RESPONSES TO FERC COMMENTS ON RESOURCE REPORT 1 & 11 FROM AUGUST 2015

JACKSONVILLE PROJECT

FERC DOCKET NO. CP17-___-000 (PF15-7-000)

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Responses to Federal Energy Regulatory Commission August 26, 2015 Comments on Jacksonville Project Draft Resource Report 1

1. Quantify the acreage of impervious surface at the project site during operation. (Section 1.1.1, page 2)

Response:

Section 1.3, Land Requirements, of Resource Report 1 identify all Facility components and their associated construction and operational acreage requirements. The operation of the Jacksonville Project will require 13.00 ac. of impervious surfaces.

2. Provide the likely destinations for domestic shipments from the proposed facility. (Section 1.1.1, page 5)

Response:

Domestic LNG shipments by truck will be regional and limited to Florida and the surrounding states. Eagle LNG has also considered supplying LNG by barge to the Port of Jacksonville and other nearby domestic ports for use in marine bunkering.

3. Section 1.1.1 indicates buildings would be constructed, but only one building is described in section 1.1.9. Specify the building types that would be included in the FERC jurisdictional facilities. (Section 1.1.1 and Section 1.1.9)

Response:

The FERC jurisdictional buildings will include:

> A Control Room Building;

> A Security Building/Guard House;

> An Administration Building; and,

> A Warehouse/Maintenance/Shop/Chemical Storage Building.

Further description for these buildings are shown in Resource Report 1, Appendix A.1, Project Mapping and RR 13, Appendix U.10.

4. Eagle LNG states that "only interconnect piping will be needed within the project site boundary." It is unclear where the interconnect pipeline would be located. The Plot Plan in Appendix 1.B and the Interconnect Pipeline Figure in Appendix 1.C show the location of the interconnect pipeline in different locations. Correct this discrepancy and indicate the length and location of any interconnect piping (if any) that would be outside of the property boundary. (Section 1.1.4, page 7)

Response:

The interconnect pipeline located outside the property boundary will be approximately 20ft in length and will be located wholly within Zoo Parkway right-of-way. Additionally, approximately 100ft of interconnect pipeline would be within the Jacksonville Project property boundary. Appendix 1.B includes a drawing of the interconnect provided by Peoples Gas and location within the facility plot plan.

5. Provide the following information and specifications regarding ships and ship traffic to the LNG Vessel Loading facility (Section 1.1.6, pages 7-9):

a. clarify if two ships can pass each other in the channel to the project site or if traffic is only one-way at a time;

b. clarify how ship traffic is coordinated if one-way traffic is required in the channel, describe how ship traffic is coordinated and describe any modifications required to accommodate the proposed project;

c. describe the U.S. Coast Guard (USCG) approval process, and the suitability of the waterways; and

d. clarify the number of ships the facility can accommodate at one time.

Response:

a. Two-way ship traffic is typical for the Jacksonville Project area. The St. Johns River / Jacksonville Harbor is accessed from sea via the St. Johns Bar Cut, a federal project which is 2.1 nautical miles (nm) long and maintained at a project width of 800 feet and depth of 42 feet. The channel is maintained at those dimensions up to the Mayport Naval Entrance Channel on the south side of the river. From there, the project depth is maintained at 38 feet to Jacksonville with project widths of at least 500 feet up to the Drummond Creek Range. Those dimensions are suitable for most ships, including the LNGCs that will call at the terminal. It must be recognized that actual vessel movement patterns are determined by the conditions that exist at the time and could be influenced by factors such as weather conditions, individual vessel characteristics, waterway conditions, and USCG safety/security zones. Further, the U.S. Coast Guard (USCG) Captain of the Port (COTP) will determine whether or not two-way traffic will be allowed for LNGC movements in completing the waterway suitability analysis (WSA).

b. Traffic would be restricted to a one-way pattern only under the conditions described above. In such case, the Pilots would schedule vessel movements accordingly. The USCG COTP routinely coordinates with the Jacksonville Marine Transportation Exchange (JMTX) and the JAXPILOTS directly as well as through mechanisms such as Notices to Mariners to ensure that all maritime interests are aware of any restrictions or special vessel traffic considerations.

c. The USCG's process for analyzing the suitability of waterways for LNG marine traffic is prescribed in Navigation and Vessel Inspection Circular (NVIC) No. 01-2011, Guidance Related to Waterfront Liquefied Natural Gas (LNG) Facilities. The Federal regulations in 33 CFR 127.007 require that a Preliminary WSA be submitted to the COTP no later than the date that the pre-filing request is submitted to FERC. The Preliminary WSA was submitted on November 25, 2015 while the follow-on WSA was submitted in October 2016. The regulations also require that a Follow-on WSA be submitted to the USCG no later than the date that the formal application is submitted to the FERC; that requirement will be satisfied. The WSA prepared by the applicant is just one part of the USCG's approval process which also includes public outreach and an analysis conducted in accordance with the guidance in NVIC 01-2011.

d. The Facility is being designed to accommodate a single self-propelled LNGC at one time. The dock will be large enough to accommodate only one barge at a time as well. The Facility will not be able to accommodate a ship and a barge simultaneously.

More information can be found in Section 1.1.6 of Resource Report 1.

6. Provide results of consultation with the utility company, JEA, regarding what modifications or changes would be required to meet the project's needs including (Section 1.1.10 and 1.12.3):

a. what facilities would be required for the project;
b. information for the shore side electrical requirements (including the analysis of the ship power requirements); and
c. information about the Jacksonville Project's tie-in such as documentation from JEA that it can accommodate a total base load of approximately 10.5 megawatt (MW) for each train of the project and location of any tie-ins.

Response:

Main electric power for the Facility will obtained from a local utility provider (JEA), supplemented by on-site power from natural gas driven reciprocating engine generator sets. Redundant 138 kV feeders will enter the Facility site above ground via electric poles and terminate at the Open Electrical Switchyard.

Within the Facility, a Main Electrical Substation and High Voltage (HV) step down transformers will distribute 13.8 kV to the MR Compressors and one common Inlet Gas Compressor, 4,160 V to the BOG Compressors and 480 V to the control room, marine facilities, storage and loading facilities, utilities, lighting and other common systems.

In general, all common systems required to operate the Facility in a single or multiple LNG train mode will be powered from the Main Electrical Substation. Typical loads in this category include:

- Facility buildings including Control Room;
- BOG Compressors;
- LNG in-tank pumps;
- Marine facilities (loading arms, vapor return blower); and
- Utilities.

Each LNG train will include a dedicated Medium Voltage (MV) / Low Voltage (LV) Substation for powering train specific loads and will include a 13.8 kV bus for a single Inlet Gas Compressor and 4,160 V and 480 V distribution for operation of LNG train loads.

The Facility will include five reciprocating engine Electric Power Generators, four operating and one spare. Each generator will be rated to develop 2 MW of continuous power at 4,160 V. During ship loading activities, the gas which would generate power in excess of 8 MW will be utilized for other plant loads. All five generators will be operating during ship loading mode. Fuel gas for the generator sets will be sourced from the BOG compression system. A master genset controller will synchronize the operation of the Electric Power Generators and main electric power supply.

Emergency power supply will be provided by an Emergency Diesel Generator connected to the Main Substation. This generator will provide 4,160 V backup power in the event of a Facility power outage for safe emergency shutdown. The Emergency Diesel Generator will be equipped with a 24-hr Diesel day tank.

Typical emergency loads include:

> Instrumentation systems for HDMS;

> Emergency Diesel Generator charging the batteries;

> Switchgear controls;

> Emergency lighting system;

> Flare and Vent System ignition controls;

- Fire water jockey pumps; and
- Navigational aids.

7. Section 1.1.10 states that closed circuit coolers would "significantly reduce the demand for water." Describe what the demand for water would be if cooling towers or a "once through" water cooling system were used and what the reduction would be compared to these other systems with the proposed closed circuit system. (page 9)

Response:

The referenced closed circuit system is no longer applicable to the current design.

8. Provide further specifications on the purpose and need of the Jacksonville Project (Section 1.2, pages 10-11):

a. define close proximity range of barges/vessels to the Port of Jacksonville;
b. specify the size of the existing berthed fleets at the Port of Jacksonville; and
c. discuss the U.S. Caribbean Basin Initiative.

Response:

a. The Port of Jacksonville is located approximately 4 to 5 miles upstream via the St. Johns River from the Jacksonville Project.

b. Vessel calls at the Port of Jacksonville in 2010 totaled 2,553. Projected vessel calls at the Port of Jacksonville for 2022 and 2032 are 2,690 and 3,243, respectively. These numbers include container ships, general cargo ships, bulker fleet, and tanker fleet. The Jacksonville Project Marine Vessel Traffic Summary (Attachment 11.A of Resource Report 11) provides a complete summary of the existing fleet that typically calls at the Port of Jacksonville. The summary is presented by vessel type.

c. The Jacksonville Project will make LNG available to markets within the Caribbean basin in a manner that will advance the objectives of the CBI, a series of trade programs facilitating the export diversification and economic development of the Caribbean Basin economies. Enacted on August 5, 1983, the Caribbean Basin Economic Recovery Act ("CBERA") authorized the granting of certain U.S. unilateral preferential trade and tax benefits for Caribbean Basin countries and territories. The Caribbean Basin Economic Recovery Expansion Act of 1990 ("CBI II") was enacted under the Customs and Trade Act of 1990. CBI II amended CBERA, thereby making its trade benefits permanent by the repeal of CBERA's 12-year termination date, which was initially set for September 30, 1995. CBI II also implemented certain improvements to CBERA's trade and tax benefits. The Caribbean Basin Trade Partnership Act ("CBTPA"), which was enacted on May 17, 2000 under the Trade and Development Act of 2000, reduces or eliminates tariffs and abolishes most quantitative restrictions on certain products that were previously not eligible for preferential treatment under either CBERA or CBI II. CBTPA benefits remained in effect during a "transition period" that continues through September 30, 2020 or the date, if sooner, on which the Free Trade Area of the Americas or another free trade agreement as described in legislation enters into force between the United States and a CBTPA beneficiary country. There are currently 19 CBERA beneficiary countries.

As a mid-scale LNG production, storage and loading facility, the Jacksonville Project is sized and designed to serve the relatively small and geographically isolated fuel markets typically found in Caribbean Basin nations. LNGCs which the Jacksonville Project will load will be smaller than the large LNGCs that serve large-scale LNG export terminals; the smaller LNGCs will be able to serve the smaller and shallower harbors found in many Caribbean Basin countries that cannot be served directly by world-scale LNGCs. The

Jacksonville Project will efficiently produce LNG in the quantities likely to be demanded by the target markets, and the Project's LNG storage capacity is sized optimally to support exports in the modest quantities the smaller Caribbean Basin markets will require.

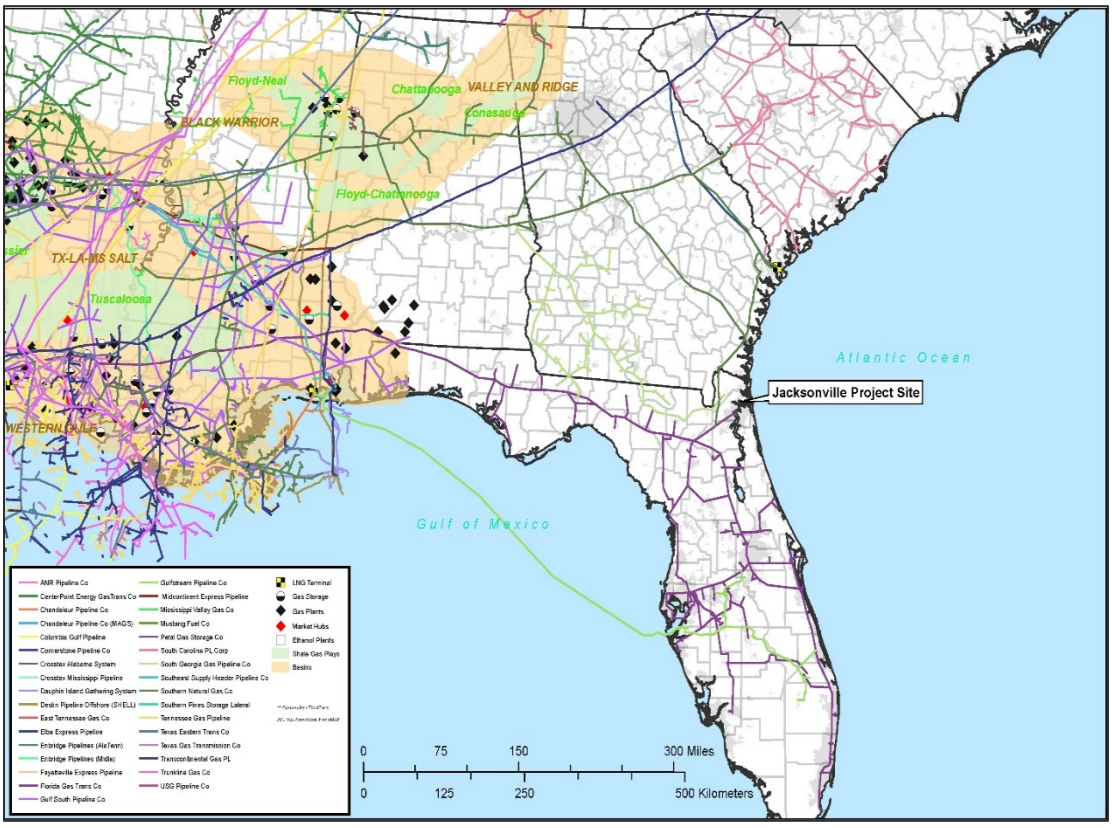
By offering a source of LNG that is scaled to the needs of Caribbean basin markets, the Jacksonville Project will permit fuel consumers in those markets to diversify away from morecostly and environmentally disruptive petroleum products. This will promote investment in the region and will enhance trade between the U.S. and Caribbean basin nations, an outcome that is a principal focus of the CBI..

9. Revise major gas pipeline system map to include labels and legends. Indicate the location of the proposed facilities on the map. (Figure 1-2.1, page 11)

Response:

The major gas pipeline system map has been revised to include labels, a legend, and the location of the proposed Project and is provided below. The revised figure is included as Figure 1.2-1 in Resource Report 1.

Major Gas Pipelines Serving Jacksonville, Florida



Source: U.S. Energy Information Administration 2016.

