# APPENDIX R

# Comments on the Draft EIS and Responses

# (continued)

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**UNITED STATES OF AMERICA**
**DEPARTMENT OF ENERGY**
**FEDERAL ENERGY REGULATORY COMMISSION**

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| **IN THE MATTERS OF** | ) | |
| | ) | |
| **Jordan Cove Energy Project, L.P.** | ) | **Docket CP17-495-0000** |
| | ) | |
| **Pacific Connector Gas Pipeline, L.P.** | ) | **Docket CP17-494-0000** |
| | ) | |

The Western Environmental Law Center, Sierra Club, Greater Good Oregon, Pipeline Awareness Southern Oregon, Oregon Shores Conservation Coalition, Trout Unlimited, Center for Biological Diversity, Oregon Wild, Oregon Coast Alliance, Oregon Physicians for Social Responsibility, Umpqua Watersheds, Inc., OPAL Environmental Justice Oregon, Honor the Earth, 350 Corvallis, Columbia Riverkeeper, Friends of Living Oregon Waters (FLOW), Oregon Women's Land Trust, Earthworks, Hair on Fire Oregon, Rogue Climate, Oregon Women's Land Trust, Cascadia Wildlands, Snattlerake Hills, LLC, Waterkeeper Alliance, Great Old Broads for Wilderness, Cascade Volcanoes Chapter, Pacific Coast Federation of Fishermen's Associations, Institute for Fisheries Resources, Rogue Riverkeeper, Beyond Toxics, and affected landowners Deb Evans and Ron Schaaf submit these comments on the Draft Environmental Impact Statement (DEIS) for the Jordan Cove Energy and Pacific Connector Gas Pipeline Projects, dated March 2019.

We incorporate by reference comments on this DEIS submitted by the Institute for Policy Integrity.

These comments refer to the DEIS and other supporting documentation available in Dockets CP17-495-0000 and CP17-494-0000. Other references are made to publicly available documents, were possible. Where references may not be available on FERC's e-Dockets or otherwise publicly available, we have included these documents in Appendix A, Exhibits.

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## I. INTRODUCTION

This draft environmental impact statement concerns a liquefied natural gas project that will require construction of massive infrastructure, directly impacting people and the environment throughout Oregon, and indirectly impacting the environment throughout the regions where exported gas is produced and, by significantly contributing to climate change, the environment worldwide.

Jordan Cove Energy Project, L.P. (Jordan Cove) seek to build liquefaction and terminal facilities capable of exporting up to 1.04 billion cubic feet per day (bcf/d) of natural gas as liquefied natural gas (LNG) from a proposed LNG export terminal in Coos Bay, Oregon. The proposed project will also have import capability. The proposed design also includes a 229-mile, 36-inch high-pressured gas pipeline capable of transporting 1.2 billion cubic feet per day of gas. This pipeline would be placed through Coos Bay and cross and permanently impair streams, wetlands, and sloughs, along with causing associated deleterious impacts to upland habitat, forest, farm, recreational, and residential uses. The pipeline would cross hundreds of waterbodies, cross more than a dozen miles of wetlands, require clear cutting of more than a thousand acres of the remaining old growth forests in Oregon, cross steep and remote terrain prone to landslides where emergency response is limited to local volunteers, and impact and permanently impair approximately 6,000 acres of state, federal and privately owned lands.

The current proposal is a modification of a prior, import-only and a second export proposal. In the course of review of these prior proposals, including FERC's NEPA review, environmental and community organizations (including many of the undersigned), state and local government officials, and other federal agencies expressed numerous criticisms regarding the project itself and the adequacy of environmental review. Many, if not most, of these criticisms continue to apply to the current proposal. The current export proposal will have even greater environmental impacts than the previous proposals (including but not limited to impacts relating to construction of liquefaction equipment and inducement of additional gas production to provide a supply for export). Many of the deficiencies in the prior environmental review have not been corrected in the current draft EIS. Accordingly, below, we frequently cite the draft and final environmental impact statements, and comments thereon, filed in FERC dockets CP04-441, CP07-444, CP13-483-000, and CP13-492-000. These documents are, obviously, already available to FERC, and must be considered part of the record here.

The current draft EIS is deficient because it glosses over the many of the Project's significant impacts and completely ignores many others. We discuss these deficiencies below. Following the structure of the DEIS, where appropriate, we roughly divide discussion of impacts of activities at the terminal site from discussion of impacts relating to the pipeline project. However, as we explain, these impacts must be considered cumulatively, and some types of impacts are common to both portions of the project. As such, some issues primarily addressed in one section also apply to the other, and each section must be understood as incorporating the others.

**II. JORDAN COVE LIQUEFIED NATURAL GAS TERMINAL**

**A. General Safety Comments**

Taken specifically and cumulatively, based even on only the risks disclosed here but even more so when an accurate picture is taken, the safety consequences of the proposed action pose an unreasonable burden on the public.

Safety is well-recognized as one of the major effects to the human environment flowing from an LNG terminal, and it ought to weigh heavily in consideration of public interest analysis and site suitability determinations. *Se e.g.* RLMS (2011), *Final Report: Suitability Assessment for LNG at Abbot Point*, (at p.i, "safety is a key driver in site selection…")

Draft EIS Conclusions regarding Safety are Unsupported and Wrong (§5.1.13) In the concluding section, the Draft EIS describes FERC's duty and conclusion as to:

> assess whether the proposed facilities would be able to operate safely and securely. As a result of our technical review…and our recommended mitigation, we believe that the facility proposed by Jordan Cove includes acceptable layers of protection or safeguards that would reduce the risk of a potentially hazardous scenario from developing into an event that could impact the off-site public.

CO28-1

DEIS, 5-10, 4-780. That conclusion makes no sense. It is not reasonably supported by the evidence before the agency, which shows substantial risks of horrific, high-consequence disasters being imposed on a host of unwilling parties. Moreover the conclusion is so vague and conclusory as to be practically worthless to inform either (1) the public and other experts, who ought to be engaged in the issue through the NEPA process, or (2) the decision-makers at FERC.

The conclusion regarding pipeline safety is even worse, stating bluntly that the "pipeline would be built and inspected according to USDOT standards. These standards ensure pipeline safety." DEIS, 5-11, 4-781. That is wrong, and dangerously misleading. Those standards kill three people each year, on average, from just this sort of pipeline.

CO28-2

The conclusions section also has paragraphs regarding the USDOT and USCG reviews, regarding the LNG facility siting and waterway suitability. DEIS, 5-10 – 5-11; 4-780 – 4-781. These paragraphs are concerning as they seem to punt consideration of core safety issues to future project stages, leaving loose ends that are likely to change important conclusions. Based on information available, both USDOT and USCG are going to find future deficiencies, which

CO28-3

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CO28-1 Section 4.13.1.5 of the final EIS discusses FERC review of the various layers of protection or safeguards proposed in the Project. If the Project is authorized, the engineering designs of these layers of protection are further developed during final design. FERC recommendations described throughout the final EIS would be available for consideration for the Order.

CO28-2 As discussed in section 4.13 of the EIS, the USDOT regulates and defines the safety standards mentioned in this comment. We have no authority to require standards beyond these (e.g., thinker pipe in rural areas).

CO28-3 As stated in section 4.13.1.2 of the final EIS, USDOT PHMSA has issued its Letter of Determination on Jordan Cove's compliance with 49 CFR 193 Subpart B siting requirements. Also, as stated in section 4.13.1.3 of the final EIS, the Coast Guard issued its Letter to Recommendation that states Coos Bay Channel be considered suitable for accommodating the type and frequency of LNG marine traffic associated with the proposed Project. As detailed throughout the safety section of the final EIS, potential impacts from/to nearby military operations, potential impacts from LNG marine vessel operations (i.e., zones of concern), potential impacts from hazardous onsite scenarios, potential impacts from natural hazards, and potential impacts from nearby roads, railways, air traffic, pipelines, and other facilities have been summarized. In addition, an Interagency Agreement among the FERC, USDOT PHMSA, and U.S. Coast Guard is in place that fosters an ongoing collaborative approach to safety and security.

the public has a right to discover in the NEPA context. It is unreasonable for FERC to conclude that safety risks are acceptable prior to even seeing those reviews. That those reviews are referred in the concluding section in this way underlines the problem that the existence of regulations and processes having to do with safety risks is taken as *assurance of safety*. As explained further in this next section, we strongly object to that complacent approach.

CO28-3 cont.

In many specific ways (detailed throughout these comments) and taken as a whole, the Draft EIS fails to meet the basic obligation to inform the public and decision-makers of the foreseeable significant impacts regarding reliability and safety. The safety section of the EIS reads like a corporate compliance document, not an environmental impact statement.

The 9th Circuit summarized some of these core principles:

> Our role in reviewing an EIS is to ensure that the agency has taken a 'hard look' at the potential environmental consequences of the proposed action." *League of Wilderness Defenders Blue Mountains Biodiversity Project v. Allen*, 615 F.3d 1122, 1135 (9th Cir. 2010) (internal quotation marks omitted). Taking a "hard look" includes "considering all foreseeable direct and indirect impacts. Furthermore, a 'hard look' should involve a discussion of adverse impacts that does not improperly minimize negative side effects." *N. Alaska Envtl. Ctr. v. Kempthorne*, 457 F.3d 969, 975 (9th Cir. 2006) (internal quotation marks and citation omitted). "[G]eneral statements about possible effects and some risk do not constitute a hard look absent a justification regarding why more definitive information could not be provided." *Or. Natural Res. Council Fund v. Brong*, 492 F.3d 1120, 1134 (9th Cir. 2007) (internal quotation marks omitted).

*League of Wilderness Defenders-Blue Mts. Biodiversity Project v. United States Forest Serv.*, 689 F.3d 1060, 1075 (9th Cir. Or. 2012).

Section 4.13.1.1 from the start sets up the false premise: "LNG facilities… can pose a risk to the public if not properly managed." DEIS, 4-698. That logic, repeated throughout the section, is both false and misleading, and betrays a sense of complacency that itself increases the risk to safety. See e.g. DEIS, 5-11 (citing future DOT and USCG reviews as supporting a current conclusion that safety is assured); DEIS, 4-725 (describing FERC staff evaluating the "adequacy" of hazard detection). The fact is that these facilities do pose a risk to the public whether or not they are "properly" managed; "proper" management is very much an imperfect science with well-known weaknesses and areas of uncertainty. The best risk management recognizes those things, the failure to do so can be catastrophic. Baker et al. 2007. The Report of the BP US Refineries Independent Safety Review Panel (The Baker Panel Report), January 2007; Rufe et al. 2011. BP Deepwater Horizon Incident Specific Preparedness Review (ISPR) Final Report. January, 2011; National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, 2011. Deepwater: The Gulf Oil Disaster and the Future of Offshore Drilling. Report to the President; Committee on Risk Assessment and Management of Marine Systems, Marine Board, National Research Council, 1998. Review of the Prince William Sound, Alaska, Risk Assessment Study. NATIONAL ACADEMY PRESS. Washington, D.C. 1998; Deepwater

CO28-4

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CO28-4 Both the USDOT and Coast Guard have provided their determinations of the proposed Project. In addition to these determinations, both the USDOT and Coast Guard would maintain ongoing oversight of the Project (if authorized and constructed) through an inspection and enforcement program to ensure continuing compliance with each agency's regulations. In addition, the FERC has conducted a preliminary review of the engineering design and associated layers of protection and has made several recommendations to improve the reliability and safety of the facilities that are often beyond and not covered by regulatory requirements. If authorized and the recommendations are adopted as conditions, the FERC would also have oversight and would conduct construction and ongoing operations inspections to verify conditions of the FERC authorization are being met.

Horizon Study Group, 2011. Final Report of the Investigation of the Macondo Well Blowout. March 1, 2011. Available online at: http://ccrm.berkeley.edu/pdfs_papers/bea_pdfs/dhsgfinalreport-march2011-tag.pdf; Bob Bea, January 22, 2006. Learning from Failures: Lessons from the Recent History of Failures of Engineered Systems. Available online at: http://ccrm.berkeley.edu/pdfs_papers/bea_pdfs/learning_from_failures2.pdf.

In addition, the DEIS doesn't really disclose *what* would happen if the risks occurred, beyond the vaguest descriptions. Hazards such as pool fires, jet fires, cryogenic spills, and cascading events are mentioned only in passing, without ever being described in either qualitative or quantitative terms. The Draft EIS never describes any safety hazard; only ways that safety hazards are mitigated.

The Draft EIS fails to provide objective metrics for the public or decision-makers to analyze the overall safety risk posed by the project. It never does discloses a body count. We are given no idea how frequently accidents are expected to occur. Risks assessments must have been done by the applicant that could be revealed here, or if they are not then FERC should gather this information. Where objective metrics can't be used and the agency needs to rely on qualitative statements like these, there arises a NEPA duty to explain why objective metrics can't be provided. *See League of Wilderness Defenders-Blue Mts. Biodiversity Project v. United States Forest Serv.*, 689 F.3d 1060, 1076 (9th Cir. Or. 2012) (citing *Klamath-Siskiyou Wildlands Ctr. v. Bureau of Land Mgmt.*, 387 F.3d 989, 994 & n.1 (9th Cir. 2004). The Draft EIS doesn't provide any explanation here. Nor could it, at least in many instances, where objective metrics are available and could be provided. CO28-5

Fundamentally, the FERC needs to re-do this EIS, with a focus on actually describing the environmental consequences. 40 CFR 1502.16; 1508.8.

The approach taken in this EIS of using regulations as the organizing principle for analysis of safety effects compounds the misleading nature of the DEIS because it fails to confront the gaps in those regulations. It is indisputable that existing regulations do not (should not, could not) cover the whole field of environmental effects that might have significance. The siting regulations regarding burn zones for example address consequences of certain fire-related scenarios, but that is an entirely different issue from siting issues related to social and geophysical risk factors or emergency response capability. It also cannot be disputed that even where regulations directly apply, they have not (could not, should not) completely eliminated risk. Whatever the policy choices made by regulators and legislators, they have left a situation where the proposed action is going to result in significant environmental effects. The duty under NEPA is not to second-guess those policy choices, but to disclose and analyze the effects in light of them. This Draft EIS fails entirely to meet that core duty, instead presenting the issue as a mere matter of regulatory compliance. This is not a Draft EIS of a public agency, but the compliance document of a private company. CO28-6

There are so many pieces of the safety puzzle outstanding here, and so many of the decisive consultations and studies have yet to occur, that the Draft EIS lacks information that is essential CO-28-7

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CO28-5 As described in section 4.13.1.2 of the final EIS, the USDOT issued a Letter of Determination on its 49 CFR 193 Subpart B siting requirements. This determination summarizes the USDOT's review of potential hazards such as pool fires, jet fires, vapor dispersion, overpressures, etc. In addition, the Coast Guard issued a Letter of Recommendation on the suitability of the waterway that considered accidental and intentional events that are summarized in section 4.13.1.3. Also, FERC staff evaluates various accidental and intentional hazard scenarios that range in size and conditions and encompasses those done in the siting analyses as well as smaller and larger releases to determine the adequacy of the preliminary engineering design, including the layers of protection incorporated into the design.

CO28-6 See comment responses CO28-4 and CO28-5.

CO28-7 See comment responses CO28-4 and CO28-5.

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to the decision, yet does not properly disclose and address that fact. *See* 40 CFR 1502.22. Under that regulation:

> When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking.
> (a) If the incomplete information relevant to reasonably foreseeable significant adverse impacts is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the environmental impact statement.
> (b) If the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency shall include within the environmental impact statement:
> (1) A statement that such information is incomplete or unavailable; (2) a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;
> (3) a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and
> (4) the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community. For the purposes of this section, "reasonably foreseeable" includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason.

CO28-7 cont.

40 C.F.R. 1502.22. The standard for whether a given scientific analysis must occur in an EIS is whether that analysis is "reasonably possible" to perform. *Pacific Rivers Council v. US Forest Service*, 668 F. 3d 609, 624 (9th Cir. 2012).

It is critically important that the safety and reliability section of the EIS be re-worked while applying that regulations. The Draft EIS here is incomplete in many important ways, with information outstanding. Rather than address safety issues, issue after issue is punted to future consideration and future project phases. The key safety consultations with cooperating agencies, like USDOT and USCG, are not complete. The FERC is restricted by regulation and policy in many ways to use and rely on results of those consultations, so that they are missing here is a major problem.

Incomplete and missing information is also a major problem related to DEIS section 4.13.1.6, which consists of a long list of "mitigation" measures, many of which consist of information to be provided or information to be reviewed at various points in the future. Those measures are sweeping in their scope, and a primary mechanism that FERC is using to evaluate safety implications of the project. This information is mostly essential to make informed public

comment and for the commission to consider, although the DEIS doesn't provide any analysis of the importance of that information. Where information is available or possible to obtain regarding impacts, it should be included in the Draft EIS.

CO28-7 cont.

A related failure throughout this section of the Draft EIS is the lack of discussion or recognition of quality scientific data. The Draft EIS exclusively relies on applicant-provided studies and data. Failure to disclose shortcomings in models is an independent NEPA violation. 40 C.F.R. § 1502.22; *See Lands Council v. USFS*, 395 F.3d 1019, 1032; (9th Cir. 2004). *See also* 40 CFR 1502.24 ("agencies shall insure the… integrity of the discussion and analyses" and identify sources and methods).

CO28-8

**1. LNG Facility Historical Review**

The discussion of historic incidents at LNG facilities is problematic in several ways. First, the triumphalist presentation shows bias and complacency. It is a strange way to characterize the history as "free of safety-related incidents," when the same sentence has to acknowledge the Cleveland incident that killed 128, and when even the very recent history shows that LNG facilities hazards. DEIS, 4-712. For example, the recent accidents at Plymouth, Washington (March 31, 2014) and Sabine Pass, off Louisiana (January 22, 2018) were both major incidents that revealed a host of flaws in regulation and engineering.

Second, this discussion focuses unduly on specific engineering causes of incidents. Such a focus can come at the expense of diligence especially to process safety hazards.

Third, even this optimistic presentation of the LNG industry safety history gives us reason for concern. There is clearly a pattern of unforeseen causes resulting in violent incidents. Cascading events appear to be a major risk. As we urged during scoping, process safety needs to be a major focus of the FERC analysis here. *See e.g.* Baker et al. 2007. The Report of the BP US Refineries Independent Safety Review Panel (The Baker Panel Report), January 2007; Rufe et al. 2011. BP Deepwater Horizon Incident Specific Preparedness Review (ISPR) Final Report. January, 2011; National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, 2011. Deepwater: The Gulf Oil Disaster and the Future of Offshore Drilling. Report to the President; Committee on Risk Assessment and Management of Marine Systems, Marine Board, National Research Council, 1998. Review of the Prince William Sound, Alaska, Risk Assessment Study. NATIONAL ACADEMY PRESS. Washington, D.C. 1998; Deepwater Horizon Study Group, 2011. Final Report of the Investigation of the Macondo Well Blowout. March 1, 2011. Available online at: http://ccrm.berkeley.edu/pdfs_papers/bea_pdfs/dhsgfinalreport-march2011-tag.pdf; Bob Bea, January 22, 2006. Learning from Failures: Lessons from the Recent History of Failures of Engineered Systems. Available online at: http://ccrm.berkeley.edu/pdfs_papers/bea_pdfs/learning_from_failures2.pdf.

CO28-9

**2. FERC preliminary engineering review**

The DEIS description of FERC's preliminary engineering review (DEIS, 4-713 – 4-714) is of an incredibly vague, apparently free-floating review of critical elements of the project. Applicants must provide "information," which the staff "evaluates." *Id.* An "acceptable" design has "various

CO28-10

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CO28-8 Applicant provided data were used in part in the development of this EIS, as well as agency data, scientific studies, and independent analysis conducted by the FERC, its contractors, and the cooperating agencies. The EIS relies on best available science, and meets the requirements of the CEQ regulations for implementing the NEPA.

CO28-9 As noted in the final EIS, the LNG industry has been free of safety-related incidents resulting in adverse effects on the public or the environment with the exception of the October 20, 1944, failure at an LNG plant in Cleveland, Ohio. Furthermore, more recent LNG industry incidents have not resulted in adverse public effects or to the environment. In addition, FERC staff did analyze process safety needs.

CO28-10 The general description on layers of protection is a precursor to the detailed review conducted by FERC staff and summarized in subsequent sections of the final EIS that are under the following headings: Process Design, Mechanical Design, Hazard Mitigation Design, Geotechnical and Structural Design, External Impact, and Onsite and Offsite Emergency Response. In addition, Section 4.13.1.4 summarizes the security features for the proposed Project.

layers" of safeguards to "reduce" risk. *Id.* Even the hazards designed against are kept safely in the zone of the theoretical, being only "potentially hazardous" events that "could impact" the public and environment. *Id.*

CO28-10

Talking in general terms about things in the abstract does not fulfill NEPA's duty to disclose and analyze site-specific effects of the particular proposed action. This sort of drifting speculation and philosophical supposition fails that core duty. Rather than giving the public and decision-maker generalities, the EIS should provide useable, specific information predicting the likely effects, and reasonable available alternatives.

**3. Process Design — process safety risks are substantial**

The Draft EIS next describes the "process design" of the facility, in a section describing some of the extremely complex engineering and related regulatory structures addressing process systems. DEIS, 4-715.

This section fails to really describe what is at stake. We are told that the result of failure "could pose potential harm if not properly safeguarded…" DEIS, 4-716. What does that mean? While the DEIS does not reveal the scope of the problem, we fear based on other information that failure of any one of these *hundreds* of different systems and components could quickly result in a massive disaster.

