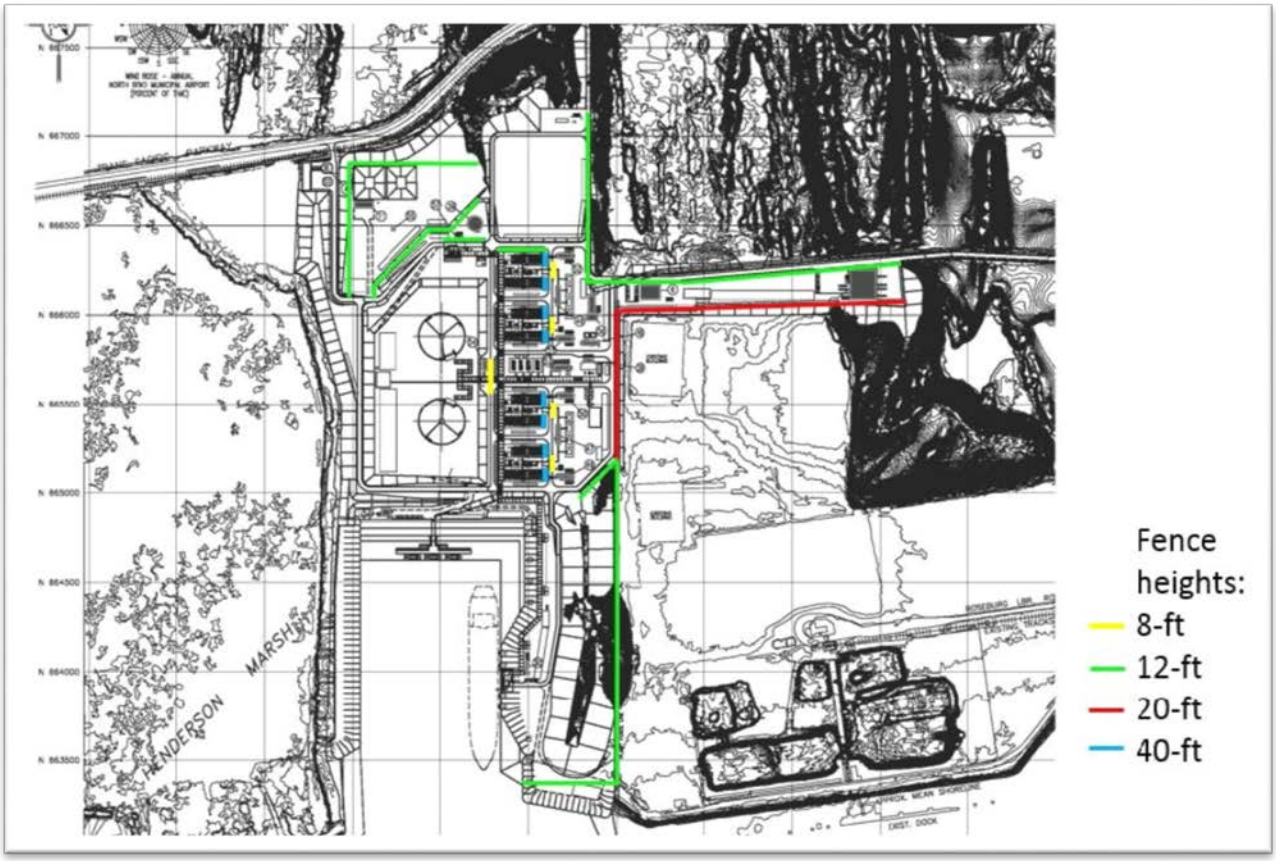


Figure 4.13-1 from DEIS
Vapor Fences at Jordan Cove Facility

Vapor Cloud Explosion hazards of LNG

The Jordan Cove Export DEIS FERC summarily dismisses the potential for methane vapor cloud explosions with the following statement:

> *The potential for unconfined LNG vapor cloud detonations was investigated by the Coast Guard in the late 1970s at the Naval Weapons Center at China Lake, California. Using methane, the primary component of natural gas, several experiments were conducted to determine if unconfined vapor clouds would*

detonate. Unconfined methane vapor clouds ignited with low-energy ignition sources (13.5 joules), produced flame speeds ranging from 12 to 20 mph. These flame speeds are much lower than the flame speeds associated with a deflagration with damaging overpressures or a detonation.

In consideration of the potential for mixtures of methane with heavier hydrocarbons that could be present at the terminal, the DEIS continues the statement immediately above with the following:

To examine the potential for detonation of an unconfined natural gas cloud containing heavier hydrocarbons that are more reactive, such as ethane and propane, the Coast Guard conducted further tests on ambient-temperature fuel mixtures of methane-ethane and methane-propane. The tests indicated that the addition of heavier hydrocarbons influenced the tendency of an unconfined natural gas vapor cloud to detonate. Less processed natural gas with greater amounts of heavier hydrocarbons would be more sensitive to detonation. … Although it has been possible to produce damaging overpressures and detonations of unconfined LNG vapor clouds, the Jordan Cove Project would be designed to receive feed gas with methane concentrations as low as 94 percent, which are not in the range shown to exhibit overpressures and flame speeds associated with high-order explosions and detonations.

However there is an important scientific paper describing the Coast Guard sponsored tests at China Lake[4] which contains the following (page 13):

The second group of tests was designed to test a postulated accident scenario in which the vapor formed during a LNG spill is mixed with air to form a flammable mixture and then diffuses into a culvert system. The mixture in the culvert ignites and the combustion wave accelerates and transitions to a detonation. This detonation wave then exits the culvert and detonates the remaining unconfined vapor cloud. … a 6 m long culvert, 2.4 m in diameter, was buried vertically in the ground in the center of the polyethylene hemisphere. A stoichiometric mixture of methane/propane and air was introduced into the hemisphere and a detonation was initiated at the bottom of the culvert using a 3.2 mm thick layer of datasheet explosive (13 kg). In tests 1 and 3 (reported to be 85% methane and 94% methane), a strong shock wave was felt at the bunker and also in the town of Ridgecrest, 22 km from the test site. … Based on the test data, it appears that in tests 1 and 3 a detonation was produced within the unconfined cloud (emphasis added).

The Coast Guard Test No. 3 described immediately above was 94% methane, the lower limit methane concentration that Jordan Coves plans to accept as input feed to the terminal. While we acknowledge the use of a high-energy ignition source in CG Test No. 3, that is not sufficient reason to dismiss this test result as being meaningful for the Jordan Cove Export Terminal hazard assessment. The possibility of intentional use of high-explosives to ignite a vapor cloud must be considered - such methods are used routinely in the military to ignite the vapor/aerosol

[4] Parnarouskis, M., et.al., "Vapor Cloud Explosion Study", Sixth International Congress on Liquefied Natural Gas, 1980.

hydrocarbon/air clouds formed in the use of fuel-air (FAE) weapons. There are additional factors which can add to the potential for accidental occurrence of a "boosted" ignition source in the vapor clouds that could be formed following the spills being considered at the JCE facility.

Perhaps most importantly, as vapor fences at the Jordan Cove Facility could (in addition to the spill-guidance trenches and impoundments themselves) provide a degree of partial confinement to the cloud, there is additional potential for run up to detonation, especially if the cloud contains more than a few percent ethane/propane or equivalent heavy components.

All of the figures presented in the DEIS of flammable vapor cloud travel distance for the LNG design spills illustrate simply that the vapor fences prevent travel (except in minor cases which FERC has provided exceptions for) beyond the applicant's property boundary. We believe these results entirely miss the point of the intention of the regulations – to provide for public safety. These figures appear to indicate that the authors of the application (Jordan Cove and their Consultants) believe that the hazard extent of these spills ends at the calculated lower flammable limit concentration reached by the cloud (the cloud boundaries depicted represent concentration LFL/2, as required by the regulation). However, this assumption was historically based on the fact that a reasonable limit on the fire damage from a vapor cloud fire, which would be of short duration, would not extend significantly beyond the flammable vapor concentration boundary. The parties that prepared the JCE DEIS must surely be aware of the serious potential for an unconfined vapor cloud explosion to extend well beyond the limits of the flammable cloud boundary. In the text above describing the Coast Guard's explosion tests at China Lake, we provided evidence of the potential for LNG clouds that contain small amounts of heavier-than-methane hydrocarbons to develop damaging overpressures. We focus on two of the figures presented in the JCE DEIS, both for the design spills from the LNG ship unloading line. The points we wish to emphasize are specified immediately following the figures.

Figure 4.13.5 from DEIS
LNG Spill from a Guillotine Rupture of the Ship Loading Header

The area covered by the cloud in Figure 4.13.5 is estimated to be approximately 320 meters wide and 480 meters long (top to bottom in the figure). We estimate this gas cloud would be between 2 and 4 meters deep. The cloud envelops a large portion of the liquefaction trains; these trains are dense packed equipment structures which are known to accelerate flames in such a gas cloud sufficiently to cause damaging overpressures. The cloud essentially surrounds the LNG storage tanks.

Figure 4.13-7 from DEIS
LNG Jetting and Flashing Scenario from a Rupture of the Ship Loading Header

The area covered by the cloud in Figure 4.13.7 is estimated to be approximately 400 meters wide and 720 meters long (top to bottom in the figure). We estimate this gas cloud would be between 2 and 5 meters deep. The cloud envelops the LNG shipping berth, indicating that a ship at the berth would be completely surrounded by the flammable cloud. While the dense packing of equipment seen in the previous figure associated with the liquefaction trains is not inside the cloud, there are containment factors associated with the space between the sea wall and the carrier that could cause damaging flame accelerations leading to explosions. We wonder what an LNG ship's Master would say if she were informed that a flammable cloud of hydrocarbons was about to surround her ship.

Vapor Cloud Explosion hazards of mixed refrigerant liquids (hydrocarbons C2-C5)

For brevity, we focus on only one of the figures presented in the JCE DEIS for mixed refrigerant liquids; the design spill from the rupture of the inter-stage refrigerant pump discharge piping. The points we want to emphasize are specified immediately below the figure.

Figure 4.13-10 from DEIS
Mixed Refrigerant Release from Rupture of the Inter-stage Refrigerant Pump Discharge Piping

The area covered by the cloud in Figure 4.13.10 is estimated to be approximately 400 meters wide and 720 meters long (top to bottom in the figure). We estimate this gas cloud would be between 2 and 4 meters deep. The cloud envelops large portions of the liquefaction trains as well as at least half of the LNG shipping berth, including the space between the ship and the sea wall. We believe that an unignited MRL vapor cloud as indicated here could have the potential to cause a catastrophic UVCE that would result in severe cascading effects endangering the entire terminal.

Vapor Cloud Explosion hazards of ethylene

The DEIS presents a single vapor cloud prediction for the 14,000 gallon ethylene design spill. The wind speed is specified as 1 m/s (essentially calm). The area covered by the cloud in Figure 4.13-13 is estimated to be approximately 320 meters wide and 400 meters long (top to bottom in the figure). We estimate this gas cloud to be between 2 and 4 meters deep as well. The cloud envelops large portions of the liquefaction trains as well as all of one of the LNG tanks and about ¼ of the other one. The DEIS states that the ethylene release scenario at the refrigerant trucking area would remain within Jordan Cove's property or extend over a navigable body of water, so it would not have a significant impact on public safety with respect to flammable vapor dispersion.

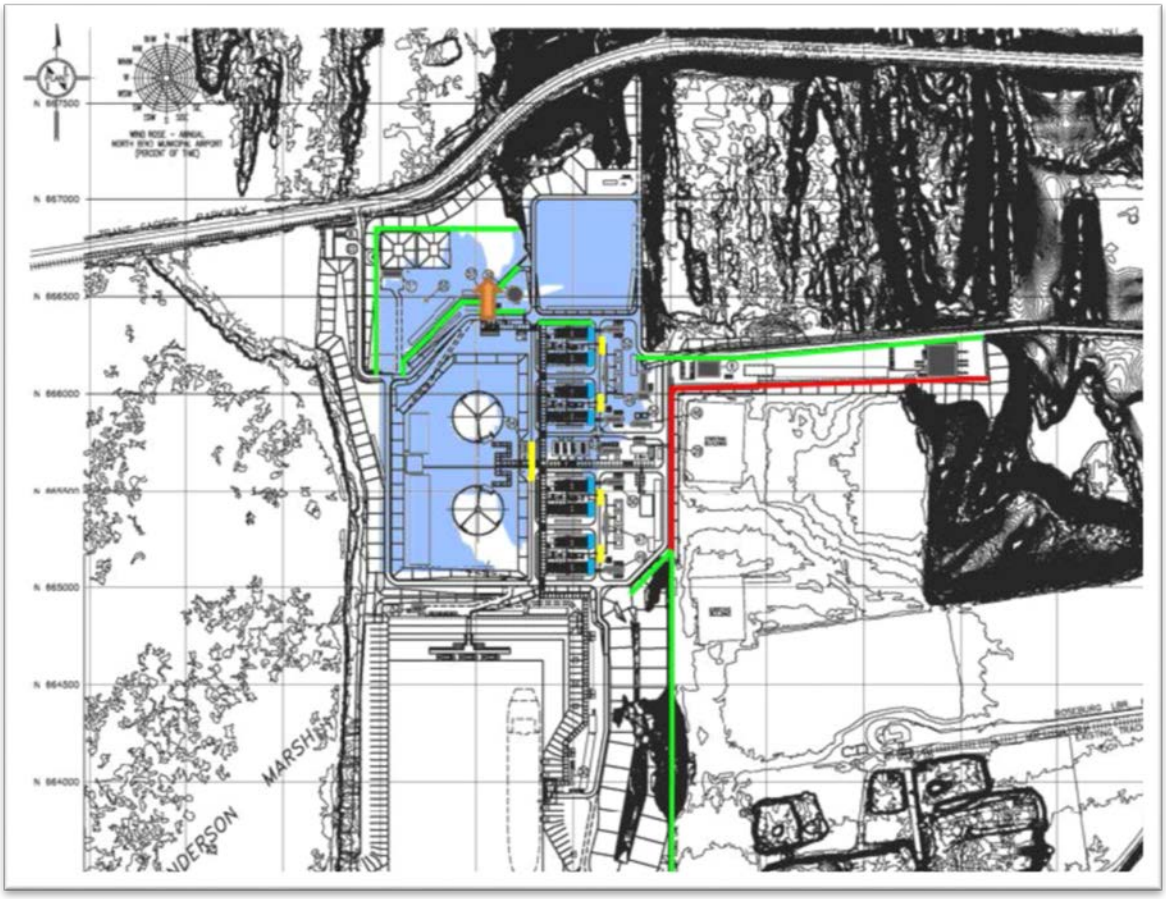


Figure 4.13-13. Ethylene Release from Rupture of the Ethylene Trucking Hose

Overpressure Analyses

The DEIS at page 4-963 states the following. "… the propensity of a vapor cloud to detonate or produce damaging overpressures is influenced by the reactivity of the material, the level of confinement and congestion surrounding and within the vapor cloud, and the flame travel distance." We add that the potential flame travel distance is the distance that can be traversed by the flame in gas/air concentrations lying within the flammable region, i.e., between the LFL and UFL. This travel distance is in turn determined by the amount of flammable gas that is mixed with air in the cloud, and thus by the amount released into the atmosphere. The implications are clear; if a very large vapor cloud can form with large distances that can be traversed by a flame burning in the flammable region, the potential for flame acceleration increases.