10. Provide further information in regards to LNG as Vessel Fuel (Section 1.2.2, pages 12-13):

a. define how the North American Emissions Control Area (ECA) boundaries were established/defined;

b. clarify what "operating" refers to such as does it include any stipulations depending on where the ship is flagged;

c. indicate anticipated time frames of construction of the TOTE/SeaStar and Crowley Maritime vessels; and

d. identify where the ships will be fueled in relation to the proposed facility, how many ships can be fueled/bunkered simultaneously, the distance requirements between ships, and if there are any port restrictions.

Response:

a. The U.S. and Canada introduced the proposal for the North American ECA designation, reflecting common interests, shared geography and interrelated economies. In July 2009, France joined as a co-proposer on behalf of its island territories of Saint-Pierre and Miquelon, which form an archipelago off the coast of Newfoundland. The area of the North American ECA includes the waters adjacent to the Pacific coast, the Atlantic/Gulf coast and the eight main Hawaiian Islands. It extends up to 200 nautical miles from coasts of the United States, Canada and the French territories, but does not extend into marine areas subject to the sovereignty or jurisdiction of other States. For further information on the ECA please see Section 1.2.2 of Resource Report 1.

b. Annex VI of the International Maritime Organization (IMO) Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78), outlines international requirements for vessel air emissions and shipboard air pollution prevention measures. MARPOL 73/78 Annex VI entered into force for the United States on January 8, 2009. Starting on that date, U.S.-flagged vessels operating anywhere around the world, and foreign-flagged vessels operating in U.S. waters with the ECA must comply with the requirements set out in MARPOL Annex VI (USCG 2012a).

c. According to publicly available press releases from Crowley and TOTE/SeaStar, the Crowley LNG-fueled vessel are scheduled to begin operations in 2017, while TOTE/SeaStar placed one vessel into service in October 2015, and another one in January 2016.

d. Bunkering barges would be loaded with LNG at the Jacksonville Project marine terminal. Only one barge would be loaded at a time. Barges would then transit to the Port of Jacksonville or to other nearby domestic ports. Bunkering (ship fueling) activities would only occur within the destination ports. Eagle LNG would implement all restrictions regarding vessels carrying LNG at the Port of Jacksonville or other ports, as necessary.

11. Provide the following information regarding LNG as domestic highway fuel (Section 1.2.3, pages 13-14):

a. indicate if there are any anticipated local/regional marine fueling facilities proposed in the area and provide the names and locations of those that are;

b. indicate the locations of the proposed Clean Energy Fuels and Royal Dutch Shell LNG truck fueling stations;

c. clarify if Clean Energy Fuels ever constructed the "70 to 80 LNG fueling stations…around major warehouse distribution centers" proposed for construction in 2013; and

d. edit Figure 1.2-3 (Phase 1 of Clean Energy LNG Truck Fueling Corridor) to reflect the current 2015 progress and completion.

Response:

a. WesPac Midstream is developing a LNG facility along the St. Johns River approximately 3 miles from the Jacksonville Project. However, by all accounts this is a marine refueling facility. Eagle LNG Jacksonville II LLC is building the Maxville LNG Facility to Supply LNG

fuel for Crowley Maritime and other domestic marine users; the Maxville facility is located approximately 27.8 miles away from the Jacksonville Project. LNG produced at the Maxville facility will be transported via truck to JAXPORT's Talleyrand Marine Terminal facility, to be used as maritime fuel.

b. Clean Energy station locations have been included in Resource Report 1 as Figure 1.2-3. No source was available to map Royal Dutch Shell highway LNG refueling locations. However, Eagle LNG will continue to pursue this information and incorporate into Resource Report 1 when found.

c. Information obtained from Clean Energy is unclear as to whether 70 to 80 refueling stations have been completed. However, it is known that there are currently 133 existing and planned LNG highway refueling stations in the U.S., according to the DOE.

d. A new figure has been added as Figure 1.2-3 to show the locations of all existing and planned highway LNG refueling stations in the U.S.

12. Clarify the land requirements for the following items (Section 1.3, page 15):

a. indicate which vendors/locations are being considered for constructions yards and how large the offsite laydown areas would be; and

b. provide the dimensions and purposes of all additional temporary workspaces.

Response:

a. The Jacksonville Project will not require offsite construction yards or offsite laydown areas outside of the on-site construction limits of disturbance.

b. All workspaces will be confined to the project property and will be used for various construction activities. The overall construction area required for the Jacksonville Project is shown in the following table which is also found in Section 1.3.

Project Land Requirements	Construction (ac.)(a)	Operation (ac.)	
		Impervious	Gravel/Pervious
Terrestrial Facility			
Switchyard Area	3.85	0.07	3.65
Construction Laydown Areas	7.59	0.00	0.00
Ground Flare Area	0.00	0.02	0.28
Feed Gas Metering and Utilities	3.39	0.49	2.40
Liquefaction Trains	5.22	1.50	3.71
Stormwater Ponds	2.78	0.00	1.86
LNG Storage and Impoundment	4.03	0.70	3.33
Truck Loading and Refrigerant Storage	2.70	0.15	0.93
Buildings and Equipment	0.57	0.87	0.00
Roads and Parking	9.50	6.94	0.00
Jetty Access and Operations	0.75	1.17	1.09
Dredge Material Management Area	9.26	0.00	0.00
Facility Open Area, Fence Line, and Berm	30.59	0.00	41.18

Terrestrial TOTAL	**80.23**	**11.91**	**58.43**
Marine Facility			
Dredging Template	10.11	0.00	10.11
Marine Terminal and Trestle	1.54	1.09	0.00
Marine TOTAL	**11.65**	**1.09**	**10.11**
	91.88	**13.00**	**68.54**

13. In order to provide feed gas for the proposed LNG terminal, describe the modifications required on Peoples Gas existing pipeline system. At a minimum, provide the following information:

a. detailed drawings showing the connections;
b. dimensions (pipe diameter, length, horsepower, etc.);
c. land requirements and associated environmental impacts;
d. gas consumption;
e. megawatt size;
f. current status of federal, state, and local permits/approvals; and
g. construction status, as appropriate.

Response:

a. The connection between the existing Peoples Gas (a TECO subsidiary) 24" gas transmission line located adjacent to the Project in the Zoo Parkway right-of-way and the 16" interconnect pipeline proposed to supply feed gas to the Project are illustrated on the drawing entitled "Heckscher Drive 16" Tap on 24" Pipeline", which was provided by TECO. Heckscher Drive is also known as Zoo Parkway. This drawing is included in Appendix 1.B.

b. The pipeline interconnect will be 16” diameter and approximately 120 feet in length. Approximately 20 feet of the pipeline interconnect will be located within the Zoo Parkway right-of-way and approximately 100 feet will be within the Eagle LNG property.

c. The pipeline interconnect will be underground, so there will be only temporary construction impacts needed to install the new pipeline and associated tie-in to the existing Peoples Gas transmission line. The workspace within the Zoo Parkway right-of-way will be approximately 50 x 20 feet (about 25 feet on each side of the pipeline interconnect).

d. This is not applicable to the Jacksonville Project.

e. This is not applicable to the Jacksonville Project.

f. Peoples Gas has stated that only a permit from the City of Jacksonville will be necessary to construct the pipeline interconnect. Peoples Gas will apply for the applicable permit in early 2017. For more detailed information see Section 1.12.2 of Resource Report 1.

g. It is anticipated that construction of the pipeline interconnect will be from approximately June 2018 through approximately December 2018.

14. Provide a description of the waste materials that would be generated by each component of the LNG trains. For each of the waste materials listed below, provide information on the anticipated volume to be generated and disposed, identify the expected disposal facilities to

be used, describe the routes and frequencies of trucks that would transport the materials, as applicable, and list the applicable waste permits and compliance requirements (Section 1.4.2, pages 17-19):

a. hydrogen sulfide from the amine gas-sweetening unit;
b. carbon dioxide from the amine gas-sweetening unit;
c. mercury from the mercury removal unit; and,
d. heavy hydrocarbons from the heavy hydrocarbon removal system.

Response:

a. Hydrogen sulfide is discussed in RR9.

b. Carbon dioxide is discussed in RR9.

c. Approximately 900 ft^3 of mercury removal absorbent bed material from the mercury guard bed and associated filter(s) will be replaced every 60 months, provided there is any mercury present in the feed gas. The materials will be sent to a waste handling facility licensed for items containing mercury. Registered mercury handlers in the State of Florida can be found at: https://fldeploc.dep.state.fl.us/www_rcra/reports/mercuryhandlers.asp

d. Heavy hydrocarbons from the heavy hydrocarbon removal system will be collected and removed from the Facility as product (not as waste). Approximately 12,000 US gallons will be removed by approximately 90 trucks per year. For more detailed information see Section 1.1.8 of Resource Report 1.

15. Provide the following information regarding construction procedures (Section 1.5.4, pages 21-26):

a. indicate where construction barges would be retrieved from, and the control measures for potential invasive species;
b. indicate how the dredged materials would be applied and describe any floodplain restrictions that may apply;
c. for site preparation and foundation installation, define what is meant by "other related proven ground-improvement techniques" for LNG storage (Section 1.5.4.4);
d. clearly identify finished grade elevation for project facilities and proposed earth berms;
e. measures to keep gravel areas clear of weeds (Section 1.5.4.6);
f. dimension (size and depth) of sediment basins used during construction and the procedures involved to convert these to permanent stormwater facilities; and
g. location(s) of the off-site concrete batch plant(s) proposed for use and specify the amount of concrete needed during construction (Section 1.5.4.9).

Response:

a. At this time, the marine contractor has not yet been chosen. However, the City of Jacksonville benefits from multiple qualified marine contractors who may participate in project construction. These contractors maintain barges and equipment in close proximity to the project site. Eagle LNG also discusses in depth USCG ballast water management systems, including the potential spread of invasives, that would be used in Section 2.1.5.3 of RR 2.

b. As currently designed, the Project intends to use all suitable dewatered dredged material for appropriate upland construction purposes. If any dredged materials are deemed inappropriate or uneconomical for construction purposes, Eagle LNG will dispose of dredged material within Jacksonville Port Authority (JAXPORT) local DMMA areas.

During construction, dredged material will initially be placed into a temporary DMMA on the Eagle LNG property (for more information reference the Jacksonville Project Marine Terminal Dredging and Dredged Material Management Area Plan (Appendix 2.E in RR 2).

c. The dredged material will be checked for construction suitability (including quality and presence of any contaminants/pollutants). Soil treatment will be performed as required by the geotechnical engineer (e.g., remediation of contaminants, if any, and/or mixing with other soils to attain acceptable soil quality). Before it can be used as fill, the dredge material may require mixing with on-shore material that is cut during the construction phase. Suitable soil will be removed from the temporary DMMA and placed on the upland portion of the site. Compaction and/or improvement of the placed soil will be performed as required by a geotechnical engineer and equipment-specific criteria. Eagle LNG will comply with local restrictions that may apply with the disposal/storage of dredged materials within a FEMA floodplain. Eagle LNG is currently investigating those restrictions through the City of Jacksonville's Ten-Step permitting process, if applicable, and will submit an update to the FERC as supplemental information

Site preparation and foundation information for the LNG storage tank is provided in Section 1.5.4.3 of Resource Report 1 and in Resource Report 13. Current plans are to support the LNG storage tank on a reinforced concrete slab foundation combined with gravel pad and soil improvement (i.e., vibro replacement or dynamic compaction).

d. Finished grade elevations are listed below for major project facilities including the berm surrounding the LNG storage tank (all elevations in NAVD88):

> Switchyard: +27

> Metering/Utilities: +27

> LNG Storage Impoundment: +15

> LNG Trains: +27

> UPL Detention Ponds: +13

> Truck Loading: +27

> Admin/Parking: +27

> DMMA: +13

e. Eagle LNG has prepared a Noxious and Invasive Weed Control Plan which explains the activities associated with controlling weeds within the Facility. This Plan is included as Appendix 3.C of RR 3.

f. The dimensions of the stormwater basins for runoff during construction and permanent operation of the Project are provided in the tables below. The South pond used during construction will be filled in (i.e., abandoned) after the permanent South pond is constructed near the jetty (south of the construction pond). The East and West ponds will be converted to their permanent condition by installing connections to the permanent stormwater system and sealing the connections to the construction stormwater system. These modifications will result in an uprate of the stormwater capacity for the permanent condition without changing the pond dimensions. The outfall structures for the East and West ponds are designed for both the construction and permanent conditions and do not need conversion. Documents will be developed during detailed design to govern the stormwater pond conversion activities (e.g., outfalls will be blocked to prevent sediment from discharging from a pond undergoing conversion).

Construction Stormwater Management Pond Sizing

Pond Name	Length (ft)	Width (ft)	Depth (ft)	Volume (ft^3)
West Pond	231	116	7	187,000
East Pond	231	116	7	187,000
Construction South Pond	50	25	10	12,500

Permanent Stormwater Management Pond Sizing

Pond Name	Length (ft)	Width (ft)	Depth (ft)	Volume (ft^3)
West Pond	231	116	12	321,000
East Pond	231	116	12	321,000
South Pond	93	49	10	45,000

g. The potential locations of concrete batch plants is discussed in Section 1.5.4.11. Estimated concrete for full build out is approximately 10,000 cubic yards.

16. Provide the following information regarding safety procedures (Section 1.7, pages 28-31):

a. applicable federal and state regulations other than those associated with Department of Transportation Pipeline and Hazardous Materials Safety Administration (DOT PHMSA) Federal Safety Standards for Liquefied Natural Gas Facilities (Section 1.7.1);
b. description of secondary containment for each quantity of LNG (Section 1.7.1);
c. location of transfer and storage area of flammable materials (Section 1.7.1);
d. contamination potential to waterways and clean up procedures resulting from use of the proposed hazard control systems (Section 1.7.4);
e. define "major incident" as used in the description of the emergency shutdown and describe how it is classified (Section 1.7.7);
f. describe "established protocol" for plant security (Section 1.7.8);
g. specify possible ground disturbance for guard house construction along Zoo Parkway (Section 1.7.8); and,
h. specify the locations.