CO28-11

This incredibly complex project poses huge risks in terms of process safety. In spite of our specifically requesting the issue be confronted in scoping comments, the Draft EIS largely fails to address safety in a useful or systematic way. We do thank you for at least referencing some of the benchmarks for process safety and management of change, but insist that the EIS must be revised so that the risks here are clearly and usefully described.

The available literature clearly establishes the importance of taking adequate stock of process safety hazards early in the process. *See e.g.* Baker et al. 2007. The Report of the BP US Refineries Independent Safety Review Panel (The Baker Panel Report), January 2007; Rufe et al. 2011. BP Deepwater Horizon Incident Specific Preparedness Review (ISPR) Final Report. January, 2011; National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, 2011. Deepwater: The Gulf Oil Disaster and the Future of Offshore Drilling. Report to the President; Committee on Risk Assessment and Management of Marine Systems, Marine Board, National Research Council, 1998. Review of the Prince William Sound, Alaska, Risk Assessment Study. NATIONAL ACADEMY PRESS. Washington, D.C. 1998; Deepwater Horizon Study Group, 2011. Final Report of the Investigation of the Macondo Well Blowout. March 1, 2011. Available online at: http://ccrm.berkeley.edu/pdfs_papers/bea_pdfs/dhsgfinalreport-march2011-tag.pdf; Bob Bea, January 22, 2006. Learning from Failures: Lessons from the Recent History of Failures of Engineered Systems. Available online at: http://ccrm.berkeley.edu/pdfs_papers/bea_pdfs/learning_from_failures2.pdf.

There is concern that the relevant analyses are being put off until too late in the process, hiding significant impacts from the public and decision-maker, and preventing consideration of safer

CO28-12

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CO28-11 To understand the meaning of the phase, the entire sentence in the final EIS should be read. The full sentence reads: "The failure of process equipment could pose potential harm if not properly safeguarded through the use of appropriate engineering controls and operation." The final EIS section then continues to describe how the Project proposes to safeguard process equipment failures through the use of control valves, instrumentation, alarm systems, operator actions, emergency shutdown systems, and various other layers of protection. The use of these components would reduce potential harm in the event of a failure of process equipment.

CO28-12 Jordan Cove submitted a HAZOP and LOPA study to identify potential hazards from the preliminary design as proposed in the application. This analysis has not been put off until a later phase in Project development as it has been completed and submitted. If the Project is authorized and moves to final design, another detailed hazard and operability review would be performed on the final design to identify major process hazards that may occur during the operation of the facilities. For such process hazards, the analysis would identify safeguards proposed to prevent or indicate how the Project would mitigate the risk from such events and if needed recommend additional safeguards to mitigate the risk.

alternatives. The HAZOP analysis for example, which appears to be the critical analysis revealing process safety issues, is put off until after final design. DEIS, 4-717. Worse, massive faith is being put into that analysis in the DEIS. In typically conclusory language, the DEIS says FERC's review of the HAZOP will "ensure" that "all systems" are addressed "appropriately." DEIS 4-718. What is appropriate is based on the vague FERC determination of what are "commensurate" layers of protection based on "generally accepted good engineering practices." *Id.*

CO28-12 cont.

The DEIS offers several recommendations to reduce process safety risks, mainly consisting of regular inspections. DEIS, 4-718; *see* DEIS §4.13.1.6. We support those measures, but urge that they are inadequate. Inspections and reports are fine, but without funding or enforcement they are weak sauce. Better would be recommendations to require regular inspections and funding, that could be done by an independent public body such as a Regional Citizen Advisory Council (RCAC).

CO28-13

We are concerned that the risks still present are higher than we are prepared to take, and certainly much higher than any public benefit to this project.

**4. Mechanical Design**

The DEIS section on mechanical design (DEIS, 4-718 – 4-719) shows the pattern of listing the applicable regulations, and identifying a number of FERC recommendations to cure apparent deficiencies. It is well and good to say there are various codes applicable to various and things, and they aim to follow all of them. But the duty under NEPA is a public discussion as to what the *effects* of the proposed action would be, and whether there are additional alternatives or mitigation measures. Please disclose and discuss any safety implications of the mechanical design of the LNG facility in a revised draft, including a discussion of the (1) predicted reliability of this sort of mechanical design, and (2) availability of any environmentally less-impactful alternatives.

CO28-14

**5. Hazard Mitigation Design**

The EIS reluctantly discloses that LNG could spill in the introduction to section on hazard mitigation design. DEIS, 4-719. Yet no discussion or analysis is provided regarding the likelihood, or range of potential releases. Information regarding the hazard is essential to any reasoned consideration of hazrd mitigation design, and should be provided for public comment in a revised or supplemental draft EIS. Please disclose and discuss a representative range of potential spills, including information regarding frequency and consequences.

CO28-15

The reader of the Draft EIS has to read between the lines to discern the threat. There is a lot of reference to fire codes and fire hazard equipment, DEIS 4-7-20, so evidently LNG releases pose a fire hazard. How frequently do fires result from releases of LNG? What range of fires occur at what sorts of frequencies?

Moreover, especially with regard to fire, the DEIS says that the regulations in this case do not include detailed fire protection provisions, leaving it to "subjective performance-based

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CO28-13 If the Project is authorized, as part of the LNG compliance program FERC staff would review the final design for compliance with the Project's Order and conduct regular construction inspections. Once placed into operation, FERC staff would conduct annual inspections throughout the entire operational life of the facility. The facility would receive a formal letter posted to the FERC docket to address any deficiency noted during the FERC inspections.

CO28-14 The Mechanical Design section of the final EIS summarizes FERC staff review to ensure applicable codes and standards would be used to design, fabrication, construction, and test the proposed equipment. The use of these codes, standards, and best practices ensures that equipment and piping are designed, fabricated, and constructed that can handle the operating conditions, process upsets, and impacts from natural hazards. These standards also specify testing and operating guidelines that assist in the reliable operation of the proposed equipment.

CO28-15 The full sentence in the final EIS reads: "If operational control of the facilities were lost and operational controls and emergency shutdown systems failed to maintain the Project within the design limits of the piping, containers, and safety relief valves, a release could potentially occur." As discussed in the preliminary engineering review section of the final EIS, each project includes various layers of protection or safeguards to reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public. These layers of protection are generally independent of one another so that any one layer would perform its function regardless of the initiating event or failure of any other protection layer. These layers are described throughout section 4.13.1.5 of the final EIS. In the event that one or multiple layers fail, there is a potential of a process release. As discussed in the Spill Containment section of the final EIS, FERC staff analyses if all hazardous liquids are provided with spill containment based on the largest flow capacity from a single pipe for 10 minutes accounting for de-inventory or the liquid capacity of the largest vessel served.

language." DEIS, 4-720. The regulations are minimal and limited, boiling down to requiring *review* of things. *Id.* The NEPA process needs to include at least a reasonable discussion of that review. The Draft EIS says the "FERC staff evaluated" a list of things to "ensure" they provide "adequate protection," and there do follow several pages of discussion reflecting a review. *See* DEIS pp.4-720 – 4-729. But that discussion doesn't support the conclusory and vague assurances of adequacy, pointing to a large number of missing and outstanding items and suggesting the presence of numerous specific hazards. Please disclose and discuss in a revised draft

- what the subjective performance standards are (e.g. how safe is considered safe enough?);
- what alternatives might exist that could keep us safer (jurisdiction is complex, but there are myriad cooperating agencies in this EIS and NEPA analysis is not restricted by lead agency jurisdiction in terms of considering alternatives)
- The range of potential fires, and objective estimates of their frequency.

CO28-15 cont.

Please consider and discuss reliability, and implications of failure of, the spill containment systems. The Draft EIS discussion of spill containment, pp. 4-720 – 4-722, is helpful as far as it goes, but does not describe the hazard.

The Draft EIS repeatedly refers to "hazardous liquids" in terms of containment and response. *E.g.* DEIS 4-721 ("we evaluate whether all hazardous liquids are provided with spill containment…"). Please clarify whether this phrase is intended to refer to LNG (which is not categorized as a hazardous liquid) or not.

CO28-16

Please also clarify how this term, and the spill containment approach, addresses the obvious fact that in spill scenarios the *liquid* turns into a gas. It is unclear if containment of *liquid* hazards would prevent spread of the *gas* that would escape in a spill.

CO28-17

Given that spill containment is so critical at the facility, it is odd that there is no discussion of spill containment in relation to loading and unloading of LNG tankers. There have been releases of LNG during this process, and there are many potential scenarios where that could possibly happen. Containment of a release during loading would appear to be difficult, especially near and over the water. Releases of LNG to water could set off rapid phase transition, or freeze the outer hull of the ship, pier or other facilities. Please disclose and discuss the issue of spill containment as it is loaded, and from the vessel, in an EIS for public comment.

CO28-18

It is not possible to maintain spill containment without also containing rainwater, which seems to be a potential issue in this rainy environment, and immediately adjacent to critical estuary and wetland environments. The DEIS suggests that stormwater is an issue, with some back and forth regarding stormwater removal pumps and normally closed valves, but it doesn't describe the implications of the issue for effects. There seems to be an inherent tradeoff between environmental and safety values involved, and the public (and commission) need information to make informed comment and decision.

CO28-19

Many alarming risks emerge between the lines of the section regarding spacing and plant layout. DEIS, 4-722 – 4-723. Rather than describe risks and their frequency, the DEIS off-handedly

CO28-20

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CO28-16 In general, FERC staff considers fluids that can pose a asphyxiation, toxic, flammable, or combustible hazard as hazardous fluids. As discussed in the third paragraph in the Spill Containment section of final EIS; LNG, refrigerants, heavy hydrocarbons, amine, nitrogen, ammonia, and diesel would be included as hazardous fluids and provided with spill containment systems.

CO28-17 Spill containment of liquid spills are designed to prevent an uncontrolled release and spread of liquid to offsite areas. The minimization of liquid spread minimizes vaporization of the liquid and subsequent dispersion distance. As the liquid vaporizes within the spill containment system, the vapor cloud dispersion would vary based on composition, temperature, wind conditions, obstructions (other structures, vapor barriers, etc.) in its path, and if an ignition source has been reached.

CO28-18 As stated in the Spill Containment section of the final EIS, LNG releases from LNG marine vessel loading piping would be directed to either the Process/Tank Impoundment Basin or the Marine Impoundment Basin. In the event of a release, an emergency shutdown would stop LNG marine vessel loading operations and would limit the released volumes. If the release occurred outside the curbed areas (at the connection to the ship), the powered emergency release coupling (PERC) connections between the shore side and LNG marine vessel would activate and a small quantity of LNG would reach and rapidly vaporize on the water.

CO28-19 As described in the final EIS, Jordan Cove's design must meet the impoundment system water removal regulations in 49 CFR 193 Subpart C. The regulations state that pumps and piping must be provided to remove water from collecting in the impoundment area and tat sump pumps must be operated as necessary to keep the impounding space as dry as practical. In addition, if authorized and recommendations are adopted as conditions, FERC staff would inspect the facilities and layers of protection, including the spill containment systems, to ensure that they are being maintained to effectively mitigate potential hazards from impacting the public.

CO28-20 The Spacing and Layout Section of the final EIS discusses how process releases would be mitigated through fire protection measures to prevent cascading damage onsite. Mitigation measures such as cryogenic protection on structural components are summarized regardless of the frequency of a cryogenic release.

refers to hazards in the context of describing risks that will be minimized. DEIS, 4-722 – 4-723. We are essentially told not to worry about, consecutively, "cryogenic spills causing causing structural supports and equipment from cooling below their minimum design metal temperature" (yikes, what happens then?), "flammable or toxic vapor ingress into buildings" and "cascading damage from explosions;" "overpressures from vapor cloud explosions," "pool fires…causing cascading damage," "jet fires … causing cascading damage." DEIS, 4-722 – 4-723. Each of these hazards has additional FERC recommendations, which all sound like excellent ideas, but which beg the question of what other or different options there might be.

Please disclose and discuss in your revised draft EIS the frequency and consequences of a reasonable range of plant releases, including, at a minimum, each of the hazards identified as risks of cascading damage on pp. DEIS, 4-722 – 4-723. CO28-20 cont.

We are concerned that the focus on preventing and assuring against offsite and "public" effects seems to mask the very real safety consequences for workers. Spills and fires within the plant, or during the loading/unloading process, are extremely hazardous. Even presuming best-possible safety practices, hazard to workers seems extremely high-consequence. We are not willing to see workers killed in this project any more than we are willing to suffer injury or death as members of the public. Please disclose and consider the onsite effects of these hazards, as well as (rightly) guarding against offsite impacts.

The DEIS section on ignition controls, DEIS pp. 4-724 – 4-725, is another vaguely reassuring ("minimal risk" ) exposition of regulations and recommendations that never describes the nature of the hazard being guarded against, or objective evaluation of the hazards for this project. We appreciate all regulators' and engineers' work to ensure safety, but that does not replace consideration of risk. This section fits the pattern of relying on vague reference to mitigation as absolute assurance against risk. CO28-21

Critical missing information here is an objective evaluation of the ability to control ignition sources in a variety of release situations. We are particularly concerned with the ability to control releases from "outside" the containment, for example during loading. With the adjacent navigation channel, controlling possible ignition sources will be especially difficult. Please disclose and discuss ignition controls in relation to the marine project areas.

The DEIS discusses hazard detection for cryogenic spills, flammable and toxic vapors, and fires briefly. DEIS, 4-725 – 4-726. Information about the nature and frequency of these hazards is first necessary to evaluate their detection, so, again, information regarding the range and frequency fo various spills and hazards is essential to meaningful comment.

The description of hazard detection is vague and conclusory. As with so much else, we are told that FERC staff "evaluated the adequacy" of the systems to "ensure adequate" coverage. DEIS, 4-725. Even then it appears that information is missing. No decisions should be made until that information is provided and incorporated into the NEPA document. CO28-22

In spite of the title of the section at DEIS, 4-725 – 4-726. the DEIS never does describe or evaluate the emergency shutdown procedures or capability. We are concerned that, especially CO28-23

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CO28-21 Information provided in the Project application and to data request is summarized in the Ignition Controls section of the final EIS. In general, ignition controls attempt to minimize ignition from energized and fired equipment through spacing and electrical area classification, which minimizes ignition energies during normal and/or fault conditions, prevents ignition from inside an explosion proof electrical box to spreading to outside through quenching and cooling of the flame based on minimum experimental safety gaps, and/or use of pressurized or purged/inserted electrical boxes to prevent flammable atmospheres.

CO28-22 The final EIS summarizes FERC staff review of the preliminary hazard detection coverage. If the Project is authorized, the final design of the hazard detection system would be developed and submitted for review and approval to ensure best practices have been considered, including the percentage of releases that must be detected and then isolated within a certain timeframe.

CO28-23 The emergency shutdown system is summarized in the Process Design section of the final EIS. Also various subsection in the Hazard Mitigation Design section of the final EIS state that a depressurization system would be provided to reduce pressure within the system during an emergency shutdown.

with high profit during operations, Jordan Cove will have incentive to manage the facility without shutdowns, at the expense of safety. In addition, we are concerned that, as with other highly complex facilities that are based on a flow of product, shutdown and startup could pose safety risks, or if the facility is designed to be capable of a sustained emergency shutdown. Please disclose and discuss the facility ability to shut down in emergency, and any relevant safety implications. CO28-23 cont.

The DEIS sections on hazard control, passive cryogenic and fire protection, and firewater systems, DEIS pp.4-726 – 4-729, similarly point to, but never directly address, alarming hazards. Please provide evaluation of direct, indirect, and cumulative impacts of these hazards for public comment in a NEPA document. CO28-24

**B. Security Concerns.**

The Draft EIS gives a general exposition of some of the many security-related requirements and regulatory structures that apply to the project. DEIS, 4-710 – 4-712. Things such as the TWIC Reader requirement, lighting and fencing, and exclusion zones will be a major endeavor. We are not privy to security-relate details so will have to leave it to officials to ensure that Jordan Cove is living up to all of these obligations.

This facility is a heightened security risk because it is located in an area not accustomed to facing risks and duties of this sort. There is no sizeable local Coast Guard presence, for example. Mariners and ATV users aren't accustomed to avoiding exclusion zones located atop historic recreation areas. There will be a need for training and particular diligence if the security requirements are going to be implemented.

The Draft EIS leaves detailed security planning to later stages, but there seems to be a fundamental problem with the facility location being located so close to the federal navigation channel. The required security exclusion zones appear not to be possible to establish, and still allow other vessels free use of the channel. Please consider and disclose this issue to the public. CO28-25

The Draft EIS does provide a map showing exposure zones for an intentional attack on an LNG tanker, but not for the Jordan Cove LNG facility. It is our understanding that the facility itself will be storing gas with energy far exceeding that of a nuclear bomb, so we are very concerned for the potential risks. Please disclose and consider the risk associated with the facility itself. The indirect consequences of many of the many strict security measures are not addressed in the Draft EIS, but they will impose high burdens on the public and the environment. Exclusion zones will cut off valued recreational and navigation areas in the estuary. Tanker security will close the whole river, essentially, and occupy the safest bar crossings. In general emergencies (such as an earthquake or tsunami!) the security priority will occupy limited response attention and resources, such as police and ambulance. CO28-26

**C. Siting Concerns.**

Pursuant to the August 31, 2018 MOU between USDOT and FERC, the DOT is supposed to issue a letter of determination (LOD) regarding whether a facility is capable of complying with location criteria and design standards in 49 CFR 193 subpart B; and FERC is committed to CO28-27

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CO28-24 These sections indicate how the proposed Project would respond to potential hazards that include cryogenic releases, vapor dispersion, and fires. The Spacing and Layout section also summarizes some of the safety measures proposed to mitigate impacts from these hazards.

CO28-25 Security information of the facilities are reviewed as part of the application and the type of documentation reviewed is briefly summarized, but is not discussed in detail given that it is considered Critical Energy Infrastructure Information that would be useful to an adversary. In addition, as stated in the Coast Guard's Letter of Recommendation, the Coast Guard may establish a moving security zone around a moving LNG marine vessel, and would work with the Pilots and patrol assets to control traffic and will allow vessels to transit the Safety/Security zone based on a case-by-case assessment conducted on scene.

CO28-26 The total amount of energy stored is not representative of the amount of energy that may be liberated over time upon a release, which is important in quantifying the actual impact from a release. For the onshore LNG facility, USDOT's siting regulations in 49 CFR 193 Subpart B require the establishment of an exclusion zone surrounding an LNG facility in which an operator or government agency must exercise legal control over the activities where flammable vapors, specified levels of radiant heat from fires, and other hazards may occur in the event of a release for as long the facility is in operation. The Zones of Concern are based on the Coast Guard's Guidance documents to review LNG marine vessel transients and apply only to the LNG marine vessel.

CO28-27 The August 31, 2018 MOU states that USDOT PHMSA would issue a Letter of Determination prior to the issuance of the final EIS; however, a change in schedule is allowable upon notification to FERC. Section 4.13.1.2 of the final EIS provides additional details on the USDOT PHMSA's Letter of Determination for this Project.

relying on it in considering the public interest. DEIS at 4-698. The Draft EIS does not contain any of that analysis, even though it appears to be (by its terms) essential information. Apparently, this analysis and review has not yet been done. DEIS @ 4-702. CO28-27 cont.

The siting requirements in 49 CFR 193 subpart B are incredibly limited and narrow in scope.

Facilities are only required to meet NFPA 59A and some limited requirements. 49 CFR 193.2051. A thermal radiation protection zone and a dispersion exclusion zone are required around containers and transfer systems, and those zones must be based on specified formulas. 49 CFR 193.2057 – 59. Facilities also must be designed to withstand wind of certain speeds. 49 CFR 193.2067.

NFPA 59A requires consideration of protection against forces of nature (§2.1.1(c)), other factors bearing on site-specific safety (§2.1.1(d)), and provisions to prevent damaging effects or flammable mixtures of vapors from crossing property lines. CO28-28

The Draft EIS is misleading in writing that these rules "ensur[e]" the location "would not pose an unacceptable level or risk to public safety." DEIS at 4-699. Those rules are actually quite a lot more limited. By their own terms they do not "ensure" anything, nor should they be read as definitive as to "acceptable" levels of risk to public safety. (moreover NEPA here requires FERC to disclose that level of risk, acceptable or not, in an objective manner).

Under FERC filing regulations, the applicant must identify how its proposed design would comply with 49 CFR 193 subpart B. 18 CFR 380.12(m) and (o).

The requirements for design spills from process or transfer areas are more stringent. For LNG spills, the 1,600 Btu/ft2-hr flux level cannot extend beyond the plant property line onto a property that can be built upon. In addition, section 2.1.1 of NFPA 59A (2001) requires that factors applicable to the specific site with a bearing on the safety of plant personnel and the surrounding public must be considered, including an evaluation of potential incidents and safety measures incorporated into the design or operation of the facility. USDOT has indicated that potential incidents, such as vapor cloud explosions and toxic releases should be considered to comply with Part 193 Subpart B.

Please analyze how the requirements under 49 CFR subpart B, that the operator exercise legal control over activities within the exclusion zone, could be met. DEIS, 4-700. Specifically, it appears to be impossible to meet this standard for the marine areas near the facility. Those are navigable maritime waters, subject to free navigation. Jordan Cove has zero authority over those waters, and even the federal government (through the U.S. Coast Guard) have only limited ability to restrict or prohibit movement there. CO28-29

Similarly, we do not see how the design spills from the transfer areas would not extend beyond the plant property line. DEIS, 4-701. Navigating vessels would seem to be directly exposed to the extreme heat flux. CO28-30

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CO28-28 USDOT PHMSA has provided a Letter of Determination regarding the Project's compliance with the siting requirements of 49 CFR 193, Subpart B. In addition, a range of releases are considered by FERC staff when evaluating the various layers of protection and reliabilities and redundancies of those layers of protection. Some of these details are not provided as they are considered privileged or Critical Energy Infrastructure Information.

