Office of
Energy
Projects

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FERC/DEIS-0298D

# DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

# for the

# Magnolia Liquefied Natural Gas Production Capacity Amendment

Magnolia LNG, LLC

Docket No. CP19-19-000

Federal Energy Regulatory Commission
Office of Energy Projects
Washington, DC 20426

**Cooperating Agencies:**

**U.S. Coast Guard**

**U.S. Department of Energy**

**U.S. Department of Transportation PHMSA**

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

In Reply Refer To:
OEP/DG2E/Gas 4
Magnolia LNG, LLC
Magnolia LNG Production
Capacity Amendment
Docket No. CP19-19-000

TO THE INTERESTED PARTY:

The staff of the Federal Energy Regulatory Commission (FERC or Commission) has prepared a draft supplemental environmental impact statement (EIS) for the Production Capacity Amendment, proposed by Magnolia LNG, LLC (Magnolia LNG) in the above-referenced docket. Magnolia LNG requests authorization to increase the liquefied natural gas (LNG) production capacity of the previously authorized Magnolia LNG Project in Calcasieu Parish, Louisiana (Docket No. CP14-347-000) from 8 million metric tonnes per annum (MTPA) to 8.8 MTPA. The increased LNG production capacity would be achieved through the optimization of Magnolia LNG's final design for the terminal, including additional and modified process equipment.

The draft supplemental EIS assesses the potential changes to the air and noise emissions, and our reliability and safety engineering analyses associated with the construction and operation of the Production Capacity Amendment from what was presented in the final EIS in Docket No. CP14-347-000 for the Magnolia LNG Project. The FERC staff concludes that the proposed modifications, with the additional mitigation measures recommended in the supplemental EIS, would continue to avoid or reduce impacts to less than significant levels.

The U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration, the U.S. Coast Guard, and the U.S. Department of Energy participated as cooperating agencies in the preparation of the supplemental EIS. Cooperating agencies have jurisdiction by law or special expertise with respect to resources potentially affected by the proposal and participate in the analysis conducted under the National Environmental Policy Act.

The Commission mailed a copy of the *Notice of Availability* to federal, state, and local government representatives and agencies; elected officials; environmental and public interest groups; Native American tribes; potentially affected landowners and other interested individuals and groups; and newspapers and libraries in the project area. The draft supplemental EIS is only available in electronic format. It may be viewed and downloaded from the FERC's website (www.ferc.gov), on the Environmental Documents

page (https://www.ferc.gov/industries/gas/enviro/eis.asp). In addition, the draft supplemental EIS may be accessed by using the eLibrary link on the FERC's website. Click on the eLibrary link (https://www.ferc.gov/docs-filing/elibrary.asp), click on General Search, and enter the docket number in the "Docket Number" field, excluding the last three digits (i.e., CP19-19). Be sure you have selected an appropriate date range. For assistance, please contact FERC Online Support at FercOnlineSupport@ferc.gov or toll free at (866) 208-3676, or for TTY, contact (202) 502-8659.

Any person wishing to comment on the draft supplemental EIS may do so. Your comments should focus on draft supplemental EIS's disclosure and discussion of potential environmental effects, reasonable alternatives, and measures to avoid or lessen environmental impacts. To ensure consideration of your comments on the proposal in the final supplemental EIS, it is important that the Commission receive your comments on or before 5:00 pm Eastern Time on **November 18, 2019**.

For your convenience, there are three methods you can use to submit your comments to the Commission. The Commission encourages electronic filing of comments and has staff available to assist you at (866) 208-3676 or FercOnlineSupport@ferc.gov. Please carefully follow these instructions so that your comments are properly recorded.

1) You can file your comments electronically using the eComment feature on the Commission's website (www.ferc.gov) under the link to Documents and Filings. This is an easy method for submitting brief, text-only comments on a project;

2) You can file your comments electronically by using the eFiling feature on the Commission's website (www.ferc.gov) under the link to Documents and Filings. With eFiling, you can provide comments in a variety of formats by attaching them as a file with your submission. New eFiling users must first create an account by clicking on "eRegister." If you are filing a comment on a particular project, please select "Comment on a Filing" as the filing type; or

3) You can file a paper copy of your comments by mailing them to the following address. Be sure to reference the project docket number (CP19-19-000) with your submission: Kimberly D. Bose, Secretary, Federal Energy Regulatory Commission, 888 First Street NE, Room 1A, Washington, DC 20426

Any person seeking to become a party to the proceeding must file a motion to intervene pursuant to Rule 214 of the Commission's Rules of Practice and Procedures (18 CFR Part 385.214). Motions to intervene are more fully described at http://www.ferc.gov/resources/guides/how-to/intervene.asp. Only intervenors have the

right to seek rehearing or judicial review of the Commission's decision. The Commission grants affected landowners and others with environmental concerns intervenor status upon showing good cause by stating that they have a clear and direct interest in this proceeding which no other party can adequately represent. **Simply filing environmental comments will not give you intervenor status, but you do not need intervenor status to have your comments considered.**

**Questions?**

Additional information about the project is available from the Commission's Office of External Affairs, at **(866) 208-FERC**, or on the FERC website (www.ferc.gov) using the eLibrary link. The eLibrary link also provides access to the texts of all formal documents issued by the Commission, such as orders, notices, and rulemakings.

In addition, the Commission offers a free service called eSubscription that allows you to keep track of all formal issuances and submittals in specific dockets. This can reduce the amount of time you spend researching proceedings by automatically providing you with notification of these filings, document summaries, and direct links to the documents. Go to www.ferc.gov/docs-filing/esubscription.asp.

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# TECHNICAL ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ACI | American Concrete Institute |
| AEGL | Acute Exposure Guideline Level |
| AIChE | American Institute of Chemical Engineers |
| API | American Petroleum Institute |
| ASME | American Society of Mechanical Engineers |
| Bcfd | billion cubic feet per day |
| BLEVE | boiling liquid expanding vapor explosion |
| BOG | boil-off gas |
| BPVC | Boiler and Pressure Vessel Code |
| BTU | British thermal units |
| CCPS | Center for Chemical Process Safety |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| $CH_4$ | methane |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| Commission | Federal Energy Regulatory Commission |
| dBA | A-weighted decibels |
| DOD | U.S. Department of Defense |
| DOE | U.S. Department of Energy |
| EIS | Environmental Impact Statement |
| EPA | U.S. Environmental Protection Agency |
| EPAct | Energy Policy Act of 2005 |
| ERP | Emergency Response Plan |
| ERPG | Emergency Response Planning Guidelines |
| ESA | Endangered Species Act of 1973 |
| FEED | front-end-engineering-design |
| FERC | Federal Energy Regulatory Commission |
| FHWA | Federal Highway Administration |
| FRA | Federal Railroad Administration |
| FSA | Facility Security Assessment |
| $ft^2$ | square foot/feet |
| FTA | free trade agreement |
| GHG | greenhouse gas |
| gpm | gallons per minute |

| | |
|---|---|
| HAP | hazardous air pollutants |
| HAZOP | Hazard and Operability |
| IBC | International Building Code |
| ISA | International Society for Automation |
| ISO | International Standards Organization |
| $L_{dn}$ | day-night sound level |
| $L_{eq}$ | equivalent sound level |
| LNG | liquefied natural gas |
| LOD | Letter of Determination |
| LOPA | Layer of Protection Analysis |
| LOR | Letter of Recommendation |
| LPG | liquefied petroleum gas |
| Magnolia LNG | Magnolia LNG, LLC |
| $m^3$ | cubic meter |
| MOU | Memorandum of Understanding |
| MTPA | million tonnes per annum |
| NOI | *Notice of Intent to Prepare a Supplemental Environmental Impact Statement for the Proposed Production Capacity Amendment and Request for Comments on Environmental Issues* |
| $N_2O$ | nitrous oxide |
| NAAQS | National Ambient Air Quality Standards |
| NEPA | National Environmental Policy Act |
| NFPA | National Fire Protection Association |
| NGA | Natural Gas Act |
| NHTSA | National Highway Traffic Safety Administration |
| NOAA | National Oceanic and Atmospheric Administration |
| $NO_x$ | nitrogen oxides |
| NSA | noise-sensitive area |
| OEP | Office of Energy Projects |
| OSHA | Occupational Safety and Health Administration |
| PHMSA | Pipeline and Hazardous Materials Safety Administration |
| PM | particulate matter |
| $PM_{10}$ | particulate matter with a diameter less than 10 microns |
| $PM_{2.5}$ | particulate matter with a diameter less than 2.5 microns |
| PSM | Process Safety Management of Highly Hazardous Chemicals |
| PVB | pressure vessel burst |
| PVC | polyvinyl chloride |
| RMP | Risk Management Program |
| Secretary | Secretary of the Federal Energy Regulatory Commission |

| | |
|---|---|
| $SO_2$ | sulfur dioxide |
| TEMA | Tubular Exchanger Manufacturers Association |
| TWIC | Transportation Worker Identification Credential |
| UL | Underwriters Laboratories |
| USC | United States Code |
| USCG | United States Coast Guard |
| USDOT | U.S. Department of Transportation |
| VOC | volatile organic compounds |
| WSA | Waterway Suitability Assessment |

# EXECUTIVE SUMMARY

The staff of the Federal Energy Regulatory Commission (FERC or Commission) prepared this draft supplemental environmental impact statement (EIS) to assess the environmental impacts associated with construction and operation of amended facilities proposed by Magnolia LNG, LLC (Magnolia LNG). The proposed amendment would modify facilities at the approved, but not yet constructed, Magnolia liquefied natural gas (LNG) terminal in Calcasieu Parish, Louisiana. The draft supplemental EIS was prepared in accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA) and the Commission's implementing regulations under Title 18 of the Code of Federal Regulations, Part 380 (18 CFR 380).

On November 19, 2018, Magnolia LNG filed an application in Docket No. CP19-19-000 requesting an authorization pursuant to Section 3(a) of the Natural Gas Act (NGA) to amend the authorization granted by the Commission on April 15, 2016, in Docket No. CP14-347-000. The proposed project is known as the Production Capacity Amendment, and would increase the total production capacity of Magnolia LNG's liquefaction project from the currently authorized 8 million metric tonnes per annum (MTPA) to 8.8 MTPA, or from 1.1 billion cubic feet per day (Bcfd) to 1.2 Bcfd. The increased LNG production capacity would be achieved through the optimization of Magnolia LNG's final design, including additional and modified process equipment. Magnolia LNG states that the liquefaction rate increase would not require any increase in the authorized 1.4 Bcfd feed gas rate or the annual number of LNG tankers (vessel traffic) previously reviewed and approved by the U.S. Coast Guard (USCG).

The draft supplemental EIS assesses the potential changes to the air and noise emissions, and our reliability and safety engineering analyses of the LNG terminal from that presented in the November 13, 2015 final EIS, and the April 15, 2016 Order Issuing Authorization in Docket No. CP14-347-000.

The purpose of the supplemental EIS is to inform the FERC decision-makers, the public, and the permitting agencies about the potential impacts of the proposed amendment and alternatives, and recommend mitigation measures that would reduce adverse impacts to the extent practicable. We[1] prepared our analysis based on information provided by Magnolia LNG and further developed from data requests, scoping, literature research, and contacts with or comments from federal, state, and local agencies.

The FERC is the federal agency responsible for authorizing LNG export facilities under the NGA and is the lead federal agency for the preparation of this supplemental draft EIS in compliance with the requirements of NEPA. The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (USDOT PHMSA), the USCG, and the U.S. Department of Energy are cooperating agencies for development of this supplemental EIS consistent with 40 CFR §1501.6(b) and interagency agreements. A cooperating agency has jurisdiction by law or has special expertise with respect to environmental resource issues associated with the project.

## PROPOSED ACTION

The Production Capacity Amendment's purpose, as stated by Magnolia LNG, is to increase the total production capacity of the previously authorized liquefaction project from 8 MTPA to 8.8 MTPA. All new or reconfigured facilities would be within the footprint of the authorized Magnolia LNG terminal site. The increased LNG production would be achieved by an increase in the capacity and pressures of the ammonia refrigerant cycle and the mixed refrigerant cycle. The auxiliary boiler stream production would also be increased to provide more power to the ammonia compressor steam turbine driver. In addition to the liquefaction uprate changes, the gas pre-treatment process would change from a single

[1] "We," "us," and "our" refer to the environmental and engineering staff of FERC's Office of Energy Projects.

heavy hydrocarbon removal column to separate deethanizer and debutanizer columns. An electrically driven overhead booster compressor is proposed as part of the heavy hydrocarbon removal changes. Furthermore, the flare stack would be relocated on the project site, and a separate marine flare added.

## PUBLIC INVOLVEMENT

On June 7, 2019, the FERC issued a Notice of Intent to Prepare a Supplemental Environmental Impact Statement for the Proposed Production Capacity Amendment and Request for Comments on Environmental Issues (NOI). This NOI was sent to 466 potentially interested parties including the environmental mailing list for the original Magnolia LNG Project (i.e., federal, state, and local officials, agency representatives, conservation organizations, Native American tribes, local libraries and newspapers in the project area, and "affected landowners" as defined in the Commission's regulations in 18 CFR §157.6(d)(2)), and any additional stakeholders identified during the processing of the amended application. Publication of the NOI established a 30-day public comment period for the submission of comments, concerns, and issues related to the environmental aspects of the proposed amendment. We received no comments on the NOI.

## PROJECT IMPACTS

The proposed modifications to equipment and subsequent changes to process conditions, such as pressures and flow rates, would result in an increase in hazard distances that are used to assess potential consequences to the public. The primary change and increase in hazard distance is associated with the anhydrous ammonia refrigeration cycle. As a result of the increased consequences for an anhydrous ammonia release, we have made recommendations to further reduce the likelihood of an incident that could impact the public. The USDOT PHMSA will provide a Letter of Determination on the amended project's compliance with 49 CFR 193 Subpart B prior to the final supplemental EIS. This determination will be provided to the Commission in order to inform its decision on whether to authorize or deny the proposed amendment. If the Magnolia LNG Project is authorized and begins construction, the facility would be subject to the USDOT PHMSA's inspection and enforcement program; final determination of whether a facility is in compliance with the requirements of 49 CFR 193 would be made by the USDOT PHMSA staff.

There would be no substantive change in construction noise or air emissions from that previously analyzed in the Commission's EIS for the Magnolia LNG Project and modeling demonstrates there would be no exceedances of the National Ambient Air Quality Standards. Operational noise impacts from the facility would increase at noise sensitive areas, but remain below the threshold of 55 decibels on the A-weighted scale (the noise threshold established to protect the public from activity interference and annoyance outdoors in residential areas). The Commission's April 15, 2016 Order requires Magnolia LNG to conduct noise surveys after each LNG train is placed into service, and again after placing the entire LNG terminal into service to ensure noise impacts resulting from the project will not be significant.

## ALTERNATIVES CONSIDERED

Because the proposed Production Capacity Amendment does not involve any change in the previously authorized LNG terminal site (i.e., "project footprint"), we did not evaluate any site alternatives to the project. We assessed the No-Action Alternative; that is, if the newly proposed equipment and process modifications are not installed and the LNG production capacity remains at 8.0 MTPA. We conclude that the No-Action Alternative would not allow Magnolia LNG to meet the purpose and need of the Production Capacity Amendment, and any alternative project to meet the market demand would not likely provide a significant environmental advantage over the proposed action.

## CONCLUSIONS

Based on our analysis of the changes to the air and noise emissions and our reliability and safety analysis, we conclude that the modifications associated with the Production Capacity Amendment, with the additional mitigation measures recommended in the supplemental EIS, would continue to avoid or reduce impacts to less than significant levels. Furthermore, we conclude that Magnolia LNG's design of the modified facilities, with the recommended mitigation measures, would include acceptable layers of protection or safeguards that would reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public. Our recommended mitigation measures are presented in section 5.1 of the supplemental EIS. We recommend that these mitigation measures be attached as conditions to any authorization issued by the Commission.