While the DEIS presents explosion overpressure predictions for the mixed refrigerant gases, it dismisses the (UVCE) explosion hazards for LNG. We believe this cannot be justified for the following reasons:

- The Coast Guard Tests show that with a strong igniter (high explosive), methane with about 6% propane added detonated. The DEIS states that Jordan Cove "will limit the heavier than methane hydrocarbon content in the LNG streams to 6%". This leaves no margin for safety, even if they could be certain of maintaining those levels.

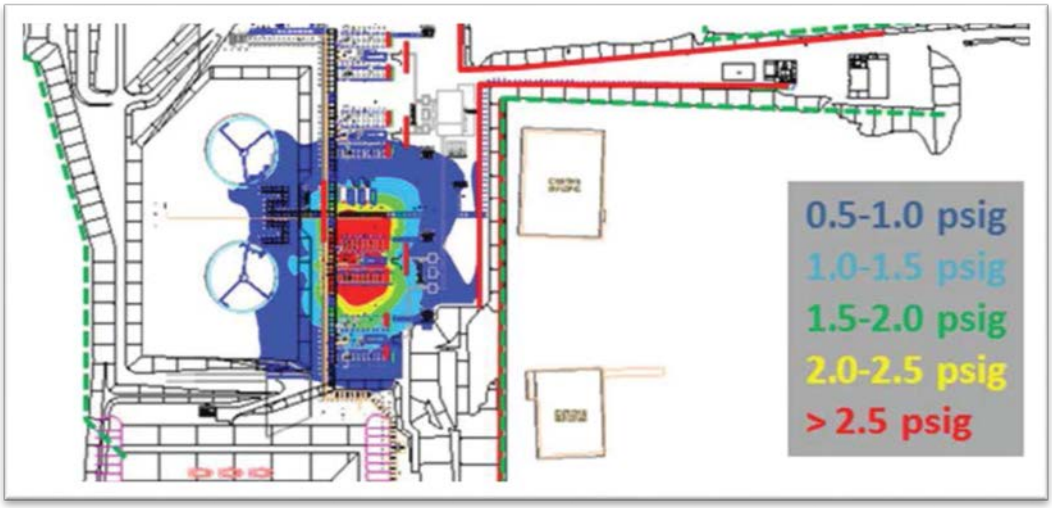
- The LNG spills are huge, and the vapor clouds formed have linear dimensions of hundreds of meters, with a corresponding potential for excessive flame acceleration.

- Secondary explosions that could boost the explosion processes cannot be discounted.

Nor do the overpressure calculations for the mixed refrigerant spills offer any consolation:

- The calculations of overpressure presented indicate very large areas of flammable gas envelopment of process equipment as well as the LNG tanks

- There are regions with linear dimensions of approximately 100 meters where the calculated pressures exceed 2.5 psig, but there is no specification of the maximum pressures reached. (See Figure 4.15-13 from the DEIS below.)



- If there exists evidence of agreement of the calculation methods used in the DEIS with large scale experiments and/or accidents that provide some confirmation of these predictions, including statements of the uncertainty which must be assumed in the overpressure predictions, such evidence should be made available for assessment, otherwise the calculations have little value, particularly in the face of recent accident experience we present below.

The DEIS acknowledges the potential for ethylene vapor clouds to detonate, but there are no overpressure calculations presented to accompany the ethylene dispersion calculations presented earlier. The mixed refrigerant spill overpressure calculations indicated approximately 2.3 psig overpressure at the LNG storage tanks. This statement is followed by "Jordan Cove stated that the LNG storage tanks would be designed to withstand an overpressure of 2.3 psig"… and that "We (presumably FERC) conclude that the siting of the proposed Project would not have a significant impact on public safety". In our opinion that statement does not indicate good engineering judgment, as it assumes a precision and accuracy of the model predictions that no scientist or engineer we know would endorse.

Potential for Catastrophic Unconfined Vapor Cloud Explosions (UVCEs)

Recent accident experience demonstrates that conditions are best for large vapor clouds to form if there is a mechanism for rapid evaporation of the spilled liquid and if there are near calm conditions which prevent rapid dispersion. The design spills considered for the Jordan Cove Export Terminal fit both criteria; the conditions considered are low-wind, near calm, and the materials are highly volatile; most volatile in the order of decreasing carbon content: methane, ethylene, propane, and pentane. The simple fact is that while the vapor clouds considered in this DEIS are prevented by physical barriers (vapor fences) from posing a vapor cloud hazard extending much beyond the property line, the holdup of very large quantities of flammable hydrocarbons by the vapor fences causes the gases to accumulate, with spreading largely driven by gravity spreading, so as to completely fill the affected areas to depths of a few meters, with large portions of those gas clouds having concentrations between the flammable limits. With these hazard-worsening conditions and the presence of densely packed processing equipment and the vapor fences which become enveloped in the cloud, one could hardly design the releases to better maximize the potential for catastrophic explosion hazard.

Catastrophic UVCEs are Becoming More Frequent

Confirmed scientific knowledge of the causes of UVCEs indicates that their frequency would increase with the potential for release of large quantities of hydrocarbons, especially highly volatile ones. As we have stated earlier, the sizes of flammable hydrocarbon vapor clouds described in the JCE DEIS have lateral dimensions of up to 720 meters (~2,400 feet). To our knowledge, there have been no UVCEs in the continental United States involving flammable clouds that large. The largest vapor cloud considered at JCE, which would follow a spill of ~3/4 million gallons of LNG, involves the most volatile of the hydrocarbons, methane (CH_4), which is lowest on the explosion sensitivity scale; but the mixed refrigerant liquid (MRL) spills are very large, and they approach the range of maximum sensitivity to explosion.

It appears that the relative rarity of large UVCEs (until recently) is very likely due to the fact that most of the very large spills that have occurred did not evaporate rapidly enough, and/or were dispersed readily by the action of wind, to allow formation of a large flammable cloud . But, now there have been at least four instances within the last ten years of devastating UVCEs following very large releases of gasoline class hydrocarbons where the evaporation of the fuels was rapid enough, and the wind speed essentially non-existent, to allow the formation of flammable vapor clouds with lateral dimensions of several hundred meters. In all four cases these clouds were ignited (presumably accidentally) and the explosions resulted in cascading events leading to catastrophic damages to the facilities (refineries/tank-farms) and injury/and/or deaths in the public sector. The first occurred in December, 2005, at Buncefield in the United Kingdom. There followed three more: Jaipur, India, 2009; San Juan, Puerto Rico, 2009; and Amuay, Venezuela, 2012. The following facts are a matter of record for all four:

- The events occurred in very low wind (near calm or calm) weather conditions.
- The maximum linear extents of the flammable clouds were at least 250 meters, ranging to at least 650 meters at Amuay.
- UCVEs occurred in every case that registered above 2.0 on the Richter Scale.
- The initiating explosions resulted in cascading events leading to total loss of the facilities.

We provide below photographs of these accidents (depicting the cascading fire and explosion effects) indicating the catastrophic damages that resulted. In our view, these four events, which have similar descriptions of the weather conditions and physical factors that could cause extremely

large flammable vapor clouds to form, and with which the vapor cloud scenarios considered in the JCE DEIS are clearly similar, should be a clear warning to parties planning facilities with similar potential for catastrophe.

Buncefield, United Kingdom

Jaipur, India

Amuay, Venezuela

San Juan, Puerto Rico

Scientific Conclusions re the Buncefield Event are Directly Relevant to the JCE DEIS

To our knowledge, detailed reports of the explosions in India, Venezuela, and Puerto Rico have not been completed. However, during the decade 2005-2015 since the Buncefield explosion occurred there have been published extensive reports of analyses thereof. The Buncefield explosion, which has been definitely established to be a UVCE, is thought to be the largest explosion that has occurred in peacetime Europe; damages now exceed two billion dollars.

In 2012, there appeared a paper in the Philosophical Transactions of The Royal Society (Great Britain) by D. Bradley, G.A. Chamberlain and D.D. Drysdale[5] entitled "Large vapour cloud explosions, with particular reference to that at Buncefield". As this paper appears to be the most

[5] Phil. Trans. R. Soc, A 2012 370, doi: 10 1098/rsta.2011.0419, published 2 January 2012

recent to summarize the present understanding of the increasing potential hazards of unconfined vapor cloud explosions (UVCE) of hydrocarbon-air mixtures, we quote directly from the Conclusions section thereof:

> **A number of mechanisms for the propagation of combustion have been discussed, without reaching any definite conclusions as to what precisely happened at Buncefield. Of particular importance was the acceleration of turbulent flames along the line of trees and hedgerows. There was no unequivocal evidence that a principal mode of reaction was a fully developed detonation sweeping across the site. There was, however, evidence that the observed damage and various camera records could be explained in terms of high-speed deflagrations and quasi-detonations. The former could generate localized flamefront over-pressures of 400 kPa and, with sufficient confinement, shock pressures of 1 MPa. Quasi-detonations, the details of which are complex, can create constant volume combustion over-pressures of about 0.7-0.8 MPa, while a detonation would give a pressure spike of 1.75 MPa.**
>
> **…**
>
> **Other areas for further study emerge, some of which are included in the Buncefield Explosion Mechanism Phase 2 programme. The most significant should include the following.**
>
> **i. Analysis of the complexities of multi-component gasoline spillage, involving droplet break-up, air entrainment and vapour production, followed by dispersion in still air over uneven terrain. Dispersion under almost still conditions provides significant modelling challenges.**
> **ii. The mathematical modelling of explosions through densely packed, small-scale, flexible obstacles and the question of whether reactant temperatures and pressures can become high enough for a DDT. The modelling of transitions to detonation and the conditions for their continuing propagation are particularly challenging, in terms of both the underlying science and the required computing power.**
> **iii. A related experimental investigation of flame acceleration, with and without "bang-box" initiation, along hedgerows and lines of trees to ascertain the probability of a DDT and its continuing propagation into an uncongested cloud. Further investigations are also needed of direct jet flame "bang-box" ignition of external vapour clouds, to define the conditions that can lead to detonation of the cloud.**
> **iv. The generation of necessary fundamental experimental and theoretical data on autoignition delay times, laminar burning velocities, and the effects of flame stretch on high turbulent burning velocities, including extinctions, all over the relevant ranges of temperature and pressure. The combinations of (ii), (iii), and (iv) could provide retrospective guidance on the relative contributions of high-speed deflagrations, quasi-detonations and detonations to the damage at Buncefield.**

In closing with these selected conclusions of this scientific paper summarizing the research that experts consider necessary in order to develop a methodology applicable to the determination of the potential for unconfined vapor cloud explosions of hydrocarbon-air

mixtures, we hope to send a clear message to the Federal Energy Regulatory Commission as well at the regulatory authority (DOT) that the methodologies depended on to ensure Public Safety in the Jordan Cove Export DEIS require careful, scientific, adjudication of the concerns we have raised – all of which we believe are supported by the extensive research regarding UVCE potential hazards post-Buncefield.

Appendix - A Brief History of LNG Regulation for Public Safety

LNG trans-ocean shipping, enabling import and export projects, has a relatively short history. The first cargo of LNG (27,400 m^3) shipped trans-ocean was delivered in 1964 from Lake Charles, Louisiana to Canvey Island (near London) in the United Kingdom[6]. The number of LNG carriers has now increased to more than 370, while ship capacities have increased by a factor of ten, with the largest ships today each carrying 266,000 cubic meters (70,264,000$^+$ gallons) of LNG. As the development of this industry has been decidedly fast-track, yet involves truly huge concentrations of energy-posing hazards in storage on land and in the ships, it is important to review the history of the development of methodology currently used by the United States Government to identify and regulate the hazards to the public that attend the operation of such facilities, onshore and off.

The Federal regulation 49 CFR 193: *Liquefied Natural Gas Facilities: Federal Safety Standards* was promulgated in 1980. 49 CFR 193, addressing the safety requirements regulated by DOT, is applicable on the land portion of the terminal(s) only. For our purposes in these comments, DOT's regulatory authority can be assumed to end at the point where the connections are made from the storage tanks on land to the loading lines on the ship. Beyond the shore-to-ship connection point, the principal authority granting approval for and regulating the operations is the Coast Guard. Both DOT and the Coast Guard have conducted extensive research, including field scale experiments, to define and quantify the hazards of fire radiation (heat damage) that could occur from vapor cloud and liquid pool fires, as well as the potential for explosion (generation of damaging overpressures) should a vapor cloud explode, to determine the appropriate measures which must be taken to provide for public safety.

Historically, the hazards of LNG are regulated based on the assumption that LNG is (primarily) liquefied methane (CH_4). In contrast, heavier-than-methane hydrocarbons, including the so-called Liquefied Petroleum Gases (LPG) which are necessarily present in large quantity in an LNG export terminal, are mixtures of hydrocarbon gases with molecular weights heavier than methane, such as ethane (C_2H_6), propane (C_3H_8), butane (C_4H_{10}), and pentane (C_5H_{12}). According to the JCE DEIS the heaviest hydrocarbons handled in significant quantities at this terminal will be C_5H_{12}. This is a vitally important point for the present discussion, because while it may be reasonable to identify, even limit, LNG hazards at import terminals assuming the LNG properties are similar to those of pure methane, LNG export terminals are another matter. Export terminals thus must receive gas (normally by pipeline) for liquefaction and shipping that contain significant amounts of heavier (than methane) hydrocarbons. Because shipped LNG must be sufficiently pure methane in order to be burned efficiently in typical natural gas burning equipment, the heavier hydrocarbons present in the gas feed stream must be removed in a natural-gas-liquefaction facility before shipping. Significant amounts of heavier-than-methane hydrocarbons must be temporarily stored at the export terminal site and ultimately become part of the products that are shipped out of the

[6] http://www.eia.gov/todayinenergy/detail.cfm?id=16771

export terminal by various means. The result is that export terminals involve storage, handling, and usage of significant amounts of these heavy hydrocarbons which constitute hazards different from, and often more-severe-than, methane (the principal component of LNG).