Response:

a. The Jacksonville Project will be designed, constructed, operated, and maintained in strict accordance with the DOT PHMSA Federal Safety Standards for Liquefied Natural Gas Facilities, 49 C.F.R. Part 193. In addition, the Project will be designed to meet all U.S. Coast Guard standards in 33 C.F.R. Part 127, Waterfront Facilities Handling Liquefied Natural Gas and Liquefied Hazardous Gas. The facilities also will meet the NFPA 59A Standard for the Production, Storage, and Handling of Liquefied Natural Gas. A comprehensive list of applicable codes and standards for the project is included in Appendix D.1 of RR 13.

b. The current design of the Facility includes one full containment LNG storage tank with a primary inner container and a secondary outer container. As an additional safety measure, a berm capable of containing over 100 percent of the capacity of the inner tank surrounds the LNG storage tank at the Facility. Please refer to the revised description of the spill containment system for the LNG storage tank in Section 1.7.1.

c. The location of the transfer and storage area of flammable materials is shown in detail on drawings included in Appendix U.1 of RR 13. Details of the spill containment system design are included in Appendix Q.3 of RR 13.

d. Based on the design of the hazard control systems, there is no potential for contamination to waterways.

e. Major incidents which could result in activation of ESD Systems can include detection of gas releases, detection of a significant LNG leak, detection of fire, and exceeding operational or LNGC loading thresholds. The detail of the ESD activation logics are included in Cause and Effect Diagrams filed in Appendix N.1 of RR 13.

f. Please refer to revised Section 1.7.8 for a description of plant security systems.

g. There will be one Security Building/Guard House located at the Facility entrance on Eagle LNG property. The Security Building/Guard House will occupy about 625 square feet. The location of this Security Building/Guard House is shown on the Facility plot plans included in Appendix 1-A. of Resource Report 1.

h. The Security Building/Guard House will be located at the Facility entrance on Eagle LNG property.

17. Specify what is involved in the abandonment and removal of facilities. (Section 1.8, page 31)

Response:

At this time, Eagle LNG has no future plans which would result in the expansion of the currently proposed Jacksonville Project facilities. If an expansion is contemplated in the future, Eagle LNG will seek the appropriate authorizations from federal, state, and local agencies.

Eagle LNG envisions a 30-year life for the Project. However, the facilities themselves would, with proper maintenance, be capable of being operated for 50 years or more. Regardless of the duration of utilization of the proposed Jacksonville Project facilities, there are no current plans developed for abandonment. Eagle LNG will obtain the necessary permission to abandon its facilities in accordance with regulations that exist at the time of abandonment and any landowner requirements..

18. Resource Report (RR) 1 indicates several items necessary for our review will be provided at a later date. Provide the following items when available, and indicate the date when each item will be provided:

a. the number of LNG storage tanks proposed for construction (page 7);
b. results of the additional geotechnical study(ies) to determine the best approach for excavating, dredging, and constructing the LNG vessel loading facility (page 23);
c. the stormwater pollution prevention plan (page 26);
d. discharge and treatment plans for stormwater (page 26);
e. the anticipated travel route and the average and peak volume of trucking for delivery of construction supplies including concrete. (page 26);
f. description of training requirements of USCG, Department of Transportation (DOT), Florida State Fire Marshall, other regulatory entities, and those required by the Project (page 27);
g. the Operations Execution Plan (OEP) (page 27);
h. facility security assessment and facility security plan (page 30);
i. abandonment and removal procedures of facilities after 30-year life span of Project (page 31); and

j. copies of any additional correspondence resulting from consultation with any federal or state agencies, or any tribes.

Response:

a. The Project includes one LNG storage tank.

b. Resource Report 13 includes two reports authored by Amec Foster Wheeler Environment & Infrastructure, Inc. outline geotechnical conditions as they relate to dredging and foundation construction, respectively, for the marine loading facility:

- Report of Geotechnical Exploration: St. Johns River Dredging, Eagle LNG Processing Terminal (Appendix 13.J.1 of RR 13)
- Report of Geotechnical Exploration Marine Structures Eagle LNG Processing Terminal (Appendix 13.J.2 of RR 13).

c. A stormwater management plan is included as Appendix 2.F in RR 2.

d. A stormwater management plan is included as Appendix 2.F in RR 2 and a spill waste plan is found in Appendix 2.B of RR 2.

e. Construction materials and equipment will be delivered directly to the Project site via ground transportation utilizing local highway routes.

Based on preliminary information, Eagle LNG anticipates an average of 20 truck deliveries per day during construction of the Project. However, for short durations (three to five days) during construction, up to 100 truck deliveries per day could occur.

When practical, large equipment units will be fabricated offsite at existing fabrication facilities serving multiple projects. All of the LNG Train Components, interconnecting pipe sections and racks, and major utility equipment will be prefabricated simultaneously, with delivery being coordinated to accommodate the Project's schedule and available laydown areas.

Pipe spool fabrication will be undertaken offsite and the spools delivered to the Project site will be as large as practical to safely minimize the number of deliveries. Pipe expansion loops will be prefabricated offsite and transported to the Project site. Packaged equipment and small buildings will be fabricated offsite and transported to the site via truck

f. The training requirements of the USCG, Department of Transportation (DOT), Florida State Fire Marshall, other regulatory entities, and those required by the Project are addressed in the Draft Emergency Response Plan included in RR13 Appendix P.3;

g. The Operations Execution Plan will be developed during the EPC phase of the Project.

h. The Facility security assessment and Facility security plan will be submitted to the USCG for review at least 60 days prior to the beginning of Facility operations.

i. Abandonment and removal procedures of facilities will be developed prior to abandonment of the proposed Project. Eagle LNG will obtain the necessary permission to abandon its facilities in accordance with regulations that exist at the time of abandonment and any landowner requirements.

j. The Letter of Intent for the Waterway Suitability Assessment and meeting memo from the follow-on WSA has been added to Appendix 1.D. Additional correspondence regarding resources discussed in the ER has been included in Appendix 1. D in RR 1.

19. Provide a written description and figure depicting the following:

a. proposed LNG vessel route(s) between the LNG terminal and the outer boundary of the U.S. Exclusive Economic Zone (EEZ) (200 nautical miles offshore); and

b. proposed LNG vessel and LNG barge routes for domestic marine distribution and bunkering. (Section 1.1.4, page 16)

Response:

a. The only route to sea follows the St. Johns River from the proposed marine terminal through the entrance jetties as show in the Figure 1.1-3 of Resource Report 1. Once beyond the jetties, the LNGCs will transit through the U.S. EEZ to foreign destinations with the only variable being the ship's heading as dictated by north Atlantic right whale recommended shipping routes and the destination port as shown in Figure 1.1-3.

b. Domestic distribution will be within the Port of Jacksonville and use the St. John River while other nearby ports may also be utilized to provide vessel bunkering. Barges traveling to other ports would utilize the Intracoastal Waterway (ICWW) for north bound and south bound routes. Figure 1.1-4 depicting routes to ports is included in RR 1.

20. Describe the proposed backup power source, including information on fuel storage and containment facilities, if applicable. (Section 1.4.7, page 20).

Response:

Please refer to RR13 Section 13.11, which describes the electrical system considered for the Project including provisions for backup power generation and equipment fuel requirements.

21. Clarify the discrepancy between resource reports regarding the number of site personnel that would be employed during operation. Section 1.6 indicates that there would be "8 to 12 Eagle LNG site personnel once the facility is operating at full LNG capacity." However, section 5.6.2 in RR 5 indicates that "Eagle LNG anticipates employing roughly 20 site personnel…" (Section 1.6, page 28 and Section 5.6.2, page 12).

Response:

A minimum of 8 to 12 Eagle LNG site personnel will be required once the Facility is operating at full capacity. As an extension to the core operations and maintenance team of 8 to 12 site personnel, specialty Eagle LNG staff and possibly third-party contractors will be engaged periodically to assist with maritime operations and scheduled preventative maintenance of the Facility. There will be more staff on-site during vessel loading operations than over the course of regular day-to-day operations.

22. For the proposed piles listed in Table 1.5-2, provide the following (Section 1.5.4.2, page 23):

a. indicate sizes of proposed drill bits for pilings;

b. the final sizes (length and diameter) and numbers of the steel and concrete piles that would be installed;

c. a figure showing the pile locations;

d. the depth to which steel and concrete pilings for the access pier, gangway access, mooring dolphins, breasting dolphins, and pier head would be installed below the bed of the St. Johns River; and

e. the pile capacities.

Response:

a. Due to the presence of limestone, the design requires a special installation technique for the pipe piles to achieve the required capacity. The contractor will install the steel pipe piles in general accordance with the following:

- Vibrate or drive the pipe pile until reaching competent limestone;
- Advance a rotary drill bit or similar equipment (with bit approximately 2 – 3 inches smaller in diameter than the outside of the pile) through the limestone and dense marl;
- Drive the pipe pile with an impact hammer to the depth required to achieve the allowable bearing and tension capacity;
- Install a steel reinforcing cage;
- Place concrete within the pipe pile by use of tremie technique.

b. Taylor Engineering applied computer analysis models (Optimoor, PASS-MOOR, STAAD, and AllPile) to determine the structural loads on each structure based on the design conditions. To date, the design has focused on analyzing service loading conditions and honing in on marine facilities layout and structural dimensions. It is expected that the gross dimensions of the structures and the type of piles will remain substantially as shown on the Marine Terminal Drawings. Variation in design detail may occur with completion of structural calculations. The following updated table summarizes the gross dimensions and number of piles for each of the structures.

Pile Requirements for Marine Terminal Structures

Structure Type	Pile Type	Estimated Pile Count	Estimated Pile Length (ft)	Estimated Length below Mudline (ft)
Trestle	24-inch square PSC	120	50-70	30-50
LNG Loading Platform	24-inch square PSC	28	50-70	20-30
Breasting Dolphin	30-inch steel pipe	54	80-100	40-60
Mooring Dolphin	30-inch steel pipe	48	80-100	60-80
Walkways	18-inch square PSC	16	40-45	20-30

c. Figure 1.5-2 provides an overview of the marine terminal structures including the pile locations.

d. The table entitled “Pile Requirements for Marine Terminal Structures” in (b) above lists the depth of the proposed steel and concrete pilings

e. Based on the results of the structural modeling, the design applies a maximum expected service loading for the steel pipe piles of 75 tons in tension and 150 tons in compression. The design applies a maximum expected service loading for the PSC piles of 37.5 tons in tension and 100 tons in compression

23. The Site Preparation Mobilization and Path of Construction Sequence figure referenced in Section 1.5.4 Construction Procedures was not provided in Appendix 1.B. Provide this figure.

Response:

The Site Preparation Mobilization and Path of Construction Sequence figure has been replaced with the figure entitled "Impact Areas (Construction)" provided in Appendix 1.A (Project Mapping) and a

narrative description of the proposed Project construction sequence contained in Section 1.5.4 (Construction Procedures) in RR1.

24. Provide documentation and correspondence to support the conclusion that there are no planned commercial or residential developments or recreational facilities within 50 miles of the site. (Section 1.9, page 34)

Response:

Table 1.9-2 has been updated to include several planned residential and mixed use developments within 50 miles of the Jacksonville Project. Eagle LNG has prepared cumulative impact section to the end of each individual RR.

25. Provide documentation of coordination with the City of Jacksonville, Office of Economic Development regarding reasonably foreseeable projects (both major and minor) within the largest geographical area identified in response to comment 27, above. (Table 1.9-1, pages 1-33 and 1-34; Appendix 1.E)

Response:

Table 1.9-2 has been updated to include several planned residential and mixed use developments within 50 miles of the Jacksonville Project. Eagle LNG has prepared cumulative impact section to the end of each individual RR.

Coordination with such agencies has been difficult in finding support. All correspondence is included in Appendix 1.D of RR 1.

26. Provide the following information relating to cumulative impacts in the relevant resource report(s). As part of the analysis for each resource potentially affected by the project (e.g. wetlands, noise, air, traffic), identify the geographic area considered in the cumulative impact assessment, as well as an explanation of how the geographical area was selected. Additionally, provide justification for why each area was selected:

- **a. Within each resource report, identify which of the projects included in RR 1, Table 1.9-1 are within the geographic area considered in the cumulative impact assessment for the resource (e.g., geology, wetlands, aquatic resources), provide an explanation of how the geographical area was selected, and provide baseline conditions of the area (what exists now).**
- **b. Indicate what time frame was used for considering "foreseeable projects in the vicinity of the Jacksonville Project site." (RR 1, Section 1.9, page 32)**
- **c. Identify the regulatory and planning boards that were contacted and the publicly available information that was used for cumulative impacts analysis, and provide references for any documents used. (RR 1, Section 1.9, page 32)**
- **d. Provide an environmental review of the non-jurisdictional facilities associated with the proposed project. (RR1, Section 1.12, page 39)**
- **e. Because mixed forested wetlands, saltwater marsh, and freshwater marsh would be impacted by the project, provide a quantitative analysis of impacts on these wetland types for other past, present and reasonably foreseeable projects. (RR 2, Section 2.4.3.1, page 2-15)**
- **f. Assess potential cumulative impacts on surface water due to reasonably foreseeable increases in impervious surfaces, dredging, discharges of ballast and cooling water on affected surface waters. (RR 2, Section 2.4.3.1, page 2-15)**

g. Assess cumulative groundwater consumption from construction and operation of concurrent projects. Identify the sources and estimated quantities of water used for other projects, and provide documentation of coordination with the St. Johns River Water Management District regarding the capacity of the Floridan aquifer to accommodate these cumulative increases in water consumption associated with the Jacksonville Project. (RR 2, Section 2.4.3.1, page 2-15).

h. Assess cumulative impacts on fishery resources from reasonably foreseeable project activities including, but not limited to, dredging, pile driving, and vessel transit. (RR 3, Section 3.6.1, page 3-32)

i. Because live oak forest, coniferous plantation forest, and mixed forested wetlands would be impacted by the project, provide a quantitative analysis of impacts on forested vegetation from other reasonably foreseeable projects. (RR 3, Section 3.6.2, page 3-32)

j. Because wildlife (including federally listed species identified in section 3.5.1, pages 3-18 to 3-24) could be impacted by habitat loss, disturbance and/or injury from the project, provide an assessment of cumulative impacts on wildlife, including migratory birds, from reasonably foreseeable projects. (RR 3, Section 3.6.3, page 3-33)

k. Assess cumulative impacts on employment, accommodations, and public services using quantitative estimates of the number of workers associated with the reasonably foreseeable projects identified in Table 1.9-1. (RR 5; Sections 5.8.1, 5.8.2, and 5.8.3; page 5-16)

l. Assess cumulative impacts on local roadway traffic based on quantitative estimates of the number of road vehicle trips associated with reasonably foreseeable projects identified in Table 1.9-1. (RR 5, Section 5.8.4, page 5-16)

m. Characterize current roadway capacity and provide documentation of coordination with the Florida Department of Transportation regarding the capacity of the existing roadway network to accommodate cumulative increases in traffic during construction. (RR 5, Section 5.8.4, page 5-16)

n. Provide documentation of coordination with the Port of Jacksonville regarding cumulative impacts on marine vessel traffic along the vessel transit route. (RR 8, Section 8.4, page 8-17)

Response:

a. Each individual Resource Report demonstrates which projects listed in Table 1.9-2 were considered in the cumulative impacts assessment.

b. For the purposes of its cumulative impacts analysis, Eagle LNG considered reasonably foreseeable actions to be future projects that are anticipated to be constructed between the present and early 2020, which is when the proposed Project construction is anticipated to be completed.

c. The following regulatory and planning boards and publically available data were consulted to gather information used in this cumulative impacts analysis to identify nearby projects:

> The City of Jacksonville City Planner (correspondence included in Appendix 1.D);

> The City of Jacksonville Office of Economic Development (correspondence included in Appendix 1.D);

> JAX Chamber, North Council;

> Florida Department of Transportation;

> Florida Times-Union;

- Jacksonville Business Journal; and
- Various other publicly available resources as referenced in Section 1.13.

d. An environmental review of these non-jurisdictional facilities has been added to Section 1.12.

e. The requested information is included in RR 2.

f. The requested information is included in RR 2

g. The requested information is included in RR 2.

h. The requested information is included in RR 3.

i. The requested information is included in RR 3.

j. The requested information is included in RR 3.

k. The requested information is included in RR 5.

l. The requested information is included in RR 5.

m. The requested information is included in RR 5.

n. The requested information is included in RR 8.