# 1.0 INTRODUCTION

On November 19, 2018, Magnolia LNG, LLC (Magnolia LNG) filed an application in Docket No. CP19-19-000 requesting an authorization pursuant to Section 3(a) of the Natural Gas Act (NGA) to amend the authorization granted by the FERC on April 15, 2016, in Docket No. CP14-347-000, to construct and operate the Magnolia LNG Project in Calcasieu Parish, Louisiana.[2] The proposed project is known as the Production Capacity Amendment, and would increase the total production capacity of Magnolia LNG's liquefaction project from the currently authorized 8 million metric tonnes per annum (MTPA) to 8.8 MTPA, or from approximately 1.1 billion cubic feet per day (Bcfd) to 1.2 Bcfd of natural gas. Magnolia LNG states that the increased liquefied natural gas (LNG) production capacity would be achieved through the optimization of its final design and would not require any increase in the authorized 1.4 Bcfd in the feed gas pipeline. Magnolia LNG stated in its application that the amended capacity would not require any additional construction, or new or modified facilities not already considered and approved in Docket No. CP14-347-000 (i.e., the approved LNG terminal site in Lake Charles, Calcasieu Parish, Louisiana); however, in response to a data request by FERC staff, Magnolia LNG provided updated engineering documentation that indicated the uprated design would have equipment changes from the design approved in Docket CP14-347-000.[3] Magnolia LNG also stated that the annual number of LNG tankers (vessel traffic) would not change from that already reviewed and approved by the U.S. Coast Guard (USCG).

## 1.1 PROJECT PURPOSE AND NEED

The Production Capacity Amendment's purpose, as stated by Magnolia LNG, is to increase the total production capacity of the previously authorized liquefaction project from 8 MTPA to 8.8 MTPA. According to Magnolia LNG, this production capacity would be achieved through optimization of the liquefaction process, resulting in an increase in the maximum total LNG that the Magnolia LNG Project would be capable of producing each year. Therefore, Magnolia LNG is seeking to increase the approved export volume of the previous authorization reflecting the maximum liquefaction capacity for the optimized Magnolia LNG Project. All new or reconfigured facilities would be within the footprint of the authorized Magnolia LNG terminal site.

Under Section 3 of the NGA, the FERC considers as part of its decision to authorize natural gas facilities, all factors bearing on the public interest. Specifically, regarding whether to authorize natural gas facilities used for importation or exportation, the FERC shall authorize the proposal unless it finds that the proposed facilities will not be consistent with the public interest.

## 1.2 PURPOSE AND SCOPE OF THIS SUPPLEMENTAL EIS

Based on its authority under the NGA, the FERC is the lead agency for preparation of this supplemental EIS in compliance with the requirements of NEPA, the Council on Environmental Quality's (CEQ) regulations for implementing the National Environmental Policy Act of 1969 (NEPA) (Title 40 of the Code of Federal Regulations, Parts 1500–1508 [40 CFR 1500–1508]), and FERC regulations implementing NEPA (18 CFR 380).

The principal purposes in preparing this supplemental EIS are to: identify and assess potential impacts on the human environment that would result from implementation of the proposed modifications;

[2] The LNG terminal has not yet been constructed.

[3] Based on Magnolia LNG's statements in its application that no new or modified facilities were proposed, FERC staff initially concluded on December 18, 2018, that no further environmental review was required. However, based on subsequent data responses, FERC staff proceeded to develop a supplemental EIS.

identify and assess reasonable alternatives that would avoid or minimize adverse effects; facilitate public involvement; and identify and recommend specific mitigation measures to avoid or minimize environmental impacts.

Based on the proposed modifications to the Magnolia LNG Project, including equipment and changes to process conditions, we[4] determined that potential environmental consequences are limited to air and noise emissions, and the reliability and safety engineering analysis. Therefore, this supplemental EIS focuses on the impacts of the proposed modifications on air quality, noise, and reliability and safety. This supplemental EIS also presents our conclusions and recommended mitigation measures. For all other environmental resources, our analysis and conclusions are unchanged from what was presented in the November 13, 2015 final EIS for the Magnolia LNG Project, and the April 15, 2016 Order Issuing Authorization in Docket No. CP14-347-000.

### 1.3 PUBLIC REVIEW AND COMMENT

On December 6, 2018, the FERC issued its Notice of Application for the Production Capacity Amendment, which provided information on how to become an intervenor in the proceedings. On June 7, 2019, the FERC issued a *Notice of Intent to Prepare a Supplemental Environmental Impact Statement for the Proposed Production Capacity Amendment and Request for Comments on Environmental Issues* (NOI). This NOI was sent to 466 potentially interested parties including the environmental mailing list for the original Magnolia LNG Project (i.e., federal, state, and local officials, agency representatives, conservation organizations, Native American tribes, local libraries and newspapers in the project area, and "affected landowners" as defined in the Commission's regulations as defined in 18 CFR §157.6(d)(2) [in this case, properties within 0.5 mile of the LNG terminal site]; as updated to account for changes in agency personnel and elected officials), and any additional stakeholders identified during the processing of the amended application. Publication of the NOI established a 30-day public comment period for the submission of comments, concerns, and issues related to the environmental aspects of the proposed amendment.[5] We received no comments on the NOI.

This draft supplemental EIS was filed with the U.S. Environmental Protection Agency (EPA), and a Notice of Availability was mailed to the environmental mailing list, as described above. The distribution list for the Notice of Availability is provided in appendix A. A formal notice that the draft supplemental EIS is available for review and comment will be published in the Federal Register. Also, this draft supplemental EIS was posted to FERC's eLibrary for public review. The public has 45 days after the date of publication of the EPA's formal notice to submit written or electronic comments on the draft supplemental EIS. All comments received related to the environmental issues presented in the draft supplemental EIS will be addressed in the final supplemental EIS.

### 1.4 COOPERATING AGENCIES

The regulations that implement NEPA and establish the CEQ regulations call on federal, state, and local government agencies to cooperate in the preparation of environmental documents (40 CFR §1501.6). A "cooperating agency" is another agency participating in the NEPA process that has jurisdiction by law over all or part of the project (e.g., issues a permit) and/or one that has special expertise with respect to the environmental issues. The review of the proposed project was aided by the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (USDOT

[4] "We," "us," and "our" refer to the environmental and engineering staff of the FERC's Office of Energy Projects.

[5] The NOI clarified that comments should be specific to the Production Capacity Amendment, and that any comments relating solely on the already approved Magnolia LNG Project would not be considered in the supplemental EIS.

PHMSA), USCG, and the U.S Department of Energy (DOE), which acted as cooperating agencies for the production of the draft supplemental EIS.

### 1.4.1 U.S. Department of Transportation

USDOT PHMSA has established minimum federal safety standards for LNG facilities in compliance with 49 U.S. Code [USC] 60101, *et seq*. Those standards are codified in 49 CFR 193 and apply to the siting, design, construction, operation, maintenance, and security of LNG facilities. The National Fire Protection Association (NFPA) Standard 59A (2001 edition), "Standard for the Production, Storage, and Handling of Liquefied Natural Gas," is incorporated into these requirements by reference.

On February 11, 2004, the USDOT Research and Special Programs Administration (superseded by PHMSA), USCG, and the FERC entered into an Interagency Agreement to ensure greater coordination among these three agencies in addressing the full range of safety and security issues at LNG terminals, including terminal facilities and tanker operations, and maximizing the exchange of information related to the safety and security aspects of the LNG facilities and related marine operations.[6] Under the Interagency Agreement, the FERC is the lead federal agency responsible for the preparation of the analysis required under NEPA for impacts associated with terminal construction and operation. USDOT PHMSA and the USCG participate as cooperating agencies but remain responsible for enforcing their regulations covering LNG facility design, construction, and operation.

On August 31, 2018, the FERC and USDOT PHMSA signed a memorandum of understanding (MOU) to improve coordination on LNG project reviews and eliminate duplicative efforts.[7] USDOT PHMSA will issue a Letter of Determination (LOD) to FERC on the 49 CFR 193 Subpart B siting requirements. The LOD will provide PHMSA's analysis and conclusions on the Subpart B regulatory requirements, which would be one of the considerations for the Commission to deliberate in its decision-making process. USDOT PHMSA also has the authority to enforce safety regulations and standards related to the design, construction, and operation of natural gas pipelines under the Natural Gas Pipeline Safety Act. USDOT PHMSA would also monitor the construction and operation of the natural gas facilities to determine compliance with its design and safety standards.

### 1.4.2 U.S. Coast Guard

The USCG has authority over the safety of an LNG terminal's marine transfer area and LNG marine traffic, as well as over security plans for the entire LNG terminal and LNG marine traffic. The USCG also exercises regulatory authority over LNG facilities that affect the safety and security of port areas and navigable waterways under Executive Order 10173; the Magnuson Action of 1950 (50 USC 191); the Ports and Waterways Safety Act of 1972, as amended (33 USC 1221, *et seq*.), and the Maritime Transportation Security Act of 2002 (46 USC 701). The USCG is responsible for matters related to navigation safety, vessel engineering and safety standards, and all matters pertaining to the safety of facilities or equipment in or adjacent to navigable waters up to the last valve immediately before the receiving tanks. As a cooperating agency, the USCG assists the FERC staff's NEPA review by evaluating whether an applicant's proposed waterway would be suitable for LNG marine traffic and whether the terminal facilities would be in accordance with 33 CFR 105 and 127.

In the previously authorized Magnolia LNG Project under Docket No. CP14-347-000, the USCG issued a Letter of Recommendation (LOR) and LOR Analysis to FERC on February 12, 2015. Until a

[6] Interagency Agreement among the FERC, USCG, and USDOT RPSA (now PHMSA) for the Safety and Security Review of Waterfront Import/Export LNG Facilities, February 11, 2004, https://www.ferc.gov/legal/mou/mou-24.pdf

[7] Memorandum of Understanding between the USDOT PHMSA and FERC regarding LNG Transportation Facilities, August 31, 2018, https://www.ferc.gov/legal/mou/2018/FERC-PHMSA-MOU.pdf

facility begins operation, applicants must also annually review their Waterway Suitability Assessments (WSA) and submit a report to the USCG Captain of the Port as to whether changes are required. In its application filed on November 19, 2018, Magnolia LNG indicated that the route, maximum size, or maximum number of LNG marine vessel transits would not change from that already reviewed and approved by the USCG. If the maximum number of LNG marine vessel transits would need to increase based on the increase in the liquefaction rate, additional USCG review would be required.

### 1.4.3 U.S. Department of Energy

The DOE, Office of Fossil Energy, must meet its obligation under section 3 of the NGA to authorize the import and export of natural gas, including LNG, unless it finds that the import or export is not consistent with the public interest. Accordingly, on December 31, 2018, Magnolia LNG filed an application with the DOE requesting that the 8.0 MTPA authorization be amended to increase the quantity of authorized exports of domestically produced LNG to 8.8 MTPA. On March 21, 2019, the DOE issued an order approving the increased quantity of authorized LNG exports to nations with which the United States has a free trade agreement (FTA) for trade in natural gas. In addition, Magnolia LNG has submitted an application to the DOE seeking authorization to increase the quantity of authorized exports to non-FTA countries by the same amount, which is currently under DOE review.

# 2.0 DESCRIPTION OF THE PROPOSED ACTION

Magnolia LNG is proposing to amend its original April 15, 2016 authorization under Docket No. CP14-347-000 to increase the total LNG production capacity of the previously authorized (but not yet constructed) Magnolia LNG export terminal by 0.8 MTPA. The increased LNG production would be achieved by an increase in the capacity and pressures of the ammonia refrigerant cycle and the mixed refrigerant cycle. The auxiliary boiler stream production would also be increased to provide more power to the ammonia compressor steam turbine driver. In addition to the liquefaction uprate changes, several other changes are proposed. The gas pre-treatment process would change from a single heavy hydrocarbon removal column to separate deethanizer and debutanizer columns. An electrically driven overhead booster compressor is proposed as part of the heavy hydrocarbon removal changes. Furthermore, the flare stack would be relocated on the project site, and a separate marine flare added.

The equipment changes identified by Magnolia LNG in its application and supplements and/or determined by FERC staff via data requests include the following:

- increased ammonia compressor capacity and system pressures;
- increased number of ammonia air coolers;
- increased mixed refrigerant system operating pressure;
- additional ammonia/mixed refrigerant cooler;
- additional heavy hydrocarbon removal vessels and compressor;
- relocation of main flare stack; and
- addition of marine flare stack.

# 3.0 ALTERNATIVES

In accordance with CEQ regulations for complying with NEPA (at 40 CFR §1502.14), this supplemental EIS compares the environmental impacts of the proposed action against the No-Action Alternative; that is, if the newly proposed equipment and modifications specific to the Production Capacity Amendment are not installed and the LNG production capacity remains at 8.0 MTPA. Because the Magnolia LNG Project was approved by the Commission, and the proposed Production Capacity Amendment does not involve any change in the previously authorized LNG terminal site (i.e., "project footprint"), other potential alternatives, such as system alternatives or site alternatives, were deemed not applicable and were not evaluated.

## 3.1 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, the Magnolia LNG Project would not be amended, and the project would retain its current production capacity of 8 MTPA. Under the No-Action Alternative, Magnolia LNG would not increase the production capacity of the Magnolia LNG Project to 8.8 MTPA, and the associated facility design changes would not be implemented. Under the No-Action Alternative, the impacts associated with the amendment (as discussed in this supplemental EIS) would not occur. However, the No-Action Alternative would not allow Magnolia LNG to meet the purpose and need of the project as described in section 1.1. Moreover, the proposed project would increase production of the natural gas in the feed gas pipeline into LNG for export without increasing the natural gas rates in the feed gas pipeline, making it more efficient than the No-Action Alternative. In the absence of Magnolia LNG's proposed amendment, some other project sponsor could propose a separate LNG export project to meet the market needs served by the amendment; such a proposal would likely have similar or more environmental impacts compared to the proposed amendment. Therefore, we do not recommend the No-Action Alternative.

# 4.0 ENVIRONMENTAL IMPACT ANALYSIS

## 4.1 AIR QUALITY

Construction and operation of the LNG terminal would affect local and regional air quality. There would be no construction emissions due to the Production Capacity Amendment not already accounted for in the previous NEPA analysis for the Magnolia LNG Project (see final EIS for Docket No. CP14-347-000; table 4.11.1-4). Therefore, we will provide some general background for air quality evaluation and will focus our discussion on the potential operational air quality impacts as changed due to the Production Capacity Amendment.

The term *air quality* refers to relative concentrations of pollutants in the ambient air. The discussion below describes well-established air quality concepts that are applied to characterize air quality and to determine the significance of increases in air pollution. These include metrics for specific air pollutants known as criteria pollutants, and well as ambient air quality standards, regional designations to manage air quality known as Air Quality Control Regions, and efforts to monitor ambient air concentrations.

Federal and state air quality standards are designed to protect human health. The EPA has developed National Ambient Air Quality Standards (NAAQS) for criteria air pollutants such as oxides of nitrogen ($NO_x$) and carbon monoxide (CO), sulfur dioxide ($SO_2$), and inhalable particulate matter ($PM_{2.5}$ and $PM_{10}$). $PM_{2.5}$ includes particles with an aerodynamic diameter less than or equal to 2.5 micrometers, and $PM_{10}$ includes particles with an aerodynamic diameter less than or equal to 10 micrometers. The NAAQS were set at levels the EPA believes are necessary to protect human health and welfare. Volatile organic compounds (VOC) are regulated by the EPA mostly to prevent the formation of ozone, a constituent of photochemical smog. Many VOCs form ground-level ozone by reacting with sources of oxygen molecules such as $NO_x$ in the atmosphere in the presence of sunlight. $NO_x$ and VOCs are referred to as ozone precursors. Hazardous air pollutants (HAP) are also emitted during fossil fuel combustion and are suspected or known to cause cancer or other serious health effects; such as reproductive effects or birth defects; or adverse environmental effects. Greenhouse Gases (GHG) produced by fossil-fuel combustion are carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$). GHGs status as a pollutant is not related to toxicity. GHGs are non-toxic and non-hazardous at normal ambient concentrations, and there are no applicable ambient standards or emission limits for GHG under the Clean Air Act.