The first author began research on LNG safety in 1976 (before the advent of 49 CFR 193) while on leave from the University of Arkansas serving as a technical advisor to the Office of Merchant Marine Safety of Coast Guard Headquarters in Washington, D.C. Havens' initial assignment was to review a collection of six mathematical (computer) model predictions of the maximum distance that could be reached by a flammable cloud of methane and air formed by spillage on water of the contents of a single tank of LNG from a typical LNG carrier of that day. The contents of a single tank on such a ship (typically containing five such tanks) was 25,000 cubic meters, or about 6 million gallons.

The problem the Coast Guard faced in 1976 was that the predictions of maximum flammable-gas-cloud extent from such a spill by six independent expert-preparers ranged from ¾ mile to 75 miles! In 1977 near the end of his off-campus-leave period Havens completed an analysis of the collection of predictions and prepared a report[7] for the Coast Guard which concluded that the lowest and highest estimates of distance were not credible and suggested that the range of distances would be much more likely to be between 3 and 10 miles. This was some progress, but the Coast Guard wanted a higher-confidence answer. Havens returned to the University of Arkansas with a contract to develop a personal-computer (PC) model capable of predicting hazardous vapor cloud dispersion distances for specified amounts of LNG spilled on water. The result was the DEGADIS model adopted by DOT and incorporated in 49 CFR 193 as the dispersion model used for LNG facility regulation to determine vapor dispersion exclusion zone (safe separation) distances.

Havens' 1977 report, in addition to enabling continuation of research on LNG vapor dispersion upon return to the University of Arkansas, had another very important effect on Havens, one which was brought back vividly while studying the Jordan Cove Export Project DEIS in preparation of these comments. Havens, at the suggestion of the Coast Guard, had sent his draft report to the authors of the predictions, requesting they provide reply-comments to the (Coast Guard) report. The authors of the predictions were informed that their replies would be published as part of the report. While all of the model-prediction-preparers provided written comments which were published in the report, and all were helpful, one preparer's reply still profoundly affects Havens' conclusions about the effectiveness of the United States regulatory program to provide for the public safety. Dr. James Fay, Professor of Mechanical Engineering at MIT, replied to Havens' request beginning with the paragraph quoted below.

> "*The discussion in the introduction (pp. 15-17) of the probability of various accident scenarios, which is clearly not an aspect of the scientific review of the various dispersion theories but more nearly a policy statement regarding risk, unfortunately tends to denigrate the value of this analysis. The reader may wonder whether the assessment is to be taken seriously, or has been carefully made, given the asserted unlikelyhood of the process being discussed. But if one ignores the casuistry of this portion of the introduction, the subsequent analysis is scientifically useful and more than worth the effort to have performed it.*"

Fay's statement had focused on a very important failing of the report - the fact that Havens

[7] Havens, Jerry, "Predictability of LNG Vapor Dispersion From Catastrophic Spills Onto Water: AN ASSESSMENT", USCG-M-09-77, April 1977.
http://www.dtic.mil/dtic/tr/fulltext/u2/a040525.pdf

appeared to have felt a responsibility to give the report's readers an excuse to discount the hazards being discussed on the basis that they were very unlikely (low probability). But the report had provided absolutely no information supporting any estimate of such events' probability of occurrence; the inclusion of the statements about "likelihood" therefore had no valid purpose. Havens continues today to acknowledge that failure; Professor Fay was entirely correct. We leave it to the readers of the Jordan Cove Export Terminal DEIS to determine the validity/justification of the suggestions therein regarding the probability of the events under discussion. Of course, our concern is that any such analysis which includes discussion of the probability of occurrence of specific realizations of the hazards must be scientifically quantified to be useful. Without careful quantitative justification such assertions are likely to encourage wishful thinking that is dangerous given the potential severity of the consequences being considered.

There were five major SAFETY HAZARDS identified that determine the regulation of safe-siting (separation) distances from the terminal to protect the public. Those five hazards are still applicable to the Jordan Cove Export (JCE) Export Terminal (we are not addressing potential environmental hazards):

- Toxicity
- Cryogenic Exposure
- Liquid Pool Fires
- Vapor Cloud Fires
- Vapor Cloud Explosions

As this submission focuses on safety hazards to the public offsite, we agree that toxicity and cryogenic exposure hazards are not nearly as likely (compared to the remaining three) to pose serious threats to the public.

The United States Government has conducted major research programs to define and quantify the hazards that attend the siting on land of LNG import terminals and the marine operations associated with LNG ship carriage. We will not attempt to describe the research efforts conducted by industry; our discussion focuses on government sponsored research designed to quantify, for regulatory purposes to provide for public safety, the three hazards identified above; liquid pool fires, vapor cloud fires, and vapor cloud explosions.

The interest in LNG importation in the United States has been highly cyclic. During the period ~1970-1985, the first four import terminals were constructed in the continental U.S., all on the East and Gulf Coasts: Everett, MA; Cove Point, MD; Elba Island, GA; and Lake Charles, LA. There were several import terminals proposed onshore and offshore California, but none were ever constructed. Extensive LNG research was performed during this period to develop the Government's knowledge base supporting public safety-regulation. Then, after a decade or more lull in interest in LNG terminals, another rush to construct import terminals developed at the turn of the century with more than fifty import terminals proposed in short order. The attack on the World Trade Towers on 9-11-2001 heightened concerns about LNG safety, partly because of the presence of the import terminal in Boston Harbor (Everett, MA). The Government's responses to the multiple terrorist attacks on 911 included preventing a scheduled LNG ship from entering the Everett, MA, terminal, holding it offshore for several days before directing it to proceed to Elba Island, GA to unload. This was due to concerns that LNG facilities in highly populated areas might be considered attractive targets for terrorist attack; this concern is still with us. Research directed to LNG safety following 911 was primarily directed to hazards to the public of the shipping side of import projects then operating. There developed as a result another period of

LNG safety research, primarily directed at marine (shipping) operations, which has continued to the present.

The First Research Period: ~1970-1985

At about the same time that Havens was digesting Professor Fay's review of the Coast Guard Report, Congress appropriated substantial sums (~$40,000,000) for the Lawrence Livermore Laboratory (LLNL) and several other Contractors, including the China Lake Naval Weapons Center, to research outstanding questions about LNG liquid pool fires, vapor cloud dispersion, and vapor cloud explosion hazards. LLNL built a purpose-designed spill test facility at the Nevada Test Site on the old (Frenchman Flat) nuclear weapons test site to conduct LNG spill research. A principal product of this work was the complex mathematical model for LNG vapor dispersion called FEM3 (acronym for Finite Element Model – 3 dimensional). The model was designed to address the need for prediction of vapor dispersion in the presence of terrain effects and obstacles such as buildings and plant structures. Extensive reports of this work are available. The University of Arkansas was subsequently contracted by the then Gas Research Institute to develop a PC version of FEM3, and the University carried out some validation experiments using a purpose-built ultra-low-speed wind tunnel (the largest ultra-low-speed wind tunnel in the world at that time). That PC version became known as FEM3A, and it was adopted by DOT as an alternative (to DEGADIS) model that could be used by LNG facility applicants to consider the effects on dispersion distances that would result from the presence of obstacles or terrain features.

Meanwhile, the China Lake Naval Weapons Test Station conducted (for the Coast Guard) a series of liquid methane and propane spills to investigate the potential for fire radiation damage extending from fires of different sizes and also conducted an extensive series of tests of unconfined gas clouds of methane and propane mixtures of uniform concentration (contained in balloons) to determine the potential for such clouds to cause damaging overpressures (explosions). Extensive reports of this work are available.

The pool fire test data from China Lake was used to develop the LNGFIRE model series, which is still used to determine the regulation-required separation distances to prevent radiative (fire) fluxes that can cause serious burns to the public. The principal results of the unconfined gas cloud explosion work, here intentionally simplified for brevity, were:

- Pure methane (unconfined) did not burn with damaging overpressures (explode) unless a sufficiently energetic "starting" explosion ignited the cloud.
- The presence of sufficient amounts (say >10-15%) heavier components such as propane mixed with methane resulted in damaging overpressures.

Since that early work there have been numerous severely-damaging accidental explosions of unconfined mixtures of propane (and heavier hydrocarbon gases) with air.

The research conducted by the Government described above occurred in the same decade in which the Atomic Energy Commission was abolished in favor of the Energy Research and Development Agency, later succeeded by the present Department of Energy. At first there was a move to design the regulatory framework for LNG management (LNG had been promoted to the class of Major Hazards by the British Health and Safety Agency by that time) based on probabilistic risk assessment procedures, as was being suggested as the favored method to regulate the safety aspects of nuclear electric power plants. However, DOE and DOT (the latter by that time the agency responsible for natural gas pipeline safety) took on the responsibility of developing regulations governing the siting of LNG terminals. The responsibility for the shipping side went to the Coast Guard.

DOT incorporated a purely consequence-based approach (with no consideration of quantitative measures of risk, meaning the probability with which an event might occur) which is still in use. Initially, regulations required the terminal applicant to determine safe separation distances, separately, for (unignited) vapor cloud travel and pool-fire radiation hazards. The applicant was required to use regulatory approved mathematical (computer) models to determine the maximum hazard distance for "worst case" vapor cloud releases and liquid pool fires. Up to ~2000, such calculations were required to be completed using DEGADIS (and later FEM3A) for vapor dispersion, and LNGFIRE for pool fires). The starting assumption (the event required to be modeled) was typically complete failure, resulting in rapid release, of the largest contained volume of LNG at the site, with no regard to the probability (or in many minds, the impossibility) of such an occurrence.

But, just as had occurred during this time period in the Nuclear Industry, there was soon adopted a practice of selecting so-called "Design" accidents which set lower requirements for the amounts of LNG to be released. The LNG regulations adopted specification of "Design" Spills to place limits upon the amount of material released and the rate at which it could be released. That is where we are today, which leads the authors to believe that an "inevitable" result has occurred - when the calculated distances required to separate the public from the hazard became "unmanageable" the release magnitudes (the so called "SOURCE" terms) were decreased. While we realize that the realities of economy as well as other factors can sometimes indicate, if not require, such changes, and that this pattern is established more or less world-wide today by major hazards industries in siting practice to protect the public, we believe it is a classic example of a process involving a seriously slippery slope. We believe that we have already reached the condition in LNG safety regulation where the determination of the design spill is effectively inseparable from the determination of the amount of land that the facility operator can purchase to insure that the public cannot intrude on. And, most importantly, the methodology for determining the "maximum" design spills that must be planned for appear to have evolved based on far-less-than-scientific reasoning processes. Although this issue is far too big to "take on" here, we want to state clearly our belief that the "agreements" on the sufficiency of the materials submitted to FERC by the applicants for the Jordan Cove Export Project have resulted far too much from "helpful cooperation" with the regulatory authority, with the result that the design spills (read spill quantity and rate of release as well as usage of vapor cloud travel "mitigation" methods) now effectively limit the hazard distances to a level considered "manageable" by the applicant.

The Second Research Period (2000-present)

As of October of 2014 seven more import terminals (beyond the original four) are in operation: Offshore Boston, Massachusetts (Excelerate Energy); Freeport, Texas; Sabine, Louisiana; Hackberry, Louisiana; Offshore Boston, Massachusetts (GDF-SUEZ); Sabine Pass, Texas; and Pascagoula, Mississippi. Three more import terminals have been approved, but are not yet under construction: Gulf of Mexico (Main Pass McMoRan Exp.); Offshore Florida; and Gulf of Mexico (TORP Technology– Benville LNG). Finally, (as of October, 2014), one export terminal has been approved and is under construction: Sabine, Louisiana. Three other export terminals have been approved but are not yet under construction: Hackberry, Louisiana; Freeport, Texas; Cove Point, Maryland. All of these import and export terminals have been approved by FERC based (with respect to safety and reliability requirements) on meeting the requirements of DOT Regulation 49 CFR 193 and Coast Guard Letters of Recommendation.

Following 911 (2001), new concerns arose that LNG ships, already plying the waters in heavily populated areas such as Boston, could pose unacceptably severe hazards to the public, either

resulting from accidents or terrorist attacks. In response, Congress appropriated substantial additional sums for research to better quantify the severity of hazards that could be realized, with emphasis on LNG ship movements to and from, and berthed at, operating LNG facilities. This research was conducted principally by the Sandia National Laboratory and focused principally on two questions about the hazard distances that could extend from LNG ships which suffered accidental (or intentional) releases of LNG onto water; by vapor cloud travel (if the spill was not immediately ignited upon release), or by fire radiation (heat damage) from the liquid pool-on-water fires that would result if the release was ignited at the spill site. By this time, the "maximum credible" release (from a ship onto water) had been pared down by a factor of two, from 25,000 m^3, still considered the typical single-tank volume, to half that size, 12,500 m^3. This reduction was considered reasonable based on the fact that the principles of physics dictated that since about half of the LNG in a tank was below the water level exterior to the ship it was extremely unlikely that the entire tank could be spilled rapidly (which was the condition originally assumed).

For our purposes (in these comments), it is possible to briefly summarize the Sandia Research Results (published in 2004[8]) of the pool fire and vapor cloud hazard distances (to a concentration of ½ the lower flammable limit of methane, or 2.5%) as follows:

- Pool fire radiation distances - assuming rapid release onto water of ½ tank with immediate ignition, the maximum distance to heat flux levels that could cause second degree burns to unprotected human skin was estimated to be about one mile.
- Vapor cloud dispersion - maximum distances, assuming the cloud is not ignited, extending beyond 1600 meters. For the JCE facility, this suggests that an unignited cloud from a large ship spill could reach well beyond the property boundaries.

Then, in 2007, the Government Accountability Office, as requested by Congress, delivered their report entitled "MARITIME SECURITY: Public Safety Consequences of a Terrorist Attack on a Tanker Carrying Liquefied Natural Gas Need Clarification." This report detailed the findings of an expert panel (seventeen members, one of whom was the first author of these comments) who were individually questioned to provide their opinions on major LNG safety issues that remained controversial. The section of the report entitled "Results in Brief" is repeated verbatim below[9]:

> *The six unclassified studies we reviewed all examined the heat impact of an LNG pool fire but produced varying results; some studies also examined other potential hazards of a large LNG spill and reached consistent conclusions on explosions. Specifically, the studies' conclusions about the distance at which 30 seconds of exposure to the heat could burn people ranged from about three quarters of a mile to 2,000 meters (about 1-1/4 miles). The Sandia National laboratories' study concluded that the most likely distance for a burn is about 1,600 meters (1 mile). These variations occurred because researchers had to make numerous modeling assumptions to scale-up the existing experimental data for large LNG spills since there are no large spill data from actual events. These assumptions involved the size of the hole in the tanker, the number of tanks that fail, the volume*

[8] Hightower, Mike, et. al., Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water, Sandia Report SAND2004-6258, December 2004.