CO28-29 USDOT PHMSA has provided a Letter of Determination regarding the Project's compliance with the siting requirements of 49 CFR 193, Subpart B. This includes USDOT PHMSA's determination if the operator exercises legal control over activities within the exclusion zone as defined in 49 CFR 193. The Coast Guard also has the authority to ensure the safety of the waterway, including enforcing any safety and security zones or restricted navigational areas that it may establish if it finds them necessary, which may be invoked on a case by case basis.

CO28-30 USDOT PHMSA's Letter of Determination depicts how the governing design spill scenarios result in vapor dispersion and thermal heat fluxes across the proposed site and how these hazards meet the exclusion zone requirements in 49 CFR 193, Subpart B. In addition, PHMSA's Letter of Determination also reviews if the Applicant or a government agency legally controls all activities with these exclusion zones. In the event of an onsite fire, the resulting heat flux on a docked LNG marine vessel is reviewed to ensure it is within an acceptable range.

Scoping comments raised concerns regarding modeling for vapor cloud dispersion and associated hazards, but these are not squarely addressed in the Draft EIS. *See e.g.* Jerry Havens, April 26, 2016, "Assessing Explosion Hazards of Large Hydrocarbon Clouds Formed in Calm Conditions: Are We Doing It Wrong?" 55th UKELG Meeting on Dispersion and Consequences of LNG Releases. If LNG spills, it vaporizes. Because these vapors are heavier than air, they form a cloud close to the ground that will eventually dissipate. However, if an ignition source is present before the vapor cloud dissipates to less than 5% to 15% concentration, the vapor cloud can ignite and burn. The concerns expressed by many commenters about the risks of the pipeline extend beyond the possibility of catastrophic seismic events, to question the modeling and methods employed to understand the risks posed by vapor at the site. For example, on February 4, 2015, Senator Ron Wyden requested that FERC and PHMSA provide information to the public regarding the hazard modeling used to measure vapor cloud dispersion. This modeling is relevant to general spills but also to the possibility of a rupture or other spill resulting from tsunami or earthquake. CO28-31

On January 14, 2015 and February 6, 2015, Jerry Havens , Distinguished Professor of Chemical Engineering at University of Arkansas, and James Venart, Professor Emeritus of Mechanical Engineering at University of New Brunswick, published two papers regarding the Jordan Cove LNG Export Terminal Draft Environmental Impact Statement under FERC Docket No. CP13-483. Professor Havens and Professor Venart found significant discrepancies and problems with Jordan Cove's hazard analysis for their LNG Export facility and determined the hazards had been significantly underestimated. Safety measures incorporated into the proposed Jordan Cove LNG Export terminal actually increased the chance of a catastrophic failure and presented a far more serious public safety hazard than regulators had analyzed and deemed acceptable.

According to comments and analysis provided during a previous iteration of this project, "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 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."

Those safety and security issues were never resolved and the new LNG terminal design may present additional problems. The concerns raised by Professor Havens and Venart need to be fully addressed and analyzed with respect to the new proposed LNG terminal design.

The Draft EIS also fails to disclose or account for the substantial uncertainty associated with such models. *See* Hideyuki Oka (2010). Consequence Analysis of Large-Scale Liquefied Natural Gas Spills on Water, NaturalGas, ISBN: 978-953-307-112-1, InTech, Available from:http://www.intechopen.com/books/natural-gas/consequence-analysis-of-large-scale-liquefied-natural-gas-spills-on-water.

While the Draft EIS addresses only UDOT siting requirements, it neglects other pertinent and relevant standards. It is important for the EIS to look at international standards. The LNG shipping industry, after all, is inherently an international endeavor, and it is managed for the most part not by nation States but by industry groups and corporations. Such standards are relevant under NEPA, regardless whether FERC has jurisdictional authority to enforce them. CO28-32

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CO28-31 For releases within the LNG terminal site, section 4.13.1.2 of the final EIS discusses that USDOT PHMSA approves hazard models to determine vapor dispersion distances. In addition, the referenced comments from Jerry Havens and James Venart were on the previous Jordan Cove Project under Docket No. CP13-483. Responses to these comments are included in appendix W of the final EIS issued for that project on September 30, 2015.

CO28-32 The siting, design, construction, and operating requirements for the Project are contained in 33 CFR 103 through 105, 33 CFR 127, and 49 CFR 193. These regulations do not require the use of SIGTTO publications. However, certain design criteria described as recommendations in SIGTTO Information Paper No. 14, Site Selection and Design for LNG Ports and Jetties, (i.e., strength/positions of mooring systems and breasting dolphins; interlinking of ship and shore ESD systems; installing quick acting valves at the PERC connections; using sensors to monitor the positions of the LNG loading arms; limiting ignition sources on the jetty; use of tugs and pilots to safely maneuver the LNG marine vessel to the jetty, etc.) are either required by regulation or are considered during the Coast Guard and FERC's evaluation of the project. In addition, as indicated in section 4.13.1.5 of the final EIS, FERC conducted an engineering review on the use of various layers of protection or safeguards to reduce risks of potential hazards to offsite public. FERC also reviewed potential impacts from natural hazards and external impacts from the surrounding areas.

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For LNG facilities, the de-facto global authority is SIGTTO, the Society of International Gas Tanker and Terminal Operators. http://www.sigtto.org. The proposal here runs afoul of SIGTTO siting standards for LNG facilities by being located in a busy port, adjacent to a populated urban area, and on the outside curve of a shipping channel. According to available summaries of the **SIGTTO siting criteria:**

- There is no acceptable probability for a catastrophic LNG release;
- LNG ports must be located where LNG vapors from a spill or release cannot affect civilians
- LNG ship berths must be far from the ship transit fairway;
- To prevent collision or allision from other vessels;
- To prevent surging and ranging along the LNG pier and jetty that may cause the berthed ship to break its moorings and/or LNG connection;
- Since all other vessels must be considered an ignition source; LNG ports must be located where they do not conflict with other waterway uses [— now and into the future. [This requires long-range planning for the entire port area prior to committing to a terminal location];
- Long, narrow inland waterways are to be avoided, due to greater navigation risk;
- Waterways containing navigation hazards are to be avoided as LNG ports;
- LNG ports must not be located on the outside curve in the waterway, since other transiting vessels would at some time during their transits be headed directly at the berthed LNG ship;
- Human error potential always exists, so it must be taken into consideration when selecting and designing an LNG port

CO28-32 cont.

*See* SIGTTO. 1997. Site Selection and Design for LNG Ports and Jetties.

That basic logic is applied with regard to siting decisions globally. *See e.g.* RLMS (2011) *Suitability Assessment for LNG Industry at Abbot Point*, p.16 "jetties should be located to remove as many risks as possible by placing terminals in sheltered locations remote from other port users, in particular where other ships do not pose a collision risk and where gas leaks can not affect local populations.")

Also relevant here are the World Bank Group Environmental, Health, and Safety Guidelines for Liquefied Natural Gas Facilities, April 11, 2017. Available online at www.ifc.org/ihsguidelines). Numerous of these standards have not been met, including conduct a spill risk assessment for the facilities and related transport/shipping, supported by internationally recognized models, or to develop a spill prevention and control plan…supported by the necessary resources and training.

**D. Vessel Safety Concerns.**

The Draft EIS starts this section with an optimistic exposition of the generally non-disastrous historic LNG vessel record. DEIS, 4-702 – 703 ("Since 1959, marine vessels have transported LNG without a major release of cargo or a major accident involving an LNG marine vessel.").

CO28-33

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CO28-33 The Coast Guard has reviewed the number of LNG marine vessels proposed to arrive at the proposed site.

First, the complacent conclusion is the wrong lesson to draw. This is a history of the world's roughly 370 LNG vessels and 100 terminals, a small sample size, and over only several decades. As the number of vessels and potential consequences of accidents increases through time, the recorded history of stochastic events like marine casualties is expected to increase. The applicant's sense of confident assurance rings as hollow here, as very similar assurances that were made prior to the *Exxon Valdez* and BP *Deepwater Horizon* oil spills, and Texas City BP refinery explosion. After those and other disasters, that prior complacency has been specifically indicted warned against in strong terms. This section of the EIS is therefore not only misleading, but betrays an affirmatively dangerous attitude that actually makes people even less safe.

CO28-33 cont.

Second, while the DEIS does not draw this conclusion, the listed casualties (among others) do show that LNG transport is and will continue to be a hazardous occupation. Vessel casualties associated with this project should be expected.

That casualties should be expected is also reflected in the known history of vessel casualties more generally (not just LNG vessels). It is true that LNG is a peculiar cargo with peculiar risks, but a vessel is a vessel and many of the risks here are inherent risks of shipping on a large scale.

The EIS entirely fails to consider new build of LNG vessels. This is important is a couple of ways. First, the global fleet of LNG vessels is expanding, so future years are mathematically more likely to see LNG vessel casualties. And second, it is significant in terms of indirect and cumulative effects, because **the proposed action will have unexplored effects to the LNG shipping and ship-building industry**. That has been the case on other LNG terminal projects and is likely to be the case here. *See* Schuler 2019. "Qatar Launches Massive LNG Shipbuilding Program That Could Exceed 100 Ships" *gcaptain.com* https://gcaptain.com/qatar-launches-lng-shipbuilding-program/ (relating tender of 100 new LNG tankers, including requirements directly linked to Golden Pass LNG, currently under construction).

The Draft EIS entirely fails to disclose or address safety considerations related to repair and/or maintenance work on LNG tankers (or tanks). Especially because the facility calls for a second slip for an LNG tanker, and the lack of other nearby ports, it is possible that repair work would be done here. And work on LNG tankers is a notably dangerous activity! Over the years, "a high number of serious casualties have occurred involving fires in the cargo containment system of liquefied gas carriers, whilst the vessels have been in shipyards. Many of these have resulted in multiple fatalities, environmental damage and serious financial loss…" SIGTTO 2001, iii. *Fire Prevention in the Cargo Containment Systems of Liquefied Gas Carriers in Shipyards.*

CO28-34

**1. LNG marine vessel safety regulatory oversight**

The Coast Guard authority is even more limited, an important factor that the Draft EIS fails to accurately disclose or analyze. 33 CFR 105 and 127. The Draft EIS goes on at length about Coast Guard responsibility and authority as though these things were firmly established and boundless. *See e.g.* DEIS at 4-704 ("The Coast Guard is responsible for matters related to navigation safety, LNG marine vessel engineering and safety standards, and all matters pertaining to the safety of facilities or equipment located in or adjacent to navigable waters up to the last valve immediately before the receiving tanks.") In actual fact, the scope of Coast Guard

CO28-35

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CO28-34 The siting, design, construction, and operating requirements for the Project are contained in 33 CFR 103 through 105, 33 CFR 127, and 49 CFR 193. These regulations do not require the use of SIGTTO publications. However, certain design criteria described as recommendations in SIGTTO Information Paper No. 14, Site Selection and Design for LNG Ports and Jetties, (i.e., strength/positions of mooring systems and breasting dolphins; interlinking of ship and shore ESD systems; installing quick acting valves at the PERC connections; using sensors to monitor the positions of the LNG loading arms; limiting ignition sources on the jetty; use of tugs and pilots to safely maneuver the LNG marine vessel to the jetty, etc.) are either required by regulation or are considered during the Coast Guard and FERC's evaluation of the project. In addition, as indicated in section 4.13.1.5 of the final EIS, FERC conducted a engineering review on the use of various layers of protection or safeguards to reduce risks of potential hazards to offsite public. FERC also reviewed potential impacts from natural hazards and external impacts from the surrounding areas. In response to the Coast Guard's review, the Project would include a western berth would serve as an emergency lay berth for LNG marine vessels that may be temporarily disabled during a port call. Mooring equipment and breasting structures would also be provided on the emergency lay berth for safe mooring operations, however process piping connections would not be provided at the emergency lay berth.

CO28-35 For foreign flagged ships, a valid Certificate of Compliance must be issued by the Coast Guard. The certificate is issued after the ship has proved that it complies with the Coast Guard regulations and after it has been satisfactorily inspected by a Coast Guard Marine Sector Office. A Certificate of Compliance is valid for a 2-year period and remains valid pending satisfactory completion of an annual mid-period examination between Certificate of Compliance renewals. In addition, section 4.13.1.3 discusses the Zones of Concern and the potential public impacts in each zone.

authority over foreign-flagged vessels (there are no U.S.-flagged LNG carriers, and it is not reasonable to foresee there will be any) remains narrow. Please disclose and discuss the actual extant USCG authority, in light of actual USCG policies and resources in the area, as that relates to safety risks. We are concerned that, especially with so few USCG resources in the area, and so little authority to begin with, the anticipates mitigation measures and safety layers will not meet the DEIS optimistic expectations. CO28-35 cont.

As the Draft EIS says, LNG marine vessels are also regulated under USCG regulations at 46 CFR 154, and the IMO Codes. DEIS @ 4-703. But the DEIS says nothing about these regulations and codes, or what impact they do or do not have in regards to predicted impacts, possible alternatives, or mitigation measures. The discussion of regulations is entirely general, only on occasion even referring to the Jordan Cove project at all. As discussed, this exposition of regulations in the abstract does not fulfill NEPA's mandate to consider effects to the human environment, and only reinforces the tendency towards complacency.

In regards to the NVIC 01-11 zones of concern, for example, the DEIS describes them in passing, without any discussion of their significance for this analysis. Does this mean that a pool fire is considered to be a likely consequence of a major vessel casualty? Of the project? Is that our operating scenario, and if so how and why was that picked? Is radiant heat a significant hazard factor from vessel casualties? CO28-36

Please discuss regulatory oversight regarding vessels (1) offshore (e.g. waiting to load); (2) using the extra slip for repairs; and (3) grounded or otherwise disabled, for example in the estuary. Those are all reasonably foreseeable scenarios, and we feel that risks are heightened due to complex and limited regulatory oversight of foreign-flagged vessels in those positions.

**2. Jordan Cove WSA**

The DEIS, scandalously, fails to disclose or discuss any of the many pressing issues discussed and identified in the WSA/LOR process. What is discussed is only a brief history of documents being filed. It lists the Jan 9, 2017 LOI and prelim WSA submitted; the April 10, 2006 applicant-prepared WSA that was used for 2017 app; and a December 29, 2012 WSA update); the Jan 23, 2017 USCG-accepted WSA; and the May 10, 2018, USCG issued LOR and LOR analysis.

There are more recent updates regarding waterway suitability that are not included, and the absence of which is not revealed or discussed. *See* 40 CFR 1502.22. For example, in the context of the DSL removal-fill process it came out that there have been more recent simulations that have resulted in adjustments to the maximum size vessels downward. The ongoing local land use processes for the four NRI dredge areas also is producing a large flurry of information and potential project changes. Please reveal the latest information in a revised draft for public comment, ensure essential information is gathered where possible and discuss any information limitations. 40 CFR 1502.22. CO28-37

Also, the *substantive* information in the waterway suitability studies and recommendations need to be revealed to the public and decision-makers in terms of predicting environmental consequences, and comment opportunity provided. The DEIS doesn't meet even the obligation to



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CO28-36 The Zones of Concern are based on Sandia Reports published in 2004 and updated in 2008 and 2012. These reports indicate that an event lead to a breach of a LNG marine vessel cargo tank would likely also ignite the release creating a pool fire. Zones 1 and 2 discussed in section 4.13.1.3 of the final EIS describe the heat impacts from the pool fires. The footnotes in section 4.13.1.2 of the final EIS describe how a range of heat fluxes would impact the public.

CO28-37 The enclosures listed in the Coast Guard's Letter of Recommendation are available on the FERC eLibrary system under accession number: 20180601-3051. All information submitted to the FERC has been reviewed and included as applicable.

disclose issues (let alone discuss them adequately, consider alternatives, etc.). The watershed suitability assessment and letter of recommendation analysis are not even included, although they easily could be. The Draft EIS Appendix B contains only the LOR itself, which is an entirely conclusory cover letter, and not even the supporting analysis. The 4 enclosures identified on that document are not included in the Draft EIS, and are not available (at least not readily so) online. Please include that information, including updates to the WSA, in a revised Draft EIS as an appendix. That information also needs to be revealed and discussed in the body of the EIS. The site-specific and project-specific direct and indirect consequences are incredibly and directly relevant to the public, and to other expert agencies, who are likely to provide useful information. That information is essential to solicit informed public comment, and to a reasoned decision.

CO28-37 cont.

**3. LNG Marine Vessel Routes and Hazard Analysis**

This section of the Draft EIS, which addresses one of the most important issues, never really gets off the ground and fails NEPA's minimum bar for a "hard look." Had the requisite hard look been taken, it would be obvious that significant and unavoidable negative impacts can be expected. *See e.g.* West Cost Offshore Vessel Traffic Risk Management Project, Final Report, July 2002.

Marine hazards are not disclosed or discussed specifically at all. The first sentence of this section, for example, brushes by the first and one of the major hazards along the route, the Coos Bay bar, without any notice whatever. DEIS, 4-707. The rest is no better, lacking disclose or consideration of a range of significant issues and impacts to the public. The four navigation reliability improvement areas, which are even now being touted as necessary to alleviate specific hazards at critical turns, are not disclosed or discussed. Two hazard zone maps are displayed, but other than being obviously alarming (showing a large part of North Bend/Coos Bay being burned alive) no explanation or analysis is given.

CO28-38

It is not correct that the vessel's transit "would begin when it reaches the entrance" of Coos Bay. DEIS, 4-707. Obviously, inherent in this project by its very nature, vessel transits will have to *begin* across the sea somewhere, presumably somewhere in Asia. They also will *end* their journeys there as well. The zone for NEPA effects consideration then necessarily must encompass crossing the Pacific Ocean. We note that a similar error is being made in the applicant-prepared BA, which restricted its consideration to the territorial sea (also begging the question of why FERC restricts its consideration even more). Many of the applicable authorities here apply out to sea. The ESA applies within the territorial sea and high seas. *See e.g. Turtle Island Restoration Network v. NMFS*, 340 F.3d 969 (9th Cir. 2003). Jurisdiction under the MSA is explicit and vast, including territorial waters and the EEZ, and for anadromous species the high seas. 16 U.S.C. §1801 *et seq.*, §1811 (anadromous fish). NOAA generally sets the scope of Essential Fish Habitat consultation to the EEZ, 200 nautical miles from the baseline. *See* 50 CFR §600.805(b)(2). Jurisdiction under the MMPA includes both the EEZ and the high seas. 16 U.S.C. §1372(a)(1). Jurisdiction under the Clean Water Act extends here through the contiguous zone and to the end of the EEZ— 200 nautical miles out to sea. Jurisdiction under NEPA extends uncontroversially to the EEZ, and we believe in this case should correctly also be applied to high seas beyond the EEZ. *See e.g. NRDC v. Dep't of Navy*, No. CV-01-07781 at 21 (C.D. Cal. Sept. 19, 2002). *See also Env. Defense Fund v. Massey*, 986 F.2d 528 (D.C.C. 1993).

CO28-39

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CO28-38 Coast Guard submitted its Letter of Recommendation after reviewing all segments of the LNG marine vessel transit to the proposed site including transiting through the "channel bar". Figures 4.13-1 and 4.13-2 of the final EIS depict the Zones of Concern. In the event of a large release of LNG that ignited, the extent of impacts to public would depend on the location of the release and subsequent fire and the entire hazard zone would not be impacted.

CO28-39 The route that would be taken by the international LNG vessels past K buoy is unknown, and would be speculative (see Section 2.2.1).

The ESA and MSA evaluations therefore must extend to include *at least* the EEZ. These are the areas our nation is privileged and responsible, under customary international law including as expressed through the MSA, to protect and manage for maximum sustained yield. In terms of anadromous fish and marine mammals, to high seas beyond the EEZ that are not within another nation's territory. Important issues related to vessel strikes, marine pollution, air pollution, and safety need to be dealt with, but would be missed under Jordan Cove's incorrect map of the world. The fact that vessels who ply these routes will be flagged in Liberia, Panama or some other flag-of-convenience country, while relevant in some ways, is not a reason to restrict careful evaluation under the ESA and MSA, as well as the MMPA, NEPA, CWA, and other authorities. The lack of U.S. "territory" beyond twelve miles, is not a reason to exclude consideration of the vast, productive and important Exclusive Economic Zone, and high seas, or to ignore the substantial authority we have through exercise of port state jurisdiction over foreign-flagged vessels.

CO28-39 cont.

**4. USCG LOR and Analysis**

The DEIS does correctly note that the Coast Guard conclusion that this waterway is suitable for LNG traffic is based on "full implementation of the strategies and risk mitigation measures identified by the Coast Guard to Jordan Cove in its WSA." DEIS, 4-709. Whatever measures these are, except for being told that they are critical, the reader (and decision-maker) must only guess at what those measures might be, and what other issues they might raise. An agency cannot avoid NEPA analysis by relying on aspirational, unstated mitigation measures. In addition to considering mitigation implementation and effectiveness, the measures themselves can have important indirect and cumulative implications.[1]

CO28-40

Relying on perfectly implemented effective mitigation is particularly arbitrary where there is no authority to require it. *See* DEIS, 4-709.