As indicated by Magnolia LNG, the Part 70 permit issued by the Louisiana Department of Environmental Quality would not need to be revised. This permit indicates that the emissions would be less than, or less than a 1 percent increase in the annual emissions from the facility as those identified for the Magnolia LNG Project. Similarly, the modeled air quality impacts from operation of the facility would be similar as those previously identified and would not result in any exceedances of the NAAQS. Thus, we conclude that the Production Capacity Amendment would not result in significant air quality impacts.

## 4.2 NOISE

The noise environment can be affected both during construction and operation of natural gas infrastructure projects. The magnitude and frequency of environmental noise may vary considerably over the course of the day, throughout the week, and across seasons, in part due to changing weather conditions and the effects of seasonal vegetation cover. Two measures to relate the time-varying quality of environmental noise to its known effect on people are the 24-hour equivalent sound level ($L_{eq}$) and day-night sound level ($L_{dn}$). The $L_{eq}$ is the level of steady sound with the same total (equivalent) energy as the time-varying sound of interest, averaged over a 24-hour period. The $L_{dn}$ is the $L_{eq}$ plus 10 decibels

on the A-weighted scale (dBA) added to account for people's greater sensitivity to nighttime sound levels (between the hours of 10 p.m. and 7 a.m.). The A-weighted scale is used because human hearing is less sensitive to low and high frequencies than mid-range frequencies. The human ear's threshold of perception for noise change is considered to be 3 dBA; 6 dBA is clearly noticeable to the human ear, and 10 dBA is perceived as a doubling of noise.

In 1974, the EPA published *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (EPA, 1974). This publication evaluated the effects of environmental noise with respect to health and safety. The document provides information for state and local governments to use in developing their own ambient noise standards. The EPA has determined that in order to protect the public from activity interference and annoyance outdoors in residential areas, noise levels should not exceed an $L_{dn}$ of 55 dBA. We have adopted this criterion (18 CFR §157.206(b)(5)) for new compression and associated pipeline facilities, and it is used here to evaluate the potential noise effects from construction and operation of the Magnolia LNG Project, as modified by the proposed Production Capacity Amendment. An $L_{dn}$ of 55 dBA is equivalent to a continuous noise level of 48.6 dBA for facilities that operate at a constant level of noise.

Construction noise from installation of the facilities necessary for the Production Capacity Amendment would not change from that identified in the final EIS for the Magnolia LNG Project under Docket No. CP14-347-000; however, Magnolia LNG has indicated that operational noise impacts would change due to the use of different turbines and other equipment that was chosen subsequent to our evaluation of the Magnolia LNG Project.

Magnolia LNG's modifications and changes for the Production Capacity Amendment indicate that noise impacts from the facility would increase at the noise sensitive areas (NSA), principally homes, near the LNG terminal site. Table 1 shows the potential increases from the amended project, and figure 1 shows the nearest NSAs. The noise attributable to the Magnolia LNG terminal is not estimated to increase the noise impacts at the NSAs beyond 55 dBA $L_{dn}$ (the threshold established to protect the public from activity interference and annoyance outdoors in residential areas); however, the noise impacts are very close to, or at our limit. Note that total noise at NSAs 1 and 2 (from both ambient noise and the noise attributable to the LNG terminal) would exceed 55 dBA $L_{dn}$. Operation of the LNG terminal, as modified by the amendment, would produce noise on a continual basis that would likely be noticeable to residents at the nearest NSAs. However, compliance with the 55dBA $L_{dn}$ noise limit would ensure that impacts are not significant.

**Table 1**
**Operational Noise Impact Analysis of LNG Terminal**

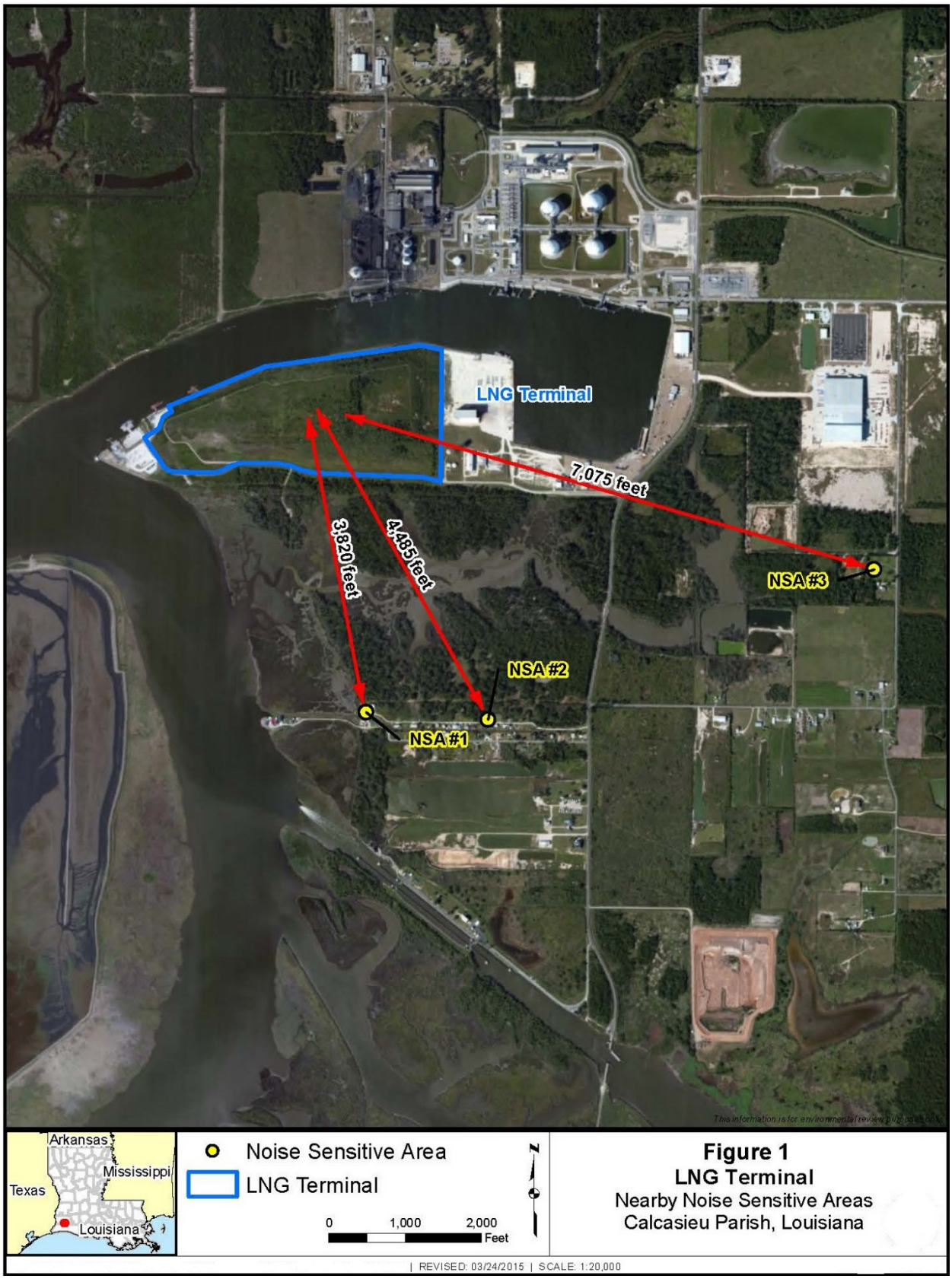
| NSA | Distance (feet) and direction | Existing Noise $L_{dn}$, dBA | Original Facility Impact $L_{dn}$, dBA | Original Facility Overall Noise Level ($L_{dn}$, dBA)[1] | Proposed Facility Impact $L_{dn}$, dBA | Proposed Facility Overall Noise Level ($L_{dn}$, dBA)[1] | Noise Increase Over Existing Ambient (dB) | Noise Increase Over Previous Noise Estimate (dB) |
|---|---|---|---|---|---|---|---|---|
| 1 | 3,820 S | 51 | 46 | 52 | 55.0 | 56.5 | 5.5 | 4.5 |
| 2 | 4,485 SE | 52 | 45 | 53 | 53.8 | 56.0 | 4.0 | 3.0 |
| 3 | 7,075 ESE | 47 | 24 | 47 | 49.4 | 51.4 | 4.4 | 4.4 |

1 Overall noise represents both ambient noise and the noise attributable to the LNG terminal.

Magnolia LNG's schedule for placing the liquefaction trains into service, generally every three months, has the potential to result in temporarily higher noise levels prior to full operation of the facility.

The Commission's April 15, 2016 Order for the Magnolia LNG Project requires interim noise surveys as each liquefaction train is placed into service, followed by a single full facility noise survey on the completed terminal. If the noise attributable to the operation of the equipment at the LNG terminal exceeds an $L_{dn}$ of 55 dBA at any nearby NSAs, Magnolia LNG must modify operation of the LNG terminal or install additional noise controls until a noise level below an $L_{dn}$ of 55 dBA at nearby NSAs is achieved. Because this condition applies to noise generated from the LNG terminal; it will account for any noise generated by the facilities specific to the Production Capacity Amendment.

With the existing requirements for noise surveys and mitigation, and Magnolia LNG's noise mitigation included in this application, we conclude that the Production Capacity Amendment would not result in significant noise impacts.


LNG Terminal
7,075 feet
4,485 feet
3,820 feet
NSA #3
NSA #2
NSA #1
Arkansas
Mississippi
Texas
Louisiana
Noise Sensitive Area
LNG Terminal
0
1,000
2,000
Feet
N
Figure 1
LNG Terminal
Nearby Noise Sensitive Areas
Calcasieu Parish, Louisiana
REVISED: 03/24/2015 | SCALE: 1:20,000

## 4.3 RELIABILITY AND SAFETY

The regulatory oversight, hazards, and engineering designs remain largely remain unchanged from that analyzed in the November 13, 2015 final EIS for the Magnolia LNG Project. However, the limited modifications to the engineering design, including additional equipment and different process conditions would result in larger offsite hazards that warranted a re-evaluation of the layers of protection. Also, there have been some changes in federal agency oversight and coordination since the issuance of the April 15, 2016 Order, including the assessment of USDOT PHMSA siting regulations and USCG security requirements (e.g., Transportation Worker Identification Credential [TWIC] readers).

### 4.3.1 LNG Facility Reliability, Safety, and Security Regulatory Oversight

LNG facilities handle flammable and sometimes toxic materials that can pose a risk to the public if not properly managed. These risks are managed by the companies owning the facilities, through selecting the site location and plant layout as well as through suitable design, engineering, construction, and operation of the LNG facilities. Multiple federal agencies share regulatory authority over the LNG facilities and the operator's approach to risk management. The safety, security, and reliability of the Production Capacity Amendment would be regulated by USDOT PHMSA, the USCG, the FERC, EPA, and the Occupational Safety and Health Administration (OSHA).

In February 2004, USDOT PHMSA, the USCG, and the FERC entered into an Interagency Agreement to ensure greater coordination among these three agencies in addressing the full range of safety and security issues at LNG terminals and LNG marine vessel operations, and maximizing the exchange of information related to the safety and security aspects of LNG facilities and related marine operations. Under the Interagency Agreement, the FERC is the lead federal agency responsible for the preparation of the analysis required under NEPA for impacts associated with terminal construction and operation. USDOT PHMSA and the USCG participate as cooperating agencies but remain responsible for enforcing their regulations covering LNG facility siting, design, construction, operation, and maintenance. All three agencies have some oversight and responsibility for the inspection and compliance during the LNG facility's operation.

USDOT PHMSA establishes and has the authority to enforce the federal safety standards for the location, design, installation, construction, inspection, testing, operation, and maintenance of onshore LNG facilities under the Natural Gas Pipeline Safety Act (49 U.S.C. 1671, *et seq*.). USDOT PHMSA's LNG safety regulations are codified in 49 CFR 193, which prescribes safety standards for LNG facilities used in the transportation of gas by pipeline that are subject to federal pipeline safety laws (49 U.S.C. 60101, *et seq*.), and 49 CFR 192. On August 31, 2018, after the issuance of the Commission's Order authorizing the Magnolia LNG Project, USDOT PHMSA and FERC signed an MOU regarding methods to improve coordination throughout the LNG permit application process for FERC jurisdictional LNG facilities. In the MOU, USDOT PHMSA agreed to issue a LOD stating whether a proposed LNG facility would be capable of complying with location criteria and design standards contained in Subpart B of Part 193. The Commission committed to rely upon the USDOT PHMSA determination in conducting its review of whether the facilities would be consistent in the public interest. The issuance of the LOD does not abrogate USDOT PHMSA's continuing authority and responsibility over a proposed project's compliance with Part 193 during construction and future operation of the facility. USDOT PHMSA's conclusion on the siting and hazard analysis required by Part 193 is based on preliminary design information, which may be revised as the engineering design progresses to final design. USDOT PHMSA regulations also contain requirements for the design, construction, installation, inspection, testing, operation, maintenance, qualifications and training of personnel, fire protection, and security for LNG facilities as defined in 49 CFR 193, which would be completed during later stages of the project. If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, the

LNG facilities as defined in 49 CFR 193, would be subject to the USDOT PHMSA's inspection and enforcement programs to ensure compliance with the requirements of 49 CFR 193.

The USCG has authority over the safety of an LNG terminal's marine transfer area and LNG marine vessel traffic, as well as over security plans for the waterfront facilities handling LNG and LNG marine vessel traffic. The USCG regulations for waterfront facilities handling LNG are codified in 33 CFR 105 and 33 CFR 127. As a cooperating agency, the USCG assists the FERC staff in evaluating whether an applicant's proposed waterway would be suitable for LNG marine vessel traffic and whether the waterfront facilities handling LNG would be operated in accordance with 33 CFR 105 and 33 CFR 127. If the facilities are constructed and become operational, the facilities would be subject to the USCG inspection program to ensure compliance with the requirements of 33 CFR 105 and 33 CFR 127. Magnolia LNG stated that there would be no additional changes to the route, maximum size, or maximum number of LNG marine vessel transits.

The FERC authorizes the siting and construction of LNG terminals under the NGA and delegated authority from the DOE. The FERC requires standard information to be submitted to perform safety and reliability engineering reviews. FERC's filing regulations are codified in 18 CFR §380.12(m) and (o), which require each applicant to identify how its proposed design would comply with the USDOT PHMSA's siting requirements of 49 CFR 193 Subpart B. The level of detail necessary for this submittal requires the applicant to perform substantial front-end engineering of the complete project. The design information is required to be site-specific and developed to the extent that further detailed design would not result in significant changes to the siting considerations, basis of design, operating conditions, major equipment selections, equipment design conditions, or safety system designs. As part of the review required for a FERC order, we use this information from the applicant to assess whether the proposed facilities would have a public safety impact and to suggest additional mitigation measures for the Commission to consider for incorporation as conditions in the order. If the facilities are approved and the suggested mitigation measures are incorporated into the order as conditions, FERC staff would review material filed to satisfy the conditions of the order and conduct periodic inspections throughout construction and operation.

In addition, the Energy Policy Act of 2005 requires FERC to coordinate and consult with the Department of Defense (DOD) on the siting, construction, expansion, and operation of LNG terminals that would affect the military. On November 21, 2007, the FERC and the DOD entered into a MOU formalizing this process.[8] On December 11, 2014, the FERC received a response letter from the DOD Siting Clearinghouse stating that the Magnolia LNG Project would have a minimal impact on military training and operations conducted in the area. Since the proposed Production Capacity Amendment does not propose to increase the footprint or maximum height of the previously authorized facilities; does not propose to change the route, maximum number, or maximum size of the LNG marine vessels; and does not propose to change the route, maximum number, or size of trucks containing hazardous fluids, FERC staff do not expect the DOD conclusions to change.