[9] Maritime Security: Public Safety Consequences of a Terrorist Attack on a Tanker Carrying Liquefied Natural Gas Need Clarification, GAO-07-316, February 2007.

of LNG spilled, key LNG fire properties, and environmental conditions, such as wind and waves. Three of the studies also examined other potential hazard of an LNG spill, including LNG vapor explosions, asphyxiation, and cascading failure. All three studies considered LNG vapor explosions unlikely unless the LNG vapors were in a confined space. Only the Sandia National Laboratories' study examined the potential for cascading failure of LNG tanks and concluded that only three of the five tanks would be involved in such an event and this number of tanks would increase the duration of the LNG fire.

Our panel of 19 experts generally agreed on the public safety impact of an LNG spill, disagreed with a few conclusions reached by the Sandia National Laboratories' study, and suggested priorities for research to clarify the impact of heat and cascading tank failures. Experts agreed that (1) the most likely public safety impact of an LNG spill is the heat impact of a fire; (2) explosions are not likely to occur in the wake of an LNG spill, unless the LNG vapors are in confined spaces, and (3) some hazards, such as freeze burns and asphyxiation, do not pose a hazard to the public. Experts disagreed with the heat impact and cascading tank failure conclusions reached by the Sandia National Laboratories; study, which the Coast Guard uses to prepare WSAs. Specifically, all experts did not agree with the heat impact distance of 1,600 meters. Seven of 15 experts thought Sandia's distance was "about right," and the remaining eight experts were evenly split as to whether the distance was "too conservative" or "not conservative enough" (the other 4 experts did not answer this question).

As a result of the GAO report, Congress directed further research to be conducted by the Sandia National Laboratory. That research (thus far) concludes that the radiant heat fluxes from large LNG fires on water, which burn without much smoke, can exceed 300 kW/m^2, and that there are potential failure modes regarding LNG carriers that could lead to a ship being at risk of sinking. The ship-safety-research continues.

Exhibit D

Submitted by

Jerry Havens
Distinguished Professor of Chemical Engineering
University of Arkansas

James Venart
Professor Emeritus of Mechanical Engineering
University of New Brunswick

Regarding the
Jordan Cove Export Terminal
Draft Environmental Impact Statement
Docket No. CP13-483

February 6, 2015

This comment, intended to supplement our comments filed January 14, 2015, is directed to the further quantification of the hazards of unconfined vapor cloud explosions that could possibly follow the JCE DEIS illustrated design spills of mixed refrigerant liquids and ethylene; specifically to the determination by mathematical model prediction of the damaging overpressures that could result. We are concerned that the potential for damage is being seriously underestimated. As in our earlier comments, for brevity we have selected two representative design spill vapor cloud illustrations; one for mixed refrigerant and one for ethylene.

Unconfined Vapor Cloud Explosion hazard of mixed refrigerant liquids

Figure 4.13-10 in the JCE DEIS depicts the area covered by the mixed refrigerant (MR) vapor cloud formed from the design spill from the refrigerant pump discharge piping.

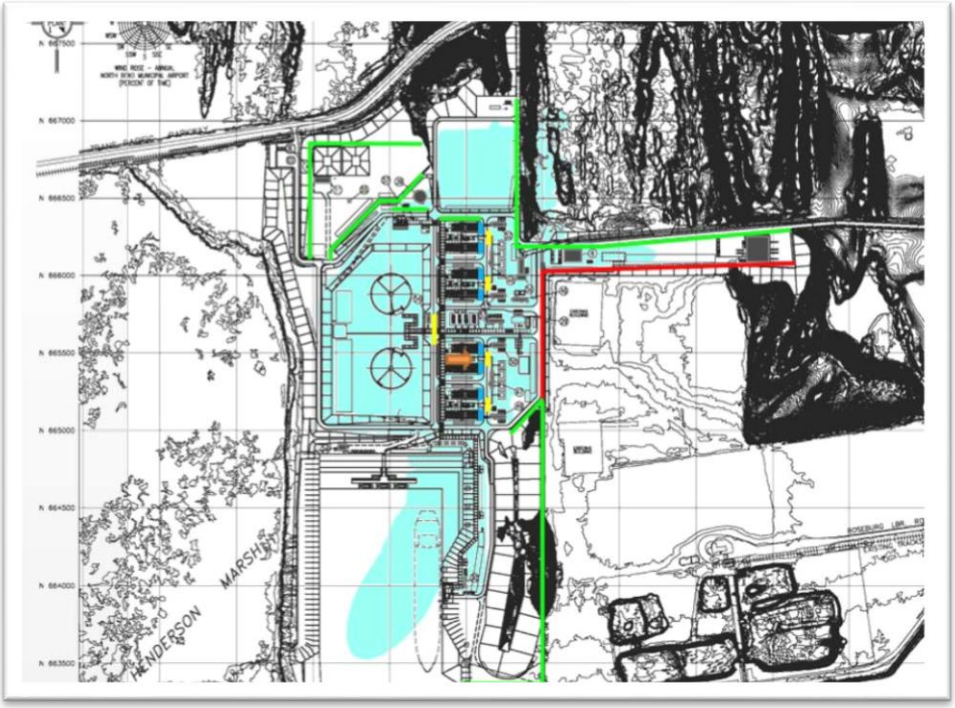


Figure 4.13-10. Mixed Refrigerant Release from Rupture of the Pump Discharge Piping

The area covered by the vapor cloud is estimated to be approximately 400 meters wide and 720 meters long. We estimate the cloud would be between 2 and 4 meters deep with a lateral area of 288,000 m^2. The cloud envelops large portions of the liquefaction trains as well as at least half of the LNG shipping berth, including the important partial-explosion-confinement space between the ship-side and the dockside.

Unconfined Vapor Cloud Explosion hazard of ethylene

Figure 4.13-13 in the JCE DEIS depicts the area covered by the ethylene vapor cloud formed from the design spill from a ruptured ethylene trucking hose. The area covered by the cloud is estimated to be approximately 320 meters wide and 400 meters long. We estimate this cloud to be between 2 and 4 meters deep with a lateral area of 128,000 m^2. The cloud envelops large portions of the liquefaction trains as well as all of one of the LNG tanks and about 2/3 of the other one.

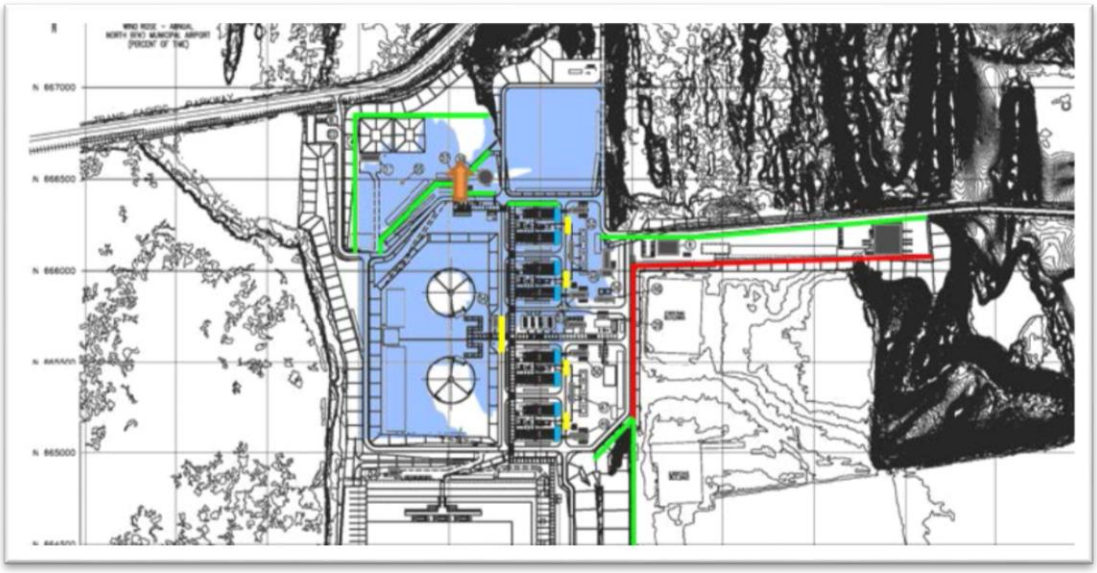


Figure 4.13-13. Ethylene Release from Rupture of the Ethylene Trucking Hose

Overpressure Analyses presented in the DEIS

The DEIS at page 4-963 states: "… the propensity of a vapor cloud to detonate or produce damaging overpressures is influenced by the reactivity of the material, the level of confinement and congestion surrounding and within the vapor cloud, and the flame travel distance." We added (in our comments of January 14) that the potential flame travel distance is the distance that can be traversed by the flame in gas/air concentrations lying within the flammable region, i.e., between the LFL and UFL. This is important because it indicates the importance of the size of the vapor cloud; if a very large vapor cloud forms with large (lateral) distances that can be traversed by a flame burning in the flammable region, the potential for flame acceleration, which can lead to damaging overpressures, increases.

The JCE DEIS appears to conclude that the potential explosion overpressures resulting from the design spills of mixed refrigerants (propane, pentane, and ethylene) will not pose a hazard to the public. The basis for those conclusions appears to be the overpressure plots presented for the design spills. It appears that the overpressure plots were prepared with the FLACS computer

model which is approved by DOT under 49 CFR 193 for determination of the extent of the flammable vapor dispersion exclusion zones for the design spills. Plots of overpressure are shown for four mixed refrigerant design spills (See typical example - Figure 4.13-15 below). There are regions in all of the mixed refrigerant spill plots with linear dimensions of approximately 100 meters where the calculated overpressures exceed 2.5 psig, but there is no specification of the maximum pressures reached. It appears that these overpressures (~2.5 psig) are considered by FERC to be sufficiently low as not to pose a hazard to the public. Although the DEIS acknowledges the potential for ethylene vapor clouds to detonate, no overpressure predictions are provided for the ethylene design spill scenario (Figure 4.13-13 shown earlier).

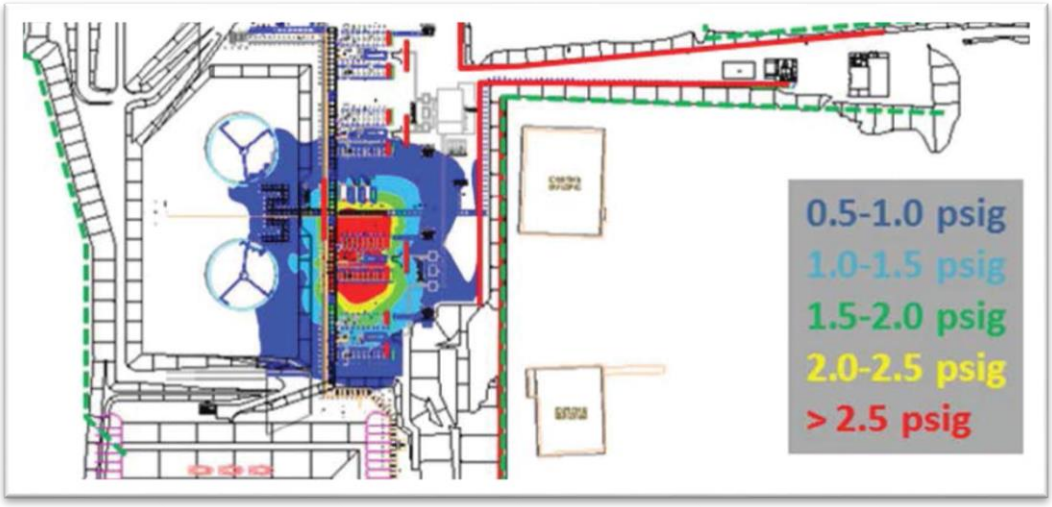


Figure 4.13-15. MR Overpressure Scenario at Train 2

The mixed refrigerant spill overpressure calculations are also stated to indicate approximately 2.3 psig overpressure at the LNG storage tanks. This statement is then followed by "Jordan Cove stated that the LNG storage tanks would be designed to withstand an overpressure of 2.3 psig"… and that "We (presumably FERC) conclude that the siting of the proposed Project would not have a significant impact on public safety". As we stated in our comments filed January 14, in our opinion this statement assumes a precision and accuracy of the model predictions for which there is no supporting evidence.

Recent Evidence of factor-of-ten greater UVCE overpressures: Research post-Buncefield

During the decade 2005-2015 since the Buncefield explosion occurred there have been published extensive reports of analyses thereof. The Buncefield explosion, which has been definitely established to be a UVCE, is thought to be the largest explosion that has occurred in peacetime Europe; damages now exceed two billion dollars.

There is an extensive literature on the investigation of the Buncefield explosion and the research programs and regulatory decision-making that followed. We do not have time or space here to do more than describe briefly the results of key research completed since Buncefield (2005) in the area of prediction of overpressures resulting from unconfined vapor cloud explosions of hydrocarbons similar to the mixed refrigerant clouds, including ethylene, considered in the JCE DEIS.

We believe the following facts can be substantiated for consideration of the explosion (overpressure) hazards that could follow ignition of the refrigerant (heavier than methane hydrocarbon) clouds illustrated in the JCE DEIS:

- Numerous vapor clouds of MR gas predicted by the FLACS dispersion code for design spills in the DEIS are of similar size and shape (pancake with comparable depth and lateral area) to the Buncefield cloud, for which the lateral area is estimated to be 200,000 m^2.
- Hydrocarbon concentrations assumed in the simulations of Buncefield using the FLACS[1] and EXSIM[2] codes are characterized as Propane or Butane, well mixed with stoichiometric amounts of air. The reactivity of the hydrocarbon gases composing the DEIS design spill clouds is then comparable (but clearly exceeded for ethylene) to the reactivity of the clouds assumed in FLACS and EXSIM for Buncefield in published predictions.
- Both FLACS and EXSIM are reported to produce pressures exceeding 200 kPA (approximately 30 psig, more than ten times higher than cited in the JCE DEIS) over large areas at Buncefield. FLACS represents the tree-line congestion present at Buncefield as (numerical) "tree-like" congestion while EXSIM represents the congestion effect of the trees with models of plant piping structures. The high overpressures predicted by both codes strongly suggest that the high overpressures result from the congestion effects causing flame acceleration.