Responses to Federal Energy Regulatory Commission August 26, 2015 Comments on Jacksonville Project Draft Resource Report 11.

1. **Provide a list of all publications, reports, and other literature or communications which were cited or relied upon to prepare the report. Include for each communications and agency contact the name and title of the person contacted, their affiliation, and telephone number.**

   Response:

   Reference to publications and literature has been made throughout the body of the report, mostly in Section 11.2. These publications include:

   > Gas Processors Association (1997) *Engineering Data Book*

   > Airgas Material Safety Datasheets for methane and propane

   > Material Measurement Laboratory, Ethylene:

   > http://webbook.nist.gov/cgi/cbook.cgi?ID=C74851&Mask=1

   > Haz-Map, Simple Asphyxiation:

   > https://hazmap.nlm.nih.gov/category-etails?id=350&table=tbldiseases

   > Biomass Energy Data Book. (2012). U.S. Department of Energy

   No agency contact has been made with respect to abovementioned cited literature. Further references are provided in Section 11.7

2. **Discuss hazards associated with loading operations, including loadout onto trucks, loadout onto ships, and transfer from ship to ship. Discuss safeguards that would be used to prevent an incident during loading/transfer operations and measures that would be used to protect the public and environment from these hazards. (Section 11.1)**

   Response:

   Hazards associated with Terminal operation are addressed in Sections 11.2, 11.3, 11.4, and in the WSA.

   Additionally, HAZID has been performed for the Facility which describes the hazards associated with loading and transfer operating and additional hazards that could result from an accident or natural catastrophe at the proposed Facility. The HAZID also identifies the safeguards which mitigate each potential hazardous scenario identified. The HAZID Report and HAZID Recommendations and Action Plan are included in Appendices G.1 and G.2 of RR 13, respectively.

   Section 11.5 describes the layers of protection that would be installed at the Facility to protect the public and the environment from these hazards.

3. **Discuss facility personnel and emergency response training standards and schedules to be used to protect the public and environment from failure of the proposed facilities as a result of accidents or natural catastrophes. (Section 11.1)**

   Response:

   Facility personnel and emergency response training standards and schedules are described in Section 11.5.3, 11.5.13 and Emergency Response Plan in Appendix P.3 of RR13.

4. **Clarify whether the Fire Protection System referenced in Section 11.1.1 would include a mechanism that detects people. (Section 11.1.1, page 6; Section 11.1.2, page 7)**

   Response:

Fire protection systems at the Facility would not include a mechanism that detects people. Details of the fire protection system design are included in Appendix C.3 of RR 13.

The Facility will have intrusion detection as part of its security system and plans. Site security is described in Sections 13.4.38 and 13.19 of RR 13 narrative. Security Systems and Plans are described in Section 11.5.6 of RR 11.

5. **Discuss the contingency safeguards if the Basic Process Control System and/or Safety Instrumented Systems malfunction, particularly in terms of whether or not facility personnel would be able to monitor and adjust process control parameters independent of these safety systems. Discuss whether process control parameters would be monitored by facility personnel in tandem with these safety systems. (Section 11.1.1, page 6)**

   Response:

   The Facility design will include a Distributed Control System (DCS) for process control and monitoring, process alarms and process shutdowns will be programed in the DCS. In addition, a Safety Instrumented System (SIS) will be included in the design. The SIS monitors, alarms, shuts down and isolates equipment and piping during process upsets or emergency conditions. The system consists of redundant process measurement devices, transmitters, and in some instances process control elements, designed and deployed to safely shut down the process. Refer to RR 13 Section 13.9 and 13.10 for a description of the plant control systems, safety systems and operator interface. Please also refer to sections 11.5.4 and 11.5.5 of RR 11. The P&IDs included in Appendix U of RR 13 also detail any fail safe designations of control equipment which as designed to fail to a safe state.

6. **Section 11.1.2 describes mechanisms/processes to mitigate adverse impacts in the event that a release occurs. Discuss the mechanisms by which releases would be prevented. (Section 11.1.2, page 7)**

   Response:

   The LNG Facility's Layers of Protection are described in Section 11.5 of RR11. Additionally, the Hazard Detection and Mitigation Philosophy for the Facility is included in Appendix C.3 of RR13.

7. **Clarify whether the facility would be equipped with an NFPA 24-compliant private service main as part of its design or if this would be provided only in the event of a fire requiring a water-based suppression system. (Section 11.1.2, page 7)**

   Response:

   The facility will be equipped with an NFPA 24 compliant firewater main and will be supplied by an on-site storage tank and firewater pumps. The water stored in the tank will be supplied from an on-site well. Please refer to Section 11.5.11 and 11.5.12 of RR11 and Sections 13.4.33 and 13.4.37 of RR13.

8. **In the bullet list describing the features of the NFPA 24-compliant system, clarify whether the hazard assessment mentioned in the fourth bullet references the Process Hazard Analysis (PHA) discussed in Section 11.1.3. (Section 11.1.2, page 7)**

   Response:

   RR 11 has been significantly revised to reflect the reliability and safety of the modified Facility design. This comment no longer applies to the revised filing package. The current design of the Hazard Control Equipment is described in RR11 Section 11.5.12.

9. **Describe or name the standards on which the Hazard and Operability (HAZOP) study, Layer of Protection Analysis (LOPA), and Safety Integrity Level (SIL) analysis would be based. (Section 11.1.3, page 8)**

   Response:

Standards for HAZOP, SIL or LOPA, if performed, will be determined during the EPC phase.

10. **Section 11.1.3 states that "the design of the plant would be altered to ensure that failures with too high of a risk and potential consequence are eliminated or mitigated..." Describe the criteria upon which risk would be evaluated and the thresholds at which risk would be considered too high. (Section 11.1.3, page 8)**

Response:

Standards for HAZOP or LOPA, if performed, will be determined during the EPC phase.

11. **Describe the additional hazards (such as fire, explosion, heat, etc.) that could result from an accident or natural catastrophe at the proposed facility, including operational and construction hazards. Describe the potential receptors and adverse environmental impacts (and affected media) that could result from such hazards. (Section 11.1.4)**

Response:

Additional hazards are described in Section 11.4 of RR11, including design spills, vapor dispersion, overpressure and fire hazards. Layers of protection for the Facility to reduce risk of a potentially hazardous scenario developing into an event are described in Section 11.5 of RR11.

Additionally, HAZID has been performed for the Facility which describes additional hazards that could result from an accident or natural catastrophe at the proposed facility. The HAZID Report and HAZID Recommendations and Action Plan are included in Appendices G.1 and G.2 of RR 13, respectively.

12. **Provide an estimate of the separate quantities of diesel fuel, lubricating oils, natural gas liquids, and other fuels and hazardous liquids that would be stored on site. (Section 11.1.4, page 8)**

Response:

Diesel fuel will be stored in dedicated 24-hr day tanks for each diesel-driven equipment package. Capacity of the day tanks will be established during detail engineering upon specific selection of equipment.

Make-up lubrication oil for rotating equipment will be stored onsite. The volume of storage will be established during detailed engineering upon specific selection of equipment.

Estimated volumes of heavy hydrocarbons, amine solution and refrigerant make-up stored onsite are provided in corresponding Data Sheets in Appendix M.3 of RR 13.

13. **Name the applicable federal, state, and local environmental regulations to which project design, construction, and operation would comply. (Section 11.1.4, page 8)**

Response:

LNG Facility regulatory oversight is described in Section 11.1 of RR11, outlining federal agencies which share regulatory authority over the siting, design, construction and operation of the Facility.

14. **Provide references for the following data or assertions:**

    a. **natural gas consumption (Section 11.1.6, page 9);**
    b. **the 500-year flood zone information (Section 11.1.8, page 10);**
    c. **the sea level rise information (Section 11.1.8, page 10);**
    d. **the maneuvering studies (Section 11.4.6.3, page 18); and**
    e. **the Taylor Engineering analysis report and/or calculations. (Section 11.4.6.5, page 18)**

Response:

a. Natural gas consumption at the facility is to provide fuel gas for operation of Hot Oil Heaters, Regeneration Gas Heaters, Thermal Oxidizer and Flare pilots. The fuel gas system, including consumption, is described in Section 13.4.25 of RR 13.

b. 500-year flood zone information is discussed in the Storm Surge Analysis in Appendix I.3 of RR13 and shown In Appendix 1.A of RR 1.

c. Sea level rise information originally presented in Section 11.1.8 was sourced from the following document:

- *U.S. Army Corps of Engineers. 2011. "Sea-Level Change Considerations for Civil Works Programs." Engineering Circular 1165-2-212(2011), U.S. Army Corps of Engineers, Washington, D.C*.
- In addition, RR 13, Appendix I.2 includes a report – *Jacksonville Project Marine Terminal Storm Surge and Hurricane Vulnerability Study* – that includes additional details on sea level rise, specifically:
- The National Oceanic and Atmospheric Administration (NOAA)has documented an average rate of sea level rise of 2.50 mm/year (yr) with a 95% confidence interval of ± 0.27 mm/yr (0.098 ± 0.010 inches/yr) at the Mayport Bar Pilots Dock NOAA Station (8720218) near the mouth of the St. Johns River. Over a 50-yr project life, the Eagle LNG site may expect mean sea level to increase between 4.9 and 5.5 inches or just under ½ foot. (http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8720218)

d. USCG and Jacksonville Pilots have determined there is no need for maneuvering studies.

e. Since the initial filing of RR 11, Taylor Engineering has completed a more thorough marine terminal design as outlined in the *Jacksonville Project Marine Terminal Basis of Design* (Appendix K.1 of RR 13). The updated mooring analysis incorporated the effects of passing ships as summarized below.

First, Taylor Engineering analyzed mooring loads for ships in the docked position. For the mooring loads, the design considers the prevailing load case as the heaviest of the anticipated design ships (i.e. the 45,000 cbm ship) in a ballast draft condition. This draft position maximizes the wind load area of the docked ship.

Taylor Engineering applied Optimoor mooring analysis software to estimate the total wind and current forces (based on 60-knot and 2-knot wind and current speeds, respectively) on the moored ship. In addition to estimating the total forces acting on the ship, the software estimated the distribution of forces to the mooring dolphins based on the geometry of the berth and the ship. Using a function in the software to determine the highest load on any mooring dolphin at any given wind direction, Taylor Engineering estimated the service mooring load demand as 160 kips per dolphin.

In addition to analyzing the wind forces on the ship, the design estimated the effects of a passing ship on the moored ship. Based on previous discussions with the Jacksonville Bar Pilots, the analysis considered a combined current and ship velocity of 7 knots. The design assumes the passing ship (900-ft long, approximately 66,000 tonnes) would maintain a distance of 300 feet from the moored ship. Based on the PASS-MOOR spreadsheet solution, Taylor Engineering estimated a maximum force perpendicular to the moored ship of approximately 600 kips, and a maximum force parallel to the moored ship of approximately 100 kips. Taylor Engineering added these loads, combined with a 30-knot wind speed, into the Optimoor software. Taylor Engineering estimated the service mooring load demand as 237 kips per dolphin.

In summary, the combined effects of the passing ship and 30-knot current govern the mooring dolphin design. This load combination results in a total maximum service load of 237 kips (108 tonnes) on any one mooring dolphin. Our review of a leading mooring bollard manufacture's information indicates that the manufacturer produces two bollards that blanket the estimated maximum service load. These two bollards have a safe working loads of 220 kips (100 tonnes) and 276 kips (125 tonnes). Taylor

Engineering has selected a mooring bollard with a safe working load of 276 kips (125 tonnes).

15. In addition to rainfall, flooding, and seismic events, discuss the hazards associated with other natural disasters likely to occur in the proposed project location, such as lightning and hurricanes. Discuss the measures that would be used to protect the public and environment from failure of the proposed facilities as a result of these natural hazards. (Section 11.1.8, page 9)

Response:

The report entitled *Jacksonville Project Marine Terminal Storm Surge and Hurricane Vulnerability Study* (Appendix I.2 of Resource Report 13) provides additional details on the likelihood of hurricanes at the site location. In addition the natural hazard assessment is included in Section 11.3.7.8 of RR11. Also refer to Wind and Rainfall Design Basis in Appendix C.4 of RR13.

The Jacksonville, Florida area experienced nine tropical systems (two hurricanes and seven tropical storms) between 1964 and 2014. NOAA National Hurricane Center (NHC) estimates the return period at Jacksonville, Florida for all hurricanes at 13 yrs. For major hurricanes, NOAA estimates the return period at 40 years. These return periods correspond to annual exceedance rates of 7.7% and 2.5%, respectively.