The EPA establishes federal safety regulations to prevent the accidental release and to minimize the consequences of any such release of extremely hazardous substances under the Clean Air Act. These regulations are codified in 40 CFR 68, Chemical Accident Prevention Provisions, also called the EPA's Risk Management Program (RMP). Typically, these regulations would not apply to LNG facilities as clarified in the EPA's preamble to its final rule in 63 Federal Register 640-645 (January 6, 1998), that

[8] *Memorandum of Understanding between the Federal Energy Regulatory Commission and United States Department of Defense to Ensure Consultation and Coordination on the Effect of Liquefied Natural Gas Terminals on Active Military Installations*, http://www.ferc.gov/legal/mou/mou-dod.pdf, November 21, 2007, updated August 29, 2014.

exempted substances in transportation, including storage incident to transportation, subject to oversight or regulation under 49 CFR 193. This would include facilities used to liquefy natural gas or used to transfer, store, or vaporize LNG in conjunction with pipeline transportation. However, the EPA has indicated that this exemption did not envision the use of toxic materials above threshold quantities to liquefy natural gas. Magnolia LNG's proposed use of anhydrous ammonia would be above the 10,000-pound threshold listed in the EPA's RMP regulations (40 CFR §68.130). Due to the quantities of anhydrous ammonia stored on site, the EPA has asserted their jurisdiction over Magnolia LNG's facility. The proposed Production Capacity Amendment would further increase the quantity of anhydrous ammonia stored and handled on site.

OSHA establishes federal safety standards for the protection of the health and safety of on-site personnel under the Occupational Safety and Health Act. These standards are codified in 29 CFR §1910.119, Process Safety Management of Highly Hazardous Chemicals (PSM). Typically, LNG facilities would not be subjected to PSM regulations as clarified in letter issued on October 30, 1992 and December 9, 1998, which precluded the enforcement of PSM regulations over gas and LNG transmission and distribution facilities. However, this letter stated that the USDOT PHMSA regulations indicate that fire and explosion hazards were adequately covered and did not reference the potential use of toxic hazards. Magnolia LNG's proposed use of anhydrous ammonia would be above the 10,000-pound threshold listed in OSHA's PSM regulations (29 CFR §1910.119 App A). Due to the quantities of anhydrous ammonia stored on site, OSHA has asserted their jurisdiction over Magnolia LNG's facility. The proposed Production Capacity Amendment would further increase the quantity of anhydrous ammonia stored and handled on site.

### 4.3.2 USDOT PHMSA Siting Requirements and 49 CFR Part 193 Subpart B Determination

Siting LNG facilities, as defined in 49 CFR 193, with regard to ensuring that the proposed site selection and location would not pose an unacceptable level or risk to public safety is required by USDOT PHMSA's regulations in 49 CFR 193, Subpart B. The Commission's regulations under 18 CFR §380.12(o)(14) require Magnolia LNG to identify how the proposed design complies with the siting requirements in USDOT PHMSA's regulations under 49 CFR 193, Subpart B. The scope of USDOT PHMSA's siting authority under 49 CFR 193 applies to LNG facilities used in the transportation of gas by pipeline subject to the federal pipeline safety laws and 49 CFR 192.[9]

The requirements in 49 CFR 193 Subpart B, state that an operator or government agency must exercise legal control over the activities as long the facility is in operation that can occur within an "exclusion zone," defined as the area around an LNG facility that could be exposed to specified levels of thermal radiation or flammable vapor in the event of a release of LNG or ignition of LNG vapor. Approved mathematical models must be used to calculate the dimensions of these exclusion zones. The siting requirements specified in NFPA 59A (2001), an industry consensus standard for LNG facilities, are incorporated into 49 CFR 193 Subpart B by reference, with regulatory preemption in the event of conflict. The following sections of 49 CFR 193 Subpart B specifically address siting requirements:

- Section 193.2051, Scope, states that each LNG facility designed, replaced, relocated or significantly altered after March 31, 2000, must be provided with siting requirements in

[9] 49 CFR §193.2001(b)(3), Scope of part, excludes any matter other than siting provisions pertaining to marine cargo transfer systems between the LNG marine vessel and the last manifold (or in the absence of a manifold, the last valve) located immediately before a storage tank.

accordance with Subpart B and NFPA 59A (2001). In the event of a conflict with NFPA 59A (2001), the regulatory requirements in Part 193 prevail.

- Section 193.2057, Thermal radiation protection, requires that each LNG container and LNG transfer system have thermal exclusion zones in accordance with section 2.2.3.2 of NFPA 59A (2001).

- Section 193.2059, Flammable vapor-gas dispersion protection, requires that each LNG container and LNG transfer system have a dispersion exclusion zone in accordance with sections 2.2.3.3 and 2.2.3.4 of NFPA 59A (2001).

- Section 193.2067, Wind forces, requires that shop fabricated containers of LNG or other hazardous fluids less than 70,000 gallons must be designed to withstand wind forces based on the applicable wind load data in American Society of Civil Engineers (ASCE) 7 (2005). All other LNG facilities must be designed for a sustained wind velocity of not less than 150 mph unless the USDOT PHMSA Administrator finds a lower wind speed is justified or the most critical combination of wind velocity and duration for a 10,000-year mean return interval.

As stated in 49 CFR §193.2051, LNG facilities must meet the siting requirements of NFPA 59A (2001), Chapter 2, and include but may not be limited to:

- NFPA 59A (2001) section 2.1.1 (c) requires consideration of protection against forces of nature.

- NFPA 59A (2001) section 2.1.1 (d) requires that other factors applicable to the specific site that have a bearing on the safety of plant personnel and surrounding public be considered, including an evaluation of potential incidents and safety measures incorporated in the design or operation of the facility.

- NFPA 59A (2001) section 2.2.3.2 requires provisions to minimize the damaging effects of fire from reaching beyond a property line, and requires provisions to prevent a radiant heat flux level of 1,600 British thermal units per square foot per hour (Btu/ft$^2$-hr) from reaching beyond a property line that can be built upon. The distance to this flux level is to be calculated with LNGFIRE3 or with models that have been validated by experimental test data appropriate for the hazard to be evaluated and that have been approved by USDOT PHMSA.

- NFPA 59A (2001) section 2.2.3.4 requires provisions to minimize the possibility of any flammable mixture of vapors from a design spill from reaching a property line that can be built upon and that would result in a distinct hazard. Determination of the distance that the flammable vapors extend is to be determined with DEGADIS or approved alternative models that take into account physical factors influencing LNG vapor dispersion.[10]

In sum, 49 CFR 193 Subpart B, and NFPA 59A (2001) require that flammable LNG vapors from design spills do not extend beyond areas in which the operator or a government agency legally controls all activities. Furthermore, consideration of other hazards which may affect the public or plant personnel must be evaluated as prescribed in NFPA 59A (2001), section 2.1.1(d).

[10] USDOT PHMSA has approved two additional models for the determination of vapor dispersion exclusion zones in accordance with 49 CFR §193.2059: FLACS 9.1 Release 2 (Oct. 7, 2011) and PHAST-UDM Version 6.6 and 6.7 (Oct. 7, 2011).

49 CFR 193 Subpart B, and NFPA 59A (2001) also specify radiant heat flux levels which must be considered for as long as the facility is in operation. For LNG spills from storage tanks, NFPA 59A (2001) requires the following:

- 1,600 Btu/ft$^2$-hr - This level can extend beyond the plant property line that can be built upon but cannot include areas that are used for outdoor assembly by groups of 50 or more persons;[11]
- 3,000 Btu/ft$^2$-hr - This level can extend beyond the plant property line that can be built upon but cannot include areas that contain assembly, educational, health care, detention or residential buildings or structures;[12] and
- 10,000 Btu/ft$^2$-hr - This level cannot extend beyond the plant property line that can be built upon.[13]

For LNG spills from process and transfer areas, the 1,600 Btu/ft$^2$-hr flux level cannot extend beyond the plant property line onto a property that can be built upon. In addition, section 2.1.1 of NFPA 59A (2001) requires that factors applicable to the specific site with a bearing on the safety of plant personnel and the surrounding public must be considered, including an evaluation of potential incidents and safety measures incorporated into the design or operation of the facility. USDOT PHMSA has indicated that potential incidents, such as vapor cloud explosions and toxic releases should be considered to comply with Part 193 Subpart B.[14]

In accordance with the August 31, 2018 MOU, USDOT PHMSA will issue a LOD to the Commission after the USDOT PHMSA completes its analysis of whether the proposed facilities would meet the USDOT PHMSA siting standards. The LOD will evaluate the hazard modeling results and endpoints used to establish exclusion zones, as well as Magnolia LNG's evaluation on potential incidents and safety measures incorporated in the design or operation of the facility specific to the site that have a bearing on the safety of plant personnel and surrounding public. The LOD will serve as one of the considerations for the Commission to deliberate in its decision on whether to authorize or deny an application.

[11] The 1,600 Btu/ft$^2$-hr flux level is associated with producing pain in less than 15 seconds, first degree burns in 20 seconds, second degree burns in approximately 30 to 40 seconds, 1 percent mortality in approximately 120 seconds, and 100 percent mortality in approximately 400 seconds, assuming no shielding from the heat, and is typically the maximum allowable intensity for emergency operations with appropriate clothing based on average 10 minute exposure.

[12] The 3,000 Btu/ft$^2$-hr flux level is associated with producing pain in less than 5 seconds, first degree burns in 5 seconds, second degree burns in approximately 10 to 15 seconds, 1 percent mortality in approximately 50 seconds, and 100 percent mortality in approximately 180 seconds, assuming no shielding from the heat, and is typically the critical heat flux for piloted ignition of common building materials (e.g., wood, PVC, fiberglass, etc.) with prolonged exposures.

[13] The 10,000 Btu/ft$^2$-hr flux level is associated with producing pain in less than 1 seconds, first degree burns in 1 seconds, second degree burns in approximately 3 seconds, 1 percent mortality in approximately 10 seconds, and 100 percent mortality in approximately 35 seconds, assuming no shielding from the heat, and is typically the critical heat flux for unpiloted ignition of common building materials (e.g., wood, PVC, fiberglass) and degradation of unprotected process equipment after approximate 10 minute exposure and to reinforced concrete after prolonged exposure.

[14] The USDOT PHMSA's "LNG Plant Requirements:Frequently Asked Questions" item H1, https://www.phmsa.dot.gov/pipeline/liquified-natural-gas/lng-plant-requirements-frequently-asked-questions, accessed Aug. 2019.

### 4.3.3 U.S. Coast Guard Safety and LNG Carrier Regulatory Requirements

Marine safety and vessel maneuverability studies were submitted for the Magnolia LNG Project under FERC Docket number CP14-347-000. Also, in accordance with 33 CFR 127, the USCG previously provided FERC with a LOR on September 15, 2014, regarding the suitability of the waterway for the type and frequency of the Magnolia LNG Project LNG marine vessel traffic. Following discussions between the USCG and FERC staff, the USCG re-issued an updated LOR and LOR Analysis on February 12, 2015. Until a facility begins operation, applicants must also annually review their WSAs and submit a report to the USCG Captain of the Port as to whether changes are required.

Magnolia LNG stated that the Production Capacity Amendment would not result in changes to the route, maximum size, or maximum number of LNG marine vessel transits. If the maximum number of LNG marine vessel transits or capacity of LNG vessels would need to increase based on the increase in the liquefaction rate, additional USCG review would be required. Annual updates to the WSA could capture any potential future increase in the number or size of LNG marine vessels if they were proposed. LNG marine carriers have safely transited the Calcasieu Pass Ship Channel and Industrial Canal when transiting to the existing Trunkline LNG import terminal that is located near the authorized Magnolia LNG Project.

The security requirements for the proposed project are governed by 33 CFR 105, 33 CFR 127, and 49 CFR 193 Subpart J - Security. 33 CFR 105, as authorized by the Maritime Transportation Security Act of 2002, requires all terminal owners and operators to submit a Facility Security Assessment (FSA) and a Facility Security Plan to the USCG for review and approval before commencement of operations of the proposed project facilities. Magnolia LNG would also be required to control and restrict access, patrol and monitor the plant, detect unauthorized access, and respond to security threats or breaches under 33 CFR 105. Some of the responsibilities of the applicant include, but are not limited to:

- designating a Facility Security Officer with a general knowledge of current security threats and patterns, security assessment methodology, vessel and facility operations, conditions, security measures, emergency preparedness, response, and contingency plans, who would be responsible for implementing the FSA and Facility Security Plan and performing an annual audit for the life of the project;
- conducting an FSA to identify site vulnerabilities, possible security threats and consequences of an attack, and facility protective measures; developing a Facility Security Plan based on the FSA, with procedures for: responding to transportation security incidents; notification and coordination with federal, state, and local authorities; prevention of unauthorized access; measures to prevent or deter entrance with dangerous substances or devices; training; and evacuation;
- defining the security organizational structure with facility personnel with knowledge or training in current security threats and patterns; recognition and detection of dangerous substances and devices, recognition of characteristics and behavioral patterns of persons who are likely to threaten security; techniques to circumvent security measures; emergency procedures and contingency plans; operation, testing, calibration, and maintenance of security equipment; and inspection, control, monitoring, and screening techniques;
- implementing scalable security measures to provide increasing levels of security at increasing maritime security levels for facility access control, restricted areas, cargo handling, LNG marine vessel stores and bunkers, and monitoring; ensuring that the TWIC program is properly implemented;

- ensuring coordination of shore leave for LNG marine vessel personnel or crew change out as well as access through the facility for visitors to the LNG marine vessel;
- conducting drills and exercises to test the proficiency of security and facility personnel on a quarterly and annual basis; and
- reporting all breaches of security and transportation security incidents to the National Response Center.

33 CFR 127 has requirements for access controls, lighting, security systems, security personnel, protective enclosures, communications, and emergency power. In addition, after the issuance of the order authorizing the Magnolia LNG Project, the USCG issued the TWIC Reader Requirements Rule on August 23, 2016 subject to LNG facilities regulated under 33 CFR 105 and 33 CFR 127. This rule requires owners and operators of certain vessels and facilities regulated by the USCG to conduct electronic inspections of TWICs (e.g., readers with biometric fingerprint authentication) as an access control measure. The final rule would also include recordkeeping requirements and security plan amendments that would incorporate these TWIC requirements. The implementation of the rule was first proposed to be in effect August 23, 2018. In a subsequent notice issued on June 22, 2018, the USCG indicated delaying the effective date for certain facilities by three years, until August 23, 2021. On August 2, 2018, the President of the United States signed into law the Transportation Worker Identification Credential Accountability Act of 2018 (H.R. 5729). This law prohibits the USCG from implementing the rule requiring electronic inspections of TWICs until after the U.S. Department of Homeland Security has submitted a report to the Congress. Although the implementation of this rule has been postponed for certain facilities, the company should to consider the rule when developing access control and security plan provisions for the facility.

49 CFR 193 Subpart J also specifies security requirements for the onshore components of LNG terminals, including requirements for conducting security inspections and patrols, liaison with local law enforcement officials, design and construction of protective enclosures, lighting, monitoring, alternative power sources, and warning signs. If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, compliance with the security requirements of 33 CFR 105, 33 CFR 127, and 49 CFR 193 Subpart J would be subject to the respective USCG and USDOT PHMSA inspection and enforcement programs.