The statement that "Neither the Coast Guard nor the FERC has authority to require waterway resources of anyone other than the applicant under any statutory authority or under the Emergency Response Plan (ERP) or the Cost Sharing Plan" makes no sense. DEIS, 4-709. What cost sharing plan and what ERP is being referred to? Why say the Coast Guard has no authority to require waterway resources of anyone other than the applicant? Coast Guard authority in the area is not restricted to this applicant at all, and they would have authority to require things of other waterway users.

CO28-41

The DEIS statement that each vessel transit is evaluated case-by-case "what, if any" safety and security measures need to be taken is confusing and alarming. DEIS, 4-710. The LOR establishes many measures that are known and mandatory, so it is not the case that we need to wait for a vessel to show up at the bar before knowing whether there are safety issues or not. Those issues can (and should be) considered now, notwithstanding the obvious fact that the Coast Guard can make judgement calls in any given case. It is alarming though to see that the purported mitigation here relies so completely on future judgements. Those judgments will all be made

CO28-42

[1] *E.g.* security zones around LNG vessels resulting in extended closures of the river channel.

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CO28-40 As discussed in Section 4.13.1.3, the Coast Guard would assess each LNG transit on a case by case basis to safeguard public health and welfare. The U.S. Coast Guard LOR is predicated on the risk mitigation measures identified in the WSA to be implemented. In addition, if appropriate resources are not in place, the Coast Guard Captain of the Port has the authority to prohibit LNG transfer or LNG marine vessel movements to protect the waterway, port, and marine environment.

CO28-41 See comment response CO28-40. Also, the Onsite and Offsite Emergency Response Plans discusses the emergency response plan and cost sharing plan.

CO28-42 Deep draft marine vessels (such as LNG marine vessels) would be required to provide a 96-hour advance notice prior to calling on a port. This would provide Coast Guard and pilots time to verify any resources needed for the LNG marine vessel are in place. In addition, if appropriate resources are not in place, the Coast Guard Captain of the Port has the authority to prohibit LNG transfer or LNG marine vessel movements to protect the waterway, port, and marine environment.

with limited information and under time pressure by a COTP who is located several hundred miles away from Coos Bay.

The concluding sentence of this section is representative of the circular non-analysis logic of this section. "If" the project is approved, and "appropriate resources" are not in place, "then the COTP would consider at that time what, if any, vessel traffic and/or facility control measures would be appropriate to adequately address navigational safety and maritime security considerations." DEIS, 4-710. What does that even mean? What is the decision-maker supposed to do with information like this?

CO28-42 cont.

**5. Missing Marine Safety Issues**

LNG vessel traffic interferes with other marine traffic, increasing safety risks to other mariners. The Draft EIS appears to entirely fail to consider the direct, indirect and cumulative effects of the proposed action on the safety of other mariners and waterway users (like surfers, clammers).

The maritime law governing vessel navigation and liability in Coos Bay is favorable to large commercial carriers of LNG, *at the expense of* other mariners, including commercial and recreational fishers. [2] In essence, larger and more dangerous vessels (like LNG tankers) take priority, so when navigation is at a bottleneck (as it is in the FNC) it is the smaller vessels whose use of the waterway is impaired. The points-of-no-return here are buoy 1 clear out beyond the bar, and the vessel slip at the facility, and the voyage optimistically takes about 90 minutes. So for every LNG vessel that enters or exits, 240 times a year and always at daylight, all of the other mariners in the area will have to make way.

CO28-43

In various filings Jordan Cove has admitted only small impact to recreational use by boaters. The Department of State Lands has requested additional information, and has not made its determination regarding effects to navigation. According to analysis in **RR5,** LNG carriers in Coos Bay would potentially impact on other boating about 7 hours per week, or about 8% of all daylight hours. This calculation is incorrect and misleading. First, daylight hours is a misleading metric because it fails to recognize that only some times are suitable for boating and recreation, and that both LNG and other users will have to compete for the best of those hours. Assuming all daylight hours are available fails to account for inclement weather, which is a common limiting factor for recreation and navigation in the estuary. Second, while couched as a worst-case calculation of maximum impact, it actually fails to admit of the sporadic interruptions caused by the new risks this project brings, in the form of vessel casualties, or unusual national security risks. Third, it ignores the significant impact of the actual dredging and construction work. The NRI dredging in Coos Bay overlaps with the salmon fishing season in October, for example. Thus the impact is experienced not only in small percentages out of a universal average, but as complete interference with uses that are seasonal for a matter of years.

**6. Hazard & Interference to Recreational Vessels**

[2] *See* COLREGS. 1972 Convention on the International Regulations for Preventing Collisions at Sea;" 33 USC 1601 – 1608; 33 CFR 89 etc. (Navigation Rules and implementing regulations) (navigation rules available online at https://www.navcen.uscg.gov/pdf/navRules/CG_NRHB_20181106.pdf);



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CO28-43 See comment response CO28-33.

The interplay with recreational users is especially important.[3] For example, on August 30, 2016, three kayakers were injured when a ferry collided with their group in the Hudson River, highlighting the dangers of recreational and commercial vessels operating on the same waterways. This led to a major effort by NTSB, which found that the most critical safety factor was cooperation between recreational and commercial users at established ports.[4] We are concerned that for Jordan Cove in particular, such cooperation has not been taking place, making the risk here especially large.

The Coos Bay estuary generally, and areas at and in the immediate vicinity of the NRI dredging and dredge lines, is used extensively by "recreational" boaters, including for fishing.[5] In 2005, recreational boaters took 30,996 boat trips in Coos Bay and engaged in 36,547 use-days of boating activity. Approximately 88% of these use days were related to fishing.

According to State data, nearly 90 percent of the boat use-days [in Coos Bay] involved fishing (including angling, crabbing, and clamming). Coos County local recreation expenditures, including hunting, fishing, wildlife, viewing, and shellfishing totaled $6.2 million dollars in 2008. Travel-generated expenditures for these activities in Coos County generated $33.5 million dollars in 2008.[6]

CO28-44

Also falling under the "recreational" vessel umbrella are subsistence fishers, for whom the activity is a cherished cultural tradition, and a matter of direct economic livelihood. Subsistence use is almost universally recognized as a highest and best use of waterways, and it warrants more careful attention here. Tribal consultation is an important part of that consideration, but that does not capture all subsistence users or interests so the broader public issue should be considered as well.

The estuary is popular for clamming and crabbing, two fisheries that are particularly disturbed by dredging, and that are particularly vulnerable to chemical changes in the water.

All four of the dredge areas are located at or adjacent to areas specifically used for fishing and/or crabbing, ensuring navigation conflicts. These and other areas also are used for fishing other species, notably salmon. The practice of "mooching the Bar" is widespread in the fall season and is centered almost exclusively around the hour before and the hour following slack high water.

[3] *See e.g.* NTSB Safety Recommendation Board, Safety Recommendation Report Shared Waterways: Safety of Recreational and Commercial Vessels in the Marine Transportation System. MSR-17/01. Available online at: https://www.ntsb.gov/investigations/AccidentReports/Reports/MSR1701.pdf.
[4] NTSB 2017 @ p.81. ("Cooperation is needed because shared waterway safety issues are a function of geography, vessel types, predominant weather, and other local factors. Local stakeholders working cooperatively are in the best position to address local issues through mutual respect and a shared commitment to safety.")
[5] Image Source: http://www.dfw.state.or.us/mrp/shellfish/maps/images/coos_shellfish_areas2.jpg. *See also e.g.* http://oregonfishinginfo.com/Coos%20Bay.html ("Good fishing for salmon extends over a wide area outside of Coos Bay" "Fishing for rockfish is excellent…" "Feeder salmon enter lower Coos Bay during the summer usually in July feeding from Charleston to Fossil Point north to Jordan Cove"); http://www.dfw.state.or.us/mrp/shellfish/maps/images/coos_shellfish_areas2.jpg;
[6] "Fishing, Hunting, Wildlife Viewing, and Shellfishing in Oregon - 2008 State and County Expenditure Estimates"; Prepared for the Oregon Department of Fish and Wildlife - Travel Oregon; Dean Runyan Associates; May 2009, available at http://www.dfw.state.or.us/agency/docs/Report 5 6 09--Final%20%282%29.pdf

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CO28-44 Additional information regarding recreation expenditures in Coos County has been added to section 4.9.1.7. A separate discussion of subsistence use has also been added. Potential impacts to clamming and crabbing are addressed in section 4.8.1.1.

The DEIS fails to identify the lower bay on the inside of the North Jetty as a popular recreational surfing spot, particularly during high and near slack outgoing tides, commonly in the winter months or periods of high ocean surf conditions. Surfers access this location by off highway vehicles via the North Spit or by paddling across the estuary from shore points in Charleston. Surfing in the lower bay is typically associated with winter periods of large ocean swells and strong fresh water runoff. Transiting LNG tank vessels would negatively impact surfing at this location and they could pose a safety hazard to one another. Please consider and discuss this issue in a revised Draft EIS.

CO28-45

**7. Vessel Casualties are reasonably foreseeable**

As with any major marine endeavor, this proposal in the Coos Bay estuary poses a significant risk of vessel casualties. Shipping casualties involving LNG vessels should be considered foreseeable during the life of this facility. The DEIS makes a major error by putting such faith in the Coast Guard to save them from all disaster.

CO28-46

Vessel casualties occur for a large variety of reasons.[7] These reasons are not entirely alleviated by routine, even tyrannically stringent mitigation. Even with pilots (which are a great help!), for example, small errors can and do occur with major consequences. The March 30, 2016 grounding of the bulk carrier *Sperna*, in the Columbia River northwest of Portland for example shows that pilotage is no guarantee of safety, especially in narrow confined channels. In that casualty the pilot's rudder order to starboard was misapplied by the helmsman to port. *Id.* While only for a moment, the result was the ship grounding on a rock, flooding the forward tanks and causing a half-million in damages. *Id.* The NTSB investigation there is informative because it found the probable cause of the casualty was the failure of the pilot and bridge team to monitor the helmsman's actions. *Id.* So it is all well and good that there will be local pilots guiding each ship in and out, but it would be reckless to pretend that that assured safe operations. Shipping is inherently dangerous and the stakes of even minor, momentary errors can be immense.

The applicant's assessment of effects to navigation entirely ignore the unique problems of earthquake and tsunami hazard at this estuary. **What happens to an LNG vessel in the facility or estuary in an earthquake/tsunami scenario?**[8] The Draft EIS failure to discuss that major problem is a fatal error. Nothing in the Coast Guard or DOT reviews excuses the lack of consideration. We are concerned with this issue for several reasons. The consequence of LNG vessel casualties is enormous, potentially killing thousands. The presence of an LNG vessel in the channel, or disabled at the slip, even with perfect survival of the facility itself would be a huge hindrance to response and safety of responders. Jordan Cove has suggested that they could unmoor the vessel and put it head-in to the wave exiting the estuary in a tsunami scenario, which (1) doesn't sound possible in light of short tsunami warning times and difficulty unmooring (needing tugs etc.); (2) would expose those crew to needless additional hazard; and (3) is most likely to be even more dangerous to the public and to response. A reasonable alternative would appear to be designing the marine slip so that *an LNG tanker* is expected to safely survive a

CO28-47

[7] *See e.g.* NTSB Safer Seas Digest 2017, Lessons Learned from Marine Accident Investigations. Available online at: https://www.ntsb.gov/investigations/AccidentReports/Reports/SPC1802.pdf

[8] *See What Happens to an LNG Tanker in a Tsunami?* B. Higginbotham, 2019. Dr Higginbotham is a published and recognized expert in tsunami effects who has specifically reviewed the current project proposal.





CO28-45 The discussion of impacts to boating and fishing in section 4.8.1.1 of the EIS has been revised to include impacts to other water-based impacts in the bay.

CO28-46 See comment response CO32-107.

CO28-47 The Coast Guard issued a Letter of Recommendation on May 10, 2018 stating that Project would be considered suitable for accommodating the type and frequency of LNG marine traffic associated with this Project. The probability of tsunami and design to be resilient against a 2,500 year event is described in the final EIS. A tsunami study was performed and filed publicly in the application as appendix I.13. A seismic study was performed and stamped by a licensed engineer, also filed publicly in the application as appendix I.13. The impact on the estuary was developed and included in the dame appendix I.13 and was stamped and sealed by a professional engineer.

tsunami. Jordan Cove has conducted some hydrodynamic analysis, but predicting currents in a tsunami is notorious unpredictable, and we do not see assurance that the marine slip can safely hold tankers through an earthquake and tsunami. Please disclose and consider this essential information in a revised draft EIS.

CO28-47 cont.

Coos bay even currently, while a small port, is a hazardous place that is difficult to manage. The bay is subject to currents, tides and winds under normal conditions. Water depth is low through most of the estuary, and for large tankers particularly the navigation channel is very narrow. According to JCEP's narrative to Coos County, the environmental conditions coupled with increasing ship size, "have caused the Coos Bay Pilots to impose ever more limiting restrictions on when vessels may safely transit the Channel," and that these "cause significant delays and increased pressure on the Pilots." JCEP Narrative to Coos County @ p.3. It is further indicated that delays decrease efficiency and competitiveness of maritime commerce, "jeopardizing continued success for maritime commerce in Coos Bay." *Id.* This is called a "pressing need." *Id.*
**Timing Restriction.** The bar channel is another obvious hazard, so significant that tankers only propose to cross it and the LOR only applies when it is crossed only at slack high tides during daylight. This limitation, combined with security measures (like the 500-yard exclusion zone, *see* USCG July 1, 2008 WSR ) particular to tankers along with ordinary navigation rules, raises a particular harm to navigation, because with 120 vessel calls per year, that means they are relying on using 240 out of the 365 available daylight high tides in the year. Having claimed the safest crossing times for themselves, all remaining vessels will have to make due with the remaining 115 available daylight slack high tides. If there are fifty other vessels, such as tank barges or export ships, using the port in a year, then for all practical purposes mariners will no longer be able to use the safest bar crossing time at all. Outgoing vessels would have to hold up just inside the bar while the LNG ship passes, or leave earlier under time pressure, both of which are situations that increase safety risks to vessels and directly impair navigation.

Relying on the high slack tides raises another navigation-related concern by creating bottlenecks on both sides of the bar. Ships will have to time their entrance and exit precisely on a chance that only comes once a day. This situation greatly increases the chances of LNG ships having to hold up offshore for longer (and inconvenient) periods of time, or making mistakes trying to time loading and exit times exactly. According to current guidance, which recognizes the hazard posed by waiting tank vessels along this navigation route and unprotected coastline, vessels holding up are directed to stay fifty nm from shore. There is no suitable anchorage for large vessels near shore, and certainly none well off the continental shelf. That means that if a bar crossing is missed for any reason it adds a roughly 100 nm to the journey, and this at one of the more hazardous locations, where vessels will burn additional fuel and increase chances for accidents to happen.

CO2-48

It is not realistic that Jordan Cove will actually be able to meet its logistic needs to move enough gas in light of the bar timing restriction. Needing to use 240 daylight high tides, best case, that leaves only 125 days to lose when ships are loading at the dock (or any other delay). If it takes even one day to load a ship, that would use up 120 of those days. Put differently, each vessel requires at least three days to enter, load, the exit— best case scenario. If it takes two days to load, then there aren't close to enough high tides in the year, so that would result in either a

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CO28-48 The Coast Guard has considered waterway conditions such as depth of water, tidal range, navigational hazards, channel bar, LNG marine vessel routing, and other vessels transiting within the channel in its waterway suitability assessment.

significant reduction in the number of vessels (and therefore amount of gas) the facility can move, or a relaxing of safety measures.

Vessel Routing **between the estuary and open ocean, around the bend and through the channel over the bar**, is an especially hazardous maneuver in both directions. At the **first NRI** the ships, after making a 95-degree turn, have to center themselves in the channel to make a 21-degree starboard turn into the Coos Bay Range, and do that within a distance of about two ship lengths, "which is much less than the minimum of 5.0 ship lengths recommended by normal industry guidance (citing USACE EM 1110-2-1613, chapter 8-2). JCEP Narrative to Coos County, 2019 @ 4. The dredging proposed for the NRI would widen the inside range channel from 300 to 450 feet, lengthening the corner cutoff from 850 feet to 1,400 feet from the turn's apex. That still leaves vessels needing to make their turns in less than normal industry guidance, and with almost no room for error. **NRI #2** addresses the turn from the Coos Bay Range to the Empire Range channels. The current cutoff distance there is only 500 feet, much less than a single ship length, which "is inadequate to allow deep draft vessels to start their turn early enough to safely make the turn and be positioned in the center of the next channel." JCEP Narrative to Coos County, 2019, @ 4. There are numerous hazards, exposed and submerged, on both sides of the channel throughout the route, but especially at the entrance and first big turn. We feel that this hazard is unacceptable, in light of the high consequence to LNG vessel casualties. CO28-48 cont.

Please disclose and discuss the likelihood and consequences of LNG vessel casualties in and around the estuary. This can and should be done qualitatively and quantitatively, consider the local conditions and foreseeable consequences to vessel traffic. We consider this information essential to making meaningful comment on the proposal.

**8. Coast Guard Review Raises numerous issues demanding NEPA analysis**

First, it must be remembered that a LOR is not a decision or regulatory document, but rather serves as comments of the Coast Guard in a NEPA process. FERC's perspective here is different from the Coast Guard, and while the views in the LOR are certainly persuasive and important, they are only the beginning of the analysis. The actual navigation of the channel by LNG tankers would be a very hazardous affair.

The LOR very weakly asserts the *applicant* is "expected to examine the feasibility of implementing such mitigation measures" in consultation with others. USCG LOR, 2018, p.2. It is hard to know what to make of a Coast Guard *expectation* that the applicant will only *examine* feasibility of measures. It is not much, and reliance on such measures to actually mitigate impacts would be purely speculative and not reasonably foreseeable. Please be sure not to rely on speculative mitigation measures in your analysis, and ensure that the removal-fill mandates regarding protection of navigation, protection of health and safety, and implementation of full mitigation are fulfilled. CO28-49

As indicated in paragraph 2 of the LOR itself, the Coast Guard simply *assumed* that the applicant is *fully* capable of doing everything it hopes to do, that actual conditions at the port are perfectly described, and even that the applicant will fully meet all regulatory requirements, even the

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CO28-49 As discussed in Section 4.13.1.3, the Coast Guard would assess each LNG transit on a case by case basis to safeguard public health and welfare. The U.S. Coast Guard LOR is predicated on the risk mitigation measures identified in the WSA to be implemented. In addition, if appropriate resources are not in place, the Coast Guard Captain of the Port has the authority to prohibit LNG transfer or LNG marine vessel movements to protect the waterway, port, and marine environment.

emergency and operations manual. The Coast Guard recommendation is "contingent" on the perfect application of everything in the WSA. USCG 2018 at 6, ¶11. Those are wild assumptions, making it incumbent on the Corps to conduct its own analysis, and to do its own consultation with the Coast Guard.

Coos Bay is subject to a pilotage requirement, illustrating the tricky nature of the port, and raising a host of new complications. There are only two pilots in Coos Bay. They have never piloted LNG tankers before, and currently only handle a light load of fifty vessels per year. CO28-50

The applicant claims to have established what it calls an "emergency response planning group," which it says is tasked with education and preparedness for the facility. *See* USCG 2018 LOR p.2 ¶10. It is dangerous that this critical issue is farmed out to an *ad-hoc* "planning group." Despite efforts to do so, our coalition has been unable to take part in this group. Pursuing official channels with the Coast Guard and State, it seems this entity is a creature of Jordan Cove's own invention, and not a part of any official prevention, preparedness and response under the National Response Framework or National Contingency Plan. What this *ad hoc* group illustrates is that, in fact, emergency responders are not in place, trained or capable of handling this facility. The LOR also reveals that the Coast Guard itself will be playing a very minimal role, reflecting its limited capacity here. The Captain of the Port is far distant in Portland. The LOR states the Coast Guard will not require any safety inspections for visiting vessels beyond the minimum required. USCG 2018 LOR p.2.

The Limited access areas for this project have yet to be established. *Id.* p.2 ¶3. This has caused confusion in the community, and hindered meaningful public engagement regarding impacts to navigation. It does seem safe to assume exclusion zones around the tanker and facility, and these would be a major hindrance to free navigation in Coos Bay. Yet, the perpetual confusion and lack of any policy are indicative of problems to come, as mariners will be frustrated by the inability to plan ahead. CO28-51

While the Coast Guard says they made a "systematic" review under NVIC 01-2011, what it describes actually occurring is an *ad hoc* process weak on expertise or stakeholder representation. No tribes, resource agencies, or public-interest representatives were present. The primary analysis occurred over a single day, during which it could not have been possible to conduct more than a cursory review of conditions and factors. For example it is said that this group considered "each" scenario and causes of events, and the contributing factors for each and their likelihood of occurrence. USCG 2018 LORA at 5 ¶8. That amounts to thousands of evaluations of probability done *ad hoc*, rather than by any objective standard.

Recent changes to vessel size as part of this Coast Guard review aren't addressed in the Draft EIS. It is interesting that the removal fill application mentions that, after recent simulations, the Coast Guard has deemed that the channel is suitable for LNG carriers up to 299.9 length, 49 meters breadth, and 11.9 draft— a reduction in all three parameters. CO28-52

**9. Rollover**

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CO28-50 Comment noted. Both pilots were part of the LNG marine vessel simulations conducted for this Project. The Coast Guard has considered any suggestions and recommendations provided by the pilots.

CO28-51 See comment response CO28-29.