The table below lists the hurricane category, annual exceedance, and encounter probabilities at the Eagle LNG site based on the ASCE 7-10 guidance. Notably, for the design of LNG facilities, 49 C.F.R. Part 193 requires the designer apply "an assumed sustained wind velocity of not less than 150 miles per hour." This design condition corresponds to a 3-second gust of 183 mph.

ASCE 7-10 Based Wind Speeds, Storm Intensity, and 50-yr Encounter Probability for the Eagle LNG Site (ASCE Risk Categories, return periods, wind speeds in bold)

ASCE Risk Category	Return Period (yrs)	Sustained Wind Speed (mph)	Saffir-Simpson Category	Annual exceedance Probability	Encounter Probability for a 50-yr Period
Below I	100	85–91	1	1.00%	39.5%
I	**300**	**93–101**	**1–2**	**0.33%**	**15.4%**
I–II	500	97–105	2	0.20%	9.5%
II	**700**	**100–108**	**2**	**0.14%**	**6.9%**
II–III	1,000	103–111	2–3	0.10%	4.9%
III–IV	**1,700**	**107–115**	**2–3**	**0.06%**	**2.9%**
Above IV	10,000	121–130	4	0.01%	0.5%

16. Section 11.1.8 states the proposed facility would be designed to survive high water levels. Discuss design standards that would be used to achieve this and the high water level threshold up to which the facility would be designed to withstand. (Section 11.1.8, page 9)

Response:

The responses below provide a brief summary of expected coastal storm surge and flooding conditions expected at this location. Review of the report entitled *Jacksonville Project Marine Terminal Storm Surge and Hurricane Vulnerability Study* (Appendix I.2 of Resource Report 13) will provide additional details and references.

The study analyzes 87 years of water level data at the Mayport NOAA stations and develops storm surge elevations for various return periods at the mouth of the St. Johns River. These elevations agree well with draft storm surge elevations from the latest Federal Emergency Management Agency (FEMA) flood insurance studies. The present study applies the final Mayport peak storm surge elevations to Florida Department of Transportation (FDOT) storm surge hydrographs and uses these resulting hydrographs as storm surge boundary condition for an existing two-dimensional (2D), depth-averaged hydrodynamic model of the St. Johns River. The hydrodynamic model propagates the storm surge from the Atlantic Ocean to the Project site and provides peak still water storm surge elevations at the Eagle LNG site for 100-, 500-, 1,000-, and 10,000-yr return period storms.

The study determines wave heights at the site by application of parametric wave models based on wind speeds, water depths, and fetch lengths. The present study analyzed 39 years of local wind data and estimated the wind speeds for 100-, 500-, 1,000-, and 10,000-yr return period storms based on the data. The wind speeds showed fair agreement with ASCE 7-10 design wind speeds. The study applies the highest of the wind speeds (ASCE or analysis) for each storm surge return period to the wave models which yield significant wave heights and peak wave periods for each storm. The study derives the maximum probable wave heights and wave crest elevations for each storm based on a Rayleigh distribution for the wave fields. The wave crest height calculation assumes non-linear waves with the crest height 70% of the wave height above the mean water level. The tables below summarize the storm surge and wave characteristics and the projected water levels including the effects of average and maximum sea level rise.

Estimated Storm Surges and Wave Characteristics at the Eagle LNG Site

Return Period (yrs)	Storm Surge Elevation (ft-NAVD)	Significant Wave Height (ft)	Peak Wave Period (sec)	Maximum Probable Wave Height (ft)	Wave Crest Height (ft)	Wave Crest Elevation (ft-NAVD)
100	4.4	4.6	3.8	8.5	5.9	10.3
500	5.7	5.1	3.9	9.5	6.7	12.4
1,000	6.3	5.7	4.1	10.5	7.4	13.7
10,000	8.7	7.7	4.7	14.3	10.0	18.7

Estimated Storm Surge and Wave Crest Elevations the Eagle LNG Site with Average, Maximum, and No Sea Level Rise

Return Period (yrs)	No Sea Level Rise		50-yr 2.5 mm/yr Average Sea Level Rise		50-yr 2.77 mm/yr Maximum Sea Level Rise	
	Storm Surge Elevation (ft-NAVD)	Wave Crest Elevation (ft-NAVD)	Storm Surge Elevation (ft-NAVD)	Wave Crest Elevation (ft-NAVD)	Storm Surge Elevation (ft-NAVD)	Wave Crest Elevation (ft-NAVD)
100	4.4	10.3	4.8	10.7	4.9	10.8
500	5.7	12.4	6.1	12.8	6.2	12.8
1,000	6.3	13.7	6.7	14.1	6.8	14.1
10,000	8.7	18.7	9.1	19.1	9.2	19.2

Considering the nature of the facility, the design team choose to design to a 500-yr return event rather than typically applied 100-yr event for significant infrastructure. As noted above, the design water levels include storm surge, wind waves, and sea level rise.

17. Section 11.1.8 indicates that engineering parameters would be determined based on American Society of Civil Engineers (ASCE) standard ASCE-7 dated 2005. Explain why the

newer (2010) version of these standards would not be used or update the standard cited to reference the newer version. (Section 11.1.8, page 10)

Response:

Per subsequent discussions on this matter with FERC, it was confirmed that the design of the Facility will comply with the American Society of Civil Engineers (ASCE) standard ASCE-7 dated 2005.

18. **Discuss the hazards associated with a release during a major rainfall or flooding event. Discuss the measures that would be used to protect the public from these hazards. (Section 11.2.1, pages 10 and 11)**

Response:

Spill containment systems in the Facility are designed to contain releases during all operational conditions. Please refer to Section 11.5.9 of RR11 for a description of the spill containment systems, as well as Rainfall Design Basis in Appendix C.4 of RR13 and Spill Containment Drawings in Appendix Q.3 of RR13.

19. **Section 11.2.1 indicates that secondary containment would be 110 percent of the LNG storage tank capacity of 8 million gallons. RR 1 indicates that use of two, 4 million-gallon tanks is being considered. Clarify whether the secondary containment would be reduced to 110 percent of 4 million gallons if Eagle LNG elects to use two smaller tanks versus one larger tank. (Section 11.2.1, page 11)**

Response:

The current design of the Facility includes one full containment LNG storage tank with net capacity of 45,000 m^3. Details of the tank design are described in Section 6 of RR 13 and Section 1.1.4 of RR1.

20. **Section 11.2.1 indicates the liquefaction and LNG storage tank impoundment would be designed for the largest single pipe rupture based on a 10-minute spill at 208 gallons per minute (gpm) per train. Section 2.1 of Appendix 11.A indicates that the flow rate for each 3-inch pipe would be 208 gpm and the piping that connects the three trains is 6 inches in diameter. Clarify whether the impoundment design would be calculated based on the flow rate of the 3-inch pipe or the 6-inch pipe. (Section 11.2.1, page 11)**

Response:

The LNG impoundment system for the current design of the Facility is described in Section 11.5.9. The sump sizing calculations are included in the Spill Containment Sizing Report, located in Appendix Q.1 of RR 13.

21. **Section 11.2.3.2.1 indicates that the potential extent of thermal radiation exposure (at or greater than 1,600 Btu/hr/ft2) would be less than 100 feet from the impoundment areas providing a margin of over 400 feet to the property line. This suggests that the distance between the impoundment areas to the property line would be roughly 500 feet. The executive summary of Appendix 11.A indicates the vapor dispersion exclusion zone around the truck loading impoundment would be 575 feet. Section 11.2.3.3 and the executive summary of Appendix 11.A indicate the vapor dispersion exclusion zones would not extend beyond the property lines. Correct this discrepancy and clarify whether the vapor dispersion zone would be entirely contained within the property boundaries and provide the actual distances of the impoundment areas to the nearest property line. (Section 11.2.3.2.1, page 12)**

Response:

Thermal radiation and vapor dispersion analysis has been performed on the current Facility design as described in Section 11.4.4 and 11.4.6 of RR11. The results are also presented in the Hazard Analysis Report in Appendix Q.1 of RR 13.

22. The contact information presented in Section 11.3.3 for military facilities in the Jacksonville Port Area is incomplete. Include all relevant information for all contacts. (Section 11.3.3, page 14)

Response:

The USCG has requested that it be the sole point of contact and coordination with all military facilities nearby. Eagle LNG has only had indirect contact through meetings at USCG offices.

23. Clarify whether the planned coordination for the proposed project would include coordination with the military facilities located within the vapor and thermal risk zones. (Section 11.3.3, page 14)

Response:

The USGC COTP advised Eagle LNG that Sector staff would handle direct coordination with the military facilities in the region and there is no need for Eagle LNG to arrange individual meetings or directly contact military facilities. Additionally, Naval Depot personnel participate in the Harbor Safety Committee (HSC) and have been represented at meetings/presentations Eagle LNG has made to the HSC.

24. Section 11.4.5 states that the bar pilots do not see a need for escort tugs, standby tugs, or restricting the LNG carriers (LNGC) to daylight hour transits or one-way traffic patterns. Provide specific references, including names and contact information, for these pilots, as well as their qualifications to make such a determination. Provide the data that supports this determination. (Section 11.4.5, page 16)

Response:

In Jacksonville, as well as in every other port in the U.S., vessel pilots licensed by the USCG and state pilot commissions are recognized by the USCG and all other maritime interests as the premier experts on the local waterways and ship channels and the conditions under which large commercial vessels can safely transit in those waters. The pilots develop vessel transit protocols and manage vessel traffic movement patterns and schedules. Without fail, the stakeholder group most influential in assessing the capability of a waterway and local marine resources to accommodate marine LNGCs is the local pilot association. The USCG COTP at Jacksonville has included the JAXPILOTS, the Harbor Safety Committee (HSC), and the JMTX in every key meeting on the Jacksonville Project. Summaries of those meetings are provided below and notes from the meetings are provided in Attachment #24.

The Eagle LNG team met on multiple occasions with the primary maritime stakeholders to address the marine traffic issues for the Jacksonville Project. The following list does not reflect all of the meetings that took place with individual stakeholder organizations; for example, there were other meetings with the USCG COTP's staff to discuss specific issues relative to the WSA as well as meetings with Jacksonville Port Authority (JAXPORT) officials and other entities such as the Riverkeeper. In addition, other members of the HSC, such as representatives of towing vessel operators, other marine terminal operators, and the U.S. Navy, participated in some of the meetings. Rather, the summaries provided below focus on the meetings relevant to this response.

These meetings were undertaken to identify key stakeholder concerns and needs, and then to discuss how those concerns and needs are being addressed in the ongoing assessments.

Meetings with Maritime Stakeholders to Address Navigation and Waterway Safety Issues

Meeting Date	JAXPORT	JMTX	HSC	SJBPA	FDMA	USCG
10/29/14	X	X		X		X
1/15/15						X

1/16/15	X	X	X	X	X	X
3/13/15		X	X	X	X	
4/8/15	X	X	X	X	X	X

25. Provide the vessel traffic statistics that support the number of deep-draft vessels that pass the project site as well as vessel trip frequencies. (Section 11.4.6.1, page 17)

Response:

The vessel traffic summary developed by Taylor Engineering using data obtained from the USACE channel deepening study is the most comprehensive description available of past and forecast vessel traffic levels in the Port of Jacksonville. The data shows deep traffic volumes ranging from approximately 2,300 to 2,700 vessel transits annually, with 2,553 in 2010, the last year of the study. The vessel traffic summary is included as Attachment 11.A of Resource Report 11.

The summary of the 3/13/15 meeting with HSC, Docking Pilots, Pilots, and USCG, the JAXPILOTS report moving an average of 185 deep draft vessels—inbound and outbound combined—each month, which is consistent with the USACE data (185 x 12 = 2,220). This indicates an average of approximately 1,275 vessel calls annually. The pilots noted only about 30% of the total deep draft vessel traffic goes beyond the Jacksonville Project site. That equates to approximately 383 vessels making port calls beyond the site — 383 inbound transits and 383 outbound transits, just one ship passing in each direction each day on average.

26. Several conclusions in the resource report regarding vessel maneuvering and transit are based on Eagle LNG's consultations with bar pilots. For the following items, provide the names and contact information for the pilots who were consulted, the qualifications of these pilots to make the determinations, and the technical data/criteria on which each determination is based:

a. The bar pilots and docking pilots assertion that vessel maneuvering simulation studies for transit or for docking and undocking are not needed. (Section 11.4.6.1, page 17)
b. The pilots do not see a need for daylight-only or one-way traffic restrictions, standby or escort tugs, or maneuvering simulation studies. (Section 11.4.6.2, page 17)
c. The pilots and HSC members consulted believe that an allision involving the LNG terminal or LNG vessels is highly unlikely. (Section 11.4.6.3, page 18)

Response:

Please note that much of this comment is addressed in Eagle's response to Comment 24. Additional information not included in Eagle's response to Comment 24 is provided below.

a. Vessel maneuvering simulation studies typically are employed to assess known or potential challenging navigation conditions such as strong current, constrained navigation areas, or difficult access to a berth. The need for simulations most often arises for scenarios with large vessels in narrow channels. None of those conditions exist for the Jacksonville Project area. The LNGCs that will call at the Jacksonville Project will be relatively small vessels, considerably smaller with lesser drafts than many of the vessels that already transit the waterway beyond the Project site. The channel with its minimum 500 foot project width is wider than that in most major ports. The pilots routinely dock such larger tank vessels at adjacent facilities immediately below (Marathon Oil) and above (Navy) the Jacksonville Project site without experiencing any difficulties. The Drummond Range Reach of the channel where the terminal is sited is not known for unusually strong current or wind effects. In light of those conditions, the pilots concluded that there is no need for simulation studies for transit or docking.

b. The pilots' conclusions on these issues are based on navigation conditions and consider the sizes of the expected LNGCs. The USCG COTP will make the final determinations with respect to transit restrictions and escorts after receiving the Follow-on WSA and completing the agency's own WSA.

c. This conclusion takes into consideration the prevailing navigation conditions as discussed above as well as the smaller vessel size, the design standards and crew qualifications for modern LNGCs, the relatively number of potential allision sites, and the historically low incident rate on the waterway.