Upon request, the Magnolia LNG provided update security drawings with the exception of lighting for the Production Capacity Amendment. However, lighting would likely change to cover the new equipment. In addition, as previously authorized, Magnolia LNG would install an impervious vapor barriers of heights ranging from 10 feet to 30 feet around portions of the property boundary. However, these could also change based on the revised siting analyses that would need to be prepared for the Production Capacity Amendment. Camera coverage and intrusion detection could also change once finalized. These updates would be incorporated into the final design and covered by existing conditions of the order under Docket No. CP14-347-000. We would verify:

- lighting coverage drawings are based upon photometric analyses demonstrating the lux levels at the interior of the terminal are in accordance with American Petroleum Institute (API) 540 and federal regulations for lighting along the perimeter fence line, along paths/roads of access and egress, at process, storage, and transfer areas, and at mooring points;
- camera coverage drawings illustrate coverage areas of each camera such that the entire perimeter of the plant is covered with redundancy and the interior of plant is covered, including cameras at the top of each LNG storage tank and coverage within pretreatment

areas, within liquefaction areas, within truck transfer areas, within marine transfer areas, and inside and outside of buildings;

- fencing drawings demonstrate a fence would deter or mitigate entry along the perimeter of the entire facility and is set back from exterior structures, and vegetation, and from interior hazardous piping and equipment by at least 10 feet;
- access and egress drawings demonstrate controlled access points with crash-rated vehicle barriers are provided to prevent uncontrolled access, inadvertent entry, and impacts to components containing hazardous fluids from vehicles.

Furthermore, in accordance with the February 2004 Interagency Agreement among FERC, USDOT PHMSA, and USCG, FERC staff would collaborate with the USCG and USDOT PHMSA on the project's security features.

### 4.3.4 FERC Engineering and Technical Review of the Preliminary Engineering Designs

#### *4.3.4.1 LNG Facility Historical Record*

The operating history of the U.S. LNG industry has been free of safety-related incidents resulting in adverse effects on the public or the environment with the exception of the October 20, 1944 failure at an LNG plant in Cleveland, Ohio. That incident led to a fire that killed 128 people and injured 200 to 400 more people.[15] The failure of the LNG storage tank was due to the use of materials not suited for cryogenic temperatures. LNG migrated through streets and into underground sewers due to inadequate spill impoundments at the site. Current regulatory requirements ensure that proper materials suited for cryogenic temperatures are used in the design and that spill impoundments are designed and constructed properly to contain a spill at the site. To ensure that this potential hazard would be addressed for proposed LNG facilities, we previously evaluated the preliminary engineering and specifications would use suitable materials of construction, and previously evaluated the spill containment system would properly contain a spill at the site. Any updates to the final design as a result of the Magnolia LNG Project Capacity Amendment would be evaluated in existing conditions on the final design.

Another operational accident occurred in 1979 at the Cove Point LNG plant in Lusby, Maryland. A pump electrical seal located on a submerged electrical motor LNG pump leaked causing flammable gas vapors to enter an electrical conduit and settle in a confined space. When a worker switched off a circuit breaker, the flammable gas ignited, causing severe damage to the building and a worker fatality. With the participation of the FERC, lessons learned from the 1979 Cove Point accident led to changes in the national fire codes to better ensure that the situation would not occur again. To ensure that this potential hazard would be addressed for proposed facilities that have electrical seal interfaces, we previously evaluated the preliminary designs and an existing condition on the previously authorized Magnolia LNG Project requires Magnolia LNG provide, for review and approval, the final design details of the electrical seal design at the interface between flammable fluids and the electrical conduit or wiring system, details of the electrical seal leak detection system, and the details of a downstream physical break (i.e., air gap) in the electrical conduit to prevent the migration of flammable vapors.

On January 19, 2004, a blast occurred at Sonatrach's Skikda, Algeria, LNG liquefaction plant that killed 27 and injured 56 workers. No members of the public were injured. Findings of the accident investigation suggested that a cold hydrocarbon leak occurred at Liquefaction Train 40 and was introduced into a high-pressure steam boiler by the combustion air fan. An explosion developed inside

[15] For a description of the incident and the findings of the investigation, see "U.S. Bureau of Mines, Report on the Investigation of the Fire at the Liquefaction, Storage, and Regasification Plant of the East Ohio Gas Co., Cleveland, Ohio, October 20, 1944," dated February 1946.

the boiler firebox, which subsequently triggered a larger explosion of the hydrocarbon vapors in the immediate vicinity. The resulting fire damaged the adjacent liquefaction process and liquid petroleum gas separation equipment of Train 40, and spread to Trains 20 and 30. Although Trains 10, 20, and 30 had been modernized in 1998 and 1999, Train 40 had been operating with its original equipment since start-up in 1981. To ensure that this potential hazard would be addressed for proposed facilities, we previously evaluated the preliminary design of the Magnolia LNG Project for mitigation of flammable vapor dispersion and ignition in buildings and combustion equipment to ensure they would be adequately covered by hazard detection equipment that could isolate and deactivate any combustion equipment whose continued operation could add to or sustain an emergency. There is also an existing condition on the previously authorized Magnolia LNG Project that requires Magnolia LNG provide, for review and approval, the final design details of hazard detection equipment, including the location and elevation of all detection equipment, instrument tag numbers, type and location, alarm indication locations, and shutdown functions of the hazard detection equipment.

On March 31, 2014, a detonation occurred within a gas heater at Northwest Pipeline Corporation's LNG peak-shaving plant in Plymouth, Washington.[16] This internal detonation subsequently caused the failure of pressurized equipment, resulting in high velocity projectiles. The plant was immediately shut down, and emergency procedures were activated, which included notifying local authorities and evacuating all plant personnel. No members of the public were injured, but one worker was sent to the hospital for injuries. As a result of the incident, the liquefaction trains and a compressor station located onsite were rendered inoperable. Projectiles from the incident also damaged the control building that was located near pre-treatment facilities and penetrated the outer shell of one of the LNG storage tanks. All damaged facilities were ultimately taken out of service for repair. The accident investigation showed that an inadequate purge after maintenance activities resulted in a fuel-air mixture remaining in the system. The fuel-air mixture auto-ignited during startup after it passed through the gas heater at full operating pressure and temperature. To ensure that this potential hazard would be addressed for proposed facilities, there is an existing condition on the previously authorized Magnolia LNG Project that requires Magnolia LNG provide a plan for purging, for review and approval, which addresses the requirements of the American Gas Association, Purging Principles and Practice, and to provide justification if not using an inert or non-flammable gas for purging. In evaluating such plans, we would assess whether the purging could be done safely based on review of other plans and lessons learned from this and other past incidents. If a plan proposes the use of flammable mediums for cleaning, dry-out or other activities, we would evaluate the plans against other recommended and generally accepted good engineering practices, such as NFPA 56, Standard for Fire and Explosion Prevention during Cleaning and Purging of Flammable Gas Piping Systems.

There is also an existing condition on the previously authorized Magnolia LNG Project that requires Magnolia LNG provide, for review and approval, operating and maintenance plans, including safety procedures, prior to commissioning. In evaluating such plans, we would assess whether the plans cover all standard operations, including purging activities associated with startup and shutdown. Also, in order to prevent other sources of projectiles from affecting occupied buildings and storage tanks, there is an existing condition on the previously authorized Magnolia LNG Project that requires Magnolia LNG incorporate mitigation into their final design with supportive information, for review and approval, that demonstrates it would mitigate the risk of a pressure vessel burst or boiling liquid expanding vapor explosion from occurring.

For past incidents of facilities handling ammonia, over 1,200 ammonia refrigeration incidents have occurred at ammonia facilities regulated under the EPA's RMP between 1994 and 2013. These

[16] For a description of the incident and the findings of the investigation, see Root Cause Failure Analysis, Plymouth LNG Plant Incident Investigation under CP14-515.

incidents have resulted in 84 injuries to the public and 1 public fatality. Lessons learned from these incidents have resulted in updates to codes and standards to reduce the risk of any incident from affecting the public. Recently on January 15, 2015, the Chemical Safety Board released a report investigating a release of 32,000 pounds of ammonia at Theodore, Alabama on August 23, 2010, after hydraulic shock caused a pipe to catastrophically fail.[17] To ensure this incident is addressed, there is an existing condition on the previously authorized Magnolia LNG Project that requires an evaluation of dynamic surge, for review and approval, to prevent failures associated with hydraulic shock. There are also additional existing conditions that have been placed on the authorized Magnolia LNG Project proposed anhydrous ammonia systems design and mitigation measures to further reduce the risk of any incidents affecting the public. Additional recommendations are also proposed to further reduce the risk of an incident given the increase in consequences.

#### *4.3.4.2 FERC Preliminary Engineering Review*

FERC requires an applicant to provide safety, reliability, and engineering design information as part of its application, including hazard identification studies and front-end-engineering-design (FEED) information for its proposed project. FERC staff evaluates this information with a focus on potential hazards from within and nearby the site, including external events, which may have the potential to cause damage or failure to the project facilities, and the engineering design and safety and reliability concepts of the various protection layers to mitigate the risks of potential hazards.

The primary concerns are those events that could lead to a hazardous release of sufficient magnitude to create an offsite hazard or interruption of service. Furthermore, the potential hazards are dictated by the site location and the engineering details. In general, FERC staff considers an acceptable design to include various layers of protection or safeguards to reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public. These layers of protection are generally independent of one another so that any one layer would perform its function regardless of the initiating event or failure of any other protection layer. Such design features and safeguards typically include:

- a facility design that prevents hazardous events, including the use of inherently safer designs; suitable materials of construction; adequate design margins from operating limits for process piping, process vessels, and storage tanks; adequate design for wind, flood, seismic, and other outside hazards;
- control systems, including monitoring systems and process alarms, remotely-operated control and isolation valves, and operating procedures to ensure that the facility stays within the established operating and design limits;
- safety instrumented prevention systems, such as safety control valves and emergency shutdown systems, to prevent a release if operating and design limits are exceeded;
- physical protection systems, such as appropriate electrical area classification, proper equipment and building spacing, pressure relief valves, spill containment, and cryogenic, overpressure, and fire structural protection, to prevent escalation to a more severe event;
- site security measures for controlling access to the plant, including security inspections and patrols, response procedures to any breach of security, and liaison with local law enforcement officials; and

[17] "Key Lessons for Preventing Hydraulic Shock in Industrial Refrigeration Systems," CSB Safety Bulletin No. 2010-13-A-AL, http://www.csb.gov/assets/1/19/final_CSB_CaseStudy_Millard_0114_0543PM.pdf, (January 15, 2015).

- onsite and offsite emergency response, including hazard detection and control equipment, firewater systems, and coordination with local first responders, to mitigate the consequences of a release and prevent it from escalating to an event that could impact the public.

The inclusion of such protection systems or safeguards in a plant design can minimize the potential for an initiating event to develop into an incident that could impact the safety of the offsite public. The review of the engineering design for these layers of protection are initiated in the application process and carried through to the next phase of the project in final design.

The reliability of these layers of protection is informed by occurrence and likelihood of root causes and the potential severity of consequences based on past incidents and validated hazard modeling. The previously authorized Magnolia LNG Project utilizes anhydrous ammonia as a refrigerant, which is toxic at certain concentrations. Toxicity is defined by a number of different agencies for different purposes. Acute Exposure Guideline Level (AEGL) and Emergency Response Planning Guidelines (ERPG) can be used for emergency planning, prevention, and response activities related to the accidental release of hazardous substances.[18] Other federal agencies, such as the DOE, EPA, and NOAA, use AEGLs and ERPGs as the primary measure of toxicity.[19, 20, 21]

There are three AEGLs and three ERPGs, which are distinguished by varying degrees of severity of toxic effects with AEGL-1 and ERPG-1 (level 1) being the least severe to AEGL-3 and ERPG-3 (level 3) being the most severe.

- AEGL-1 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, these effects are not disabling and are transient and reversible upon cessation of the exposure.
- AEGL-2 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.
- AEGL-3 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

The EPA directs the development of AEGLs in a collaborative effort consisting of committee members from public and private sectors across the world. FERC staff uses AEGLs preferentially as they are more inclusive and provide toxicity levels at various exposure times (10 minutes, 30 minutes, 1 hour, 4 hours, and 8 hours). The use of AEGLs is also preferred by the DOE and NOAA. Under the RMP regulation, the EPA currently requires the determination of distances to toxic concentrations based on

[18] U.S. Environmental Protection Agency, *Dose-Response Assessment for Assessing Health Risks Associated With Exposure to Hazardous Air Pollutants*, http://www2.epa.gov/fera/dose-response-assessment-assessing-health-risks-associated-exposure-hazardous-air-pollutants, July 3, 2014.

[19] U.S. Department of Energy, *Temporary Emergency Exposure Limits for Chemicals: Methods and Practice*, DOE Handbook, DOE-HDBK- 1046-2008, August 2008.

[20] U.S. Environmental Protection Agency, *40 CFR 68 Final Rule: Accidental Release Prevention Requirements: Risk Management Programs Under Clean Air Act Section 112(r)(7)*, 61 Federal Register 31667-31732, Vol. 61, No. 120, Thursday, June 20, 1996.

[21] U.S. National Oceanic and Atmospheric Administration, *Public Exposure Guidelines*, http://response.restoration.noaa.gov/oil-and- chemical-spills/chemical-spills/resources/public-exposure-guidelines.html, December 3, 2013.

ERPG-2 levels.[22,23] ERPG levels have similar definitions, but are based on the maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing similar effects defined in each of the AEGLs.

Under the EPA's RMP, Magnolia LNG would be required to evaluate a worst-case release as well as alternative release scenarios. The EPA has defined (40 CFR §68.3) a worst-case release as the release of the largest quantity of a regulated substance from a vessel or process line (pipe) failure that results in the greatest distance to a specified endpoint. Magnolia LNG previously selected a 10-minute release from the largest anhydrous ammonia containing vessel, the high pressure ammonia receiver, as the worst-case scenario.

Under the Magnolia LNG Project, the toxic endpoint would reach 2.6 miles to the ERPG-2 level using the EPA RMP*Comp results, and the population within 2.6 mile radius would be approximately 1,429 people (2010 census data).[24] Under the Production Capacity Amendment, the amount of anhydrous ammonia in the largest vessel would increase the toxic endpoint to 3.6 miles to the EPRG-2 level using the EPA RMP*Comp results, and the population within 3.6 miles would be approximately 7,710 (2010 census data) per FERC staff's evaluation.[25] While the population of the area within the EPRG-2 distance is approximately 7,710, the actual population which could be impacted following an anhydrous ammonia release is likely less. The vapor cloud dispersion would depend on the prevailing wind direction as well as other landscape features such as buildings and forested areas. A release would not impact the entire area within the toxic endpoint radius, only a segment. However, given the potential increase in impacts, FERC staff re-evaluated all of the various layers of protection in the proposed design.

Magnolia LNG did conduct a separate vapor dispersion modeling for the worst case anhydrous ammonia release. In their August 8, 2019 filing, Magnolia LNG indicated their vapor dispersion results showed a toxic endpoint, which would reach a shorter distance. While this toxic endpoint distance is lower than the EPA RMP*Comp results for the same anhydrous ammonia release, the vapor dispersion modeling software used can under predict vapor concentrations by a factor of at least 2, which would equate to approximately the same distance as the EPA RMP*Comp results. Therefore, we used the 3.6-mile distance in evaluating the potential risk to the public. As a result of the increased consequences, we have made additional recommendations to further reduce the likelihood of an incident that could impact the public.

#### *4.3.4.3 Process Design*

The process design modifications in the Production Capacity Amendment remain largely unchanged from the previously authorized Magnolia LNG Project. However, there are some modifications to increase the efficiency of the refrigeration process. The increased LNG production is a result of an increased capacity and pressures of the ammonia refrigerant cycle and the mixed refrigerant cycle. The auxiliary boiler steam production would also be increased to provide more power to the ammonia compressor steam turbine driver. In addition to the liquefaction uprate changes, the gas pre-treatment process would change from a single heavy hydrocarbon removal column to separate deethanizer and debutanizer columns. Furthermore, an electrically driven overhead booster compressor is proposed

[22] The EPA has issued a request for information that is exploring the use of AEGL in lieu of ERPG. Available online at https://www.federalregister.gov/articles/2014/07/31/2014-18037/accidental-release-prevention-requirements-risk-management-programs- under-the-clean-air-act-section.