Research into the Buncefield Explosion Mechanism is continuing in a joint industry project (Buncefield Phase 2)[3]. That research involves large scale experiment explosion testing as well as continuing utilization of computational fluid dynamics (CFD) modeling. We quote the abstract of Pekalski, et al's paper:

> "*The paper reviews large scale experiments with various fuels in air where successful deflagration to detonation transition (DDT) took place. This includes a recent experiment disclosed in the Buncefield R&D program, where DDT developed in the propane/air mixture. The DDT occurred in branches of deciduous trees in a premixed stagnant mixture. An internal R&D investigation programme was initiated to better understand the phenomena. A large scale experiment in an open space with ethane air mixture is presented in the paper. The premixed mixture was ignited at the edge of the congested three dimensional rigs which consisted of vertical and horizontal pipes. After ignition, the flame accelerated in the congestion and transitioned to detonation at the end of congestion. Stable detonation propagated through the remaining open and uncongested space. The flame acceleration process leading to DDT is scale dependent. It also depends on many parameters leading to a large investigation array and, significant cost. However, such R&D efforts aimed toward a safer plant design, i.e. the prevention of occurrence of a major accident, are a small fraction of a real accident cost*".

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[1] Davis, Scott G. et al, Investigation Techniques used to Determine the Massive Vapor Cloud Explosion at the Buncefield Fuel Depot. www.gexconus.com/images/docs/trees-GexCon.pdf

[2] Buncefield Explosion Mechanism – Phase 1, Volumes 1 and 2, UK Health and Safety Executive Research Report RR718, Prepared by the Steel Construction Institute for the Health and Safety Executive, 2009.

[3] Pekalski, Andrzeu, et al., DDT in a vapour cloud explosion in unconfined and congested space; large scale test, Tenth International Symposium on Hazards, Prevention, and Mitigation of Industrial Explosions, Bergen, Norway, 10-14, June 2014.

In view of the evidence in the last decade from Buncefield, UK; Amuay, Venzuela; Jaipur, India; and San Juan, Puerto Rico, of unexpected unconfined vapor cloud explosions of hydrocarbon clouds with similarities (specified above) to the flammable clouds presented for the design spills in the JCE DEIS, we respectfully request additional information about the overpressure calculations using FLACS in the JCE DEIS, for which the calculated overpressures were limited to levels of approximately 2 psig, or an order of magnitude lower than published predictions using FLACS for Buncefield).

- Please provide a statement of the extent to which DOT/PHMSA included in its evaluation of FLACS as an alternate method (to DEGADIS and FEM3A) for determining vapor cloud exclusion zones any evaluation performed of the accuracy/applicability of the FLACS code to the simulation of the Buncefield explosion or to any other applicable documented UVCE experience, as a condition for its acceptance for explosion overpressure prediction under the requirements of 49 CFR 193.
- Please provide a description of the gas assumed to represent the mixed refrigerant design spill(s), and the concentration of such gas or gas mixtures that is assumed for the vapor cloud at the instant of ignition and the locations of same. If the concentration throughout the cloud is assumed to be that associated with the FLACS prediction of the vapor cloud extent shown in the "dispersion" illustrations, please state the range of concentrations existing in the cloud at that time.
- Please provide a description of any overpressure calculations performed for the ethylene spill.
- Please provide a description of any provision in the FLACS code predictions for the JCE DEIS for flame speed enhancements caused by congestion due to the plant/piping structures in the JCE facility.
- Please provide a description of any provision for the effect upon explosion that could result from the partial confinement of the cloud by the extensive vapor fencing utilized to limit the vapor cloud exclusion zones.

Exhibit E

UNITED STATES OF AMERICA
DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY

In the Matter of:
NERA Economic Consulting Study)
"*Macroeconomic Impacts of LNG*)
***Exports from the United States*"**)
December 3, 2012)
_____)

FR Doc No: 2012-29894

The following sent by Email to LNGStudy@hq.doe.gov

Jody McCaffree
Individual / Executive Director
Citizens Against LNG Inc
PO Box 1113
North Bend, OR 97459

January 24, 2013

U.S. Department of Energy (FE-34)
Office of Natural Gas Regulatory Activities
Office of Fossil Energy
P.O. Box 44375
Washington, DC 20026–4375

Re: 2012 LNG Export Study

Dear Mr. John Anderson / Mr. Edward Meyers:

On December 11, 2012, the Office of Fossil Energy at the U.S. Department of Energy posted in the Federal Register a Notice of Availability of a 2012 LNG Export Study and a request for comments. The Federal Register Notice listed the following 15 proposed LNG Export terminals:

- Freeport LNG Expansion, L.P. and FLNG Liquefaction, LLC - [FE Docket No. 10–161–LNG]
- Lake Charles Exports, LLC - [FE Docket No. 11–59–LNG]
- Dominion Cove Point LNG, LP - [FE Docket No. 11–128–LNG]
- Carib Energy (USA) LLC - [FE Docket No. 11–141–LNG]
- Freeport LNG Expansion, L.P. and FLNG Liquefaction, LLC - [FE Docket No. 11–161–LNG]
- Cameron LNG, LLC Gulf - [FE Docket No. 11–162–LNG]
- Gulf Coast LNG Export, LLC - [FE Docket No. 12–05–LNG]
- Jordan Cove Energy Project, L.P - [FE Docket No. 12–32–LNG]
- LNG Development Company, LLC (d/b/a Oregon LNG) - [FE Docket No. 12–77–LNG]
- Cheniere Marketing, LLC - [FE Docket No. 12–97–LNG]
- Southern LNG Company, L.L.C - [FE Docket No. 12–100–LNG]
- Gulf LNG Liquefaction Company, LLC - [FE Docket No. 12–101–LNG]
- CE FLNG, LLC - [FE Docket No. 12–123–LNG]
- Excelerate Liquefaction Solutions I, LLC - [FE Docket No. 12–146–LNG]

• Golden Pass Products LLC - [FE Docket No. 12–156–LNG]

Currently (as of January 11, 2013) there are now 23 proposed LNG export terminals seeking approval before the U.S. Department of Energy, Office of Fossil Energy, to export LNG.[1] These 23 proposed terminals have a combined capacity request to export 31.41 Bcf/d of LNG to Free Trade Agreement Nations and 24.80 Bcf/d of LNG to Non-Free Trade Agreement Nations. The U.S. Department of Energy, Office of Fossil Energy, has already approved LNG exports totaling 29.21 Bcf/d of LNG exports requested, mostly to Free Trade Agreement Nations. The NERA LNG Export study considered a High/Rapid LNG scenario of LNG export at 12 Bcf/d phased in at a rate of 3 Bcf/d per year. (NERA Page 14). This is far below what the U.S. Department of Energy (DOE) has already approved. In addition to this, the NERA study stated on page 210 the following;

> "Since the EIA assumed that all of the demand for domestic production associated with LNG exports was located in the Gulf region, it was not possible in this study to examine regional impacts on either natural gas prices or economic activity. The Gulf Coast is not necessarily a representative choice given the range of locations now in different applications, so that any attempt to estimate regional impacts would be misleading without more regional specificity in the location of exports." [2] (*Emphasis added*)

This is just a few of numerous inconsistencies and shortcomings we have found reviewing the recently released NERA Economic Consulting study commissioned by the U.S. Department of Energy (DOE). We agree with Senator Wyden's January 10, 2013, letter to the Department expressing concerns with the Department of Energy's approval process for liquefied natural gas ("LNG") export applications. The Natural Gas Act ("NGA") requires the Department to determine whether approving an application to export LNG is in the "public interest," and the Department has indicated that this report will be central to the approval process for these applications. The shortcomings of the NERA study are numerous and render this study insufficient for the Department to use in any export determination.

The NERA study left out significant data in its analysis and would need to be updated to include this data along with new EIA projections, more realistic market assumptions, regional impacts of the proposed actual export terminals, and evaluations of the actual impacts on consumers and businesses of exporting LNG. Since the DOE has approved more LNG export volumes to Free Trade Agreement Nations than the NERA 2012 LNG Export Economic Study fully analyzed in its modeling, **we have to wonder if the LNG export volumes that have already been approved by the DOE are currently even feasible**?

Before the DOE proceeds with making any more decisions to allow exports of LNG, it is imperative that the U.S. Department of Energy, Office of Fossil Energy and the Federal Energy Regulatory Commission assess the entire economic and environmental impacts of ALL the proposed LNG export projects as a whole, not just in the Gulf Coast but in other regions of the United States as well. (*See Exhibits A, B, C, D & E*) The programmatic environmental assessment should include the cumulative environmental impacts of hydraulic fracking and the cumulative impacts of all proposed LNG export projects on water and air quality and water supply. An assessment of alternative ways to meet energy needs should also be considered along with an independent analysis of what the sustainable natural gas supplies truly are. **It would not be a good idea to allow LNG Export facilities to be built which may need to be**

[1] http://www.fe.doe.gov/programs/gasregulation/reports/summary_lng_applications.pdf
[2] NERA Economic Consulting Study "*Macroeconomic Impacts of LNG Exports from the United States,*" Dec 2012 http://www.fossil.energy.gov/programs/gasregulation/reports/nera_lng_report.pdf

abandoned due to an overbuild of these facilities and/or the lack of an adequate fuel supply. A rigorous independent unbiased economic analysis that includes "all" potential probabilities and impacts (both negative and positive) of Exporting Domestic and Canadian natural gas is needed. This analysis should include both the cumulative and individual impacts of all the proposed LNG Export terminals in North America.

We have brought to the attention of the DOE in previous letters a host of issues and concerns having to do with public interest issues and concerns with the exportation of LNG, specifically with regards to the Jordan Cove Energy Project. (*See Exhibits F & G*) Many of our concerns have not yet been addressed by the DOE nor have they been addressed in this current NERA Study. The NERA Study fully admits that it is inadequate on pages 210 and 211 and supplies a list of factors that the Study did not include in its analysis. These are listed as:

A. How Will Overbuilding of Export Capacity Affect the Market
B. Engineering or Infrastructure Limits on How Fast U.S. Liquefaction Capacity Could Be Built
C. Where Production or Export Terminals Will Be Located
D. Regional Economic Impacts
E. Effects on Different Socioeconomic Groups
F. Implications of Foreign Direct Investment in Facilities or Gas Production

Additional concerns with the NERA 2012 LNG Export Study are addressed further below.

1) <u>The NERA Study based its predictions and assumptions on "EIA IEO 2011 Natural Gas Production and Consumption" which is now two years old and outdated</u>.

Many of the current proposed LNG Export terminals were actually proposed Import terminals in 2011. In addition to this, the NERA analysis also did not consider LNG Export terminals that are currently being built and/or proposed to come on-line in the international market as well. 31 percent of global LNG exports in 2011 were supplied from Qatar, which also accounted for two-thirds of export growth. But that outlook is set to change over the next decade. The NERA study stated on page 5:

> "The global LNG market was treated as a largely competitive market with one dominant supplier, Qatar, whose decisions about exports were assumed to be fixed no matter what the level of U.S. exports…"

According to the GIIGNL (International Group of Liquefied Natural Gas Importers), in 2011 there were 10 LNG export projects in the works in Australia, one to three in Canada, two in Indonesia, and others in Algeria, Angola, Libya, Nigeria, Papua New Guinea, and Qatar.[3] Major new gas finds off the coast of West Africa and in South America suggest other new exporters in the pipeline. Angola LNG will open the African nation's first liquefaction plant in the first quarter of this year, about a year later than planned, Petroleum Minister Jose Maria Botelho de Vasconcelos said last month.[4]

[3] GIIGNL (International Group of Liquefied Natural Gas Importers) The LNG Industry in 2011 - Report (pg http://www.giignl.org/fileadmin/user_upload/pdf/A_PUBLIC_INFORMATION/LNG_Industry/GIIGNL_The_LNG_Industry_2011.pdf

[4] http://www.bloomberg.com/news/2013-01-22/billionaire-fredriksen-winning-as-lng-tanker-rates-drop-freight.html

Projects in Australia, Papua New Guinea and Indonesia were once considered potential sources of LNG for the Jordan Cove Energy LNG Project when it was proposing to Import LNG. Should the Jordan Cove LNG Export project actually be permitted and built, these projects would end up being in competition with Jordan Cove when and if it should ever come on-line.

The NERA study did not take into account all these additional exporting projects and proposals in its economic analysis. The study admits that it did not analyze, "*Implications of Foreign Direct Investment in Facilities or Gas Production*" and states on page 211:

> "In this report it is assumed that all of the investment in liquefaction facilities and in increased natural gas drilling and extraction come from domestic sources..."

The NERA Study on page 35 states:

> "It is outside the scope of this study to analyze alternative responses by other LNG suppliers in order to determine what would be in their best economic interest or how they might behave strategically to maximize their gains. This would require a different kind of model that addresses imperfect competition in global LNG markets and could explain the apparent ability of some large exporters to set prices for some importing countries at prices higher than the cost of production plus transportation." (*Emphasis added*)

2) The NERA study did not consider the development of natural gas extraction and distribution technology happening in other countries that are currently importing LNG.

According to an Oct 2012 article in InvestorPlace, China accounted for 22% of Asia-Pacific gas consumption last year and 4% of global demand. How it's meeting that demand could be a cause concern for U.S. natural gas suppliers — especially the firms looking to export some or all of their production. The article states:

> "It seems that China has begun to ramp its imports of piped natural gas from Eurasia…"
>
> "According to recent customs data, China for the first time is importing more natural gas overland via pipeline than it is by sea via LNG tanker. The country increased pipeline shipments from Turkmenistan by more than 55% to 9.85 million metric tons in the first eight months of the year. The ex-Soviet nation is home to one of the largest non-shale natural gas reserves on the planet, and it provides of almost all China's piped-in supplies…"
>
> "… Given China's growing thirst for cheaper piped natural gas, as many as 12 U.S. projects that have applied for an LNG export license — including Cheniere's (NYSE:LNG) Sabine Pass facility in Louisiana — could be thrown for a loop. At the same time, more $100 billion worth of LNG projects in Australia, such as Exxon Mobil's (NYSE:XOM) and BHP Billiton's () Scarborough gas field and Hess's (NYSE:HES) Equus project could be canceled if China continues to expand its usage of piped natural gas…." [5] (*Emphasis added*)

[5] "*Trouble in China for U.S. LNG Exports?- U.S. firms may find it's meeting demand from other sources"* By Aaron Levitt, InvestorPlace Contributor | Oct 16, 2012; http://investorplace.com/2012/10/trouble-in-china-for-u-s-lng-exports/

China is also looking to develop its own natural gas resources from shale beds just like the United States. Forbes reported the following in September:

> "…China is expected to put up 17 shale gas blocks for auction in the coming weeks in a bid to develop a robust shale gas industry. It is hoping to attract American energy firms to invest in the industry and form partnerships with domestic companies. It wants to see the success of the American shale gas industry replicated in China. China had no commercial shale gas production in 2011, but has set itself an ambitious target of producing 229.5 billion cubic feet of shale gas a year by 2015…" [6]

The issue of hydrofracking and the development of natural gas extraction being developed in other countries was also addressed to some degree in the following April 8, 2012, article that ran in the Eugene Register Guard concerning the proposed Jordan Cove LNG Export project:

> "….So, will it happen? The proposed Coos County import terminal has some tactical advantages over facilities on the Gulf Coast in its proximity to Asia, but it faces competition with a terminal in Kitimat, B.C., that won approval in October to export gas.
>
> "Western Canada has a big advantage over Coos Bay," Pursell said. "I'd be shocked if your facility got built."
>
> Braddock says he can get gas to Asia just as cheaply as Kitimat, but he's much farther behind. He also said there are far more abundant supplies of natural gas in other countries, but that they haven't developed the technology — yet — to tap into it.
>
> "What we have is a head start in the technology, and they will get it, too, no question," Braddock said. "If no export facilities are built within the next seven or eight years, export facilities will probably never be built."…. [7] (*Emphasis added*)

In other words, in 7 to 8 years the proposed Jordan Cove LNG Export facility would most likely be obsolete. Why build it then? Why wasn't this issue addressed in the NERA economic study?