27. Clarify whether the referenced tug requirements refer to regulatory requirements or project requirements. If this refers to regulatory requirements, provide a specific reference to the applicable regulations. (Section 11.4.6.2, page 17)

Response:

Tug requirements are not specified in USCG regulations or policy. Tug requirements for each transit are very much vessel specific and vary with vessel size, mechanical condition, and maneuvering characteristics as well as environmental conditions. Arranging for tug support is the responsibility of the vessel owner, operator, or crew and generally is handled by the vessel's agent. The vessel's pilot determines how many tugs and the type and power ratings of the tugs necessary for a specific operation whether that is escort or docking/undocking assistance. In the Jacksonville area, two tugs typically are used to assist in docking and undocking seagoing vessels with a third tug engaged or on standby when conditions warrant. For vessels the size of the expected LNGCs, two tugs are expected to be used under normal marine conditions.

The overall recommendations from maritime meetings consisting of experts from USCG, JAXPILOTS, Harbor Safety Committee, and the JMTX are as follows regarding tug requirements:

> Two tugs will be used for docking and undocking; the current fleet—9 tugs—is adequate to meet expected needs. Tug companies routinely augment local fleets when needs arise.

> Pilot workforces (14 Bar Pilots, 11 Docking Pilots) are adequate to meet expected needs. It takes 2 years to get a new pilot qualified.

> Overall, there are no unusual challenges anticipated with the Project or the proposed ships.

> Typical transit speed will be about 10 knots (Kts), which means a resource will be in a risk zone for about 4 minutes, of which less than 1 minute will be in high risk Zone 1.

> Transit will take about 1.5 hours between the sea buoy and the terminal. Docking will take an additional 45 to 90 minutes; undocking will take 30 to 45 minutes.

> Pilots see no need for daylight-only or one-way traffic restrictions for the LNGCs.

> Pilots see no need for standby or escort tugs for LNGC transits.

> The group sees no need for vessel maneuvering simulation studies.

28. Discuss the basis for the conclusion that the probability of a passing vessel suffering a loss of propulsion power or steering control is very low. (Section 11.4.6.3, page 18)

Response:

The probability of a passing vessel suffering a loss of propulsion power or steering control is very low under any circumstances. This conclusion is based on discussions with stakeholders during preparation of the WSA that indicate no history of such failures in the Jacksonville port area, which is generally reflective of the nature of modern vessel systems and capabilities. No specific data is available to reflect the lack of or frequency of such incidents but the likelihood is addressed by the WSA process. Seagoing vessels typically have redundant steering control and engine control systems and procedures for testing systems prior to transits.

Furthermore, numerous maneuvering studies for other LNG terminals in which members of the Jacksonville Project team participated have assessed the potential for a failure to occur and result in an allision. Those studies found that the window of opportunity for an allision is very small and that the range of conditions under which an allision might occur are very constrained. In general, a vessel operator would have to lose all control of the vessel's movement at the exact time the vessel is turning toward the LNG berth, with the wind, current, and the vessel's own momentum sufficient and properly aligned to direct the vessel toward the berth. This is a very small window made smaller by the fact that the channel reach is straight so that a passing vessel will not be turning toward the LNG Terminal. Further, it presupposes that a vessel's crew and pilot are unable to take any action, such as dropping the vessel's anchor, to prevent the allision.

Discussions with the pilots and other HSC members indicate that in their collective opinion such an allision is highly unlikely. The collective opinion takes into consideration the prevailing navigation conditions as discussed above as well as the smaller vessel size, the design standards and crew qualifications for modern LNGCs, the relatively number of potential allision sites, and the historically low incident rate on the waterway.

29. Describe the basis for the conclusion that simulations to address the effect of the berth location on passing vessels would be unnecessary. (Section 11.4.6.4, page 18)

Response:

This conclusion is based on discussions with the pilots during preparation of the WSA. The berth will be sited between two much larger existing terminals. It will be set back from the channel at least as much as those existing oil docks and the LNGCs will be smaller than the vessels docking at those terminals providing a greater clear distance from the channel. The pilots noted that the speed for vessels passing the site will be on the order of four kt, which helps to minimize hydrodynamic effects associated with a vessel's transit.

30. Discuss how the hydrodynamic effects of passing ships would impact the proposed project. (Section 11.4.6.5, page 18)

Response:

Many factors determine how a docked ship would react to the effects of a passing ship. These factors include the length and draft of both the docked ship and the passing ship, the distance between the two ships, the current speed and direction, and the passing ship speed and direction.

Based on previous discussion with the Jacksonville Bar Pilots, the maximum expected passing ship would be on the order of 900-ft long traveling at a combined current and ship velocity of 7 knots. This passing ship condition would apply a maximum force perpendicular to the moored ship of approximately 600 kips, and a maximum force parallel to the moored ship of approximately 100 kips. This load, combined with a 30-knot wind speed produces the largest force on the facilities mooring dolphins. The total force transferred to a single mooring dolphin is approximately 48% larger than the force of a 60-knot wind speed transferred to a single mooring dolphin. Therefore, the hydrodynamic effects of a passing ship control the mooring dolphin design. *The Jacksonville Project Marine Terminal Basis of Design* (Appendix K.1 of Resource Report 13 provides additional details.

31. Address the following issues in Appendix 11.A:

d. Section 1.0 indicates the parcel size is 193 acres. Section 11.1.3 of RR 11 indicates the parcel size is 194 acres. Clarify this discrepancy with the correct acreage.
e. Section 1.0 suggests the possibility of a rail loadout facility. Clarify whether rail systems are being considered.
f. Describe how flow rate for the 6-inch pipe discussed in Sections 2.1 and 2.1.1 was calculated.

g. Provide a reference for the threshold failure frequencies provided in Table 1 of Section 2.1.1.
h. Describe how the flow rate for the 4-inch truck loading piping discussed in Section 2.2 was calculated.
i. Clarify whether the vapor dispersion and thermal radiation exclusion zones for the truck loadout facility were calculated based on the flow rate of the truck loading piping or the volume of the largest truck. (Section 2.2)
j. Provide a reference for the hourly weather condition values from the Jacksonville Naval Air Station (KNIP) from January 1, 2010 to December 31, 2014 that was used to determine the ambient conditions for the thermal radiation exclusion zones. (Section 3.1)
k. Discuss the appropriateness of calculating thermal radiation and vapor dispersion exclusion zones distances from the center of the impoundments and not the edges of the impoundments. (Sections 3.2 and 3.3)

Response:

a. The correct acreage is 193.4 acres.
b. There are no provisions for a rail loadout facility in the current design of the Facility. Should the project decide to add this capability, proper documentation will be provided for review and approval at that time.
c. The values stated in the previously filed Draft RR 11 do not apply to the current design. Please refer to the Spill Containment Sizing Report in Appendix Q.1 of Resource Report 13.
d. The values stated in the previously filed Draft RR 11 do not apply to the current design. Please refer to Hazard Analysis Report in Appendix Q.1 of Resource Report 13.
e. The values stated in the previously filed Draft RR 11 do not apply to the current design. Please refer to Spill Containment Sizing Report and Hazard Analysis Report in Appendix Q.1 of Resource Report 13.
f. The values stated in the previously filed Draft RR 11 do not apply to the current design. Please refer to Hazard Analysis Report in Appendix Q.1 of Resource Report 13.
g. The meteorological data analysis performed to determine the weather conditions to be used to calculate thermal radiation and vapor dispersion exclusion zones for the Jacksonville Project are included in the Meteorological Data Report located in Appendix Q.2 of RR 13.
h. The analyses presented in the previously filed Draft RR 11 do not apply to the current design. Please refer to Hazard Analysis Report in Appendix Q.1 of Resource Report 13.

32. Draft Resource Report 11 did not include pertinent information for each single accidental leakage source, such as the equivalent hole size and corresponding design spill parameters, <u>as public information</u> that can be used in the NEPA environmental document. Provide the following <u>as public information</u>:

a. design spills selected (hole diameter, location, pressure, temperature);
b. input parameters (scenario flow rate, duration); and
c. results (distances) of calculations and modeling for thermal radiation, vapor dispersion, toxicity overpressures, etc.

Note that supporting information (e.g., modeling runs, calculations, etc.) should be placed in the appendix to Resource Report 11 and, if necessary, may be labeled as “Critical Energy Infrastructure Information” (CEII). However, figures depicting the results of the vapor dispersion, thermal radiation, toxicity, and overpressure analyses should be filed <u>as public information</u>.

Response:

Section 11.4 of RR11 as well as the Hazard Analysis Report included in Appendix Q.1 of RR 13 describe the comprehensive selection of design spill scenarios, input parameters and results of calculations and modeling for thermal radiation, vapor dispersion, toxicity and overpressure analysis. Figures depicting results of this analysis are filed as public information within the Application package.

33. Section 11.1.4 Safety Hazards and Environmental impacts describes properties, hazards and environmental effects of natural gas, but does not describe the properties and hazards of any other hazardous materials stored, transferred, handled, or processed at the proposed facility. Section 11.1.4 should describe the hazards of all hazardous materials stored, transferred, handled, or processed at the proposed facility. In addition, the information should be filed as public for FERC staff to disclose in its NEPA environmental document in order to describe the safety and reliability and disclose any potential public impact. At a minimum, the hazards described should include the following:

a. high or low temperature hazards from liquid, vapor, and gaseous releases;
b. toxicity hazards from ingestion, inhalation, or contact of toxic liquid, vapor, and gaseous releases;
c. overpressure and radiant heat hazards from ignition of flammable vapor clouds;
d. radiant heat hazards from pool fires and jet fires; and
e. cascading event hazards from failures of facility components from the initial hazard that could exacerbate the initial hazard, such as overpressure and radiant heat from boiling liquid expanding vapor explosions (BLEVEs) or failure of the process vessels or LNG storage containers.

Response:

a. Description of high and low temperature hazards are presented in section 11.4.2 of RR 11.

b. Asphyxiant and toxic vapor dispersion analysis is presented in section 11.4.3 of RR 11 and detailed in the Hazard Analysis Report included in Appendix Q.1 of RR 13.

c. Overpressure and radiant heat hazards from ignition of flammable vapor clouds as well as radiant heat hazards from jet fires will be described in the subsequent version of the Hazard Analysis Report which will be filed with the final Application package.

d. Radiant heat hazards from pool fires and jet fires are presented in section 11.4.6 of RR 11 and described in the Hazard Analysis Report included in Appendix Q.1 of RR 13.

e. Cascading events from Facility hazards are considered in section 11.2.2 of RR 11. The design of the LNG Facility includes multiple layers of protection to reduce the risk of a potentially hazardous scenario developing into an event, which could affect off-site infrastructure. These layers of protection are described in section 11.5 of RR 11.

34. Section 11.2.1 does not provide the specifics on the containment systems serving each area of the proposed facility. Provide the useable volumes, materials of construction, and dimensions for the largest spill volume, truck container, storage container, or process vessel serving each containment area <u>as public information</u> containing the following:

a. LNG;
b. heavy hydrocarbons (propane);
c. C3+;
d. nitrogen;
e. amine;
f. hot oil; and
g. any other hazardous liquid.

Response:

Description of spill containment systems is included in Section 11.5.9 of RR11.

35. Provide an analysis of the potential hazards from a liquid nitrogen release into its impoundment, and determine whether protective measures for operators in the area, such as oxygen sensors, would be prudent.

Response:

Potential hazards from a liquid nitrogen release as well as protective measures for the operators are described in Section 11.2.2.3 of RR11. The current design does not include any containment for the liquid nitrogen system. Section 11.4.3 summarizes the results of the nitrogen asphyxiant modeling and demonstrates that oxygen sensors are not necessary. Further details are included in the Hazard Analysis in RR 13, Appendix Q.1.

36. Draft Resource Report 11 did not include a toxicity analyses from a release of toxic components in the acid gas and heavy hydrocarbon streams. For a release of toxic components, such as hydrogen sulfide, benzene, toluene, ethylbenzene, and/or xylene, provide the following:

a. dispersion modeling with results based on Acute Exposure Guideline Levels (AEGL-1, -2, and -3) maintained by the U.S. Environmental Protection Agency and averaging times based on the potential exposure duration;
b. a summary of the distance and duration of concentrations in relation to the AEGLs;
c. a summary of the software that was used for the modeling, including the suitability of the model and corresponding uncertainty factors (e.g. ½ AEGLs); and
d. all input and output data and files for the model.

Response:

Asphyxiant and toxic vapor dispersion analyses are addressed in Section 11.4.3 of RR11. Methodology for dispersion modeling based on Acute Exposure Guideline Levels (AEGL-1, -2, and -3) maintained by the U.S. Environmental Protection Agency and averaging times based on the potential exposure duration are described in Hazard Analysis Report included in Appendix Q.1 of RR 13. The dispersion modeling, a summary of the distance and duration of concentrations in relation to the AEGLs, a summary of the software that was used for the modeling, including the suitability of the model and corresponding uncertainty factors (e.g. ½ AEGLs), and all input and output data and files for the model are included in this report.

37. Describe the mitigation measures that would be taken to prevent the vapor dispersion and ignition of LNG and other flammable fluids into confined areas, such as buildings.

Response:

Please refer to Section 11.2.2 of RR11 for mitigation measures described for potential events with respect to LNG and other flammable fluids.

38. Draft Resource Report 11 did not include an overpressure analysis from a release of flammable fluids (i.e., methane, propane, ethylene) from the liquefaction area dispersing to the most confined and congested regions of the facility. Provide an overpressure evaluation based on 1 psi overpressures that accounts for any uncertainty factors based on the model used (e.g., ½ psi overpressure).

Response:

Section 11.4.5 of RR11 describes the overpressure analysis for the Facility. Methodology for overpressure evaluation is described in Hazard Analysis Report included in Appendix Q.1 of RR 13.

39. The U.S. DOT PHMSA, in FAQ 18 of its LNG Facility Siting Application Requirements: Frequently Asked Questions (found at: http://primis.phmsa.dot.gov/lng/faqs.htm), indicates that thermal radiation from jet fires should be evaluated in an LNG facility siting analysis. Provide an analysis of the potential jet fires from design spill releases. Provide a figure, as public information, depicting the distance to the 1,600 Btu/ft^2-hr level and property line.

Response:

Thermal radiation from LNG jet fires are described in Section 11.4.6.2 of RR11. Methodology for an analysis of the potential jet fires from design spill releases are described in Hazard Analysis Report included in Appendix Q.1 of RR 13. Results of the analysis as well as figures depicting the distance to the 1,600 Btu/ft2-hr level and property line are included. This information will be filed as public information in the Application package.