[23] RMP toxic endpoints are based on ERPG-2 levels where these levels are available. For substances that do not have established ERPG-2 levels, the toxic endpoint is the level of concern from the EPA's 1987 Technical Guidance for Hazards Analysis.

[24] Magnolia LNG and Lake Charles Expansion Projects – Final EIS CP14-347-000.

[25] Per EPA environmental justice mapping tool https://ejscreen.epa.gov/mapper.

as part of the heavy hydrocarbon removal changes. We have included a description of the complete process design, including what is proposed to be modified, for completeness.

The inlet gas would be conditioned to remove solids and water droplets prior to entering feed gas pretreatment processes. Once the inlet gas is conditioned, the feed gas would enter the mercury and sulfur removal system to reduce their concentration in the feed gas. After mercury removal, the feed gas would contact an amine-based solvent solution in the amine contactor column to remove the $CO_2$ (i.e., acid gas) present in the feed gas. Once the acid gas components accumulate in the amine solution, the amine solution is routed to an amine regenerator column that utilizes a reboiler to create hot amine vapor. Contact with the hot amine vapor would regenerate the amine solution by using heat to release the acid gas. The regenerated amine solution would be recycled back to the amine contactor column and the removed acid gas would be sent to a thermal oxidizer, where $CO_2$, trace amounts of $H_2S$ not removed in the sulfur removal unit, and trace amounts of hydrocarbons would be incinerated. The feed gas exiting the amine contactor column would enter a knock out drum where bulk water would be recovered and recycled back to the amine contactor column. After the knock out drum, any remaining water in the feed gas would be removed using regenerative molecular sieve beds. Water collected during the molecular sieve regeneration process would be routed back to the amine regenerator column. After water removal, the treated dry gas would flow to the heavy hydrocarbon removal process. This part of the process has remained largely unchanged from the previously authorized Magnolia LNG Project.

Heavy hydrocarbon removal would occur prior to the liquefaction process. A heat exchanger coupled with an expander would reduce the temperature of the gas before entering the Deethanizer column. Liquids would be removed from the gas in the Deethanizer column. The gas would then be heated in a heat exchanger, compressed and routed to the liquefaction unit. The liquid portion from the deethanizer would flow into the debutanizer where the reboiler stabilizer would further separate the heavier hydrocarbons from the lighter hydrocarbons. The heavier hydrocarbons exiting the debutanizer would be sent to the fuel gas system and the lighter hydrocarbons would be returned to the deethanizer for further processing. This part of the process has changed from a single heavy hydrocarbon removal column to two separate deethanizer and debutanizer columns. Furthermore, an electrically driven overhead booster compressor is proposed as part of the heavy hydrocarbon removal changes. Lean gas from the deethanizer is precooled with anhydrous ammonia in a heat exchanger prior to entering the liquefaction cold box. The LNG exiting the refrigeration process would flow to an expansion valve to reduce pressure before flowing to two full containment LNG storage tanks.

In order to achieve the cryogenic temperatures needed to liquefy the natural gas stream in the above process, the gas would be cooled by a thermal exchange process driven by a closed loop refrigeration system using an anhydrous ammonia refrigeration cycle and then mixed refrigerants comprised of a mixture of nitrogen, methane, ethane, and butane. The anhydrous ammonia, nitrogen, ethane, and butane refrigerants required for the liquefaction process would be delivered in ISO Containers dropped off by truck and stored temporarily onsite for initial filling and use, as needed, for make-up. Methane would be provided from the treated dry feed gas stream entering the refrigeration process. The Production Capacity Amendment would primarily increase the flow rates and pressures of the anhydrous ammonia refrigerant cycle and mixed refrigerant cycle to achieve a higher liquefaction rate. The increase in pressure and inventories of anhydrous ammonia is the cause of the higher worst-case scenario. The higher liquefaction flow rate of LNG would also increase hazards, but to a lesser degree than the anhydrous ammonia. However, the higher LNG flow rates would also increase the fill rates and potentially reduce the time for an operator to safely prevent overfilling. In addition, the Production Capacity Amendment increased LNG hazards are a result of the increased LNG flow. As a result, we recommend in section 4.3.5 that Magnolia LNG include LNG tank fill flow measurement with high flow alarm as an added precaution to better prevent overfilling and mitigate the potential for higher LNG consequences than those evaluated. The increased flow will also produce increased boil-off gas, therefore we also recommend in section 4.3.5 that Magnolia LNG specify a discretionary vent valve on each LNG

storage tank that is operable through the DCS with a car sealed open manual block valve upstream of the discretionary vent valve. In addition, there is a higher potential with the increased flow to have liquid carry overs to the BOG system and therefore we recommend in section 4.3.5 that Magnolia LNG specify a means to prevent liquid flows to the BOG compressor (e.g., BOG suction/knock out drum with high alarm and high high level shutdown).

During export operations, LNG stored within the LNG storage tanks would be sent out through multiple in-tank pumps (the pump discharge piping would penetrate through the roof and is an inherently safer design when compared to penetrating the side of an LNG storage tank) and would be routed through a marine transfer line and multiple liquid marine transfer arms connected to an LNG marine vessel. In order to keep the marine transfer line cold between LNG export cargoes, an LNG recirculation line would keep the marine transfer line cold and avoid cool down prior to every LNG marine vessel loading operation. The LNG transferred to the LNG marine vessel would displace vapors from the marine vessel, which would be sent back through a vapor marine transfer arm, a vapor return line, to the LNG storage tanks, and into the boil-off gas (BOG) header. Once loaded, the LNG marine vessel would be disconnected and leave for export. Low pressure BOG generated from stored LNG (LNG is continuously boiling), vapors returned during LNG marine vessel filling operations, and flash gas from the LNG flash vessel would be compressed and would be routed to the liquefaction system cold box to be re-liquefied. The closed BOG system would prevent the release of BOG to the atmosphere and would be in accordance with NFPA 59A. This would be an inherently safer design when compared to allowing the BOG to vent to the atmosphere. This part of the process has remained largely unchanged from the previously authorized Magnolia LNG Project.

The Magnolia LNG Project would include many utilities and associated auxiliary equipment. The major auxiliary systems required for the operation of the liquefaction facility include BOG, fuel gas, flares, instrument and utility air supply, water supply, demineralized water, steam, aqueous ammonia, nitrogen, diesel, and backup power. Two flare systems would be designed to handle and control the vent gases from the process areas. The warm and cold flare would be routed to a common flare stack. Additionally, Magnolia LNG would install a marine flare to handle and control vent gasses from the marine and truck loading areas. The addition of the marine flare is proposed to better handle the smaller loads associated with the marine transfer and is not a result of the Production Capacity Amendment. High-pressure steam created from the refrigerant compressor gas turbine exhaust gas waste heat would drive the steam turbine drive for the anhydrous ammonia refrigerant compressors. An auxiliary steam boiler would be provided to augment the steam production from the refrigerant compressors gas turbines. Four emergency diesel generators that would support critical equipment and systems would be provided with their own fuel tank. Three separate diesel storage tanks would also supply the diesel firewater pumps: one diesel firewater pump for the process area, and two diesel fire water pumps for the tank deluge system. Each diesel pump would have a dedicated diesel tank. Trucks would fill a liquid nitrogen storage tank and vaporizers would supply gaseous nitrogen for refrigerant make-up. Site generated nitrogen would be used for compressor seals, purging activities, and utility stations as well as for pre-commissioning and start-up activities. In addition, aqueous ammonia, phosphate and an oxygen scavenger would be used to adjust water quality in the steam system. This part of the process has remained largely unchanged from the previously authorized Magnolia LNG Project, but the Production Capacity Amendment would increase the auxiliary boiler steam production to provide more power to the anhydrous ammonia compressor steam turbine driver.

The failure of process equipment could pose potential harm if not properly safeguarded through the use of appropriate engineering controls and operation. The previously authorized Magnolia LNG Project and proposed Production Capacity Amendment would install process control valves and instrumentation to safely operate and monitor the facilities. Alarms would have visual and audible notification in the control room to warn operators that process conditions may be approaching design

limits. Magnolia LNG previously committed to design and maintain their control systems and human machine interfaces to the International Society for Automation (ISA) Standards 5.3, 5.5, 60.1, 60.3, 60.4, and 60.6, and other standards and recommended practices. There is also an existing condition on the Magnolia LNG Project that requires Magnolia LNG to specify an alarm management program, for review and approval, prior to construction of final design. We would verify that the alarm management program would be in accordance with recommended and generally accepted good engineering practices, such as ISA 18.2.

Operators would have the capability to take action from the control room to mitigate an upset. Magnolia LNG would develop facility operation procedures after completion of the final design; this timing is fully consistent with accepted industry practice. There is an existing condition in the Magnolia LNG Project that requires Magnolia LNG provide more information, for review and approval, on the operating and maintenance procedures, including safety procedures, hot work procedures and permits, abnormal operating conditions procedures, and personnel training prior to commissioning. We would evaluate these procedures to ensure that an operator can operate and maintain all systems safely, based on benchmarking against other operating and maintenance plans and comparing against recommended and generally accepted good engineering practices, such as American Institute of Chemical Engineers (AIChE) Center for Chemical Process Safety (CCPS), *Guidelines for Writing Effective Operating and Maintenance Procedures*, AIChE CCPS, *Guidelines for Management of Change for Process Safety*, AIChE CCPS, *Guidelines for Effective Pre-Startup Safety Reviews*, American Gas Association, *Purging Principles and Practices*, and NFPA 51B, *Standards for Fire Prevention During Welding, Cutting, and Other Hot Work*. In addition, there is an existing condition in the Magnolia LNG Project that requires Magnolia LNG tag and label instrumentation and valves, piping, and equipment and provide car-seals/locks to address human factor considerations and improve facility safety and prevent incidents. There is also an existing condition that requires Magnolia LNG to maintain a detailed training log that demonstrates the operating staff has completed all required training prior to commissioning.

In the event of a process deviation, emergency shutdown valves and instrumentation would be installed to monitor, alarm, shutdown, and isolate equipment and piping during process upsets or emergency conditions. The Magnolia LNG Project proposed to have a plant-wide emergency shutdown system to initiate closure of valves and shutdown of the process during emergency situations as well as the ability to shutdown specific areas to address local emergency conditions. Magnolia LNG also previously committed to design and maintain their safety-instrumented systems to comply with ISA Standard 84.00.01 and other recommended and generally accepted good engineering practices. In addition, Magnolia LNG would install remotely actuated shut-off valves to enable rapid isolation of inventories. There is also an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to file information, for review and approval, on the final design, installation, and commissioning of instrumentation and emergency shutdown equipment to ensure appropriate cause-and-effect alarm or shutdown logic and enhanced representation of the emergency shutdown system in the plant control room and throughout the plant. There is also an existing condition on the Magnolia LNG Project that requires Magnolia LNG to specify emergency shutdown valve closure time and release volumes. We would evaluate whether the emergency shutdown systems would be capable of limiting the amount of anhydrous ammonia from any release to as low as reasonable practicable, and ensure it is no more than the amount assumed in the updated hazard analyses.

In developing the FEED, Magnolia LNG previously conducted, as part of the Magnolia LNG Project, a Hazard Identification review of the project's preliminary design based on the proposed process flow diagrams and the plot plans. The Hazard Identification analysis identified potential hazards in the early stage of the project's design that could produce undesirable consequences through the occurrence of an incident by evaluating the materials, systems, process, and plant design. In addition, there is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to perform a

Hazard and Operability (HAZOP) and Layer of Protection Analysis (LOPA) Studies, for review and approval, prior to construction of final design. The HAZOP analysis would be performed by Magnolia LNG during the final design to identify the major process hazards that may occur during the operation of the facilities. The HAZOP study would be intended to address hazards of the process, engineering, and administrative controls and would provide a qualitative evaluation of a range of possible safety, health, and environmental consequences that may result from the process hazard, and identify whether there are adequate safeguards (e.g., engineering and administrative controls) to prevent or mitigate the risk from such events. Where insufficient engineering or administrative controls were identified, recommendations to prevent or minimize these hazards would be generated from the results of the HAZOP review. We would evaluate the HAZOP to ensure all systems and process deviations are addressed appropriately based on likelihood, severity, and risk values with commensurate layers of protection in accordance with recommended and generally accepted good engineering practices, such as AIChE, *Guidelines for Hazard Evaluation Procedures*. The existing condition of the order authorizing the Magnolia LNG Project also requires Magnolia LNG to file the resolutions of the recommendations generated by the HAZOP review for review and approval by FERC staff. The LOPA would be used to analyze selected scenarios of high risk to personnel, the environment, or assets, as identified in the HAZOP, to assure the appropriate risk level reduction, based on risk reduction factors for the hazard. The LOPA should account for the Production Capacity Amendment and subsequent increase in consequences from anhydrous ammonia releases and should result in a commensurate increase in Significant Impact Levels. We would evaluate the LOPA to ensure the Significant Impact Levels are being determined in accordance with recommended and generally accepted good engineering practices, such as AIChE, *Layer of Protection Analysis: Simplified Process Risk Assessment*, AIChE, *Guidelines for Initiating Events and Independent Protection Layers in Layers of Protection Analysis*, AIChE, *Guidelines for Enabling Conditions and Conditional Modifiers in Layers of Protection Analysis*, ISA 84.00.01, *Application of Safety Instrumented Systems for the Process Industries*, ISA 84.00.02, *Safety Instrumented Functions: Significant Impact Levels Evaluation Techniques*, ISA 84.00.03*, Mechanical Integrity of SIS*, ISA 84.00.04, *Guidelines for the Implementation of ISA 84.00.01,* ISA 84.00.07, *Guidance on the Evaluation of Fire and Gas System Effectiveness*, and other recommended and generally accepted good engineering practices.

Once the design has been subjected to a HAZOP and LOPA review, the design development team would track, manage, and keep records of changes in the facility design, construction, operations, documentation, and personnel. Magnolia LNG would evaluate these changes to ensure that the safety, health, and environmental risks arising from these changes are addressed and controlled based on its management of change procedures. There is also an existing condition of the order authorizing the Magnolia LNG Project that requires Magnolia LNG to file any modifications, for review and approval, prior to using that modification. In addition, major modifications could require an amendment or new proceeding.

If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, Magnolia LNG would install equipment in accordance with its design. There is an existing condition of the order authorizing the Magnolia LNG Project that requires the facility be subject to inspections and that Magnolia LNG provide, for review and approval, commissioning plans, procedures and commissioning demonstration tests that would verify the performance of equipment. In addition, there is an existing condition of the order authorizing the Magnolia LNG Project that requires Magnolia LNG provide semi-annual reports that include abnormal operating conditions and planned facility modifications. Furthermore, there is an existing condition of the order for the Magnolia LNG Project that requires the facilities be subject to regular inspections throughout the life of the facilities to verify that equipment is being properly maintained and to verify basis of design conditions, such as feed gas and process conditions, do not exceed the original basis of design. These conditions also extend to the Production Capacity Amendment.

#### *4.3.4.4 Mechanical Design*

Magnolia LNG previously provided codes and standards for the design, fabrication, construction, and installation of piping and equipment and specifications for the facility. The design specified materials of construction and ratings suited to the pressure and temperature conditions of the process design. The Production Capacity Amendment has changed some of those conditions and resulted in changes to specifications for certain piping and equipment. For the previously authorized Magnolia LNG Project and Production Capacity Amendment, piping would be designed, fabricated, assembled, erected, inspected, examined, and tested in accordance with the American Society of Mechanical Engineers (ASME) Standards B31.3, B36.10, B36.19 as well as ASME B31.5 in accordance with International Institute of Ammonia Refrigeration standards for anhydrous ammonia refrigerant piping. The Magnolia LNG Project previously committed to designing, fabricating, assembling, inspecting, and maintaining valves and fittings in accordance with API 600, 602, 607, 609, and 623; ASME B16.5, B16.10, B16.20, B16.21, B16.34, and B16.47; ISA 75.01.01; and other recommended and generally accepted good engineering practices.