CO28-52 The current Project proposal under review by the FERC does not include ship vessels of this size. FERC is reviewing the Project as proposed by the Applicant. Jordan Cove provided LNG marine vessel simulations for 89,000 m3 to 160,000 m3 size vessels, and would need to request a modification from FERC and U.S. Coast Guard for using larger LNG marine vessels. As part of this request, Jordan Cove would be expected to provide LNG marine vessel simulations to FERC and U.S. Coast Guard that demonstrate large LNG marine vessels can safely navigate with them before being allowed to receive them. If such a request is made, FERC would also work with U.S. Coast Guard to evaluate the risk of the larger vessels, but note that larger vessels would likely decrease the number of LNG shipments needed, and, as described in Sandia Report, Breach and Safety Analysis of Spills Over Water from Large Liquefied Natural Gas Carriers, 2008, larger LNG marine vessels, such as the 217,000 m3, more significantly affect the hazard duration, but do not significantly affect on the hazard footprints used to define the Zones of Concern that are used in part to assess the risk to the public by the U.S. Coast Guard and FERC. In addition, DOT FAA would need to evaluate the impacts to air traffic for larger LNG marine vessels.

The Draft EIS does not address the problem of "roll-over," which occurs in large LNG storage tanks when different densities of LNG mix inappropriately within a tank. *See* "Rollover in LNG Storage Tanks 2nd Edition: 2015: Summary Report by the GIIGNL Technical Study Group on the Behaviour of LNG in Storage", http://www.giignl.org/sites/default/files/PUBLIC_AREA/Publications/rollover_in_lng_storage_tanks_public_document_low-res.pdf; World Bank EHS, 13, at Sec. 1.2.2. CO28-53

**10. Indirect effects of vessel casualties are not disclosed or addressed**

The Draft EIS fails to address the indirect and cumulative impacts of the maritime safety risks associated with tanker and tug traffic. Should an LNG vessel go ashore or become stranded in the channel, for instance, what would be the indirect consequences of that? It would appear that for about a 9-mile stretch, from buoy 1 outside the channel to the slip at the facility, any serious casualty would leave any vessel sitting in an extremely inconvenient location. CO28-54

**E. Geological Hazards.**

The Cascadia Subduction Zone (CSZ) is located off the Oregon coast and extends from Northern California to Vancouver, B.C, where the oceanic Juan de Fuca and Gorda Plates meet the North American Plate. The zone widens from 60 km off southern Oregon to 150 km off the northern Olympic Peninsula in Washington. According to US Geological Survey's 2009 Earthquake Probability Mapping there is a 10% chance of a greater than 5.0 magnitude earthquake in the CSZ in the next 30 years. This probability increases as the years go on with a 20-25% chance in the next 50 years and a 30-40% chance in 100 years. A recent study based on 13 years of research finds that the Coos Bay area is more vulnerable than northern stretches of the CSZ, and concludes that there is a 40 percent chance of a major earthquake in the Coos Bay region during the next 50 years.[9] The study author, Chris Goldfinger, a professor at Oregon State University, states that "major earthquakes tend to strike more frequently along the southern end – every 240 years or so – and it has been longer than that since it last happened."[10] Forecasts predict that the CSZ is due for an earthquake similar in strength to the 9.0 magnitude earthquake felt off the coast of Japan in March 2011. A high magnitude earthquake in this zone would create several different conditions that may severely impact the stability of the terminal and pipeline.

The Jordan Cove LNG Terminal will be constructed on dredged spoils. This poses a threat from earthquake liquefaction hazards which occur when water-saturated sediment is exposed to strong seismic shaking. The shaking causes the grains to lose grain-to-grain contact and the sediment acts as a fluid. Liquefaction is more likely in loose sandy soil with a shallow water table. Liquefied sediment layers may vibrate with displacements large enough to rupture pipelines, move bridge abutments, or rupture building foundations.

[9] Goldfinger, *et al*., *Turbidite Event History Methods and Implications for Holocene Paleoseismicity of the Cascadia Subduction Zone*, in EARTHQUAKE HAZARDS OF THE PACIFIC NORTHWEST COASTAL AND MARINE REGIONS, USGS PROFESSIONAL PAPER 1661 (Robert Kayen, ed.) July 17, 2012.
[10] Oregon State University Press Release, *13-Year Cascadia Study Complete And Earthquake Risk Looms Large* (Aug. 1, 2012). *Available at* http://oregonstate.edu/ua/ncs/archives/2012/jul/13-year-cascadia-study-complete-%E2%80%93-and-earthquake-risk-looms-large

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CO28-53 FERC's review of the process design did confirm that the Project would include provisions to monitor and alarm LNG density differences within each LNG storage tank. In addition, in-tank pumps as well as LNG recirculation would help with mixing the stored LNG to minimize the potential for rollovers.

CO28-54 The Coast Guard's Letter of Recommendation on the suitability for LNG marine vessel traffic within Coos Bay Channel would require 2 tug boats to assist in escorting the vessel and a third tug boat during docking activities.

The Coos Bay area has a population of about 31,750 according to the 2010 Census. There are residential areas, businesses, and an airport all located within half a mile of the Jordan Cove site. A hazardous event at the site could seriously impact the safety and infrastructure of the surrounding area. The Jordan Cove site will include two large LNG storage tanks, the liquefaction terminal, pipeline connections, marine facilities, and a natural gas fueled power plant. Disruption of the site from earthquake or tsunami could compromise the integrity of any of these components and possibly lead to leaking of gas or LNG, disruption in power service to the local grid, gas explosion or other catastrophic event.

A recent study of large historic landslides along the Oregon coast indicates that they were most likely caused by a high magnitude earthquake occurring in the CSZ. A future earthquake could result in further movement of existing rockslides as well as formation of new rockslides along the coast. Landslides along the pipeline route could result in breakage or movement of the pipeline.

The DEIS recommends that further geotechnical studies (which have not yet been performed) and detailed designs of ground improvements be submitted to FERC for review and approval prior to construction. It is unclear why FERC believes that the initial information presented by the applicant is sufficient to make the determination that the site is suitable for this project, given the proximity of the Coos Bay communities and infrastructure as well as the risks and probabilities of a major megathrust earthquake at this location. CO28-55

While existing mapping and planning programs will provide communities with a better sense of what to expect in the event of an earthquake or tsunami, the 2011 Japanese tsunami is a prime example of the fact that even where planning programs and mitigation measures are in place for such a disaster, there are significant challenges to predicting the full extent of damage that may be caused by natural hazards. The DEIS does not adequately address the level of destruction possible at this location. CO28-56

**F. Safety Issues.**

**1. Spills**

If LNG spills, it vaporizes. Because these vapors are heavier than air, they form a cloud close to the ground that will eventually dissipate. However, if an ignition source is present before the vapor cloud dissipates to less than 5% to 15% concentration, the vapor cloud can ignite and burn. The concerns expressed by many commenters about the risks of the pipeline extend beyond the possibility of catastrophic seismic events, to question the modeling and methods employed to understand the risks posed by vapor at the site. For example, on February 4, 2015, Senator Ron Wyden requested that FERC and PHMSA provide information to the public regarding the hazard modeling used to measure vapor cloud dispersion. This modeling is relevant to general spills but also to the possibility of a rupture or other spill resulting from tsunami or earthquake. CO28-57

According to comments and analysis provided by professors of chemical and mechanical engineering Jerry Havens and James Venart, "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

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CO28-55 The geotechnical information provided in the application is viewed as sufficient to provide preliminary information for front end engineering design. Additional information is requested as more detailed design work is performed to ensure that the proposed designs appropriately account for design ground motions set forth in codes, standards, and regulations.

CO28-56 The draft EIS evaluates the historically worse case events and probabilistic effects of natural hazards (e.g., ground motions, wind velocities, wave runup and wave heights). In addition, natural hazards are discussed in the Geotechnical and Structural Design section of the final EIS.

CO28-57 See comment responses IND2-1 through IND2-7. For releases within the LNG terminal site, section 4.13.1.2 of the final EIS discusses that USDOT PHMSA approves hazard models to determine vapor dispersion distances.

catastrophic levels that could cause the near 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." *See* Havens & Venart Comment, Jan 14, 2015.

**2. Aviation Hazards.**

The proposed terminal would be less 0.6 miles from the Southwest Oregon Regional Airport (SORA). DEIS 4-750. LNG carriers would pass within 0.75 mile of the end of SORA's runway number 4/22[11]. Construction and operation of the proposed project may have significant impacts on aviation, presenting both physical obstacles (including permanent structures and LNG carriers) and a hazardous thermal plume. The DEIS fails to take the required hard look at either impact.[12]

**a. Obstruction Hazards**

Under the Federal Aviation Act of 1958, the Federal Aviation Administration ("FAA") determines whether proposed construction will present a hazard to air navigation. *BFI Waste Sys. of N. Am., Inc. v. F.A.A.*, 293 F.3d 527, 528 (D.C. Cir. 2002) ("*BFI Waste*").

Here, the two LNG tanks, the amine regenerator, the oxidizer, and LNG carrier vessels will, by virtue of their height and location relative to the airport, constitute "obstruction[s] to air navigation." *See* 14 C.F.R. §§ 77.17(a), 77.19(b). It is likely that cranes and other construction equipment will also constitute such obstructions, but Jordan Cove has not yet submitted information on this equipment to the FAA, DEIS 4-750, and the DEIS provides no discussion of the extent to which this equipment will impact aviation. CO28-58

On May 7, 2018, the FAA issued "notices of presumed hazard" for the tanks, amine regenerator, and oxidizer, and for seven LNG carrier vessel transit points. DEIS, 4-750.[13] For the amine regenerator, oxidizer, and westernmost vessel transit point, the FAA informed Jordan Cove that it could request additional study of whether the obstruction would pose an adverse impact to aviation. The other ten notices, however, explained that unless the height of the obstruction at issue was reduced, the obstruction would be deemed to have an adverse impact *per se*, because of, *e.g.*, intrusions into "traffic pattern airspace." *See* FAA, "Procedures for Handling Airspace Matters," JO 7400.2M at 6-3-8 d.1.b (Feb. 28, 2019).[14]

**b. The DEIS Understates the Impact of LNG Carrier Vessels on Aviation**

The DEIS provides only one short paragraph discussing the impact of LNG carriers on aviation: CO28-59

[11] FAA. Aeronautical Study No. 2018-ANM-7-OE (May 7, 2018) (providing coordinates of 43-24-55.79N, 124-16-29.14W for LNG Carrier Stack Transit Point 4); http://www.airnav.com/airport/KOTH (providing coordinates of 43-24.883747N, 124-15.635873W for end of Runway 4/22)
[12] This section addresses potential impacts of the project on aviation. The DEIS also fails to adequately address the potential impacts of aviation on the project, e.g., of an aircraft crashing into an LNG storage tank.
[13] Copies of these notices are included in the docket at Accession No. 20180510-5165, Part 8.
[14] Available at http://www.faa.gov/documentLibrary/media/Order/7400.2M_Bsc_dtd_2-28-19.pdf. Courts have described this handbook as "binding" and "controlling." *BFI Waste*, 293 F.3d at 529.

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CO28-58 See our updated analysis in section 4.10 and 4.13 of the final EIS related to the FAA assessment, and the Project's potential impacts to the Southwest Regional Airport.

CO28-59 See our updated analysis in section 4.10 and 4.13 of the final EIS related to the FAA assessment, and the Project's potential impacts to the Southwest Regional Airport.

> During operation of the Jordan Cove LNG Project, LNG carriers in the Federal Navigation Channel would cross [t]he airport approach pathway. Jordan Cove has indicated that aircraft would be delayed by about 13 minutes for each passing vessel, consisting of a 10-minute advance notice period, and 3 minutes of actual time during which airspace would be potentially obstructed. LNG carrier transit times could also be adjusted to avoid conflict with air traffic, if the need arises.

DEIS, 4-625.

The DEIS does not explain how the 13 minute estimate was calculated or provide any citation in support. There is no indication that the FAA, the agency with expertise in this matter, agrees that the period of potential obstruction will only be three minutes long. Transit point 1 is more than two miles from the slip.[15] Carriers will travel between 4 and 6 knots, DEIS, 2-14, requiring roughly 20 to 30 minutes to cross this distance. Turning and mooring the carrier will require another 90 minutes, *id.*, after which time the carrier will be loaded, and the process reversed. All in all, each carrier will ordinarily be in locations where it will have a *per se* adverse impact for roughly 20 hours. *Id.* (explaining that total time spent east of Buoy K will be "about 22 hours"), *see also id.* 4-255 ("Jordan Cove estimates that about 110 to 120 LNG carriers would visit its terminal each year," and remain "at the terminal dock for a period of about 17.5 to 24.5 hours.").

CO28-59 cont.

Even if conflicts between aviation and carriers could be resolved by delaying flights by 13 minutes, the DEIS fails to present any discussion of the impact of such delays. The DEIS does not address how often such delays will occur, an analysis that requires, at a minimum, consideration of the amount of carrier traffic, the amount of present and foreseeable future aviation traffic,[16] and the expected timing of each. The DEIS does not address whether, how often, or how severely delaying one aircraft operation will delay other operations at the airport. Nor does the DEIS provide any explanation as to how adjusting LNG carrier transit times would reduce impacts to aviation, or the feasibility of such adjustments: with an average of more than 50 aircraft operations per day,[17] the slow speed of carriers, and the scope of the area that obstructs the airport, there may never be a good time.

We note that Jordan Cove currently expects to utilize significantly taller carriers than were previously proposed, and as such, prior analyses of the impacts of carriers on aviation (and other resources) do not address the impacts of the current proposal. According to Jordan Cove's most recent submissions to the FAA, the proposed carriers stack height will be 211' Above Mean Sea Level (AMSL),[18] 45' taller than was indicated by Jordan Cove's prior FAA submissions.[19]

**c. Structures**

[15] FAA. Acronautical Study No. 2018-ANM-4-OE (May 7. 2018) (providing coordinates of 43-23-49.37N. 124-16-56.55W).
[16] The North Bend Airport had 18,549 aircraft operations (takeoffs and landings) in 2018. https://www.gcr1.com/5010web/airport.cfm?Site=OTH&AptSecNum=2 (last visited June 12, 2019).
[17] *Id.*
[18] FAA. Acronautical Study No. 2018-ANM-4-OE (May 7. 2018)
[19] *See also* Memo from J.C Smith, Commander, Sector Columbia River/Captain of the Port/Captain, U. S. Coast Guard to Jordan Cove Energy Project, L. P. dated 7 November 2018

According to the FAA, as currently proposed, the two LNG storage tanks will cause *per se* adverse impacts to aviation, and the amine regenerator and thermal oxidizer are obstacles that may cause adverse impacts. [20] Jordan Cove has not provided FERC or the FAA with any information about the height of cranes or other construction equipment; it is likely that this equipment would cause additional adverse impacts while onsite.

The DEIS suggests that permanent structures would not in fact impact aviation, because other existing obstacles already require aircraft to operate at altitudes and locations that provide an adequate buffer around the proposed terminal structure. DEIS 4-751 (summarizing comments of Southwest Oregon Regional Airport regarding prior proposed terminal design). [21] The DEIS does not provide detail or information sufficient to demonstrate that the structures will not in fact impact aviation. And, as the DEIS notes, the FAA has not agreed with the Airport's position, in reviewing either the prior or the current design. Finally, nothing in the DEIS or the Airport's 2015 letter addresses the impact of construction equipment on aviation. CO28-60

Nonetheless, we agree with the Airport on one issue: the "option" of flipping flight patterns for Runway 04 should be avoided, because such a flip would cause adverse impacts as described in the Airport's 2015 letter. If the project cannot be reconciled with the current flight patterns, the project should be modified or rejected.

**d. FERC Must Not Issue Certificates Until the FAA Has Completed Its Evaluation**

The DEIS recommends that Jordan Cove "file the final determinations from the FAA prior to initial site preparation." DEIS 4-751. This is too late. FERC cannot determine whether the terminal is consistent with the public interest, and thus whether a certificate should issue, until FERC knows whether the project will present an aviation hazard and the nature and extent of the impact of the project on aviation, and FERC needs to consider the FAA's input in making this determination. If "a determination of no hazard cannot be reached," the FERC's response may need to be much more than issuance of "a modification, variance, or amendment." *Id.* Nor can FERC issue a certificate for the pipeline, and allow, *inter alia*, condemnation for the right of way to commence, prior to resolving these issues for the terminal. If the terminal cannot be reconciled with continued operation of the airport, the terminal should be denied, and the pipeline with it. This issue cannot wait to be resolved after issuance of a conditional certificate. CO29-61

**3. Thermal Plume**

Separate from physical obstructions, the project risks impacting aviation by creation of a thermal plume. Unlike physical obstructions, the FAA does not at present regulate impacts of thermal plumes on aviation. However, "the FAA has determined that thermal exhaust plumes in the vicinity of airports may pose a unique hazard to aircraft in critical phases of flight (particularly

[20] *See supra* note 2 and accompanying text.
[21] Although not specifically cited by the DEIS, the letter discussed at DEIS 4-750 to 4-751 can be found at Accession No. 20150803-5249.

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CO28-60 See our updated analysis in section 4.10 and 4.13 of the final EIS related to the FAA assessment, and the Project's potential impacts to the Southwest Regional Airport.

CO28-61 See our updated analysis in section 4.10 and 4.13 of the final EIS related to the FAA assessment, and the Project's potential impacts to the Southwest Regional Airport.

takeoff, landing and within the pattern) and therefore are incompatible with airport operations."[22] Similarly, the National Academy of Sciences has recognized the impacts thermal plumes can have on aircraft.[23] NEPA and the Natural Gas Act require FERC to consider these impacts here.

The DEIS's dismissal of the risk of thermal plumes is nonsensical and arbitrary. DEIS 4-625 to 4-626. Thermal plumes are principally created by combustion. In the prior design, the largest source of combustion and heat was the proposed South Dunes Power Plant, where gas would be burned to generate electricity, which would then power the liquefaction equipment. As the DEIS notes, the current design does away with the South Dunes Power Plant. DEIS 4-626. However, it does not follow that "the LNG terminal would not general thermal plumes." *Id.* The current design still combusts gas; it just moved the location of that combustion from an electricity-generating powerplant to, principally, five gas combustion turbines integrated into liquefaction trains at the terminal site.[24] Combustion in these turbines will still generate significant heat, and FERC must take a hard look at the impact of the resulting thermal plume. Indeed, it may be that the thermal plume is now closer to the airport and runway ends, closer to actual flight paths, and/or at a location will prevailing wind will cause thermal plumes to be more, rather than less, of a problem. CO28-62

Although the impacts of thermal plumes depends on many factors, we note that at least one facility, the Eastshore Energy project, has been rejected on the basis of the impact its thermal plume would have on aviation, even though that facility would have had a lower heat input and would have been farther from the affected airport than Jordan Cove's current proposal. *Compare* DEIS 4-656 (Jordan Cove will have five 524.1 mmbtu/hr combustion turbines, in addition to other heat sources) with Eastshore Energy Center CEC Air Quality Permit Application, Table 8.1-2[25] (proposed heat input of 1000 mmbtu/hr), National Academy of Sciences 2011 at 29 (Eastshore Energy "would consist of fourteen 70-ft-tall exhaust stacks located approximately 1 mile from the airport.").

Thus, FERC must model the size and severity of the thermal plume(s) that would be generated by the proposed terminal, and the impact on aviation. The FAA has developed, and recommends, a tool for performing this modeling: the "Exhaust-Plume-Analyzer" developed by the MITRE corporation. The prior, 2013 analysis of Jordan Cove's impacts preceded development of this tool, and was conducted using a different methodology.[26] In analyzing the effects of the current design's thermal plume, FERC must explain its choice of methodology.

**4. Geotechnical and Structural Design**

[22] Federal Aviation Administration, Technical Guidance and Assessment Tool for Evaluation of Thermal Exhaust Plume Impact on Airport Operations, at 2 (Jan. 21, 2015), https://www.faa.gov/airports/environmental/land_use/media/Technical-Guidance-Assessment-Tool-Thermal-Exhaust-Plume-Impact.pdf

[23] "Investigating Safety Impacts of Energy Technologies on Airports and Aviation", Transportation Research Board of the National Academics, 2011, p. 29

[24] Jordan Cove, Resource Report 9, at 5 (September 2017).

[25] Attached.

[26] Thermal Plume Study at 1-5 (July 2013).



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CO28-62 The discussion of thermal plumes in section 4.10.1.4 of the draft EIS has been expanded to provide more information about the potential impacts from thermal plumes based on the current Project configuration.

As elsewhere in this document, a primary comment is that the DEIS approach is vague and conclusory, relies too heavily on mitigation and future evaluations, dismisses incomplete and unavailable information without comment, and gives the misleading impression that there are no serious geotechnical issues or alternatives on this project. Overall this approach encourages complacency of the sort that, time and again, leads to large industrial disasters. The section opens by explaining that Jordan Cove provided geotechnical and structural design information to demonstrate they "would be appropriate" and "ensure" accordance with all regulations, standards, and "generally accepted good engineering practices." DEIS 4-729. CO28-63

The DEIS gives an extended description of a geotechnical investigation done by KBJ and contracted by Jordan Cove. DEIS, 4-730 – 4-732. We strongly request use of images, which are certainly available, to illustrate this information.