40. Draft Resource Report 11 indicates that LNG truck loading area is located within the 10,000 Btu/ft^2-hr hazard zone from the LNG truck loading sump. Provide an analysis of the potential for a boiling liquid expanding vapor explosion (BLEVE) of the LNG trucks in the truck loading area, without relying on active mitigation measures, due to thermal radiation from the nearby sump or swale. If a BLEVE would be possible, provide an analysis of the extent of fireball radiant heats equivalent to a thermal dose of 1,600 Btu/ft^2-hr for 40 seconds, overpressures to 1 psi, and fragment travel distances. Alternatively, provide passive protection to prevent a BLEVE from occurring.

Response:

In the current design, the LNG truck loading scales are not within the 10,000 Btu/ft2-hr hazard zone from any sump. Please refer to Figure 7-1 of the Hazard Analysis Report in Appendix Q.1 of RR13.

41. According to Resource Report 1, on page 1-8, "the cryogenic loading line would consist of approximately 2,700 feet of 20-inch-diameter insulated line extending from the LNG storage tank to the vessel loading area." Describe the spill containment system for the 20-inch-diameter LNG loading line from the LNG storage tank to the vessel loading area.

Response:

The LNG spill containment systems for the current design are described in Section 11.5.9 of RR11. Please refer to Spill Containment Sizing Report in Appendix Q.1 of RR13 for details of impoundment sizing criteria and calculations.

42. Section 11.2.1 Impoundment Sizing Criteria and Dimensions states that all spills in the liquefaction area and around the LNG storage tank would be directed via trenching and grading to the LNG Storage Tank Secondary Containment Sump. However, the basis and assumptions that would be used to select the size of the trenches were not provided. Provide the following:

a. open channel calculations that demonstrate the proposed trench system would adequately convey the maximum liquid spill into the impoundment sumps;
b. table of the hydraulic design data (inflow, outflow, slope, invert elevations, depth) of the trenches leading to the LNG Storage Tank Secondary Containment Sump; and
c. conceptual drawing(s) of the LNG spill collection system for each distinct section of the trench system.

Response:

a. The spill containment systems have been re-designed to reflect the current design of the Facility. The revised design of the trench system would adequately convey the maximum liquid spill into the impoundment sumps. This information will be provided as part of detail design of the Facility

b. The LNG spill containment systems for the current design are described in Section 11.5.9 of RR11. Please refer to Spill Containment Sizing Report in Appendix Q.1 of RR13 for details of impoundment sizing criteria and calculations, as well as Spill Containment Drawings in Appendix Q.3 of RR13

c. The LNG spill containment systems for the current design are described in Section 11.5.9 of RR11. Please refer to Spill Containment Sizing Report in Appendix Q.1 of RR13 for details of impoundment sizing criteria and calculations, as well as Spill Containment Drawings in Appendix Q.3 of RR13.

43. Appendix 11.A, Section 2.1.1 provides the failure scenarios selected to determine vapor dispersion exclusion zones. Provide pump curves and other supporting documentation to demonstrate that the release scenarios have accounted for the effect of pump runout.

Response:

The failure scenarios are determined based on the current design of the Facility and submitted as part of the Hazard Analysis Report included in Appendix Q.1 of RR 13. Justification on pump runout values are included therein.

44. According to Section 11.2.1, the impoundment sump serving spills from the liquefaction area and LNG storage tank would be designed based on a 10-minute spill from the LNG storage tank supply header. Clarify whether this impoundment sizing spill accounts for the effect of pump runout and multiple pumps running concurrently. Indicate whether mechanical interlocks or passive preventative measures would be installed to prevent all pumps from running concurrently.

Response:

A description of LNG impoundment sumps for the current design is included in Section 11.5.9 of RR11. Please also refer to Spill Containment Sizing Report in Appendix Q.1 of RR13. Mechanical interlocks for preventing pumps from running concurrently in the event of full failure of the LNG loading line will be included in the design. However, the Facility design includes 2x50% LNG Transfer pumps for loading LNG carriers as opposed to multiple 100% capacity pumps. As such the total runout is independent of the mechanical interlocks.

45. Section 11.2.1 indicates that all spills from the liquefaction area would be directed to the LNG Storage Tank Secondary Containment. However, Appendix 11.A, Section 2.1.2 Spill Containment indicates that spills from the liquefaction area would be directed to the Liquefaction Train Containment Sump. Clarify this discrepancy. Additionally, provide drawings showing how a spill from the liquefaction area would flow from this area into the LNG Storage Tank Secondary Containment.

Response:

A description of LNG impoundment sumps for the current design is included in Section 11.5.9 of RR11. Please also refer to Spill Containment Sizing Report in Appendix Q.1 of RR 13.

46. Section 11.2.2 Design Spills should acknowledge the status of coordination with PHMSA on the design spill criteria and methodology used to determine the single accidental leakage sources for compliance with 49 C.F.R. Part 193.

Response:

The design spill selection is in accordance and in compliance with 49 C.F.R. Part 193 as acknowledged in Section 11.4.1 of RR11.

47. Appendix 11.A should identify the release orientation for hazard calculations that produces the largest exclusion zone distance. Refer to the U.S. DOT PHMSA, FAQ 14 of its LNG Facility Siting Application Requirements: Frequently Asked Questions (found at: http://primis.phmsa.dot.gov/lng/faqs.htm).

Response:

The Hazard Analysis Report (Appendix Q.1 of RR 13) filed with the Application package and identifies the release orientation for bounding release scenarios.

48. Appendix 11.A, Section 3.1 Weather indicates a wind speed of 2 m/s was considered for vapor dispersion modeling. The wind speeds should be based on a wind sensitivity analysis for PHAST simulations that produce the maximum vapor dispersion distance. This may require wind speeds beyond the 2 m/s listed. Provide a sensitivity analysis that demonstrates lower and higher wind speeds do not result in longer dispersion distances or demonstrate that wind speed selected occurs at least 90 percent of the time (refer to 49 C.F.R. Part 193.2059).

Response:

Sensitivity analysis for vapor dispersion modeling is included in the Hazard Analysis Report (Appendix Q.1 of RR 13). Please refer to Section 11.4 of RR 11, Meteorological Data Report included in Appendix Q.2 of RR13, and the Hazard Analysis Report included in Appendix Q.1 of RR13.

49. Appendix 11.A, Section 3.3 3 Flammable Vapor Dispersion Exclusion Zones indicates that PHAST Version 7.1 was used to calculate the ½-LFL distance from LNG in the containment sumps. However, vapor dispersion from conveyance of LNG to the respective containment sumps (i.e., trenches serving to direct LNG spills to the associated containment sumps) should also be evaluated. Provide a revised vapor dispersion analysis that accounts for a liquid spill into the trenches.

Response:

The Hazard Analysis Report (Appendix Q.1 of RR 13) considers vapor dispersion from conveyance of LNG to the respective containment sumps.

50. Appendix 11.A, Section 3.3 Flammable Vapor Dispersion Exclusion Zones indicates that PHAST Version 7.1 was used to calculate the flammable vapor dispersion exclusion zones. However, PHAST Version 6.6 and Version 6.7 are the only PHAST versions approved by PHMSA. Provide consultation from PHMSA that PHAST Version 7.1 would be an approved dispersion model.

Response:

PHAST Version 6.6 and Version 6.7 as approved by PHMSA will be used for any hazard analysis performed for the Facility. Please refer to Section 11.4 of RR11 and to the Hazard Analysis Report included Appendix Q.1 of RR13.

51. Provide both the input and output files for the PHAST software in electronic format (e.g., .PSU files) to support the vapor dispersion results.

Response:

Input and output files will be provided with the final Application package in December 2016.

52. Appendix 11.A, Section 3.3 Flammable Vapor Dispersion Exclusion Zones indicates that the liquefaction area and truck loading spill basins would be lined with insulated concrete. Provide the thermophysical properties (thermal conductivity, thermal diffusivity) of the insulated concrete used for the spill basins. Additionally, clarify whether the trenches would also be lined with insulating concrete. Note this information should be filed <u>as public information</u>.

Response:

As detailed in the Spill Containment Sizing Report in Appendix Q.1 of RR 13, insulating concrete will be used for impoundments and trenches. The estimated thermophysical properties are as follows:

thermal conductivity of .6 W/m·K, and thermal diffusivity of 3.5E-7m^2/s. Final properties of the concrete will be determined in detailed design.

53. Appendix 11.A, Section 3.2 Thermal Radiation Exclusion Zones does not provide the thermal heat fluxes from the LNG storage tank secondary containment dike. The inside dimensions of LNG storage tank dike should be used as the pool fire dimensions.

Response:
Thermal radiation zones corresponding to the current design of the LNG storage tank are demonstrated in Figure 7.1 of Appendix Q.1 included in RR13.

54. Discuss whether Eagle LNG intends to implement any mutual aid agreement or voluntary response program to assist in responding to potential LNG truck incidents.

Response:
Any mutual aid agreements will be detailed as the Emergency Response Plan for the Facility is further developed. The Draft Emergency Response Plan can be found in Appendix P.3 of RR13.

55. Provide a description of the LNG carrier routes to and from the facility. Additionally, describe any zones of concern impacted along the vessel route for both accidental and intentional events and provide associated figures <u>as public information</u>.

Response:

The sole route will be directly from the marine terminal to sea via the St. Johns River. The Zones of Concern issues for LNG transits have been discussed at length with the USCG staff and are addressed in detail in the WSA. The USCG has agreed that application of the standards developed by the Sandia National Laboratories and referenced by the USCG in NVIC 01-2011 are appropriate for the Jacksonville Project even though those calculations are based on potential releases from much larger vessels. This reflects a conclusion, which is supported by the Sandia results, that the thermal effects of a fire resulting from a release of LNG over water would be essentially the same for any incident, with a larger volume resulting in longer duration.

Attachment #55 is a concept paper dated March 9, 2015 that adapts the results of the Sandia material and other studies to provide a reasonable and conservative approach. During a meeting on March 13, 2015 the USCG COTP's project staff agreed that this approach is acceptable.

Graphic depictions of the Zones of Concern are included in Figure 11-1 of Resource Report 11. Those are included in the WSA. While the WSA is classed as Sensitive Security Information (SSI) and may not be included in public information, the Zones of Concern determinations may be made publicly since the documents on which they are based are public and anyone could easily map the zones independently.

ATTACHMENTS

Attachment #24	Agency Contacts and Meeting Notes in reference to the decision not requiring escort tugs, standby tugs, or restricting the LNG carriers (LNGC) to daylight hour transits or one-way traffic patterns.
Attachment #55	Zones of Concern for Thermal and Vapor Dispersion Risks for the Eagle LNG Small LNG Carrier Operations on the St. Johns River at Jacksonville, FL

Attachment #24

Resource Report 11

Comment #24

Agency Contacts and Meeting Notes in reference to the decision not requiring escort tugs, standby tugs, or restricting the LNG carriers (LNGC) to daylight hour transits or one-way traffic patterns.

Primary Stakeholder Representatives for meetings and coordination:

- USCG
  - LT Allan Storm, Waterways Section Chief, Eagle LNG Project Officer, 904-564-7563
  - Mr. Robert Butts, LNG Specialist, 904-564-7664
  - LCDR Marc Montemerlo, Inspection Division Chief, 904-564-7563
- JAXPORT
  - Charles White, Director of Public Safety, 904-357-3351
- JMTX
  - James McLaughlin, Executive Director, 904-553-3667
- JMTX HSC
  - Capt. Mike Getchell, Harbor Safety Chair, 904-634-1598
- St. Johns Bar Pilots Association (SJBPA) "JAX PILOTS"
  - Capt. Tim McGill, President, 904-249-5631
- Florida Docking Masters Association (FDMA) "Docking Pilots"
  - Capt. Tony Hogg, 904-620-0640

The key points from those meetings relevant to this response are provided below.

10/29/14 Meeting at USCG Sector Jacksonville

Attendees represented USCG and JAXPILOTS, JMTX, JAXPORT who were invited by the USCG as the principal stakeholders for the waterway issues. Discussion points included:

- PILOTS
  - Currently have 15 Bar Pilots
  - State pilots are compulsory on foreign-flag vessels
  - Docking Masters handle vessels when state pilot is not required
  - Marathon Oil – dock about 200 feet off channel
  - Setback distance in that area – 200 feet worked out with the HSC and USACE
  - 800 feet Panamax vessels typical; some larger, some smaller
  - Other traffic passes that area "as slow as possible…down to 4 knots (kt)"
  - Estimate 2 hours transit inbound from bar to dock
  - Large vessels outbound take about 3 hours (draft and flood tide factor into that) (less for smaller vessels)
- USCG
  - Safety Zone rule already in place for tank vessels, cruise ships, military vessels
  - USCG escorts for Certain Dangerous Cargoes (CDC); LNG not yet being moved
  - USN and USMC all aware of LNG development; USCG coordinates with them (note: expect that formal reviews and comment processes will be handled through the DOD Clearinghouse process)

1/15/15 Meeting at USCG Sector Jacksonville

This meeting followed the Eagle LNG site visit and included the COTP and the Sector command staff. Discussion points included:

> Briefed COTP on the Jacksonville Project details, discuss any areas of particular concern to USCG, and review USCG process for handling the Waterway Suitability Assessment as a primer for the meeting with the JMTX HSC on 1/16/15.

> Discussed the process for the WSA and the remaining stakeholder outreach efforts expected including the HSC meeting and the USCG's process, including an additional stakeholder workshop and a public notice in the Federal Register; the later will come after submittal of the Follow-on WSA.

> Discussed planning for security issues USCG reiterated the need to address Zones of Concern for LNG releases along with the other risk analyses for the Jacksonville Project.

1/16/15 Meeting with HSC

Attendees included the USCG, JAXPILOTS, JMTX, JAXPORT, and numerous other maritime stakeholders including U.S. Navy. Discussion points included:

> Overview of the Jacksonville Project.

> Facility and anticipated vessel design details (dimensions, capacities, etc.).

> Open discussion of navigation and safety issues.

> JMTX, the principal record keeper for the waterway, reported that St John's River has experienced only "one or two" traffic incidents out of thousands of transits.