Pressure vessels must be designed, fabricated, inspected, examined, and tested in accordance with ASME Boiler and Pressure Vessel Code (BPVC) Section VIII and per 49 CFR 193 Subparts C, D, and E and NFPA 59A (2001). LNG storage tanks must be designed, fabricated, tested, and inspected in accordance with 49 CFR 193 Subpart D, NFPA 59A (2001 and 2006), and API 620. In addition, Magnolia LNG would design, fabricate, test, and inspect the LNG storage tanks in accordance with American Concrete Institute (ACI) 376. Other low-pressure storage tanks such as the amine storage tank would be designed, inspected, and maintained in accordance with the API Standards 650. All LNG storage tanks would also include boil-off gas compression to prevent the release of boil-off to the atmosphere in accordance with NFPA 59A (2001) for an inherently safer design. The Heat exchangers would be designed to ASME BPVC Section VIII standards; API 661; the Tubular Exchanger Manufacturers Association (TEMA) standards; and Aluminum Plate-Fin Heat Exchanger Manufacturer's Association guidelines. Rotating equipment would be designed to standards and recommended practices, such as API 610, 613, 614, 617, 618, 619, 670, 672, and 682; and ASME B73.1 and B73.2. Fired heaters would be specified and designed to standards and recommended practices, such as API 530, 556 and 560.

Pressure and vacuum safety relief valves, a vent stack, and flares would be installed to protect the storage containers, pressure vessels, process equipment, and piping from an unexpected or uncontrolled pressure excursion. The safety relief valves would be designed to handle process upsets and thermal expansion within piping, per NFPA 59A (2001) and ASME Section VIII; and would be designed in accordance with API 520, 521, 526, 527, and 2000; ASME B31.3; and other recommended and generally accepted good engineering practices. In addition, the operator should verify the set pressure of the pressure relief valves meet the requirements in 33 CFR §127.407. There is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG provide final design information on pressure and vacuum relief devices, vent stack, and flares, for review and approval, to ensure that the final sizing, design, and installation of these components are adequate and in accordance with the standards reference and other recommended and generally accepted good engineering practices. If the Production Capacity Amendment is authorized, Magnolia LNG would need to include the changes into its final design filing.

Since the approval of the Magnolia LNG Project design under CP14-347-000, there have been updates to many of the referenced standards. For example, several International Institute of Ammonia Refrigeration codes have been added, and several such Bulletins/Guidelines have been withdrawn. In addition, the previously authorized Magnolia LNG Project and Production Capacity Amendment did not include API 537, 594, 598, 603, 608, 625, 653, 660, 674, 675, or 676; ASME B16.9, B16.25, or B16.36; ISA 75.05.01, 75.08.01, or 75.08.05; NFPA 85; or other recommended and generally accepted good engineering practices. There is an existing condition in the order for the Magnolia LNG Project that

requires Magnolia LNG provide the final specifications for all equipment. If the Production Capacity Amendment is authorized, Magnolia LNG would need to include the changes into its final design filing.

There is also an existing condition of the order authorizing the Magnolia LNG Project that requires Magnolia LNG to demonstrate hazardous fluid piping and piping nipples of 2 inches nominal pipe size or less in diameter are designed to withstand external loads, including vibrational loads in the vicinity of rotating equipment and operator live loads in areas accessible by operators. There is also an existing condition that ammonia piping meet the minimum requirements of ASME B31.5 and ASME B31.3 specified as Category M. Given the potential increase in consequences of the release of anhydrous ammonia, we also recommend in section 4.3.5 that Magnolia LNG specify that for anhydrous ammonia, piping and piping nipples 2 inches or less in diameter to be no less than schedule 160 for carbon steel and no less than schedule 80S for stainless steel in accordance with ASME B36.10M and ASME B36.19M, respectively. Similarly, we also recommend in section 4.3.5 that Magnolia LNG specify that pressure vessels meet the minimum requirements for lethal service in accordance with ASME BPVC Section VIII.

In addition, Magnolia LNG previously committed that the majority of the anhydrous ammonia piping connections would be welded connections instead of flanges to minimize potential leaks associated with flanges. 49 CFR §193.2301, under Subpart D, requires non-destructive examination in compliance with NFPA 59A (2001). NFPA 59A (2001) section 6.6.3.1 requires longitudinal or spiral welded pipe subject to service temperatures below -20 °F to have a design pressure less than 2/3 of the mill proof test pressure or subsequent shop or field hydrostatic test pressure unless it has been subject to 100 percent radiographic or ultrasonic inspection of the longitudinal or spiral weld. In addition, NFPA 59A (2001) section 6.6.3.2 requires all circumferential butt welds to be 100 percent radiographically or ultrasonically inspected with exceptions of liquid drain and vent piping with an operating pressure that produces a hoop stress less than 20 percent of the specified minimum yield stress if it is visually inspected in accordance with ASME B31.3 and piping operating above -20 °F if 30 percent of each day's circumferential welds are non-destructively tested over the entire circumference in accordance with ASME B31.3. NFPA 59A (2001) section 6.6.3.3 also requires all socket welds and fillet welds be 100 percent examined by liquid penetrant or magnetic particle inspection.

49 CFR §193.2321, under Subpart D, requires butt welds in LNG storage tanks to meet NFPA 59A (2006) section 7.3.1.2 and Appendices C and Q of API 620. In sum, NFPA (2006) section 7.3.1.2 and Appendices C and Q of API 620 require LNG storage tanks to have 100 percent radiograph of all annular plate radial joint butt welds and 100 percent examination of all vertical and horizontal butt welds associated with the container wall, except for the shell to bottom welds associated with a flat bottom container. 49 CFR §193.2321, under Subpart D, requires pressure vessels to have 100 percent non-destructive examination of welds in both longitudinal/meridional and latitudinal/circumferential of hydraulic load bearing shells with curved surface subject to cryogenic temperatures in accordance with ASME BPVC Section VIII, Division 1.

Given the consequences of the release of anhydrous ammonia are potentially greater than larger scale releases of LNG, we also recommend in section 4.3.5 that Magnolia LNG specify all piping be subject to the same requirements in NFPA 59A (2001) section 6.6.3 as cryogenically rated piping and have 100 percent of all longitudinal, spiral, circumferential butt, socket, and fillet welds be radiographed or ultrasonically tested in accordance with ASME B31.3. In addition, we recommend in section 4.3.5 that Magnolia LNG specify all pressure vessels containing anhydrous ammonia subject to 100 percent non-destructive examination of welds in both longitudinal/meridional and latitudinal/circumferential of hydraulic load bearing shells with curved surface in accordance with ASME BPVC Section VIII, Division 1.

If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, Magnolia LNG would install equipment in accordance with its specifications and design, and

FERC staff would verify equipment nameplates to ensure equipment is being installed based on approved design. In addition, FERC staff would conduct construction inspections including reviewing quality assurance and quality control plans to ensure construction work is being performed according to proposed project specifications, procedures, codes, and standards. Given the phased construction of the project and increase in potential hazards, we also recommend in section 4.3.5 that Magnolia LNG file piping and instrument diagrams, specifications, and procedures that clearly show and specify the tie-in details required to safely connect subsequently constructed facilities with any operational facilities. There is also an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG provide semi-annual reports that include equipment malfunctions and abnormal maintenance activities. In addition, there is an existing condition in the order for the Magnolia LNG Project that requires the facilities be subject to inspections to verify that the equipment is being properly maintained during the life of the facility. These conditions also extend to the Production Capacity Amendment.

#### *4.3.4.5 Hazard Mitigation Design*

If operational control of the facilities were lost and operational controls and emergency shutdown systems failed to maintain the project within the design limits of the piping, containers, and safety relief valves, a release could potentially occur. FERC regulations under 18 CFR §380.12(o)(1) through (4) require applicants to provide information on spill containment, spacing and plant layout, hazard detection, hazard control, and firewater systems. In addition, 18 CFR §380.12(o)(7) require applicants to provide engineering studies on the design approach and 18 CFR §380.12(o)(14) requires applicants to demonstrate how they comply with 49 CFR 193 and NFPA 59A.

As required by 49 CFR 193 Subpart I and by incorporation section 9.1.2 of NFPA 59A (2001), fire protection must be provided for all USDOT PHMSA regulated LNG facilities based on an evaluation of sound fire protection engineering principles, analysis of local conditions, hazards within the facility, and exposure to or from other property. NFPA 59A (2001) also requires the evaluation on the type, quantity, and location of hazard detection and hazard control, passive fire protection, emergency shutdown and depressurizing systems, and emergency response equipment, training, and qualifications. If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 Subpart I and would be subject to USDOT PHMSA's inspection and enforcement programs. However, NFPA 59A (2001) also indicates the wide range in size, design, and location of LNG facilities precludes the inclusion of detailed fire protection provisions that apply to all facilities comprehensively and includes subjective performance-based language on where emergency shutdown systems and hazard control are required and does not provide any additional guidance on placement or selection of hazard detection equipment and provides minimal requirements on firewater. Also, the previously authorized project marine facilities would be subject to 33 CFR 127, which incorporates sections of NFPA 59A (1994), which have similar performance-based guidance. FERC staff evaluated the Production Capacity Amendment changes to the Magnolia LNG Project on the proposed spill containment and spacing, hazard detection, emergency shutdown and depressurization systems, hazard control, firewater coverage, structural protection, and onsite and offsite emergency response to ensure they would provide adequate protection of the LNG facilities as described below.

Magnolia LNG previously performed a preliminary fire protection evaluation to ensure that adequate mitigation would be in place, including spill containment and spacing, hazard detection, emergency shutdown and depressurization systems, hazard control, firewater coverage, structural protection, and onsite and offsite emergency response. Some of these have changed as a result of the Production Capacity Amendment. There is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG provide a final fire protection evaluation that evaluates the type, quantity, and location of hazard detection and hazard control, passive fire protection, emergency shutdown and depressurizing systems, and emergency response equipment, training, and qualifications in

accordance with NFPA 59A (2001), and to provide more information on the final design, installation, and commissioning of spill containment, hazard detection, hazard control, firewater systems, structural fire protection, and onsite and offsite emergency response procedures for review and approval. If the Production Capacity Amendment is authorized, this existing condition would apply to the Production Capacity Agreement as part of its final design filing.

**Spill Containment**

In the event of a release, sloped areas at the base of storage and process facilities would direct a spill away from equipment and into the impoundment system. This arrangement would minimize the dispersion of flammable vapors into confined, occupied, or public areas and minimize the potential for heat from a fire to impact adjacent equipment, occupied buildings, or public areas if ignition were to occur.

49 CFR §193.2181, under Subpart C, specifies that each impounding system serving an LNG storage tank must have a minimum volumetric liquid capacity of 110 percent of the LNG tank's maximum design liquid capacity for an impoundment serving a single tank, unless surge is accounted for in the impoundment design. If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 Subpart C and would be subject to USDOT PHMSA's inspection and enforcement programs. FERC staff previously verified in the Magnolia LNG Project that the two full containment LNG storage tank's outer concrete wall would have a liquid capacity of at least 110 percent of the inner LNG tank's maximum liquid capacity. In addition, Magnolia LNG previously committed to install an earthen berm around both of the LNG storage tanks to limit liquid in the storage tank area from flowing off-site in the event of an outer tank impoundment failure.

Under NFPA 59A (2001), section 2.2.2.2, the capacity of impounding areas for vaporization, process, or LNG transfer areas must equal the greatest volume that can be discharged from any single accidental leakage source during a 10-minute period or during a shorter time period based upon demonstrable surveillance and shutdown provisions acceptable to USDOT PHMSA. If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 Subpart C and would be subject to USDOT PHMSA's inspection and enforcement programs. However, we evaluate whether all hazardous liquids are provided with spill containment based on the largest flow capacity from a single pipe for 10 minutes accounting for de-inventory or the liquid capacity of the largest vessel (or total of impounded vessels) served, whichever is greater and whether providing spill containment reduces consequences from a release. Magnolia LNG previously indicated that all piping, hoses, and equipment that could produce a hazardous liquid spill would be provided with spill collection and/or spill conveyance systems. In addition, Magnolia LNG previously committed to install curbing, paving, and trenches to direct potential LNG, refrigerant, heavy hydrocarbon or anhydrous ammonia liquid releases to the Process Area Impoundment Basin or the LNG Tank Area Impoundment Basin. Magnolia LNG also previously designed for LNG releases from ship loading piping to be directed to either the Tank Area Impoundment Basin. Releases in the refrigerant storage area or from refrigerant delivery trucks were previously designed to be collected in curbed areas and directed via a trench to the Process Area Impoundment Bain. The basin was sized to collect a 10 minute spill from the LNG rundown line. The amine system as well as the 3,800 gallon Lean Amine Tank would be installed within module 1 of each train. Any liquid amine released from the amine process or the Lean Amine Tank would be contained within an irregularly shaped 6-inch curbed area in module 1. This previously authorized curbed area would have a containment volume of approximately 23,665 gallons. Nitrogen piping as well as a 44,000 gallon Liquid Nitrogen Tank would be installed within module 5 of each train. A liquid nitrogen release would be contained within the irregularly shaped 6-inch curbed area in module 5. This previously authorized curbed area would have a containment volume of approximately 68,663 gallons.

Some of these spill containment systems would change as a result of the Production Capacity Amendment. There is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG provide final spill containment drawings, for review and approval, prior to construction of final design. FERC staff would verify that the spill containment drawings show containment for all hazardous fluids, including all toxic liquids and flammable and combustible liquids handled above or near their flashpoint, from the largest flow from a single line for 10 minutes, including de-inventory, or the maximum liquid from the largest vessel (or total of impounded vessels) or otherwise demonstrate that providing spill containment would not significantly reduce the flammable vapor dispersion or radiant heat consequences of a spill. FERC staff would review this for all authorized facilities associated with the Magnolia LNG Project. If the Production Capacity Amendment is authorized, FERC staff would also review the increased spill containment volume capacities needed to accommodate the larger anhydrous ammonia, mixed refrigerant, and LNG flows associated with the Production Capacity Amendment.

Furthermore, Magnolia LNG indicated that the stormwater pumps would be automatically operated by level control and interlocked using redundant low temperature detectors to prevent pumps from operating if LNG is present within the LNG spill basins. Although stormwater removal pumps would be proposed for the large impoundment basins, Magnolia LNG previously proposed in the Magnolia LNG Project to install normally-closed valves on local curbed areas and within bund walls to allow analysis of stormwater prior to routing it to the drainage channels. In addition, low temperature detectors would not stop the stormwater removal pumps from operating in the event a relatively warm heavy hydrocarbon release reaches the impoundment basins. The previously authorized Magnolia LNG Project also has gas detectors near the impoundment basins. However, it is unclear if these gas detectors would trip the stormwater removal pumps if warm refrigerant or heavy hydrocarbon releases could reach an impoundment basin. There is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG provide, for review and approval, the cause and effect matrices for process instrumentation, fire and gas detection system, and emergency shutdown system. If the Production Capacity Amendment is approved and the Magnolia LNG Project is constructed, final compliance with the requirements of 49 CFR 193 Subpart C, would be subject to USDOT PHMSA's inspection and enforcement programs. We have also recommend in section 4.3.5 that Magnolia LNG consult with USDOT PHMSA staff as to whether the use of drain valves to remove stormwater from curbed areas would meet USDOT PHMSA requirements.

If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, Magnolia LNG would install spill impoundments in accordance with its final designs and FERC staff would verify during construction inspections that the spill containment system including dimensions, and slopes of curbing and trenches, and volumetric capacity matches final design information. In addition, there is an existing condition in the order for the Magnolia LNG Project that requires the facilities be subject to inspections to verify that impoundments are being properly maintained throughout the life of the facility. There is also an existing condition in the order for Magnolia LNG Project that requires Magnolia LNG to report significant non-scheduled events, including release of hazardous fluids for five minutes or more and any leaks in a facility that contains or processes hazardous fluids that constitutes an emergency. This condition will also extend to the Production Capacity Amendment.