We are concerned with bias where the applicant's study lacks peer review, even with FERC staff evaluation (which, naturally, "ensure[s] the adequacy." DEIS, 4-732. Outright scientific fraud is very rare in our experience; science is more frequently manipulated by strategically manipulating the questions. Here, KBJ will have been focused, quite ethically, on regulatory compliance for its high-paying client. That is a different mission from what FERC's duty is here, which is to present high-quality scientific information to the public and commission. Please further discuss the reliability of this and other applicant-provided studies where they are being relied on. Please also draw on independent information, or gather new information where that is necessary, to ensure a best available information is used. CO28-64

Please also critically evaluate effectiveness of the proposed liquefaction mitigation. We are concerned that Jordan Cove has underestimated how shifty the sand is here. Whatever mitigation is necessary for the foundation needs to be done at the start.

Our concern ultimately is that the facility sits on a shaky foundation. That is the message we read between the lines of the DEIS analysis. *See e.g.* DEIS, 4-733. This is sand, with high groundwater, basically surrounded by salt water. It would be hard to imagine a shiftier foundation to build on. Moreover the very ground on which the facility sits is envisioned to be dredged spoils from the marine estuary, also sand and silt, and a poor foundation material. Expected settlement of up to nearly a foot sounds alarming, given the high stakes. DEIS, 4-733. The upper limit for settlement is essential information that needs to be in the public NEPA document. We are concerned they are playing too close to the edge of safety, and that the potential consequence of error is immense. CO28-65

The DEIS concludes, after describing settlement and slumping and poor soils, that Jordan Cove's results indicate that conditions "are suitable" for the facilities, "if" the proposal and recommendations are implemented. That conclusory statement fails the NEPA standard for a hard look.. Without any idea what your standard for "suitable" is, and not even being told what the risks are[27], there is little to meaningfully comment about. DEIS, 4-733.

**a. Structural and Natural Hazard Evaluation**

[27] What are the potential safety and reliability-related consequences of settlement or slumping? Foundation issues tend to have cascading consequences to structures.



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CO28-63 A comprehensive geotechnical investigation has been performed and reviewed. If the Project is authorized, it must receive federal permits or authorizations prior to moving to the construction phase. The foundation design would be stamped and sealed by the professional engineer-of-record during final design and submit for review. Also, see comment response SA2-16.

CO28-64 A comprehensive geotechnical investigation has been performed and reviewed. Also, see comment response SA2-16.

CO28-65 See comment response CO28-63. Liquefaction potential and proposed mitigation is discussed in the final EIS.

The Draft EIS offers a few of the relevant hazard-related regulations (18 CFR 380.12(m), 18 CFR 380.12(o)(14), 49 CFR 193, NFPA 59A. First, the results of some of these regulations should be described and analyzed. What were the potential hazards to the public from facility failure? What is the likelihood of natural disaster impacting on the facility? Given that these standards are largely subjective, it is especially important that they be exposed to public view and commission judgement. CO28-66

Second, even in the EIS gaps in the regulation emerge, to where the conclusion becomes arbitrary. The Coast Guard has no regulation criteria regarding earthquake or tsunami, for example, so the basis (or fact) of their "approval" in that regard is a mystery. DEIS, 4-734. None of the regulations appears to encompass an all-hazard review. *Id.* The FERC conclusion is vague and conclusory, rather than providing the public and commission with useful information regarding the natural hazards. What does it mean that FERC staff "evaluated potential … design to withstand impacts from natural hazards?" DEIS, 4-734. CO-67

**b. Earthquakes, Tsunamis, and Seiche**

The Draft EIS is extremely understated about the truly alarming risk of Cascadia Subduction Zone earthquake and associated tsunami. *See* DEIS 4-734 et seq. At the outset of this issue we note that the hazard is framed in a narrow and overly restricted way. Rather than evaluate consequences of a range of foreseeable scenarios, and plan for the hazard in the context of wider emergency response planning for a major CSZ event, Jordan Cove has contracted for its own narrow analysis of this location.

In any case relying on the applicant alone is misguided here, where scientific knowledge is advancing, uncertainty is high, and there is wide expertise among the commenting public. Please do not rely on Jordan Cove's assessment alone. *See* DEIS, 4-735 (relating We are concerned that Jordan Cove is relying on much smaller design earthquakes than could likely occur. Please evaluate earthquake hazard under the very-large earthquake possibilities, using best-available science. CO28-68

For example, all of the later modeling and hazard planning is on the assumption that there are no faults and nor risk of faulting below the facility. DEIS, 4-735. However, because of the deep sand, investigations actually were not able to determine whether or not there was historic faulting. DEIS 4-736. That uncertainty needs to be closed as much as possible with the best available science, and the reliability of the resulting information disclosed in a NEPA document for public review. CO28-69

The Draft EIS does at least recognize that a CSZ earthquake is likely during the lifetime of the project, although the assumptions are not clearly presented. DEIS, 4-736. The best available science, which is subject to change and uncertainty, indicates a range of likely earthquake intensities. According to US Geological Survey's 2009 Earthquake Probability Mapping there is a 10% chance of a greater than 5.0 magnitude earthquake in the CSZ in the next 30 years. This probability increases as the years go on with a 20-25% chance in the next 50 years and a 30-40% chance in 100 years. A recent study based on 13 years of research finds that the Coos Bay area is CO28-70

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CO28-66 To meet 18 CFR §380.12(m) and 18 CFR §380.12(o)(14), Resource Reports 11 and 13 were submitted with the Project application. FERC staff review of the site-specific design information in these resource reports has been summarized in the reliability and safety section of the final EIS, including the basis of design of the facilities to withstand or be protected from various natural hazards, such as earthquakes and tsunamis, described in both terms of magnitude and likelihood. USDOT PHMSA's Letter of Determination addresses the Project's compliance with 49 CFR 193 Subpart B siting requirements. USDOT PHMSA's 49 CFR 193 regulations have incorporated the 2001 edition and portions of the 2006 edition of NFPA 59A.

CO28-67 See comment response CO28-66.

CO28-68 See comment response SA2-309.

CO28-69 See comment response SA2-307.

CO28-70 See comment response CO28-47.

**CO28 continued, page 42 of 302**

more vulnerable than northern stretches of the CSZ, and concludes that there is a 40 percent chance of a major earthquake in the Coos Bay region during the next 50 years.[28] The study author, Chris Goldfinger, a professor at Oregon State University, states that "major earthquakes tend to strike more frequently along the southern end – every 240 years or so – and it has been longer than that since it last happened."[29] Forecasts predict that the CSZ is due for an earthquake similar in strength to the 9.0 magnitude earthquake felt off the coast of Japan in March 2011. A high magnitude earthquake would create several different conditions that may severely impact the stability of the terminal and pipeline.

It isn't quite clear what earthquake intensities Jordan Cove planned for or modeled, or how their assumptions compare with other available planning assumptions. Following regulatory guidance from DOT, the operating basis earthquake is quake of a 10% probability in 50 years (475-year return interval) and the SSE (safe shutdown earthquake) is of a 2% probability n 50 years (2,475-year return interval quake. DEIS, 4-736. Elsewhere it is explained that both quakes correspond to a magnitude 6 or greater quake. DEIS, 4-738. Please disclose and consider the likelihood of earthquakes (and tsunami) on using the conservative end of the best-available science.

CO28-70 cont.

Rather than plan for a single design earthquake of only a moderate size, please analyze and disclose earthquake likelihood on a sliding range. We are concerned that, for whatever reason, the DEIS only considers two design earthquake intensities, neither of them reflecting the unhappy end of the predicted range of likely CSZ events. For example, on page 4-737 the DEIS says (in passing) that the OBE and SSE provided by Jordan Cove are only 80% of the values from ATC/USGS websites. DEIS, 478. Please clearly disclose and discuss the operating basis earthquake and tsunami events. Please ensure Jordan Cove plans and builds for a conservative assumption, and explain in a NEPA document what the resulting effects might be under different size earthquakes.

Stability of facilities against earthquakes is presented in a vague and conclusory manner, and the likely effects never are disclosed or evaluated. The obvious conclusion is stated in a vague way at the end of a paragraph, buried among technical jargon and citations, where it is recognized that, in light of CSZ risk and local soils, "the seismic risk to the site is considered high." DEIS, 4-737. The risk of what!? What is the range of outcomes of earthquakes that the applicant is planning for? That risks ought the public to know about and the commission to consider?
It is unclear why FERC believes that the initial information presented by the applicant is sufficient to make the determination that the site is suitable for this project, given the proximity of the Coos Bay communities and infrastructure, risks and probabilities of a major megathrust earthquake at this location, and hazardous soils. The DEIS does discuss for several pages FERC staff reviews of various seismic hazard studies, in its characteristic conclusory fashion, but even this does not seem to support a conclusion that the location is suitable. *See e.g.* DEIS, 4-738

[28] Goldfinger, et al., Turbidite Event History – Methods and Implications for Holocene Paleoseismicity of the Cascadia Subduction Zone, in EARTHQUAKE HAZARDS OF THE PACIFIC NORTHWEST COASTAL AND MARINE REGIONS. USGS PROFESSIONAL PAPER 1661 (Robert Kayen, ed.) July 17, 2012.
[29] Oregon State University Press Release, 13-Year Cascadia Study Complete – And Earthquake Risk Looms Large (Aug. 1, 2012). Available at http://oregonstate.edu/ua/ncs/archives/2012/jul/13-year-cascadia-study-complete-%E2%80%93-and-earthquake-risk-looms-large

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("site would experience…violent shaking and a potential for heavy damage to structures.") (identifying site as design category D and risk category of II, III or IV).

We are very concerned with liquefaction risks on the site, especially in combination with tsunami risk and other hazards. The Jordan Cove LNG Terminal will be constructed on dredged spoils. This poses a threat from earthquake liquefaction hazards which occur when water-saturated sediment is exposed to strong seismic shaking. The shaking causes the grains to lose grain-to-grain contact and the sediment acts as a fluid. Liquefaction is more likely in loose sandy soil with a shallow water table. Liquefied sediment layers may vibrate with displacements large enough to rupture pipelines, move bridge abutments, or rupture building foundations. The liquefaction concern is especially dire when seen in context and the indirect and cumulative effects emerge. How do we empty damaged tanks if the marine slip is closed up? If an earthquake hits in combination with a tsunami, how might liquefaction change exposure to inundation in the tsunami? The discussion in the Draft EIS is inadequate. Even though a high hazard seems to exist, no risk or possible ill consequences are presented. *See e.g.* 4-739 (explaining the presence of liquefiable soils, then pivoting on supposed mitigation with "deep soil mixing or… deep foundations" and a "permanent sheet pile wall" at the marine berth. *Id.* Such blind reliance on mitigation, without even disclosure of possible impacts, does not comply with NEPA. CO28-71

We are concerned with the risk of cascading fires or large leaks from the facility in the event of an earthquake, which could very quickly and easily impact the public offsite. The Coos Bay area has a population of about 31,750 according to the 2010 Census. There are residential areas, businesses, and an airport all located within half a mile of the Jordan Cove site. The Jordan Cove site will include two large LNG storage tanks, the liquefaction terminal, pipeline connections, marine facilities, and a natural gas fueled power plant. Disruption of the site from earthquake or tsunami could compromise the integrity of any of these components and possibly lead to leaking of gas or LNG, disruption in power service to the local grid, gas explosion or other catastrophic event. A hazardous event at the site could seriously impact the safety and infrastructure of the surrounding area. CO28-72

The DEIS entirely fails to address effects of LNG tankers as related to an earthquake. What risks attend loading an LNG tanker in the event of an earthquake? How do response times compare with warnings for earthquakes? Is the loading process, which is not under the same DOT jurisdiction, designed to meet the same operating and safe shutdown standards for earthquake? CO28-73

The important cumulative effects regarding earthquake planning are entirely missed by the Draft EIS. Indirect and cumulative effects are missed in several important ways, including: CO20-74

- Effect of the proposed action (LNG tankers, facility, and pipeline) on earthquake/emergency preparedness (e.g. redirecting response resources; introducing new and difficult-to-handle hazards);
- The combined effects of earthquake, tsunami, and liquefaction, under actual operating conditions (i.e. tanker tied up and loading);
- Redirection of response personnel and resources to the project site, where they are at increased exposure to earthquake and tsunami risk;

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CO28-71 A comprehensive geotechnical investigation has been performed and reviewed. Also, see comment response CO28-47 for Tsunami and Seismic responses.

CO28-72 See comment responses CO28-23; CO28-24 and CO28-47.

CO28-73 For LNG marine vessels docked at the facility, Jordan Cove would install powered emergency release coupling (PERC) valves on each LNG marine vessel loading arm connection. In the event a seismic event, ship loading operations would be shut down and a breakaway of a LNG marine vessel would activate the PERC valves on each marine arm that would instantaneously close the connections and isolate the LNG flow with minimal release of LNG.

CO28-74 As discussed in the final EIS, emergency response plans would be developed in coordination with local, state, and federal agencies, including response to natural hazards and potential evacuation routes. In addition, the impacts to natural hazards, including earthquakes, tsunamis, and potential for liquefaction are discussed.

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- Ability to adequately evacuate, in light of need for response resources in the area (emergency center, navigation channel, airport).

CO28-74 cont.

Please consider the earthquake hazard including in the context of larger regional exposure to the CSZ, including attendant **tsunami risk**. Numerous factors inherent in the location at Jordan Cove and Coos Bay estuary make it extremely vulnerable to earthquake and tsunami hazard.

**First, a large earthquake and tsunami must be viewed as reasonably foreseeable**. The level of risk, while inherently uncertain, can be objectively quantified. The Cascadia Subduction Zone (CSZ) off the Oregon Coast makes large earthquakes inevitable.[30] Modeling shows a significant probability— on the order of 40% in 50 years — of large earthquakes hitting the Coos Bay area during the life of this project.[31] When (not if) an earthquake hits, the chances of a tsunami hitting Coos Bay are high. The State of Oregon has invested significant effort to quantifying tsunami risk.

Distant tsunamis caused by earthquakes on the Pacific Rim strike the Oregon coast frequently but only a few of them have caused significant damage or loss of life. Local tsunamis caused by earthquakes on the CSZ happen much less frequently but will cause catastrophic damage and, without effective mitigation actions, great loss of life.

With respect to distant sources, Oregon has experienced 25 tsunamis in the last 145 years with only 3 causing measurable damage. Thus, the average recurrence interval for tsunamis on the Oregon coast from distant sources would be about 6 years. However, the time interval between events has been as little as one year and as much as 73 years. The two most destructive tsunamis occurred only 4 years apart (1960 and 1964) and originated from two different source areas (south central Chile and the Gulf of Alaska). Because only a few tsunamis caused measurable damage, a recurrence interval for distant tsunamis does not have much meaning for this region with respect to losses. However, every time NOAA issues a distant tsunami warning for the coast, evacuation plans are triggered at significant cost to local government and business.

Geologists predict a 10% chance that a CSZ tsunami will be triggered by a shallow, undersea earthquake offshore Oregon in the next 30 years, causing a tsunami that will strike all parts of the Oregon coast about 15–20 minutes after the earthquake. This forecast comes from the 10,000-year geologic record of 19 CSZ fault ruptures extending the entire length of the Oregon coast (i.e., recurrence of approximately 500 years)

[30] Cascadia Subduction Zone. Pacific Northwest Seismic Network. https://pnsn.org/outreach/earthquakesources/csz.
[31] *See* Goldfinger, *et al.*, *Turbidite Event History – Methods and Implications for Holocene Paleoseismicity of the Cascadia Subduction Zone*, in EARTHQUAKE HAZARDS OF THE PACIFIC NORTHWEST COASTAL AND MARINE REGIONS, USGS PROFESSIONAL PAPER 1661 (Robert Kayen, ed.) July 17, 2012.; Chris Goldfinger, 13-Year Cascadia Study Complete – And Earthquake Risk Looms Large, OREGON STATE UNIVERSITY NEWSROOM (Aug. 1, 2012), http://oregonstate.edu/ua/ncs/archives/2012/jul/13-year-cascadia-study-complete-%E2%80%93-and-earthquake- risk-looms-large; Goldfinger, C., et al. (2017) The importance of site selection, sediment supply, and hydrodynamics: A case study of submarine paleoseismology on the northern Cascadia Margin, Washington USA. Marine Geology: http://dx.doi.org/10.1016/j.margeo.2016.06.008; Schmalzle, G.M., et al. (2014) Central Cascadia subduction zone creep. *G3 Geochemistry, Geophysics, Geosystems*. DOI: 10.1002/2013GC005172.

(DOGAMI, 2009). As previously mentioned, the southern Oregon coast has a higher chance of experiencing a local tsunami and earthquake, the probability increasing progressively southward. The last CSZ event occurred approximately 300 years ago (Satake et al., 1996).

Owing to much faster arrival and generally larger size, tsunamis originating from the CSZ will cause much larger life and property losses than most distant tsunamis and are at least as frequent as the largest distant tsunamis. Inundation from the largest distant tsunamis approximates inundation from the "Small" Cascadia tsunami on Oregon Tsunami Inundation Maps (TIMs). Oregon Natural Hazards Mitigation Plan 2015, pp.373 – 74.

The DEIS inadequately presents the risk of tsunami here. One problem relates to optimistic assumptions regarding maximum wave height. The Draft EIS recognizes the tsunami risk generally, referring to Jordan Cove modeling showing that a tsunami could not reach run-up elevation of more than 34.5 ft. DEIS, 4-739. First, such hydrodynamic models are subject to a high degree of uncertainty, and the result depends largely on the size of design earthquake that was used. That uncertainty is not acknowledged. Second, other sources appear to show much higher potential wave heights, giving rise to the question of Jordan Cove's operating assumptions. *See e.g.* Tsunami Inundation Map, State of Oregon DOGAMI, 2012. The DEIS discusses a few of the parameters and says that FERC staff found the tsunami elevation "suitable" for the project site. DEIS, 4-740. CO28-75

Please evaluate the quality of that information, and gaps and uncertainties associated with information, under NEPA. This information is essential to meaningful public comment. As a general rule increasing the width and depth of the channel will tend to increase the amplitude of the tsunami as it strikes upstream facilities. This project presents potentially extreme hazards to the local community. The project site on the North Spit is located at a bend in Coos Bay, where tidal energy is deflected. The elevation of the land at this location could significantly alter the direction and velocity of an incoming tsunami. For example, instead of running up onto the North Spit and inundating the land there, the proposed sand wall, if it survives the liquefaction and lateral spreading effect of the earthquake, would deflect and redirect the force of a tsunami. The deeper channel could increase the amplitude of that deflected energy. The proposed significant alteration of the shoreline at this location could have important effects on the inundation of other areas within the Bay Area communities. In other words, the risks of these types of hazards extend beyond just the inundation, liquefaction, and ground shaking at the project site. The project's proposed alterations of the shoreline at the project location could have significant impacts to the communities of the Coos Bay area. The application does not provide information to tell, and does not suggest this factor has been considered. Jordan Cove's hydrodynamic analysis does show that proposed dredging and fill associated with the project will change currents at various points in the estuary, generally increasing them. Even that does not include the large dredging project, ostensibly proposed by the Port. It says nothing explicitly about behavior in tsunami. The access channel changes combined with a relatively large amount of erosion and deposit of sediment, the new slip and LNG facility, introduces new hydrologic features that could behave in unpredictable and potentially deadly ways in a tsunami. The general trend, showing changes to sediment erosion & deposition and increased currents, is CO28-76

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CO28-75 As discussed in the final EIS, LNG facilities are designed to be resilient against an approximate 2,500 year tsunami event. This return period is consistent with FERC guidance and the most up to date American Society of Civil Engineers (ASCE) 7 structural code for the most critical infrastructure with the highest consequences. ASCE 7 is the most commonly referenced structural code and other infrastructure with lower consequences would not need to be designed to be resilient against the same event. A tsunami study was performed and filed publicly in the application as appendix 13.I. A seismic study was performed and stamped by a licensed engineer, also filed publicly in the application as appendix I.13. The impact on the estuary was developed and included in the dame appendix I.13 and was stamped and sealed by a professional engineer.

CO28-76 The proposed Project would not change the natural behavior of tsunami. See comment response SA2-324.

enough to say now that unconsidered channel dredging impacts to tsunami behavior represent a significant public health and safety impairment.

> Deepening of channels by dredging to improve navigability also enables greater penetration of tsunami energy into the harbor. Similar problems occurred along major rivers, e.g., the Mississippi River, when construction of levees restricted the channel width, negating the purpose of natural flood plains to distribute and absorb the excess water volume during major floods (e.g., severe flooding in the Midwest and South in 1973 [2]).

CO28-76 cont.

Barberopoulou, A., Legg, M., & Gica, E. (2015). Time evolution of man-made harbor modifications in San Diego: Effects on tsunamis. *Journal of marine science and engineering*, 3(4), 1382-1403. Don: 10.3390/jmse3041382.

Second, a tsunami hitting Coos Bay is predicted to be enormously destructive. Cumulative Effects are not addressed - CSZ Event would be Broadly Destructive – overwhelming response resources. *See e.g.* Oregon Natural Hazards Mitigation Plan, pp.373 – 74, 2015, According to the State of Oregon, "The entire coastal zone is highly vulnerable to tsunami impact." Oregon Natural Hazards Mitigation Plan 374, 2015. A tsunami would be a regional disaster event. An earthquake and/or tsunami that impacted this facility is also expected to have wide-ranging impacts, especially on the coast. According to the Oregon Natural Hazards Mitigation Plan (2015), p.290:

Tsunamis may take the form of distant or local events. The CSZ earthquake and local tsunami event have the potential to affect the entire coastline through severe ground shaking, liquefaction of fine- grained soils, landslides, and flooding. In addition to causing significant loss of lives and development, a CSZ earthquake and local tsunami would dramatically affect the region's critical infrastructure, including principal roads and highways, bridges, tunnels, dams, and coastal ports. The region has the most seismically vulnerable highway system in the state. Seismic lifelines will be fragmented along US-101 and along east-west routes that connect the region to the rest of the state.