3) <u>The NERA study did not consider the impacts or costs of hydrafracking which could entail environmental, economic and health related problems and issues</u>.

These issues were brought to the DOE's attention in detail in our August 6, 2012, letter to the DOE. (*Attached as Exhibit F*) Issues surrounding LNG Exports including Hydrofracking are covered in detail in the two following attached reports:

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[6] *"Will ConocoPhillips Help China Tap Its Shale Gas Reserves?"* Forbes – 9/19/2012 http://www.forbes.com/sites/greatspeculations/2012/09/19/can-conocophillips-help-china-tap-its-shale-gas-reserves/

[7] *" IN THE PIPELINE? Proposed Coos Bay natural gas terminal remains up in the air";* By Winston Ross / The Register-Guard – April 8, 2012 ; http://www.registerguard.com/web/business/27868629-41/gas-braddock-natural-terminal-energy.html.csp

- Exhibit H: "*OIL AND GAS Information on Shale Resources, Development, and Environmental and Public Health Risks"*; By U.S. Government Accountability Office, September 2012
- Exhibit I: "*LOOK BEFORE THE LNG LEAP - Why Policymakers and the Public Need Fair Disclosure Before Exports of Fracked Gas Start*"; By Craig Segall, Staff Attorney, Sierra Club Environmental Law Program.

While the gas industry looks to reap huge profits, local communities will be left to deal with the consequences such as poisoned drinking water, devastated coasts, and extreme air pollution. Both the liquefaction and fracking process will contribute to an increase in green house gasses emissions, thus contributing to climate-disrupting global warming pollution and more violent weather and storms. In addition, the massive super-cooling process needed to create the liquefied natural gas for export uses an incredible amount of energy. That is energy that could have been used here domestically. Why is it assumed by the DOE and the NERA study that we will have an infinite amount of fossil fuel energy in the future?

The following articles noted below have also been included as exhibits since they address many significant issues with regard to the viability of LNG Export and hydrofracking:

- Exhibit J: *"Gas Bubble Leaking, About to Burst"* by Richard Heinberg, originally published by Post Carbon Institute | Oct 22, 2012
- Exhibit K: The New York Times "*Exports of American Natural Gas May Fall Short of High Hopes*" January 4, 2013

4) The NERA study did not include the economic impacts of the influx of manufacturing that is coming back to the United States due in part to lower natural gas energy prices and production costs.

In December of 2012, The Atlantic reported in an article entitled, "*The Insourcing Boom,"* that after years of offshore production, General Electric (GE) was moving much of its far-flung appliance-manufacturing operations back home to Appliance Park, in Louisville, Kentucky, and GE was not alone in this move. The Atlantic article went on to state that part of the reason for this move was lower manufacturing costs brought on in part by lower natural gas energy costs:

> "…The natural-gas boom in the U.S. has dramatically lowered the cost for running something as energy-intensive as a factory here at home. (Natural gas now costs four times as much in Asia as it does in the U.S.)…" [8]

In February 2012, GE opened an all-new assembly line to make cutting-edge, low-energy water heaters. As The Atlantic article further explains, GE wasn't just able to hold the retail sticker to the "China price." It beat that price by nearly 20 percent. The China-made GeoSpring retailed for $1,599. The Louisville-made GeoSpring retails for $1,299.

In March 2012, GE started a second assembly line to make new high-tech French-door refrigerators. Another assembly line is under construction to make a new stainless-steel dishwasher starting in early

[8] "*The Insourcing Boom"* by Charles Fishman, December 2012, The Atlantic Magazine http://www.theatlantic.com/magazine/archive/2012/12/the-insourcing-boom/309166/

2013. "I don't do that because I run a charity," Jeff Immelt, CEO of GE, said at a public event in September. "I do that because I think we can do it here and make more money."

GE is not alone in moving the manufacture of many of its products back to the U.S. Forbes reported in December that Tim Cook, Job's successor as CEO of Apple, had announced that Apple will resume manufacturing one of their existing Mac lines in the U.S. next year.[9] Cook told BusinessWeek that Apple plans to spend $100 million on manufacturing in the U.S. in 2013. This transformation is mirrored in dozens of other places, with Whirlpool bringing mixer-making back from China to Ohio, Otis bringing elevator production back from Mexico to South Carolina, even Wham-O bringing Frisbee-molding back from China to California**.** As the Atlantic article explains in more detail, **lower energy and production costs in the U.S. are playing a key part in making this all happen.**

Thousands of manufacturing jobs are in the process of coming back to the U.S. but the NERA study did not consider or analyze this influx of new manufacturing jobs in its analysis.

Recently Huntsman Corporation announced that it has joined a coalition of U.S. manufacturers and others opposed to proposals from LNG exporters to permit the unlimited export of American natural gas. According to an LNG World News article:

> **"Peter Huntsman, President and CEO of Huntsman**, stated, *"We think it very short-sighted and bad public policy to allow our nation's natural gas advantage to be stripped and sent overseas to build a new manufacturing base that would otherwise be built here in the U.S."*
>
> He continued, *"Completely unfettered U.S. exports may enrich a few LNG exporters in the short term, but real, sustained and broad-based growth in the U.S. economy will come from a balanced approach that considers the needs of American manufacturers and consumers, and ensures that natural gas can be exported without undermining this emerging sunrise for American manufacturing and all the supporting industries and services. Our nation must not squander this opportunity."*[10]

Bloomberg's Businessweek reported in August that Dow Chemical Co. had e-mailed out a statement that laid out all the benefits that cheap natural gas has had for manufacturers, before concluding; *"[D]ecisions around the export of natural gas should include a rigorous analysis of potential impact on the domestic economy and job creation, and place a high priority on the manufacturing sector*." The Businessweek article also stated that **the large supply of cheap natural gas had helped revive U.S. manufacturing, which had added 500,000 jobs since February 2010**.[11]

The NERA study on the other hand, states on page 2 that, "LNG exports are not likely to affect the overall level of employment in the U.S…." This may be true for workers in the natural gas sector but would obviously not be true for workers in the manufacturing sector. Economic models as we know are only as good as their inputs and as we explained in our September 12, 2012, response letter in Jordan Cove's DOE FE Docket No. 12-32-LNG, (*See Exhibit G*) those inputs can sometimes be incorrect and/or wrong and may end up favoring a certain outcome that later proves to be incorrect.

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9 "*Why Apple and GE Are Bringing Back Manufacturing*" by Steve Denning, Forbes 12/7/2012
http://www.forbes.com/sites/stevedenning/2012/12/07/why-apple-and-ge-are-bringing-manufacturing-back/

10 "*U.S. Manufacturers Oppose LNG Exports*" Posted January 23, 2013
http://www.lngworldnews.com/u-s-manufacturers-oppose-lng-exports/

11 *"Strange Bedfellows Debate Exporting Natural Gas"* By Matthew Philips on August 22, 2012, Bloomberg Businessweek:
http://www.businessweek.com/articles/2012-08-22/strange-bedfellows-debate-exporting-natural-gas

5) The NERA study did not consider the future economic costs to Americans from exporting our current known reserves of natural gas.

We have exported LNG from Alaska until now the supply in Cook Inlet is running out. In November the Alaska Journal of Commerce stated the following:

> "...There is increasing sensitivity to the Cook Inlet gas supply situation because existing fields are declining in production and local utility demand is expected to exceed annual production by the 2014-15 winter, requiring gas to be imported as LNG or compressed natural gas, utility officials told the state regulatory commission in a recent briefing.
>
> Several companies are exploring for oil and gas in Cook Inlet but no major discoveries have been made yet. Even if they are it is unlikely they can be put into production in time to meet the projected 2014-15 shortfall...." [12] (*Emphasis added*)

We should also learn a thing or two from China. China started out exporting their coal and then one day they had no more coal to export, nor any for their own energy needs. They then had to become an importer of coal in order to keep their economy going. **Is America so DUMB that we will do the same thing with natural gas?**

6) The NERA Study Did not consider that some of the companies proposing these American LNG Export projects, such as the Jordan Cove Energy Project, are foreign owned and controlled.

Capital Resources for the most part would not come back to the United States in these cases as the NERA study assumes. Our resources would end up being exploited in this scenario with no real benefit to the "Public Interest." The NERA study on page 78 assumes that "owners of businesses involved directly and indirectly in natural gas production and exports" would be American, which we have explained in earlier testimony to the DOE will clearly not be the case with the Jordan Cove Energy Project. The NERA study on page 211 states that that study did not address, "*Implications of Foreign Direct Investment in Facilities or Gas Production*":

> "In this report it is assumed that all of the investment in liquefaction facilities and in increased natural gas drilling and extraction come from domestic sources. Macroeconomic effects could be different if these facilities and activities were financed by foreign direct investment ("FDI") that was additional to baseline capital flows into the U.S. FDI would largely affect the timing of macroeconomic effects, but quantifying these differences would require consideration of additional scenarios in which the business model was varied."

The NERA study also did not consider that some of the natural gas supply proposed to be exported from American Export terminals is proposed to be coming from Canadian sources.

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[12] *"Hilcorp consent degree will cap gas prices, limit LNG sales"* Tim Bradner, Alaska Journal of Commerce; Nov 15, 2012 http://www.alaskajournal.com/Alaska-Journal-of-Commerce/November-Issue-3-2012/Hilcorp-consent-degree-will-cap-gas-prices-limit-LNG-sales/

7) The NERA study assumes the market will be able to regulate itself as to whether LNG export of American gas will be feasible. The study did not consider the cost for projects that may be built based on wrong economic assumptions.

The philosophy and thinking that the free market will regulate itself and do the right thing has not proven to be correct in the past with regard to other large scale energy projects. As we have also seen more recently in the banking industry, the market needs regulation and guidance to ensure the protection of investors, the public and the environment.

A good example of how energy projects can go very wrong can be found in the Northwest in the 1970′s. The Washington Public Power Supply System (WPPSS, aka "whoops") began in the 70's the largest nuclear power plant construction project in U.S. history: reactors 1, 2, and 4 at Hanford, and reactors 3 and 5 at Satsop, west of Olympia. By 1983, cost overruns, delays, a slowing of electricity demand growth, concerns over nuclear power, and several other factors led to cancellation of two plants and a construction halt on two others. **The agency in the end defaulted on $2.25 billion in municipal bonds, which is still the largest municipal bond default in U.S. history**. The monumental court case which followed took nearly a decade to fully resolve. At Satsop, construction was well along on plants 3 and 5, with plant number 3 being about 85% complete, with the reactor in place, when the default occurred. Cooling towers, 480 feet tall, never saw a breath of steam, and demolition costs are estimated to be in the hundreds of millions. Ironically, the energy blackouts predicted by the industry to justify the building of the plants never occurred after the projects were stopped. The unfinished plants have been sitting there in limbo at Satsop ever since - too expensive to tear down, too unwieldy to be bought, too costly to maintain in mothballs forever. Proposals to turn them into everything from a nuclear weapons demolition plant to a theme park have come and gone.

These plants I am sure met energy modeling criteria at the time they were proposed to be built similar to what has been done by the NERA study, but they proved that even the best assumptions and predictions can end up being wrong in the end. In similarity to the WPPSS fiasco, the Jordan Cove LNG Export project is just one of a multitude of proposed LNG "plant" projects that are being proposed on the Pacific Coast. Another Pacific Coast LNG export "plant" project is being proposed in Warrenton, Oregon, along the Columbia River, and there are several more proposed projects near Kitimat, British Columbia, Canada. Canada's National Energy Board has already handed LNG-export licenses to at least two of the planned liquefaction projects there. In addition, another LNG export project is also being proposed in Alaska.

There are several West Coast LNG terminals that are already existing and/or being proposed to be built. These include the following:

West Coast "Existing" LNG Import/Export Terminals:

- Baja California, MX: 1.0 Bcfd, (Sempra – Energia Costa Azul)
- Kenai Alaska - ConocoPhillips LNG Export Plant - Currently in operation although the plants future remains unclear due to declining reserves. The plant has a license to export LNG until March 2013.

West Coast "Approved" LNG Import/Export Terminals

- Manzanillo, MX: 0.5 Bcfd (KMS GNL de Manzanillo) [Approved - Under Construction]
- Baja California, MX : 1.5 Bcfd (Sempra - Energia Costa Azul - Expansion) [Approved - Not Under Construction yet]

West Coast "Proposed" LNG Export Terminals

● Coos Bay, OR: 0.8 - 1.2 Bcfd (Jordan Cove Energy Project) - Fort Chicago LNG II U.S.L.P., a Delaware limited partnership (Canadian) owns seventy-five percent. Energy Projects Development L.L.C., a Colorado limited liability company, owns twenty-five percent.
● Astoria, OR: 1.25 - 1.5 Bcfd (Oregon LNG) - LNG Development Company, LLC, d/b/a Oregon LNG, Warrenton, Ore
● Alaska Gasline Port Authority: 2.0 - 2.4 Bcfd (Pipeline Capacity 3 – 3.5 Bcfd); LNG Export Terminal development partnership between the State of Alaska, ExxonMobil, ConocoPhillips, BP and TransCanada.