3/13/15 Meeting with USCG

Attendees included LCDR Montemerlo who oversees the waterways programs, LT Storm who is the project officer for the WSA, and Rob Butts who is the LNG specialist on for the USCG team. Discussion points included:

> USCG accepted the approach proposed for determining the "zones of concern" distances for thermal and vapor dispersion risk distances.

> They also accepted the concept being used for security assessments; for example, the need for safety/security zone rules and vessel escorts will be based on risks and threat assessments rather than any permanent requirements.

> They didn't identify any specific concerns that Eagle is not already addressing.

3/13/15 Meeting with HSC, Docking Pilots, Pilots, USCG

Attendees included HSC Chairman, JMTX Director, JAXPILOTS, and Docking Pilots. Discussion points included:

> Discussed berth design and expectations relative to LNG carrier design. They are very satisfied with facility layout and design.

> Overall, they don't see any problems of unusual challenges with the Jacksonville Project or the proposed ships. These general points came out:

- Typical transit speed will be about 10 kt, which means a resource will be in a risk zone for about four minutes and less than one minute for Zone 1 high risks.
- Will take about 1.5 hours to transit between the sea buoy and the marine terminal. Docking will take an additional 45 to 90 minutes; undocking will take 30 to 45 minutes.
- Dock design – only one issue; passing vessels do affect ships berthed along that part of the channel; Pilots "deal with it all the time" and take appropriate precautions; mooring system design will take that into consideration; Taylor Engineering has that well in hand.
- Bar Pilots move an average of 85 deep draft vessels—inbound and outbound combined––each month.
- Only about 30% of total deep draft vessel traffic goes beyond the Eagle site.

- Pilots see no need for daylight-only or one-way traffic restrictions for the LNGCs (Note: This is based on navigation safety needs; it does not mean that the USCG COTP will not require USCG escorts for LNGCs, for which a decision has not yet been made).
- Pilots see no need for standby or escort tugs for LNGC transits. (Note: This determination is based on vessel size and other factors; it does not mean that the USCG COTP will not require USCG escorts for LNGCs, for which a decision has not yet been made)
- No need for vessel maneuvering simulation studies.
- They'll use two tugs for docking and undocking; the current fleet—nine tugs—is adequate to meet expected needs; tug companies routinely augment local fleets when needs arise.
- Pilot workforces (14 Bar Pilots, 11 Docking Pilots) are adequate to meet expected needs. It takes two years to get a new pilot qualified.

4/8/15 Meeting with HSC, Docking Pilots, Pilots, USCG

Essentially a follow-on meeting with the same attendees as the previous meeting to update the stakeholders on project development, navigation issues, and the WSA process including the Zones of Concern and the schedule for development and future meeting needs.

Attachment #55

Resource Report 11

Comment #55

Zones of Concern for Thermal and Vapor Dispersion Risks for the Eagle LNG Small LNG Carrier Operations on the St. Johns River at Jacksonville, FL

The studies conducted by the Sandia National Laboratories (SNL) in 2004 and updated in 2008 are the only definitive evaluations of available for large LNG releases over water. At the time those were done, most LNG carriers had capacities in the 125,000 to 140,000 cubic meter (m^3) range and typical cargo tanks had capacities of 25,000 m^3 which is the size that SNL evaluated. The studies also considered cascading events affecting as three cargo tanks.

Review of available published materials did not identify any similar studies, any studies or reports that contradicted the SNL findings, or any other comprehensive assessments of LNG releases over water subsequent to those by SNL.

Review of available published materials did not identify any studies similar to those done by SNL for releases from small LNGCs. That review did, however, identify other assessments that built on the SNL results for smaller events:

> *Consequences of LNG Marine Incidents*, R. M. Pitblado et al, Det Norske Veritas, CCPS Conference Orlando June 29 - July 1, 2004 (DNV Paper)
>
> *Modeling the Release Spreading, and Burning of LNG, LPG, and Gasoline on Water*, David W. Johnson et al, Quest Consultants, February 20, 2007 (Quest Paper)

Those materials together with the SNL report are the basis for this discussion of zones of concern.

The LNGCs that will call at Eagle LNG Jacksonville will have total capacities of no more than 45,000 m^3, and the purpose-built vessels that will represent most of the traffic will have capacities on the order of 15,000 m^3. The design of the ships is not yet complete; however, similar size vessels are in operation in other parts of the world. Whether they use independent tanks or membrane tanks, small LNGCs typically have three or four tanks. Taking the worst case, it is expected that the greatest single tank capacity for the largest LNGCs that will call at Eagle LNG will be approximately 10,000 m^3. For most of the LNGCs expected the volume will be substantially less.

The studies cited above evaluated a wide range of scenarios that potentially could result in the accidental or intentional release of LNG. In general, SNL found that the potential for a release, either as a result of a casualty or a deliberate action, is very small. Due to the nature of LNG carrier design—robust structures, interstitial spaces, and multiple containment barriers—most accident scenarios are not likely to result in damage sufficient to breach the cargo tanks. For example, all LNGCs are double-hulled with the inner structures designed to contain any leakage. In general, the only breach scenario that created a major release was a high-speed collision. SNL also concluded that any collision or other impact sufficient to result in major damage and release of cargo would also be expected to generate sufficient energy to result in ignition of the cargo vapors.

Intentional releases were not as clearly defined, but deliberate discharge of LNG cargo overboard would seem to be the most likely. The intentional scenarios resulted in larger spills due to the potential delay in observers learning of the release and taking action to stop it. SNL concluded that such releases have a low probability of occurring. In practice, it would be extremely difficult for a small group of people on a vessel to initiate a deliberate discharge without alerting the rest of the crew. Further, it is expected that most if not all of the Eagle LNG traffic will involve vessels in dedicated service under long-term contracts which is characteristic of the LNG industry overall and which will minimize variations in crew make-up. The smaller vessels and the natures of the foreign ports they will call—primarily in the Caribbean—will greatly reduce the potential for persons other than the crew to gain access to the vessels.

It is important to note that there is no documented case of any of the scenarios occurring and resulting the intentional discharge of LNG from a vessel anywhere in the world. Considering the broader arena of all

commercial vessel operations overall, the incidence rates for accidents are clearly far greater than those for inimical actions even when piracy in certain parts of the world in recent years is factored in. Such would be the case on the St. Johns River. Thus it is reasonable to conclude that any potential release of LNG would be associated with an accident.

The potential for a major vessel casualty involving a small LNGC on the St. Johns River is no higher than for any other commercial vessel of comparable size. Considering that there is no history of large vessel accidents on the river, it is reasonable to conclude that the potential for a major accident is low. Further considering that LNGCs are designed, built, and operated under some of the most rigid standards applied to any commercial vessels, the likelihood of an accident is reduced even further. SNL concluded that the risk to public safety exists with a high speed collision, primarily with a large angle of incidence, which is not a high probability event on the St. Johns River with its limited amount of cross traffic; other than the Intracoastal Waterway (ICW) there is just one ferry crossing, at Mayport. Still, since an accident cannot be categorically ruled out, the potential for a spill must be considered.

The SNL studies concluded that LNGC size was not a determinant factor in risks associated with releases. The scenarios resulted in a range of hole sizes that determined spill rates and volumes, and the hole sizes were the same for any vessel in the same scenario. Evaluating damage scenarios showed that the most likely size for a hole in the cargo tank itself generally is less than one-meter square. That standard is applied here.

In general, SNL concluded that the most probable large spill was one-half the contents of the tank, i.e. 12,500 m^3 for the vessels studied. Applying that to the largest Eagle LNGCs with 10,000 m^3 tanks would result in a potential spill of 5,000 m^3.

SNL also noted the possibility of a cascading casualty that would involve as many as three LNG tanks. Applying that to the Eagle LNGCs would result in a spill of 15,000 m^3 which is one-third of the total contents of the largest vessel expected to call and essentially 100% of the cargo on the smaller vessels. SNL also noted that the cascading release would result in prolonging the duration of a pool fire but not the size.

The SNL figure of 12,500 m^3 is a little less than the Eagle LNG figure of 15,000 m^3. Thus, it is reasonable to conclude that a catastrophic release from the LNGCs that will call at Eagle LNG would result in risk conditions similar to those evaluated by SNL. Using the SNL assessment provides a consistent approach to assessing potential risks on the St. Johns River.

SNL also concluded that a vapor cloud without ignition is an unlikely outcome in an accidental release scenario. Thus applying the SNL thermal energy levels for pool fires is a reasonable approach to evaluating risk zones.

The SNL study concluded that the hazard results were based on a range of nominal, or most likely, spill conditions and are not site specific. Site specific hazard distances will change depending upon the location of the facility, number, size and type of LNG carriers or regasification vessels used, as well as environmental conditions. Based on this, it's reasonable to apply to the Eagle LNG operations result in these "zones of concern":

Zone 1 with a 35 kW/m^2 thermal hazard level extends 250 meters (m) from the source

Zone 2 with a 5 kW/m^2 thermal hazard level extends from 250 m to 750 m

Zone 3 where risks are lowest extends beyond 750 m

Unignited vapor clouds could extend to 1,700 m

250 m = 0.155 mi, approximately 1/6 of a mile = 820 ft

750 m = 0.455 mi, approximately 1/2 of a mile = 2,460 ft

1,700 m = 1.056 mi, approximately 5,576 ft

The Quest and DNV researchers generally reached the same conclusions about small volume spills. As noted in the DNV paper, the researchers found that a 1 m^2 square hole and a release of 12,500 m^3 of cargo

represent the most probable spill scenario, similar to the SNL findings. Other findings also were similar to SNL's.

The DNV researchers reported that when overall design variations are considered in total, the risks for LNGCs with membrane tanks and those with independent tanks are similar. That is expected to be the case for small LNGCs as well since the basic design concepts are generally the same regardless of vessel size. The DNV researchers also address vessel damage scenarios for potential accidents and found that a beam-on high energy collision would be necessary to result in cargo tank penetration for large LNGCs. It's reasonable to expect that a "T" collision involving a small LNGC could result in greater damage; however, considering the lack of cross-traffic situations for the Eagle LNG traffic, it is reasonable to conclude that any accident with another deep-draft vessel would involve bow-to-bow or side-to-side contact and would be less likely to result in tank damage.

The DNV paper reported these maximum potential risk distances:

> Thermal hazard range of 5 kW/m2 for a pool fire is 440 m

> Thermal hazard range of 5 kW/m2 for dispersion and a flash fire is 750 m

> Downwind flammable vapor range for all credible scenarios is 920 m

> 440 m = 0.27 mi, approximately 1,443 ft

> 920 m = 0.57 mi, approximately 3,018 ft

The studies and reports all conclude that the likelihood of an unignited vapor cloud extending to the calculated distance is very small; thus the focus is on thermal hazards for a fire. Since the SNL data provides somewhat greater distances for thermal hazards, those Zones of Concern were applied for the project area.

> Zone 1 extends 250 meters (m)

> Zone 2 extends from 250 m to 750 m

> Zone 3 extends beyond 750 m

Applying these zones to the LNGC transit on the St. Johns River and conservatively assuming that the LNGC would be at the edge of the channel closest to the potentially affected shoreline resources. In applying these zones to the LNGC transit on the St. Johns River, the assessment conservatively assumes that the LNGC would be at the edge of the channel closest to the potentially affected shoreline resources.

Portions of NAVSTA Mayport near the jetty and along the riverside of the berth area are in Zone 1; portions of the industrial area and much of the NAVSTA berth area are in Zone 2; the rest of the NAVSTA would be in Zone 3.

The north end of the NAS Jacksonville runway and the fuel dock and fuel storage area are in Zone 1; other portions of the NAS runway would be in Zone 2; the rest of the NAS are in Zone 3.

Little Talbot Island State Park on the north bank is partly in Zone 2.

Portions of Mayport and Atlantic Beach including USCG Sector Jacksonville facilities and the St. George Island - Mayport Ferry are in Zone 1; the remainder is in Zone 2.

Portions of the communities on Batten Island and Fanning Island with residential development, commercial marine activities, and small industrial facilities, are in Zone 1; the remainders are in Zone 2 until nearing Blount Island.

Portions of the Timucuan Ecological and Historic Preserve, which includes more than 46,000 acres of land and water along both sides of the river, would be in Zone 1; that includes the Visitor Center and the Fort Caroline National Memorial. Much of the remainder of the preserve, including the park Headquarters, lies in Zone 2.

Huguenot Memorial Park and Helen Cooper Floyd Memorial Park lie in Zone 1.

Portions of Blount Island, Alligator Island, and Dames Point are in Zone 1, most of the remainder is in Zone 2. The Yellow Bluff Fort State Historic Site is in Zone 2.

The power line crossing the river at Blount Island and the I-295 Bridge is in Zone 1.

The portion of the city of Jacksonville opposite the project area is in Zone 3.

The Marathon Oil Terminal is in Zone 2 while the LNGC passes and while moored.

The Naval Fuel Depot is in Zone 3 while the LNGC is moored.

Graphic representations of the zone distances are attached as Figure 1.

Potential risks for all resources in Zone 1 and all in Zone 2 other than Marathon Oil are substantially reduced by the very limited dwell time for the LNGCs in transit. The St. Johns River Bar Pilots have advised that the typical transit speed for the expected LNGCs will be 10 knots which is equivalent to 305 meters/minute (1,000 feet/minute). At that speed, a resource point would be within Zone 1 for less than one minute and within Zone 2 for less than five minutes. Even at slower transit speeds the dwell time at any point would be very limited — less than 2 minutes and 10 minutes, respectively for a 5 knot transit.

The risk level relative to the Marathon Oil terminal, the only resource in Zone 2 relative to the moored LNGC, is in line with the risks at that terminal from oil cargoes.

The Zone 1 and Zone 2 distances, dwell times, and risk levels are consistent with those applied to and accepted for existing and proposed marine LNG traffic in other port areas, generally for much larger vessels. Discussions with the St. Johns River Bar Pilots found that there is no higher level of transit risk for the LNGCs than for other vessels. Discussions with Jacksonville Fire and Rescue Department officials found that they feel that the community is prepared to deal with threats associated with the marine LNGC traffic.

In addition to this assessment, GEXCON AS has model vapor dispersion and risks associated with a release of LNG from various locations on the terminal including the LNG storage tank. The risk zones from that study have been considered along with those described above and the larger of those will be used in assessing mitigation needs, developing the Emergency Response Plan, and any other required actions.