CO28-77

There are 1,300 state facilities in Region 1. Of these, the following are in earthquake or tsunami zones:

- All 1,300 state-owned/leased facilities, valued at over $336 million, are in the earthquake zone. Of these, 186 are critical/essential facilities.
- 676 state-owned/leased facilities, valued at approximately $134 million, are in the tsunami hazard zone. Of these, 98 are critical/essential facilities.
- In addition, there are 913 non-state-owned critical/essential facilities in the earthquake hazard zone. Of these, 243 are in the tsunami zone.

The destruction caused by a Tsunami is likely to be much worse as a result of the hazard introduced LNG terminal and pipeline operations. Even in the best case the likely emergency response measure is going to be evacuation from the area around the LNG terminal, but that





CO28-77 See comment response CO28-75.

shuts down the estuary and perhaps even the airport. This hazard is entirely ignored by the Draft EIS.

The Draft EIS entirely fails to discuss or consider the indirect effects of tsunami and earthquake on the surrounding area. Inundation of a large part of the sand spit that the facility is built on, and the road in and out, and the area airport, with all the debris and assorted flotsam and jetsum associated with a tsunami, is going to significant impact on terminal operations. Even the capability to shut down safely after an earthquake and tsunami is not addressed.

CO28-77 cont.

Third, this LNG facility is directly exposed to tsunami risks in many ways. During-construction risks are uniquely large, as well as operations near the marine areas during loading. Effectively all of the terminal work occurs in mapped tsunami inundation zone, and the on-water work will obviously be directly subject to tsunami risk as well. The APCO site, the trans-pacific parkway/Highway 101 interchange, and on the North Fill area are all in tsunami exposure zones. Earthquake and/or Tsunami response during dredging is not addressed in their applications, imposing yet another public safety and navigation cost of the project. Anchored dredges and long slurry lines through the bay would obviously be both themselves at risk during an event, and potentially pose additional hazard to others.

CO28-78

The proposed mitigation of a protective berm seems a bit absurd. Please analyze and discuss the likely reliability of that envisioned mitigation. The bottom of the LNG storage tanks are only 20 ft above sea level, and failure of that mitigation could be catastrophic.

CO28-79

The Draft EIS entirely fails to address what might happen to an LNG tanker in a tsunami. This is a major omission that needs to be corrected. Nothing in the Coast Guard planning provides adequate assurance. As explained in the summary, "What happens to an LNG tanker in a tsunami?" by expert Brentwood Higginbotham, PhD, tankers would be exposed to risky tsunamis, especially if they are in the channel but also in dock. Even without a tank rupture, the presence of a tanker in the estuary would be a major added hazard.

CO28-80

**c. Hurricanes, Tornadoes, and other Meteorological Events**

The Draft EIS discussion of storms, DEIS, 4-740 – 4-744, while relatively lengthy, never does present the relative risk of storms, or explain the objective basis for assumptions about likely wind speeds. The DEIS tells us the details of the wind speeds assumptions in various contexts, but without saying in plain English what the relative risks, or the available mitigation or alternatives, are. While not subject to hurricanes like the Gulf Coast, the coast can see very strong gusts and occasional sustained strong winds, so the facility should be built to withstand it. It appears that Jordan Cove is hoping to rely on only regulatory compliance, and even that to weaker standards, which increases our concern.

CO28-81

The wind hazard in relation to the LNG vessels is one of the major everyday safety hazards associated with the proposed operation, and it is a major omission from the Draft EIS. Please disclose and discuss the planning assumptions that were made with regard to wind impacts on LNG tankers, and explain the risks of high wind gusts causing tanker casualties.

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CO28-78 Emergency response plans would be largely developed prior to initial site preparation with periodic meetings in consultation with local, state, and federal agencies. Emergency response to natural hazards is a normal part of emergency response plans.

CO28-79 The LNG storage tank basins would have an elevation of approximately +27 feet NAVD 88 that would be surrounded by a tertiary protective berm with a crest elevation of no less than +46 feet NAVD 88. Preliminary design of the associated geotechnical and structural design has been evaluated and the final design, including calculations, is recommended to be provided, stamped and sealed by a professional engineer of record in the state of Oregon, prior to construction of final design. FERC staff also recommend a special inspector during construction for added quality assurance and control.

CO28-80 It is anticipated that any effects from a tsunami event would be similar to effects on other sea faring vessels such as cargo carriers, oil tankers, cruise ships, etc. However, these other sea faring vessels typically do not consist of double hull design present in LNG marine vessels. The LNG facilities would be designed to be resilient against a 2,500-year event as described in the final EIS. A tsunami study was performed and filed publicly in the application as Appendix 13.I. A seismic study was performed and stamped by a licensed engineer, also filed publicly in the application as Appendix I.13. The impact on the estuary was developed and included in the dame Appendix I.13 and was stamped and sealed by a professional engineer. Also, see response to CO28-75.

CO28-81 A wind speed assessment was performed and filed publicly in the application as Appendix I.13. DOT PHMSA regulations require the LNG facilities to be designed against a 10,000-year mean recurrence interval (MRI), which exceeds the most up to date American Society of Civil Engineers (ASCE) 7 structural standard adopted by most states, which requires a 3,000-year MRI for the most critical infrastructure with the highest consequences. The final EIS also compares the wind speeds to more common contexts, such as hurricane Saffir Simpson categories even though hurricanes would not occur on the West Coast due to different weather patterns. The final EIS also describes wind speed relative to tornadic events and frequencies. The Coast Guard has also reviewed the suitability of the Coos Bay Channel for LNG marine vessel transits. This review considered high wind conditions and concluded that LNG marine vessels would require tug boats to escort and dock them. The Coast Guard review also would limit LNG marine vessel transits during high wind conditions.

The DEIS discloses that the project is not planned to survive a tsunami that occurred during a storm surge. Storm surge can be as high as 24 ft. at the project site, so a tsunami on top of it could easily swamp the protective berm. In light of the decision not to plan for that event, please disclose the consequence of tsunami (or storm surge) that inundated the facility. CO28-82

**d. External Impact Review**

The Draft EIS includes a strange section assessing potential impact from external events (DEIS 4-745 – 4-749). For some reason, , here we see detailed mathematical descriptions of projectile ranges as related to fireball diameters. That detail is perplexing, especially because the fire effects of releases from the facility itself were so meticulously avoided.

The mathematical details here are interesting, however, and suggest to us that the range of possible consequences of releases includes truly massive fireballs and hurling objects.
In regards to pipelines it is a perplexing omission and serious error that the proposed Pacific Connector pipeline is not considered in terms of external impact review. The end of the line is a location that is especially prone to explosions and other disasters, and at this complex and unique facility and risks are even higher. The connection of the pipeline, LNG facility, and LNG tankers are three locations where a proper focus on process safety would have revealed a need for special focused attention CO28-83

**e. On-site and Offsite Emergency Response Plans**

The Draft EIS describes emergency response planning regulations as though the field is covered, when anyone in that field can tell you that it isn't. DEIS, 4-753 – 4-755. During the recent revision to the Northwest Area C-plan under OPA-90, for example, the Coast Guard didn't even know whether that plan addressed LNG or not. LNG-specific regulations remain a blank spot in Oregon law. LNG response isn't addressed in interagency response plans in Oregon.

Even where other plans do exist, other responders generally aren't prepared to address unique LNG risks. Normal fire-fighting is largely inapplicable to LNG fires. Beyond vague and conclusory assurances that the necessary training and equipment will be provided, we have seen no indication that area emergency responders will be equipped to respond to emergencies. Many of the basic needed facilities just don't exist, which presents uniquely higher risks. At the most basic level, the Coos Bay area doesn't even have a burn ward, should there be any injury in any sort of fire. Transportation options are limited and the location is remote from industrial centers. Local communities struggle just to keep the lights on, let alone to keep tabs on a hazardous industrial facility. CO28-84

The Coos Bay Geographic Response Plan, part of the Northwest Area C-plan by the Northwest Area Committee, for example, which is touted by the applicant as representing preparedness, is specific to liquid spills, and so is largely inapplicable to LNG spills or gas leaks.

The existing response planning too shows the generally overloaded nature of emergency response capability. As discussed above in the context of tsunami and earthquake response, response resources in this area are susceptible to being rapidly overwhelmed.

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CO28-82 Load combinations and load factors are dictated by American Society of Civil Engineers 7 structural code. The load combinations would call for a combination of loads, including a combination of wind and flood loads with other basic loads. However, the natural hazards described in the final EIS would be from very low frequency events often with other already conservative low likelihood worst case assumptions and the likelihood of two or more extreme events, such as seismic and wind and flood coinciding would be even less likely and would not be considered credible and therefore would not be required to be considered at full load factors. We note that ASCE 7 and its load combinations and load factors are used to design a multitude of buildings and structures based on occupancy/risk categories and LNG facilities exceed those requirements even for the most critical infrastructure with the highest consequences.

CO28-83 Section 4.13.2 of the final EIS discusses the proposed Project pipeline. Specifically, USDOT safety standards under 49 CFR 192 would apply over the entire pipeline route, including at the proposed LNG terminal site. The pipeline into the facility would also include a High Integrity Pressure Protection Systems (HIPPS) that would protect the facility from high pressure events. The U.S. Coast Guard has prepared a letter of recommendation to the FERC indicating the waterway is suitable for the type and frequency of LNG marine vessels proposed. For LNG marine vessels docked at the facility, Jordan Cove would install powered emergency release coupling (PERC) valves on each LNG marine vessel loading arm connection. In the event a tsunami event causes a breakaway of a LNG marine vessel, the PERC valves on each marine arm would instantaneously activate and isolate the LNG flow with minimal release of LNG. For reference, see Golar Freeze incident in the LNG Marine Vessel Historical Record section of the final EIS. While LNG marine vessels are in transit, it is anticipated that any effects from a tsunami event would be similar to effects on other sea faring vessels such as cargo carriers, oil tankers, cruise ships, etc. However, these other sea faring vessels typically do not consist of double hull design present in LNG marine vessels. As stated in section 4.13.1.3, LNG marine vessels have transported LNG since 1959 without a serious accident at sea or in port which has resulted in a spill due to a release from the LNG marine vessel's cargo tanks. Lastly, if there is a large enough tsunami event that would damage a LNG marine vessel, the incremental risk as a result of damage to the LNG marine vessel would likely be relatively small compared to the consequences of the tsunami event itself that could trigger such damage.

CO28-84 As discussed in the Onsite and Offsite Emergency Response Plans of the final EIS, and in accordance with EPAct 2005, the emergency response plan as well as cost sharing plan must be filed prior to construction. EPAct 2005 also stipulates that the emergency response plan develops with consultation with Coast Guard, state agencies, and local agencies. As recommended in section 4.13.1.6 of the final EIS, the progress in finalizing the emergency response plan and the cost sharing plans would be provided to FERC staff at 3-month intervals.

Evacuation-related problems are a particularly significant emergency response deficiency, that is not addressed in the Draft EIS. There are many situations in emergency response to LNG or gas leaks and fires that call for evacuation from the area.

The DEIS says that Jordan Cove submitted a draft ERP that would address emergencies and potential releases, and FERC appears poised to consider that adequate pending a few recommendations for filing updates. Information regarding this planning is essential to meaningful comment, and it needs to be included in a NEPA document for public review. We challenge any idea that there is a robust collaboration of Jordan Cove and emergency responders, and emphasize for the commission that this project is going to have to plan to bring all of its own emergency response with it.

CO28-84 cont.

**f. FERC recommendations**

The DEIS section 4.13.1.6 (pp. 4-755 - 768) contains a long list of recommendations for various measures at various times. A mere listing of mitigation measures, without consideration or discussion of their role and effectiveness, fails to meet the hard look duty under NEPA.

Many of the provisions relate to studies and information regarding hazards that Jordan Cove needs to provide. *See e.g.* DEIS, 4-755 (vapor dispersion modeling, etc.) This information needs also to be provided to the public. Also, relevant portions of that information needs to be included in the NEPA document itself to enable public comment and commission understanding of the issues.

CO28-85

We are concerned that the project leaves so much back-loaded work to be done, and the management-of-change procedure is so vague, that later information and changes to the project will result in unforeseen changes and unevaluated risks. As explained above, the analysis under 40 CFR 1502.22 of missing information needs to be done specifically for the many recommendations for later information. Where important steps are necessarily forced into the future, please meet the duty now to disclose the likely impacts.

**5. Social Welfare & Public Safety.**

Construction of oil and gas infrastructure, including processing plants, export terminals, extraction sites and pipelines, requires a large influx of labor with frequently unforeseen impacts on local communities. Temporary labor camps associated with fracked gas facilities impose outsized impacts on local infrastructure, public services, and public health through increases in crime, drug use, assaults, kidnapping, sex trafficking, and sexually transmitted infections. Native American communities, especially women and girls, have suffered disproportionately from these impacts.

The influx of labor necessitates temporary housing and makes demands on local communities to provide for and adjust to the sudden increase in population and need for services. Frequent reports in the past ten years have documented burdens on local infrastructure, public services and

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CO28-85 The Project application consisted of a preliminary Front End Engineering Design (FEED) and provided site-specific details necessary to confirm that the Project would consist of a feasible design. The FEED and associated layers of protection that would mitigate potential public safety impacts are described in the Reliability and Safety section, including relevant codes, standards, and recommended and generally accepted good engineering practices and areas identified by FERC staff that may need enhancing, including elements that are subjective or not addressed in codes, standards, and recommended and generally accepted good engineering practices. If authorized, the Project has committed to conducting additional design work during final design that would not result in changes to the siting considerations, basis of design, operating conditions, major equipment selections, equipment design conditions, or safety system designs considered during the FERC review. The list of recommendations in the final EIS directs the Applicant to take certain actions to enhance the reliability and safety of its facilities and/or ensures that the Project addresses requirements that would normally be developed in final design after FEED and would be submitted for review and approval by FERC staff. Also, as described in the final EIS, FERC staff would require a change log for items that change from FEED to final design and would use recommended and generally accepted good engineering practices, such as American Institute of Chemical Engineers Guidelines on Management of Change in its evaluations.

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public health and increasingly on nearby tribal communities through increases in crime, drug use, assaults, kidnapping, sex trafficking, and sexually transmitted infections (STI).

- In Williams County, North Dakota, in the Bakken Shale, increases in crime have corresponded with the flow of oil. The infusion of cash has reportedly attracted career criminals who deal in drugs, violence, and human sex trafficking. In 2014 the *Williston Herald* portrayed the rapid rise of "violent crimes that result in the immediate loss of an individual's property, health or safety, such as murder, larceny and rape." With fewer than 100 law enforcement personnel, crime in Williams County "has risen in kind with the county's population, but funding, staffing and support training for law enforcement has not."[32]

- According to the North Dakota Health Department, the number of HIV and AIDS cases in North Dakota more than doubled between 2012 and 2014, and cases were shifting to the state's western oil fields, where 35-40 percent of all new cases occurred. Previously, only 10 percent of cases were in that region.[33] This trend followed on the heels of an upsurge in sexually transmitted chlamydia cases in the same region. The North Dakota state director of disease control, Kirby Kruger, attributed the uptick in HIV cases to the drilling and fracking industry and attempted to spread HIV prevention messages at the "man camps" that house young male workers in the oil industry.[34] Human sex trafficking accompanied the fracking boom, but a shortage of medical professionals hampered response to the public health crisis, according to Kruger, who noted that it was difficult to hire nurses and medical staff who could live in the area on a public health wage.

- In 2017 the Southwest Pennsylvania Environmental Health Project established a voluntary public health registry to track and analyze impacts of shale gas development on people living near gas production facilities. According to a spokesperson, "The vast majority of independent science is looking at [shale gas development] and saying something's not good there. We need to know more … The findings of this registry will allow the health care community to be more informed about what problems people are experiencing when they walk into their offices."[35]

- Sexually transmitted infections (STI) can increase through sexual mixing patterns associated with labor migration. A longitudinal, ecologic study was conducted from 2000–2016 in a prolific shale gas region situated in Ohio. Reported cases of chlamydia, gonorrhea and syphilis by county and year were obtained from the Ohio Department of Health. All 88 counties were classified as none, low, and high shale gas activity in each year, using data from the Ohio Department of Natural Resources.

[32] (Bell, 2014) Retrieved from http://www.willistonherald.com/news/modernized-slavery/article_84e257d8-3615-11e4-a4f8-001a4bcf887a.html
[33] (Associated Press, 2014) Retrieved from http://billingsgazette.com/news/state-and-regional/montana/north-dakota-hiv-aids-rate-rises-with-population- growth/article_a939fcd6-f737-5cfb-957f-ab800673f4d7.html
[34] (Heitz D. , 2014)
[35] (Hopey, 2017)

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Compared to counties with no shale gas activity, counties with high activity had 21% increased rates of chlamydia and 19% increased rates of gonorrhea.[36]

One of the underreported effects of the fracking boom is the strain on the area's healthcare system. Motor vehicle accidents and deaths, for example, are many times higher for oil and gas workers than workers in other industries, leading to over-burdened hospitals and emergency response services. One study found oil and gas workers died from work-related motor vehicle accidents 8.5 times more frequently than other wage and salary workers.[37]

The Methodist Healthcare Ministries executive report of the South Texas Community Needs Assessment describes the consequences of the fracking boom on healthcare in rural Texas counties near the Eagle field shale (EFS) area. Results include:

- Increased STIs (rates of chlamydia in part of the EFS area is 365 per 100,000 people—compared to a national average of 84 per 100,000).
- Increases in the number of uninsured patients, as much work in the oilfield is done by subcontractors who do not have health insurance. Additionally, workers in the industries that have grown to provide services to oil field workers are generally uninsured. At a single site in the study, the percentage of uninsured patients grew from 60 percent in 2011 to 74 percent in 2013. Across the study, self- pay, and charity cases increased 11%.
- Increases in heat exhaustion, dehydration, sleep deprivation, exposure to oil and gas spills, and accidents.
- Increase in traffic accidents. In one county, accidents increased 412% between 2009-2011.

The impact on hospitals has also been described in the Bakken oil field region of North Dakota:

- Trauma services have increased in some rural areas by over 1000%. Half these trauma visits are attributed to oil field injuries, though many are drug overdose related.
- In North Dakota between 2012-2014 HIV/AIDS cases doubled. 35% occurred in the western oil fields, the site of large "man camps" which had already seen a significant increase in chlamydia cases.