West Coast Canadian "Proposed" LNG Export Terminals

● Douglas Island, BC: 0.25 Bcfd (BC LNG Export Cooperative) - A privately held 13-member co-operative.
● Kitimat, BC: 0.7 Bcfd (Apache Canada Ltd.) - Backed by Apache Corp, Encana Corp and EOG Resources;
● Prince Rupert Island, BC: 1.0 Bcfd (Shell Canada) - Shell Canada Limited (Royal Dutch Shell plc) (40%),and its partners Korea Gas Corporation (KOGAS) (20%), Mitsubishi Corporation (20%), and PetroChina Company Limited (20%)

The gas slated to supply several of these proposed West Coast LNG Export projects appears to be coming from the same supply sources. We have concerns about the cumulative impacts of all these LNG Export proposals on gas supply and the domestic price of natural gas.[13] Environmental impacts are of concern also.[14] Property where pipelines and LNG facility development occurs would be limited in the future from use by other development should the LNG projects default after being built. Pipeline right of ways would negatively impact local industries such as Ranching, Timber, Farming, Fishing, Recreation and Tourism.

A Programmatic Economic and Environmental Impact Study based on sound science and true impacts should be completed first in order to determine which proposals, if any, applying for this same market share of natural gas would be the least environmentally impacting and in the best interest of Oregonians and Americans as a whole. The NERA study admits on page 210 that it did not address directly "*Regional Economic Impacts"* nor "*Where Production or Export Terminals would be located*." The study states on page 210 the following:

> "There are proposals for export facilities in the Mid-Atlantic, Pacific Northwest and Canada, all of which could change basis differentials and potentially the location of additional natural gas production, with corresponding implications for regional impacts. To analyze alternative locations

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[13] "*Exports of LNG May Raise U.S. Prices as Much as 54%, Agency Says*"
- By Katarzyna Klimasinska – Jan 19, 2012 – Bloomberg:
http://www.bloomberg.com/news/2012-01-19/lng-exports-may-spur-higher-u-s-natural-gas-prices-report-says.html

[14] ***"****Methane and the greenhouse-gas footprint of natural gas from shale formations****"***
A letter – Robert W. Howarth, Renee Santoro and Anthony Ingraffea – Published April 12, 2011
http://journalistsresource.org/studies/environment/energy/natural-gas-hydrofracking-greenhouse/

"*Comparative Life-Cycle Air Emissions of Coal, Domestic Natural Gas, LNG, and SNG for Electricity Generation****"***- Paulina Jaramillo; W. Michael Griffin; and H. Scott Matthews – Civil and Environmental Engineering Department, Tepper School of Business, and Department of Engineering and Public Policy, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, Pennsylvania 15213-3890 – July 25, 2007
http://www.ce.cmu.edu/~gdrg/readings/2007/09/13/Jaramillo_ComparativeLCACoalNG.pdf

of export facilities it would be necessary to repeat both the EIA and the NERA analyses with additional scenarios incorporating demand for natural gas export in different regions." (*Emphasis added*)

It is imperative that the U.S. Department of Energy, Office of Fossil Energy follow their own NERA study's advice here. The shortcomings of the NERA study as we have stated previously and throughout this letter are numerous and render this study insufficient for the Department to use in any export determination.

A thorough independent programmatic analysis on LNG exports is still needed, however. Unfortunately, citizens in rural poor areas such as Coos Bay, Oregon, do not have the resources that the multinational corporations and the gas and oil industry have to conduct such a thorough independent analysis. We citizens depend on agencies such and the U.S. Department of Energy and the Federal Energy Regulatory Commission to do such an analysis for us and to make sure their decisions are in the public interest. It would not be fair to citizens who live in poor rural areas to have large scale LNG Export projects pushed off on them due to the fact they lack the resources to be able to do the independent and thorough analysis that is needed.

Sincerely,

/s/ Jody McCaffree

Jody McCaffree

Index for Exhibits
For Citizens Against LNG Comments to the DOE
January 24, 2013
Re: 2012 LNG Export Study

Exhibit A: *Existing Operational LNG Terminals in the United States.* www.ferc.gov

Exhibit B: *North American LNG Import /Export Terminals – Existing as of Dec 5, 2012 Operation*

Exhibit C: *North American LNG Import /Export Terminals – Approved as of Dec 5, 2012*

Exhibit D: *North American LNG Import /Export Terminals – Proposed/Potential as of Dec 5, 2012*

Exhibit E: *Applications Received by the DOE/FE to Export Domestically Produced LNG from the Lower-48 States, as* of January 11, 2013;
http://www.fe.doe.gov/programs/gasregulation/reports/summary_lng_applications.pdf

Exhibit F: CALNG August 6, 2012, Motion to Intervene, Protest and Comments sent to the DOE regarding the Jordan Cove Energy Project, L.P., FE Docket No. 12-32-LNG

Exhibit G: CALNG September 12, 2012, Response to Answer of Jordan Cove Energy Project, L.P. to Protests of Application for Long-Term Authorization to Export Liquefied Natural Gas to Non-Free Trade Agreement Nations, FE Docket No. 12-32-LNG

Exhibit H: "*OIL AND GAS Information on Shale Resources, Development, and Environmental and Public Health Risks*"; By U.S. Government Accountability Office, September 2012

Exhibit I: "*LOOK BEFORE THE LNG LEAP - Why Policymakers and the Public Need Fair Disclosure Before Exports of Fracked Gas Start*"; By Craig Segall, Staff Attorney, Sierra Club Environmental Law Program.

Exhbit J: "*Gas Bubble Leaking, About to Burst*" by Richard Heinberg, originally published by Post Carbon Institute | Oct 22, 2012

Exhibit K: The New York Times "*Exports of American Natural Gas May Fall Short of High Hopes*" January 4, 2013

Exhibit F

UNITED STATES OF AMERICA
Before the
DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY

In the Matter of:		
NERA Economic Consulting Study	**)**	**FR Doc No: 2012-29894**
"*Macroeconomic Impacts of LNG*	**)**	
***Exports from the United States*"**	**)**	
December 3, 2012	**)**	
	)	

The following Reply Comments sent by Email to LNGStudy@hq.doe.gov

Jody McCaffree
Individual / Executive Director
Citizens Against LNG Inc
PO Box 1113
North Bend, OR 97459

February 25, 2013

U.S. Department of Energy (FE-34)
Office of Natural Gas Regulatory Activities
Office of Fossil Energy
P.O. Box 44375
Washington, DC 20026–4375

Re: 2012 LNG Export Study Reply Comments

Dear Mr. John Anderson / Mr. Edward Myers:

Please accept the following reply comments to issues raised in initial comments submitted to the U.S. Department of Energy (DOE) Office of Fossil Energy (FE) on or before January 24, 2013, concerning the NERA 2012 LNG Export Study.

1. Responding to comments concerning the DOE allowing Unlimited LNG Exports

On January 25, 2013, one day after initial comments were due to the U.S. Department of Energy (DOE) Office of Fossil Energy (FE) concerning the NERA LNG Export Study, Bloomberg reported on an interview that had occurred with Peter Voser, chief executive officer of Royal Dutch Shell Plc on the sidelines of the World Economic Forum's annual meeting in Davos, Switzerland. The interview between Voser and Bloomberg's Ryan Chilcote discussed U.S.

shale-gas production and exports, China's gas reserves and exploration in the Ukraine.[1] A Bloomberg article written about the interview stated the following:

> "Exports will happen," said Voser, 54, whose company is the world's largest LNG supplier. "But I hope that the U.S. will actually keep most of the gas back because it will help them to industrialize parts of the U.S. more." …
>
> …Elsewhere in the world, Shell is optimistic about prospects for shale gas production in China and Ukraine. The company signed a production agreement with the eastern European country yesterday.
>
> "In China, it is very encouraging what we find," Voser said. Shell is exploring for shale gas with China National Petroleum Corp. "If you just look at the reserves it could outnumber the U.S." …[2] (*Emphasis added*)

In response to the concerns raised in initial comments about limiting LNG exports, **if the CEO of Royal Dutch Shell Plc, the world's largest LNG supplier, is saying we should keep back our gas to help us industrialize parts of the U.S., the DOE should seriously take note and consider this in their decision making.** Voser also states in the interview that they are already developing and producing natural gas in China and that Shell is contemplating possibly building their own LNG terminal in North America. Shell is interested in multiple LNG projects including projects to turn gas into liquid fuel such as diesel to power trucks and ships and to feed chemicals plants.

2. Responding to comments about LNG Export Terminals and Options not considered in the NERA Study

The list of proposed LNG export terminals continues to grow and as we previously stated in our initial comments to the DOE, the NERA study did not consider the impacts of all the proposed and/or potential LNG export projects that are in the works in North America. In our January 24, 2013, comments we made a list of proposed, potential and already existing LNG terminals on the West Coast. Since that time additional details about proposed and potential LNG terminals and export options for the West Coast have been brought to our attention:

Alaska

On February 15, 2013, executives from ExxonMobil, BP, ConocoPhillips and TransCanada submitted a letter to Alaska Governor Sean Parnell outlining the concept for an **Alaska LNG project and related pipeline**. The facility would be located on the North Slope near Prudhoe Bay and would receive approximately 3 – 3.5 Bcf/d of natural gas and produce 15 - 18 million

[1] http://www.bloomberg.com/video/shell-may-build-own-u-s-lng-export-terminal-BdUodfh7QpCl5XRLD1eD7g.html

[2] Bloomberg "*U.S. to Cap LNG Exports to Boost Economy, Shell's Voser Says"* By Will Kennedy - Jan 25, 2013 ; http://www.bloomberg.com/news/2013-01-25/u-s-will-cap-lng-shipments-to-boost-economy-shell-s-voser-says.html

tonnes per annum (MTPA) of LNG. This is considerably more than what we had previously listed in our initial comments for this particular LNG proposal. (*See Exhibit A for their letter*)

Canada

Another proposed Canadian LNG Export project not mentioned in our "initial" comments is currently being proposed by Progress Energy Canada Ltd. (Progress), a wholly owned subsidiary of Petroliam Nasional Berhad (Pertronas). Progress Energy is proposing to construct and operate the **Pacific Northwest LNG Project** on Lelu Island within the lands and waters under the jurisdiction of the Prince Rupert Port Authority, within the District of Port Edward, British Columbia (BC). This project would convert natural gas from northeast BC into LNG for export to Pacific Rim markets in Asia. Two LNG carrier berths would accommodate two 217,000 m^3 capacity LNG carriers up to 315 m long. The facility would receive approximately 3 Bcf/d of natural gas and produce up to 18 million tonnes per annum (MTPA) of LNG.[3] On February 19, 2013, the Canadian Environmental Assessment Agency (CEAA) started their environmental review of the project. This is yet another example of a North American LNG export project not considered in the NERA economic study and analysis.

Hawaii

The NERA study also did not consider the economic impacts from alternative LNG export options such as what is being proposed by The Gas Company, LLC, out of Hawaii. Despite the fact that the Jordan Cove Energy Project listed Hawaii as a potential receiver of their LNG exported gas, The Gas Company, LLC, submitted to FERC on August 9th [4] an application [5] to import LNG via a fleet of up to 20 40-foot cryogenic intermodal containers (also known as "ISO" containers). These "ISO" containers would be transported to Hawaii on common carrier cargo vessels utilizing already existing industries and infrastructure. The company anticipates that it will utilize port facilities on the West Coast, such as the ports of Los Angeles and Long Beach, California. The company could potentially also utilize ports on the U.S. Gulf Coast. It would seem that using already existing infrastructure and industries would be far less environmentally impacting and more economical than building additional pipelines and LNG terminals. A properly completed Economic and Environmental Programmatic Analysis would have brought this option to light and is another example as to why it is essential that this type of analysis be completed first before the DOE makes any further decisions with regard to LNG exports.

[3] *Pacific Northwest LNG – Project Description* ; Prepared for Progress Energy Canada Ltd. by Stantec Consulting Ltd.; February 2013; Project No. 1231-10537; http://www.ceaa-acee.gc.ca/050/documents/p80032/86105E.pdf

[4] Application to FERC by The Gas Company, LLC, out of Hawaii for Authorization under Section 3 of the Natural Gas Act; August 9, 2012; http://elibrary.FERC.gov/idmws/file_list.asp?accession_num=20120809-5100

[5] ISO is an international organization for standardization which establishes standards for the construction of these containers. ISO-certified intermodal containers are bulk transport units designed to be shipped from one mode of transportation to another (*e.g.*, from truck to ship) or from one location to another.

3. Responding to comments concerning Shale Natural Gas Resources and Impacts

Many initial comments to the DOE including our own expressed concerns with regard to the impacts from hydraulic fracturing of Shale beds and the viability of Shale resources and reserves. The NERA study as we have already stated did not address any of this in its analysis. Several studies have been published since the DOE January 24, 2013, comment deadline which contain information on this issue that should be considered by the DOE.

3.1 ***"Shale and Wall Street – Was the Decline in Natural Gas Prices Orchestrated?"***
By Deborah Rogers, February 2013, Energy Policy Forum: (*See Exhibit B*)

As documented in this report listed above, emerging independent information on shale plays in the U.S. confirms the following:

"· Wall Street promoted the shale gas drilling frenzy, which resulted in prices lower than the cost of production and thereby profited [enormously] from mergers & acquisitions and other transactional fees.

· U.S. shale gas and shale oil reserves have been overestimated by a minimum of 100% and by as much as 400-500% by operators according to actual well production data filed in various states.

· Shale oil wells are following the same steep decline rates and poor recovery efficiency observed in shale gas wells.

· The price of natural gas has been driven down largely due to severe overproduction in meeting financial analysts' targets of production growth for share appreciation coupled and exacerbated by imprudent leverage and thus a concomitant need to produce to meet debt service.

· Due to extreme levels of debt, stated proved undeveloped reserves (PUDs) may not have been in compliance with SEC rules at some shale companies because of the threat of collateral default for those operators.

· Industry is demonstrating reticence to engage in further shale investment, abandoning pipeline projects, IPOs and joint venture projects in spite of public rhetoric proclaiming shales to be a panacea for U.S. energy policy.

· Exportation is being pursued for the differential between the domestic and international prices in an effort to shore up ailing balance sheets invested in shale assets

<u>It is imperative that shale be examined thoroughly and independently to assess the true value of shale assets, particularly since policy on both the state and national level is being</u>

implemented based on production projections that are overtly optimistic (and thereby unrealistic) and wells that are significantly underperforming original projections." (*Emphasis added*)

3.2 ***"Drill Baby Drill - Can Unconventional Fuels Usher in a New ERA of Energy Abundance"*** By J. David Hughes, February 2013, Post Carbon Institute [6]

J. David Hughes, the author of the report noted above, is a geoscientist who has studied the energy resources of Canada for nearly four decades, including 32 years with the Geological Survey of Canada as a scientist and research manager. He developed the National Coal Inventory to determine the availability and environmental constraints associated with Canada's coal resources. The Report spells out the details and concludes the following:

> "The U.S. is a mature exploration and development province for oil and gas. New technologies of large scale, multistage, hydraulic fracturing of horizontal wells have allowed previously inaccessible shale gas and tight oil to reverse the long-standing decline of U.S. oil and gas production. This production growth is important and has provided some breathing room. Nevertheless, the projections by pundits and some government agencies that these technologies can provide endless growth heralding a new era of "energy independence," in which the U.S. will become a substantial net exporter of energy, are entirely unwarranted based on the fundamentals. At the end of the day, fossil fuels are finite and these exuberant forecasts will prove to be extremely difficult or impossible to achieve.
>
> "A new energy dialogue is needed in the U.S. with an understanding of the true potential, limitations, and costs—both financial and environmental—of the various fossil fuel energy panaceas being touted by industry and government proponents. The U.S. cannot drill and frack its way to "energy independence." At best, shale gas, tight oil, tar sands, and other unconventional resources provide a temporary reprieve from having to deal with the real problems: fossil fuels are finite, and production of new fossil fuel resources tends to be increasingly expensive and environmentally damaging. Fossil fuels are the foundation of our modern global economy, but continued reliance on them creates increasing risks for society that transcend our economic, environmental, and geopolitical challenges. The best responses to this conundrum will entail a rethink of our current energy trajectory.
>
> "Unfortunately, the "drill, baby, drill" rhetoric in recent U.S. elections belies any understanding of the real energy problems facing society. The risks of ignoring these energy challenges are immense. Developed nations like the United States consume (on a per capita basis) four times as much energy as China and seventeen times as much as India. Most of the future growth in energy consumption is projected to occur in the

[6] *"Drill Baby Drill - Can Unconventional Fuels Usher in a New ERA of Energy Abundance"* By J. David Hughes, February 2013, Post Carbon Institute - http://shalebubble.org/drill-baby-drill/ [**NOTE**: The file size of this report was over 30 MB which made it too large to send and include as an official exhibit by e-mail.].

developing world. Constraints in energy supply are certain to strain future international relations in unpredictable ways and threaten U.S. and global economic and political stability. The sooner the real problems are recognized by political leaders, the sooner real solutions to our long term energy problem can be implemented." (*Emphasis added*)

3.3 "***State of the Science of Endocrine Disrupting Chemicals 2012 – Summary for Decision-Makers***," A Report by the United Nations Environment Programme (UNEP) and the World Health Organization (WHO), Edited by Ake Bergman, Jerrold J. Heindel, Susan Jobling, Karen A. Kidd, R. Thomas Zoeller Publication date: 19 February 2013, [7] (*See Exhibit C*)

On February 19, 2013, an assessment of the state of the science of endocrine disruptors prepared by a group of experts for the United Nations Environment Programme and the World Health Organization was released. Many synthetic chemicals, untested for their disrupting effects on the hormone system, could have significant health implications according to this "*State of the Science of Endocrine Disrupting Chemicals"* report. The document provides the global status of scientific knowledge on exposure to and effects of endocrine disrupting chemicals (EDCs).

Endocrine disruptors are chemical compounds that interfere with the proper function of endocrine systems in humans and other organisms. Substances grouped together as Endocrine Disruptors, and often called EDCs.

The endocrine system includes glands — such as the thyroid, pituitary, pancreas, testes or ovaries — that secrete natural chemicals to regulate growth, behavior, reproduction, metabolism, etc. EDCs may interfere with the amount of natural hormones (such as estrogen or adrenaline) the body makes, block the way they are made, or mimic a hormone and give a "wrong" chemical signal. Endocrine systems are very similar across vertebrate species. Effects shown in wildlife or experimental animals may also occur in humans if they are exposed to EDCs at a vulnerable time and at concentrations leading to alterations of endocrine regulation. Of special concern are effects on early development of both humans and wildlife, as these effects are often irreversible and may not become evident until later in life. The WHO Press Release for their report states the following:

> "We urgently need more research to obtain a fuller picture of the health and environment impacts of endocrine disruptors," said Dr Maria Neira, WHO's Director for Public Health and Environment. "The latest science shows that communities across the globe are being exposed to EDCs, and their associated risks. WHO will work with partners to establish research priorities to investigate links to EDCs and human health impacts in order to mitigate the risks. We all have a responsibility to protect future generations."[8] (*Emphasis added*)

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[7] "*State of the Science of Endocrine Disrupting Chemicals 2012 – Summary for Decision-Makers*," A Report by the United Nations Environment Programme (UNEP) and the World Health Organization (WHO), Edited by Ake Bergman, Jerrold J. Heindel, Susan Jobling, Karen A. Kidd, R. Thomas Zoeller Publication date: 19 February 2013, Languages: English, ISBN: 978 92 4 150503 1 ; http://www.who.int/ceh/publications/endocrine/en/index.html

[8] *Effects of human exposure to hormone-disrupting chemicals examined in landmark UN report*
News release - 19 February 2013 | GENEVA ;

Human exposure to EDCs occurs via ingestion of food, dust and water, via inhalation of gases and particles in the air and through dermal uptake. Several Research Reports have linked EDC's to natural gas development and impacts from hydraulic fracturing of Shale beds. Selected polycyclic aromatic hydrocarbons (PAHs) were found near Shale development sites at concentrations greater than those at which prenatally exposed children in urban studies had lower developmental and IQ scores. The human and environmental health impacts of the non-methane hydrocarbons (NMHCs), which are ozone precursors, should be examined further given that the natural gas industry is now operating in close proximity to human residences and public lands.

You would think that if the United Nations Environment Programme and the World Health Organization are having significant concerns about these issues that the DOE and/or the FERC would be showing some concerns about them too. Unfortunately as we have already indicated in initial comments, the environmental and health impacts of hydraulic fracturing of Shale beds is not being analyzed or considered by either the DOE or FERC despite research showing a clear link to these compounds and other health impacts from this type of gas production.
(*See Exhibits C, D and E*)

4. Responding to Public Official Comments

In response to comments submitted on January 24, 2013, by Rick Wetherell of North Bend, Oregon, and Roger Craddock of Coos Bay, Oregon, we have attached the following petitions and would like to point out links to petition sheets that have previously been submitted to FERC.[9] Thousands of Citizens in the North Bend and Coos Bay area have signed petitions stating they do not believe a LNG terminal in our Port is a well conceived or appropriate industry for our Port and would present an unacceptable risk to the citizens living here. Citizens in the Coos Bay Port District have never been allowed to vote on this issue and are no match to the seemingly endless dollars handed out and promised to local elected officials by the Jordan Cove Energy Project.

I would also like to point out that despite the fact the Jordan Cove Energy Project expressed problems in their comments with the Department of Energy's NERA Study, both Mayor Wetherell and Mr. Craddock praised the Report and its findings. Since the NERA Study itself noted its own shortcomings, we hope that the DOE will seriously take those notations and our comments previously made about them into account before making any decisions concerning proposed LNG Export projects including the Jordan Cove Energy LNG Project.

5. Responding to issues raised about China and Coal Imports

I would like to clarify a statement made in our January 24, 2013, comments to the DOE concerning China and their switch from coal exports to coal imports. Historically China has

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http://www.who.int/mediacentre/news/releases/2013/hormone_disrupting_20130219/en/index.html

[9] Petition Filing 1) http://elibrary.FERC.gov/idmws/file_list.asp?accession_num=20070326-0003 (14.4MB)
Petition Filing 2) http://elibrary.FERC.gov/idmws/file_list.asp?accession_num=20070906-0013 (4.7MB)
Petition Filing 3) http://elibrary.FERC.gov/idmws/file_list.asp?accession_num=20091112-5040 - Exhibit P (6.3MB)

been a net coal exporter but in 2009 the global coal market witnessed a dramatic realignment as China burst onto the scene importing coal from as far away as Colombia and the United States. With 182 million tons (Mt) of coal sourced from overseas suppliers in 2011, China has overtaken Japan as the world's top coal importer. [10] Moreover, as the world's top coal consumer, China's imports are predicted to rise significantly again by 2015.[11] Prior to 2009, China was a net coal exporter. Coal is a cornerstone of the Chinese economy, representing 77 percent of China's primary energy production and fueling almost 80 percent of its electricity. Moreover, China is the world's top coal consumer, accounting for nearly half of global consumption in 2010.[12] Despite the fact that China is home to the world's second largest proven coal reserves after the United States, those reserves are not necessarily being mined. According to a Carnegie Policy Outlook Report, "*Understanding China's Rising Coal Imports*," [13] several factors could be contributing to this and China's sudden entrance into coal import markets including transportation bottlenecks, environmental and safety considerations, economic factors, and concerns about depleting coking coal reserves.

For comments made by those accusing the U.S. of violating its World Trade Organization commitments if it should limit LNG exports, if that was the case, why wouldn't it also apply to China and their not developing and/or exporting their own coal reserves?

7. Responding to initial comments concerning Renewable Energy Options

As Erin Crump and several others have pointed out in their initial comments to the DOE, the real solution to our energy problems is to develop alternative energy systems such as wind, solar, geothermal and other sustainable renewable energy solutions and options. The following attachment on Renewable Energy Alternative Solutions (*See Exhibit F*) clearly shows how this can be and is already being done in some parts of the country. Renewable energy solutions can meet our energy needs not only in the United States but essentially across the entire world. **It would make far more economic sense for us to be exporting renewable energy products and solutions over environmentally impacting and difficult to obtain fossil fuels.** This would also be more in line with the *public interest*. As referenced above from the recent report by J. David Hughes, fossil fuels are finite and the exuberant forecasts of natural gas from shale beds will prove to be extremely difficult or impossible to achieve. The sooner the real problems are recognized by political leaders, the sooner real solutions to our long term energy problem can be implemented.

We stand with Industries and Associations who commented to the DOE such as Alcoa, American Forest & Paper Association, American Iron and Steel Institute, American Public Gas

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[10] O. Tsukimori and C. Aizhu, "*China overtakes Japan as world's top coal importer*," Reuters, January 26, 2012, www.reuters.com/article/2012/01/26/coal-china-japanidUSL4E8CQ3GS20120126 .
[11] R. Kebede and M Taylor, "*China coal imports to double in 2015*," Reuters, May 30, 2011
[12] National Bureau of Statistics, *China Energ y Statistical Yearbook* (Beijing: China Statistics Press, 2012); *Statistical Review of World Energ y* (London: British Petroleum, 2011).
[13] Carnegie Policy Outlook, "*Understanding China's Rising Coal Imports*" Kevin Jianjun Tu and Sabine Johnson-Reiser, February 16, 2012, http://www.carnegieendowment.org/files/china_coal.pdf

Association, CarbonX Energy Corporation Inc, DOW Chemical Company, Industrial Energy Consumers of America, Nucor Corp, Rentech Inc, The Aluminum Association, and The Fertilizer Institute in their concerns with the DOE's NERA LNG Export Study.

We also stand with the concerns and issues raised with the NERA LNG Export Study by citizen and environmental groups who commented such as the Catskill Citizens for Safe Energy, Citizen Power, Clean Line Energy Partners Inc, Clean Ocean Action, Credo Action, Keep Tap Water Safe, Landowners United, New York Climate Action, Pepacton Institute LLC, Save our Supplies (SOS), The Natural Resources Defense Council (NRDC) – Clean Energy Council, Cascadia Wildlands, Environmental Working Group, Civil Society Institute, Food and Water Watch, Oregon Shores, Oregon Wild, Sierra Club, Joseph Patrick Quinn of Umpqua Watersheds, and the Delaware Riverkeeper Network along with 87 other Organizations and thousands of citizens.

We continue to request that the complete Economic and Environmental Impacts of LNG Exports be fully considered in a Programmatic Review and that the National Environmental Policy Act be followed and adhered to first [14] by the U.S. Department of Energy, Office of Fossil Energy before any decisions regarding LNG Exports are made.

Sincerely,

/s/ Jody McCaffree

Jody McCaffree

[14] December 12, 2012, Letter from Citizens Against LNG to Oregon Governor Kitzhaber (sent also to the DOE FE) addressing issues with regard to the Jordan Cove Energy Project and NEPA regulations. http://elibrary.ferc.gov/idmws/file_list.asp?accession_num=20121218-0008

Index Reference for Exhibits

Exhibit A:
February 15, 2013, letter to Alaska Governor Sean Parnell from executives at ExxonMobil, BP, ConocoPhillips and TransCanada outlining the concept for an **Alaska LNG Export project and related pipeline.** http://gov.alaska.gov/parnell_media/resources_files/letter021513.pdf

Exhibit B:
Shale and Wall Street – Was the Decline in Natural Gas Prices Orchestrated?" By Deborah Rogers, February 2013, Energy Policy Forum
http://energypolicyforum.org/portfolio/was-the-decline-in-natural-gas-prices-orchestrated/

Exhibit C:
"***State of the Science of Endocrine Disrupting Chemicals 2012 – Summary for Decision-Makers***," A Report by the United Nations Environment Programme (UNEP) and the World Health Organization (WHO), Edited by Ake Bergman, Jerrold J. Heindel, Susan Jobling, Karen A. Kidd, R. Thomas Zoeller ; Publication date: 19 February 2013
http://apps.who.int/iris/bitstream/10665/78102/1/WHO_HSE_PHE_IHE_2013.1_eng.pdf

Exhibit D:
"***An Exploratory Study of Air Quality near Natural Gas Operations***" - Peer-reviewed and accepted for publication by Human and Ecological Risk Assessment (November 9, 2012). Theo Colborn, Kim Schultz, Lucille Herrick, and Carol Kwiatkowski
http://www.endocrinedisruption.com/files/HERA12-137NGAirQualityManuscriptforwebwithfigures.pdf

Exhibit E:
"An Analysis of Possible Increases in Exposure to Toxic Chemicals in Delta County, Colorado Water Resources as the Result of Gunnison Energy's Proposed Coal Bed Methane Extraction Activity"- October 22, 2002, Letter by Theo Colborn, PhD to the Colorado Bureau of Land Management and the United States Forest Service.
http://www.endocrinedisruption.com/files/cP02591Colborn20021022coalbedmethane2-BEcommments.pdf

Exhibit F:
Renewable Energy Alternative Options – Studies, News Articles and Information **c**ompiled by Jody McCaffree

Petition Exhibit:
Current Citizens Against LNG Petition sheets