Reports are emerging of disproportionately severe trauma to tribal communities near temporary labor camps. In January 2014, James Anaya, the United Nations special rapporteur, opened the meeting of the UN's Permanent Forum stating: "It has become evident … that extractive industries many times have different and often disproportionately adverse effects on indigenous

[36] (Deziel N.C., 2018) https://doi.org/10.1371/journal.pone.0194203
[37] (Retzer, 2013)

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peoples, and particularly on the health conditions of women." He detailed the effects on Native American women and girls, including increased rates of STIs and HIV/AIDS, physical assault, and sexual harassment and violence. He additionally noted that "contamination of indigenous lands and natural resources resulting from extractive activities has significant implications for reproductive health, having contributed in many cases to birth defects, delayed child development and disease among community members." In addition, he noted, the full range of health effects are yet to be determined, igniting fears among Native Americans about the unknown intergenerational effects that the contamination will have on their communities.[38]

A 2016 opinion piece in the *Boston Globe* exposed the risks Native American women faced due to the Dakota Access Pipeline: "It also endangers women and girls. That's because, in this country as around the world, extractive industries create so-called 'man camps,' places where male workers often work twelve-hour days, are socially isolated for weeks or months at a time, and live in trailers in parks that extend for miles. Many men retain their humanity, but as advocacy organizations like First Nations Women's Alliance have noted, these man camps become centers for drugs, violence, and the sex trafficking of women and girls. They also become launching pads for serial sexual predators who endanger females for miles around."[39]

In 2014 the U.S. Justice Department Office on Violence Against Women awarded three million dollars to five rural and tribal communities to prosecute crimes of violence against women and provide services to victims of sexual assault, domestic violence, and stalking in the Bakken Region of North Dakota and Montana.[40] Rationale documented by tribal leaders, law enforcement, and the FBI included, "rapid development of trailer parks and modular housing developments often referred to as 'man camps'; abrupt increase in cost of living, especially housing; rapid influx of people, including transients, in a previously rural and stable community; constant fear and perception of danger; and a lost way of life. Local and tribal officials and service providers reported that these changes have been accompanied by a rise in crime, including domestic and sexual violence."[41]

To address the community health and safety harms linked to temporary labor camps of extractive industries, the British Columbia Ministry of Aboriginal Relations and Reconciliation funded a research project in 2017, carried out in consultation with First Nations. The project noted that "increased domestic violence, sexual assault, substance abuse, and an increased incidence of sexually transmitted infections (STIs) and HIV/AIDS due to rape, prostitution, and sex trafficking are some of the recorded negative impacts of resource extraction projects, specifically as a result of the presence of industrial camps and transient work forces." The objectives of the project were to stimulate dialogue and to develop detailed protective steps for Nations, government, and industry in advance of the initiation of planned extraction projects in the region,

[38] (Rickert, 2014). http://nativenewsonline.net/currents/un-special-rapporteur-oil-gas-mining-operations-brings-increased-sexual-violence/

[39] (Nagle, 2016)

[40] (U.S. Department of Justice, 2014) Retrieved from http://www.justice.gov/opa/pr/associate-attorney-general-west- announces-3-million-grants-address-violence- against-women

[41] (U.S. Department of Justice. 2014) Retrieved from http://www.justice.gov/sites/defaultfiles/ovw/legacy/2014/04/25/fy2014-initative-for-the-bakken-region-enhanced-services-for-victims.pdf

in order to prevent violence against women and other life changing negative effects linked to the industrial camps.[42]

Jordan Cove LNG has applied for a permit for a 2100-person temporary labor camp to be built on the north sand spit in Coos Bay during construction of the fracked gas processing plant. Access would be limited to one way in and out. Access for emergency responders and escape for visitors and personnel in case of emergencies would be inadequate and present a serious danger. CO28-86

Proposed temporary housing would be serviced by new utilities including water supply and waste disposal. Will proposed utilities be adequate to handle a large influx of workers? If not, there is potential for negative impacts on the waters of Coos Bay, the estuary, and the ocean shore with the potential for contamination of soils and water as well as significant stress on the public water system by significantly increased usage. The large influx of labor will likely also place increased stress on the police, fire, and health resources of Coos Bay, North Bend, and surrounding communities. CO28-87

Many temporary labor camps may be needed to build the proposed Pacific Connector Pipeline, especially in rural areas in and near tribal lands, raising concerns of increased risks to rural communities of communicable diseases, crime, drug use, assaults, and homicides. Local communities do not have the resources or the ability to protect their community members, and public health resources are insufficient to respond to the projected adverse health impacts. CO28-88

**6. Occupational Health and Safety.**

When fossil fuel export projects are proposed, supporters emphasize economic opportunities, particularly job creation. What is left out of the discussion is how dangerous and unhealthy these jobs can be. Workers in the fossil fuel industry are exposed to myriad health risks and are killed on the job at rates four to seven times higher than other industries.[43]

The many detrimental health impacts of oil and gas field work are well studied and documented, including benzene exposure;[44] [45] silicosis;[46] endocrine disruption;[47] radiation and noise exposure;[48] exposure to hydrogen sulfide;[49] and increased overall mortality rates, especially due to work-related motor vehicle accidents.[50] [51]

With remarkable disregard for public health, the oil and gas industry, specifically, is exempt from disclosing the chemicals they use and from most federal statutes protecting worker, resident

[42] (Gibson, 2017) Retrieved from http://www.thefirelightgroup.com/thoushallnotpass/wp-content/uploads/2016/03/Firelight-work- camps-Feb-8-2017_FINAL.pdf
[43] (AFL-CIO, 2018)
[44] (Lombardi, 2014)
[45] (Esswein E. e., 2014)
[46] (Bang, 2015)
[47] (O'Neill, 2014)
[48] (Witter, 2014)
[49] (Cribb, 2017)
[50] (AFL-CIO, 2018)
[51] (Olsen, 2014)

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CO28-86 As part of its application, Jordan Cove indicated that the Project would develop a comprehensive ERP with local, state, and federal agencies and emergency response officials (see section 4.13 of the draft EIS). Jordan Cove would continue these collaborative efforts during the development, design, and construction of the Project. The emergency procedures would provide for the protection of personnel and the public as well as the prevention of property damage that may occur as a result of incidents at the Project facilities. The facility would also provide appropriate personnel protective equipment to enable operations personnel and first responder access to the area. Note also that as currently proposed, the temporary workforce housing facility would accommodate common facilities and 200 to 700 beds.

CO28-87 Water would be supplied to the proposed workforce housing facility from the existing Coos Bay North Bend Water Board (CBNBWB) water pipeline. Sanitary waste generated by the workforce housing facility would either be collected and taken off-site for disposal by a licensed contractor, or treated prior to discharge to the IWWP, and any solid waste would be disposed of off-site by a licensed contractor.

CO28-88 Impacts to utilities are addressed in sections 4.9.1.6 (LNG terminal) and 4.9.2.6 (Pipeline) of the draft EIS. No temporary labor camps are proposed other than the proposed workforce housing facility that would be located at the LNG terminal site. Concerns related to the influx of temporary workers are discussed throughout section 4.9 of the draft EIS.

and environmental health, including, but not limited to, the Clean Water Act, Clean Air Act, Compensation and Liability act and the Toxic Release Inventory.[52] Despite high mortality rates from fire and explosion, the oil and gas industry is also exempt from OSHA regulations called process safety management (PSM), which regulate industries to prevent workplace explosions.[53]

Diesel emissions expose large numbers of fossil fuel workers to known respiratory hazards. The US Department of Transportation (DOT), responsible for the health and safety of interstate truck and bus drivers, has neither a standard for diesel emissions nor other health standards with explicit exposure limits.[54] Nor does OSHA have any standard specifically for exposure to diesel exhaust.[55] Only a small proportion of the thousands of chemicals present in the gas and particulate matter of diesel emissions is covered by OSHA standards, and most of these standards require only that specified limits not be exceeded over an 8-hour work shift. Components in the gas phase rarely exceed their limits. Their greatest potential threat comes from their adsorption onto diesel engine particulates, bringing them deep into the lungs. This exposure is unlimited and unregulated. Similarly, for environmental contaminants, components taken separately rarely exceed their limits, but their threat is increased when combined with simultaneous exposure to other contaminants.

The oil and gas industry is currently exempt from much of OSHA's noise standards as well, despite numerous health risks to workers from noise levels resulting from drilling, heavy equipment, diesel engines, and pipe-fitting operations.[56]
The majority of jobs offered by the Jordan Cove project will come during the short-term construction of the facility (which is true of each of the proposed fracked gas projects). In its Resource Report 1, the parent company Pembina estimates an average of 1,023 construction employees per month over a five-year construction period. Work would include pile driving and dredging of the bay, road and infrastructure construction, and building the processing facility itself.[57]

While not a definitive accounting of all occupational risks, Jordan Cove exemplifies the specific risks to workers' health posed by projects of this scale:

- Acute and continuous exposure to diesel fumes, VOCs, and other toxic emissions from heavy construction machinery, high levels of bus and truck traffic, and the presence of two large diesel-fired generators as well as two black diesel backup generators.
- Nighttime use of vehicles and heavy equipment: dredging and pile driving of the bay is expected to occur 24 hours per day over two years. Many of the workers would be

CO28-89

[52] (Colborn, 2011)
[53] (Soraghan M. , 2015)
[54] (American Public Health Association, 2014)
[55] (U.S. Department of Labor: Occupational Safety and Health Administration, n.d.)
[56] (Witter, 2014)
[57] (Jordan Cove Energy Project L.P., 2017)



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CO28-89 Health and safety for workers is addressed in the Safety and Security Plan for the Project, which is included in the draft EIS as Appendix V to the Plan of Development (see appendix F.10 of the EIS). Reliability and safety are discussed further in section 4.13 of the EIS.

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temporary and come from out of county, likely commuting long distances and leading to higher risk of over-exhaustion and vehicular death.

- High noise exposure would occur from ongoing and wide use of heavy machinery.
- Silica exposure from high levels of dust produced in concrete work, dredging, and masonry.

When completed, the facility would require 180 permanent positions.[58] Employees at the terminal will similarly experience constant high noise level exposure and possible over-exhaustion from nighttime operations. They are also at risk of acute and deadly exposure to VOCs, benzene, and methane during routine testing and maintenance of the gas storage tanks. The greatest risk for workers at Jordan Cove comes from potential fires and explosion from unknown or unrepaired leakages, exemplified by the explosion at the William's Company LNG storage facility in Plymouth, Washington. These risks are augmented by the possibility of earthquake and tsunami.

CO28-89 cont.

Pembina has promised to build what they call the Southwest Oregon Regional Safety Center (SORSC) near the terminal, including a "security center" and an "emergency operations center". They have also promised to build a fire station nearby in a separate facility, staffed with industrial firefighters.

However, as the explosion in Plymouth demonstrated, significant safety issues were not necessarily mitigated by the presence of firefighters; in fact, the firefighters and trained LNG employees who responded to the situation in Plymouth could not immediately act due to continued leakage of explosive fumes. The root problem of the above case was not a lack of firefighters or emergency crews, but the degradation of storage equipment, employee error, proximity of flammables, and scale of the facility.

Pipeline construction workers will experience many of the same risks as those at Jordan Cove: high diesel fume exposure, long and irregular hours including nighttime work and commuting, continual noise pollution, and high risk of silica dust exposure from digging equipment.

Pipeline monitors, likewise, face what can be lethal exposure to methane, VOCs, and other noxious gasses potentially released during maintenance at compressor stations, as well as during any leak repair.

Because the PCGP will transport fracked gas in unprocessed, pressurized form there would be continuous risk of leaks and explosions. If a pipeline failure occurs, Pacific Connector employees and local emergency responders would be responsible for resolving the problem at their own risk. Pacific Connector Gas Pipeline LP writes in their "Resource Report No. 11, Reliability and Safety" that they would plan for this by sharing information with existing safety organizations. They do not, however, plan to provide emergency training in the case of gas leakage, or pay for more emergency equipment, suggesting the burden of risk will fall on local emergency responders and local jurisdictions.

[58] (Draft Environmental Impact Statement for the Jordan Cove Energy Project. 2019)

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In addition, in many places along the pipeline, the company has only promised to patrol and check for leaks once per year.[59]

Climate change has already dramatically increased the number and severity of wildfires in Oregon. According to Firefighters United for Safety, Ethics and Ecology (FUSEE), over half the 229-mile long pipeline would cross through lands already designated by the U.S. Forest Service as having moderated to very high wildfire risk.[60] The result will be a pipeline that functions like a quick-burning fuse, causing, in case of a spill and ignition, major wildfires in the surrounding area. Firefighters responding to the disaster would face a dangerous double-risk: the need to suppress the pipeline explosion as well as suppressing the fires that would threaten surrounding communities and themselves.

**a. Fire and Explosions.**

According to numbers compiled by *Energywire*, the oil and gas industry employs less than 1% of the U.S. workforce but is responsible for nearly 10% of occupational deaths from fire.[61] Between 2009 and 2013, the sector had the highest rate of mortality from fire and explosions of any private industry, and the second highest of all occupations, behind only firefighting.[62]

- In Seattle in 2016, a gas line exploded injuring nine firefighters and destroying multiple businesses. The line was supposed to have been shut off in 2004, but the contractors hired by Puget Sound Energy failed to properly cut and cap the line and gas had been flowing through it for 12 years.[63]

- On August 1, 2018 outside Midland, Texas, two pipelines began leaking at their intersection. Five workers from the pipeline companies, Kinder Morgan and Navitas Midstream, and two local firefighters responded to the leak by attempting to shut off the flow. A fire ignited and a series of explosions followed. All seven workers were hospitalized and one later died of his injuries. No report has yet determined the cause of the explosion.[64] One week later a different pipeline exploded, killing a three-year old child in her home.

- The Williams Company's LNG storage facility in Plymouth, Washington is the largest in the Pacific Northwest, with two fourteen-million-gallon storage tanks. (See section "Natural and Human Caused Disasters" above for more) At eight a.m. on March 31, 2014, fracked gas inside the LNG processing station ignited, creating a series of rolling explosions, that fragmented equipment, sent 250 pounds of metal flying up to 900 feet away, and lit the facility on fire. Four employees were injured from the shrapnel, and one was burned. Before the explosion, plant operators had

[59] (Jordan Cove LNG, 2017)
[60] (Firefighters United for Safety, Ethics and Ecology, 2019)
[61] (Soraghan M. , 2015)
[62] (Soraghan M. , 2015)
[63] (Lacitis, 2017)
[64] (San Angelo Standard-Times, 2018)

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temporarily dismantled the site's safety monitors, so the plant continued to operate and leak fracked gas through the emergency. Company officials requested that employees repeatedly reenter the facility to manually shutdown dangerous equipment. Though more than a hundred emergency responders arrived on-site, they were unable to enter the facility for eight hours until the wind changed enough to drive out the flammable fracked gas. The extreme cold of LNG also made plugging the leaks time intensive: holes would freeze over until ambient temperature melted enough to begin leaking again. Despite the five injured employees, the company recorded only one injury in the official report months later because federal regulations only mandate that oil and gas producers report injuries leading to death or overnight hospital stays.[65]

**b. Deadly gases and airborne hazards**.

The production, transport and storage of fracked gas exposes workers and adjacent communities to numerous toxic air pollutants during each stage of its life cycle: drilling, well completion and fracking; transport by rail, pipeline or ship; liquefaction, refining, processing, and storage. Airborne toxins pose more serious risks for workers, as likelihood and severity of exposure increases significantly with proximity to operations, as well as during particular stages of production.[66]

Common hazardous air pollutants emitted during fracked gas production, processing, and transport include, among others: volatile organic compounds (VOC) like benzene, toluene, ethylbenzene, and xylene; formaldehyde; hydrogen sulfide; carbon monoxide; sulfur oxide; diesel particulates; ozone; and radon gas.[67] [68]

Researchers in Colorado found, during the extraction process alone (fracking), companies used 944 different products, which together contained 632 different chemicals. Of these chemicals:[69]

- More than 75% affect skin, eyes, and other sensory organs, as well as respiratory and gastrointestinal systems;
- 40-50% affect the brain and nervous systems;
- 37% affect the endocrine system; and
- 25% cause cancer and mutations

Still largely unstudied on their own, these chemicals can also combine and potentially form new reactants when exposed to air, high temperatures, and other variables of the extraction process.[70]

**c. Hydrogen Sulfide**

[65] (Powell T. , 2016)
[66] (McKenzie, Human health risk assessment of air emissions from development of unconventional natural gas resources, 2012)
[67] (Shonkoff S. c., 2014)
[68] (McKenzie, Human health risk assessment of air emissions from development of unconventional natural gas resources, 2012)
[69] (Colborn, 2011)
[70] (Kaden, 2015)

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Hydrogen sulfide, or "sour gas," is one of the most common and dangerous byproducts of oil and gas production, causing acute and chronic breathing issues, neurological defects, and death. It can also corrode metal, making storage dangerous. In high concentrations the gas deadens a person's sense of smell, making it undetectable.[71, 72] A study in the Alberta tar sands found that of workers interviewed, 35% experienced high exposure levels, and 10% had at some point been "knocked down" (lost consciousness) by the gas.[73] Hydrogen sulfide is regulated in many states producing oil and gas, but according to Energy Wire's reporting, in the years 2013 and 2014 alone, five workers died from exposure in the fracking fields. In 1975, the gas was responsible for the deaths of nine in Denver City, Texas.[74]

**d. Volatile Organic Compounds.**

Between 2010 and 2015 at least nine workers died from close proximity to hydrocarbon vapors, also known as volatile organic compounds (VOC), trapped in fracked gas storage containers.[75] All petroleum contains potentially lethal levels of VOCs. But according to a study by the National Institute for Occupational Safety and Health (NIOSH), VOC exposure in fracked gas is more unpredictable and often more dangerously concentrated than in conventional oil and gas production.[76] Exposure to these trapped gases can lead to sudden loss of consciousness and death.[77] An investigation by Energywire found that one of the ways workers are taught to avoid these sudden exposures is by "testing the wind" before they open the hatch.[78] Workers face these risks during all routine container tests—at the fracking site, during transport, and at processing facilities.[79]

**e. Silicosis.**

Exposure to silica dust is a well-known hazard in mining, construction, sandblasting, and other industries. It is a known lung carcinogen. In hydraulic fracturing, intensive blasting of sand and the general lack of regulation creates conditions where silica exposure can become extremely hazardous. A study by NIOSH of eleven fracking sites in five states found that full-shift silica exposure exceeded the criteria for safe levels, sometimes by ten times or more. Even wearing a respirator was ineffective.[80]

The huge amount of sand required by hydraulic fracking has led to a surge of intensive sand mining in parts of Minnesota and Wisconsin. This has in turn led to higher health risk for miners, and likely their communities as well due to the ambient silica dust released during the extraction

[71] (Kaden, 2015)
[72] (Lee, 2014)
[73] (Hessel. 1997)
[74] (Lee, 2014)
[75] (Harrison, 2016) https://www.cdc.gov/mmwr/volumes/65/wr/mm6501a2.htm
[76] (Esswein E. c., 2014)
[77] (NIOSH-OSHA, 2018)
[78] (Soraghan M. , SAFETY: Poisoned by the Shale? Investigations Leave Questions in Oil Tank Deaths, 2014)
[79] (Harrison, 2016)
[80] (Esswein, Occupational Exposures to Respirable Crystalline Silica During Hydraulic Fracturing, 2013)

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process.[81] Recently, the American Thoracic Society called for greater recognition of the harm of silicosis, citing its prevalence, seriousness and yet underrepresentation in occupational health cases.[82] Silicosis risks will occur during construction of fracked gas pipelines, processing, and storage facilities.

A report by researchers in Quebec found that, while all major construction projects expose workers to silica, pipeline laborers had some of the highest risks of silicosis exposure due to their frequent use of jackhammers, masonry saws, and other dust producing heavy machinery.[83]

**f. Diesel Engine Exhaust (DEE).**

Workers encounter diesel engine exhaust (DEE) from heavy machinery throughout gas production and transport. Diesel exhaust components include carbon monoxide, nitric oxide, nitrogen dioxide, sulfur oxides, and polycyclic aromatic hydrocarbons, as well as fine particulate matter. When NIOSH conducted a full shift study of diesel exhaust exposure at multiple fracking sites, they found the mean exposure over time (17 µg/m3, ranging from 0.1–68 µg/m3) near to the state of California's maximum safe exposure level (20 µg/m3). 10% of their measurements exceeded this limit.[84]

DEE is a recognized carcinogen and cause of lung cancer.[85] U.K. researchers have estimated DEE to be the third largest contributor to occupationally induced lung cancer (after asbestos and silica) and estimate DEE is responsible for up to 6% of all lung cancer deaths.[86] Diesel fumes not only impact workers at close proximity, but create regionally hazardous air quality.

**g. Radiation.**

Radon is a component of fracked gas, but its concentration levels can far exceed safe levels as a result of the extraction process. These concentrations can then travel with the gas and dissolve into the mixed fluids, or "slurry", produced during the disposal of fracking wastes.[87] Radon will remain in the gas and disposal slurry until the radioactive isotopes fully decay, creating a long-term exposure risk for both workers and downstream consumers.[88] Radon is second only to tobacco as a cause of lung cancer. [89]

**h. Noise Impacts.**

[81] (Korfmacher, 2013) https://doi.org/10.2190/NS.23.1.c
[82] (Deslauriers, 2016)
[83] (Beaudry, 2013)
[84] (Esswein E. e., Measurement of Area and Personal Breathing Zone Concentrations of Diesel Particulate Matter (DPM) during Oli and Gas Extraction Operations, Including Hydraulic Fracturing, 2018)
[85] (Benbrahim-Tallaa, 2012)
[86] (Vermeulen, 2013)
[87] (Steinhäusler, 2004)
[88] (Kaden, 2015)
[89] (Al-Zoughool, 2008)

Risks from noise generation are higher with fracking than conventional gas production due to the greater scale and length of time when workers are exposed to noise during horizontal drilling and other unconventional extraction methods.[90]

While this draft Environmental Impact Statement (DEIS) alleges to be an "analysis of potential noise impacts on human receptors," there is actually no discussion of the impact on humans, only estimates of predicted noise levels without any mention of what these noise levels might do to humans. The only concern in this DEIS seems to be the extent to which the project complies with existing regulations and FERC guidelines.

Today's literature on the health effects of noise is replete with research studies on the adverse effects of noise on health. These effects include sleep disruption, communication interference, cardiovascular and endocrine effects, job performance decrements, and adverse educational effects. Extensive studies of the health impact of excessive noise reveal that these effects are often caused or exacerbated by stress. The adverse effects of community noise exposure are often stated in terms of the degree of annoyance or aversion experienced by a population, up to a point where communities will take action against the source of this disruption. Adverse effects are also described in terms of their effects on physical health, particularly the cardiovascular and endocrine effects. Future iterations of the EIS must include a discussion these effects along with an attempt at quantification in order to properly describe the impact of the proposed LNG terminal. Several references are provided at the end of these comments to facilitate this process.

It is unfortunate that the State of Oregon exempts construction projects from its noise regulations, along with other major noise sources: vehicles, rail traffic, and airport operations.[91] In addition to construction noise, noise levels from all of these sources may be increased by this proposed project and exacerbate the impact on individuals and communities, although the DEIS has not addressed these additional sources. The DEIS points out that the Oregon regulations have established noise limits for "designated quiet ares" but that the State has designated no such areas. The DEIS does address construction noise with respect to the FERC guidelines, as well as the Oregon regulations covering noise from industrial and commercial activities. However, the DEIS reveals many instances in which the proposed project will not comply. In these cases, FERC recommends mitigation measures, which, as I will point out, are unlikely to be used.

The DEIS states clearly that the Coos Bay community would be subjected to prolonged, high levels of noise from the construction of this project and possibly during its operation as well. According to the DEIS noise contours (Fig. M-3), a substantial part of the town would exceed the EPA maximum recommended day-night noise level ($L_{dn}$) of 55 dBA[92] and portions would exceed an $L_{dn}$ of 60 dBA during the four years of construction. Average noise levels in the recreational area are projected to be as high as 65 dBA and above. Maximum noise levels ($L_{max}$) would range from 65 dBA in the town to 69 dBA in the recreational area. Once construction is completed, the DEIS predicts an increased noise level over the existing ambient that is not

[90] (Kaden, 2015)
[91] OAR 340-035-0035.
[92] Information on levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety (EPA/ONAC Report 550/9-74-004). U.S. Environmental Protection Agency. Washington, DC, 1974. Available at: http://www.nonoise.org/library/levels.htm.



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