**Spacing and Plant Layout**

The spacing of vessels and equipment between each other, from ignition sources, and to the property line must meet the requirements of 49 CFR 193 Subparts C, D, and E, which incorporate NFPA 59A (2001). NFPA 59A (2001) includes spacing and plant layout requirements and further references NFPA 30, NFPA 58, and NFPA 59 for additional spacing and plant layout requirements. If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, LNG

facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 and would be subject to USDOT PHMSA's inspection and enforcement programs.

In addition, FERC staff previously evaluated the spacing in the Magnolia LNG Project to determine if there could be cascading damage and to inform what fire protection measures may be necessary to reduce the risk of cascading damage. If spacing to mitigate the potential for cascading damage was not practical, we evaluated whether other mitigation measures were in place and evaluated those systems in further detail as discussed in subsequent sections in section 0. We previously evaluated the spacing of buildings in line with AIChE CCPS, *Guidelines for Evaluating Process Plant Buildings for External Explosions and Fires and API 752*, which provide guidance on identifying and evaluating explosion and fire impacts to plant buildings and occupants resulting from events external to the buildings. In addition, FERC staff previously evaluated other hazards associated with releases, as part of the Magnolia LNG Project, and whether any damage would likely occur at buildings or would result in cascading damage. The Production Capacity Amendment proposed to rearrange some of the equipment that was previously analyzed. There is an existing condition in order for the Magnolia LNG Project that requires Magnolia LNG provide final plot plans. If the Production Capacity Amendment is authorized, these changes would need to be incorporated into the final design filings of the Magnolia LNG Project.

To minimize the risk of cryogenic spills causing structural supports and equipment from cooling below their minimum design metal temperature, Magnolia LNG would generally locate cryogenic equipment away from process areas and would have spill containment systems for cryogenic spills that would direct them to a remote impoundment. In addition, Magnolia LNG should protect equipment and structural steel against cold shocks through selection of suitable materials of construction or by the application of cold spill protection, which is discussed in subsequent sections in section 0.

To minimize risk for flammable or toxic vapor ingress into buildings and from reaching areas that could result in cascading damage from explosions, Magnolia LNG would generally locate buildings away from process areas and would locate fired equipment and ignition sources away from process areas. In addition, the LNG storage tanks are generally located away from process equipment and process facilities are relatively unconfined and uncongested. In addition, Magnolia LNG would install hazard detection, which is discussed in subsequent sections in section 0.

To minimize overpressures from vapor cloud explosions, we previously evaluated how flammable vapors would be prevented from accumulating within confined areas. There is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to include hazard detection at inlets to fired equipment and heating/ventilation/air conditioning units that would shut down and isolate the intake upon detection of flammable concentrations. In addition, the previously authorized LNG storage tanks would be situated on grade, which would not allow for LNG vapors to migrate underneath the tanks. Explosions in process areas were also previously evaluated and demonstrated to produce more than 1 pound per square inch side on overpressure at the LNG storage tanks for an ethane explosion. However, the Production Capacity Amendment indicates rearrangement of some process equipment that would change these results. There is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to file LNG storage tank structural design details demonstrating that the tanks would withstand these overpressures. If the Production Capacity Amendment is authorized, the filing for the condition would need to reflect these changes.

To minimize the risk of pool fires from causing cascading damage, Magnolia LNG located the spill impoundments such that the radiant heats would have a minimal impact on most areas of the plant. Fires within the process impoundments would be spaced such that there would not be high radiant heats on any equipment. A fire from the LNG storage tank outer containment walls would result in radiant heats over 10,000 Btu/ft$^2$-hr at the adjacent LNG storage tank. On April 1, 2015, Magnolia LNG clarified that the design would install a deluge water system to protect the LNG storage tanks. Therefore, there is

an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to file an analysis for review and approval demonstrating the tanks can withstand the radiant heat from adjacent LNG storage tank fires. Magnolia LNG would install fixed water spray systems that would cover numerous pieces of equipment within each train.

To minimize the risk of jet fires from causing cascading damage that could exacerbate the initial hazard, Magnolia LNG would locate flammable and combustible containing piping and equipment away from buildings and process areas that do not handle flammable and combustible materials. Magnolia LNG would also install emergency shutdown systems that would limit the duration of a jet fire event, depressurization systems that would reduce the pressure in equipment, and would install firewater systems to cool equipment and structures as described in subsequent sections.

In addition, FERC staff previously evaluated the spacing to determine if there could be cascading damage and to inform what fire protection measures may be necessary to reduce the risk of cascading damage. Thermal radiation levels from an LNG tank roof top fire and other impoundments could potentially impact process equipment, process vessels, and piperacks located within the trains, BOG compressor area, and refrigerant storage area. To mitigate against a LNG tank roof top fire, impoundment fires, and jet fires within the plant, Magnolia LNG proposes thermal radiation mitigation measures to prevent cascading events in the design, including thermal protection insulation, fire-retardant insulation materials, emergency depressurization, flame, combustible gas and low temperature detectors, fixed automatic firewater spray system, high expansion foam system, and firewater monitors and hydrants. However, Magnolia LNG did not specify any passive mitigation measures such as thermal insulation, fireproofing, or radiant heat shielding. Therefore, there is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to specify passive mitigation measures to address potential boiling liquid expanding vapor explosion incidents in the refrigerant storage area.

If the Production Capacity Amendment is authorized, Magnolia LNG would finalize the plot plan, and there is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to provide any changes for review and approval to ensure capacities and setbacks are maintained. If the Magnolia LNG Project, as modified by the Production Capacity Amendment, is constructed, Magnolia LNG would install equipment in accordance with the spacing indicated on the final plot plans. In addition, there is an existing condition in the order for the Magnolia LNG Project that requires the facilities be subject to inspections to verify that impoundments are being properly maintained throughout the life of the facility. These conditions would also extend to the Production Capacity Amendment.

**Ignition Controls**

Magnolia LNG's terminal site plant areas would be designated with a hazardous electrical classification and process seals commensurate with the risk of the hazardous fluids being handled in accordance with NFPA 59A (2001), 70, 497, and API RP 500. If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 and would be subject to USDOT PHMSA's inspection and enforcement programs, which require compliance, by incorporation by reference, with NFPA 59A (2001) and NFPA 70 (1999). The authorized marine facilities must comply with similar electrical area classification requirements of NFPA 59A (1994) and NFPA 70 (1993), which are incorporated by reference into the USCG regulations in 33 CFR 127. Depending on the risk level, these areas would either be unclassified or classified as Class 1 Division 1, or Class 1 Division 2. Electrical equipment located in these areas would be designed such that in the event a flammable vapor is present, the equipment would have a minimal risk of igniting the vapor. We previously evaluated Magnolia LNG's electrical area classification drawings as part of the Magnolia LNG Project to determine whether Magnolia LNG would meet these electrical area classification requirements and good engineering practices in NFPA 59A, 70, and 497. We recognized that Magnolia LNG appears to meet NFPA 59A

(1994 and 2001), NFPA 70 (1993 and 1999), and most of NFPA 497, and there is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to provide final electrical area classification drawings for review and approval. Magnolia LNG also provided changes to the electrical area classification drawings as a result of the Production Capacity Amendment. If the Production Capacity Amendment is authorized, FERC staff would verify these changes are incorporated into the final design and also verify it meets recommended and generally accepted good engineering practices, such as NFPA 59A, 70, 497, and API 500.

If the Production Capacity Amendment is authorized, Magnolia LNG would finalize the electrical area classification drawings and would describe changes made from the FEED design. If the Magnolia LNG Project, as modified by the Production Capacity Amendment, is constructed, Magnolia LNG would install appropriately classed electrical equipment, and there is an existing condition in the order for the Magnolia LNG Project that requires the facilities be subject to periodic inspections during construction for FERC staff to spot check electrical equipment and verify equipment is installed per classification and are properly bonded or grounded in accordance with NFPA 70. In addition, there is an existing condition in the order for the Magnolia LNG Project that requires the facilities be subject to regular inspections throughout the life of the facility to ensure electrical equipment is maintained (e.g., bolts on explosion proof equipment properly installed and maintained, panels provided with purge, etc.), and electrical equipment are appropriately de-energized and locked out and tagged out when being serviced. These conditions also extend to the Production Capacity Amendment.

In addition, submerged pumps and instrumentation must be equipped with electrical process seals, and instrumentation in accordance with NFPA 59A (2001) and NFPA 70. There is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to provide, for review and approval, final design drawings showing process seals installed at the interface between a flammable fluid system and an electrical conduit or wiring system that meet the requirements of NFPA 59A (2001) and NFPA 70. In addition, there is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to file, for review and approval, details of an air gap or vent equipped with a leak detection device that should continuously monitor for the presence of a flammable fluid, alarm the hazardous condition, and shut down the appropriate systems. These are unlikely to change as a result of the Production Capacity Amendment.

**Hazard Detection, Emergency Shutdown, and Depressurization Systems**

Magnolia LNG would also install hazard detection systems to detect cryogenic spills, flammable and toxic vapors, and fires. The hazard detection systems would alarm and notify personnel in the area and control room to initiate an emergency shutdown, depressurization, or initiate appropriate procedures, and would meet NFPA 72, ISA Standard 12.13, and other recommended and generally accepted good engineering practices. Magnolia LNG would also install ammonia detection systems throughout the plant that would initiate automated shutdown systems in the event of an anhydrous ammonia release. In addition, there is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to provide specifications, for review and approval, for the final design of fire safety specifications, including hazard detection, hazard control, and firewater systems. The Production Capacity Amendment would change some of these drawings. If the Production Capacity Amendment is authorized, the final design filings associated with these conditions would need to reflect these changes.

FERC staff also previously evaluated the adequacy of the general hazard detection type, location, and layout to ensure adequate coverage to detect cryogenic spills, flammable and toxic vapors, and fires near potential release sources (i.e., pumps, compressors, sumps, trenches, flanges, and instrument and valve connections). Magnolia LNG provided updated hazard detection drawings based on the Production Capacity Amendment. There is a condition in the order for the Magnolia LNG Project that requires Magnolia LNG to provide additional information, for review and approval, on the final design of all

hazard detection systems (e.g., manufacturer and model, elevations, etc.) and hazard detection layout drawings, including consideration of liquid nitrogen releases and mitigation, such as low oxygen detectors. In addition, there is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to conduct a technical review of the facility, for review and approval, identifying all combustion/ventilation air intake equipment and the distances to any possible flammable gas or toxic release; and verify that these areas would be adequately covered by hazard detection devices that would isolate or shut down any combustion or heating ventilation and air conditioning equipment whose continued operation could add to or sustain an emergency. As part of these reviews, FERC staff would verify whether adequate ventilation and detection in the battery rooms would be present to mitigate hydrogen build up from battery off-gas. Given the potential increase in consequences of a potential cascading event, we also recommend in section 4.3.5 that Magnolia LNG file a hazard detection study to evaluate the effectiveness of their flammable and combustible gas detection and flame and heat detection systems in accordance with ISA 84.00.07 or equivalent methodologies. This evaluation would need to demonstrate that 90 percent or more of releases (unignited and ignited) that could result in an off-site or cascading impact would be detected by two or more detectors and result in isolation and de-inventory within 10 minutes. The analysis should take into account the set points, voting logic, wind speeds, and wind directions. FERC staff also previously reviewed the fire and gas cause and effect matrices to evaluate the detectors that would initiate an alarm, shutdown, depressurization, or other action based on the FEED. Magnolia LNG did not provide the fire and gas system cause and effect matrices that indicate how each detector would initiate an alarm, shutdown, depressurization, or conduct other action. Therefore, there is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to provide, for review and approval, the cause and effect matrices for process instrumentation, fire and gas detection system, and emergency shutdown system.

If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, Magnolia LNG would install hazard detectors according to its final specifications and drawings. There is an existing condition in the order for the Magnolia LNG Project that requires the facilities be subject to periodic inspections during construction to verify hazard detectors and emergency shutdown pushbuttons are appropriately installed per approved design and functional based on cause and effect matrixes prior to introduction of hazardous fluids. In addition, there is an existing condition in the order for the Magnolia LNG Project that requires the facilities be subject to regular inspections throughout the life of the facility to verify hazard detector coverage and functionality is being maintained and calibrated, and are not being bypassed without appropriate precautions. These conditions also extend to the Production Capacity Amendment.

**Hazard Control**

If ignition of flammable vapors occurred, hazard control devices would be installed to extinguish or control incipient fires and releases, and would meet NFPA 59A; NFPA 10, 12, 17, and 2001; API 2510A; and other recommended and generally accepted good engineering practices. We previously evaluated in the Magnolia LNG Project the adequacy of the number and availability of handheld, wheeled, and fixed fire extinguishing devices throughout the site based on the FEED. FERC staff also previously evaluated whether the spacing of the fire extinguishers would meet NFPA 10 and agent type and capacities meet NFPA 59A (2009 and later editions). The hazard control plans appeared to meet NFPA 10 travel distances to most components containing flammable or combustible fluids (Class B) for handheld fire extinguishers (30 to 50 feet) and wheeled extinguishers (100 feet) and NFPA 10 travel distance to most other components that could pose an ordinary combustible hazard (Class A) or associated electrical (Class C) hazard for handheld extinguishers (75 feet). Buildings would be provided with handheld extinguishers that appeared to satisfy NFPA 10 requirements, including placement at each entry/exit. The agent type (potassium bicarbonate) and agent storage capacities for wheeled (minimum

125 pounds) and for handheld extinguishers (minimum 20 pounds) also appeared to meet NFPA 59A requirements.

In addition, we previously evaluated whether clean agent systems would be installed in all instrumentation buildings in accordance with NFPA 2001. Magnolia LNG would install clean agent fire suppression systems in accordance with NFPA 2001 in buildings that house electrical and control equipment such as the Control Room, power distribution equipment rooms, and power generation houses. Magnolia LNG also previously indicated as part of the Magnolia LNG Project that $CO_2$ extinguishers would be provided in the electrical powerhouses. In addition, Magnolia LNG previously committed to providing a clean agent extinguishing system for the refrigerant compressors gas turbines.

Magnolia LNG indicated that there were no changes to the hazard controls as a result of the Production Capacity Amendment and no updated hazard control drawings were provided upon request. However, there would likely need to be some changes to the hazard control layout to take into account the additional facilities and rearrangement of previously authorized facilities. There is an existing condition in the order for the Magnolia LNG Project to provide finalized hazard control drawings. Travel distances, installation heights, visibility, flow rate capacities, and other requirements would be confirmed in final design and in the field where design details, such as manufacturer, obstructions, and elevations, would be better known.

If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, Magnolia LNG would install hazard control equipment, and there is an existing condition in the order for the Magnolia LNG Project that requires the facilities be subject to periodic inspections during construction to verify hazard control equipment is installed in the field and functional prior to introduction of hazardous fluids. In addition, there is an existing condition in the order of the Magnolia LNG Project that requires the facilities be subject to regular inspections throughout the life of the facility to verify in the field that hazard control coverage and is being properly maintained and inspected. These conditions also extend to the Production Capacity Amendment.

**Passive Cryogenic and Fire Protection**

If cryogenic releases or fires could not be mitigated from impacting facility components to insignificant levels, passive protection (e.g., fireproofing structural steel, cryogenic protection, etc.) should be provided to prevent failure of structural supports of equipment and pipe racks. The structural fire protection must comply with NFPA 59A (2001) and other recommended and generally accepted good engineering practices. NFPA 59A (2001) section 6.4.1 requires pipe supports, including any insulation systems used to support pipe whose stability is essential to plant safety, to be resistant to or protected against fire exposure, escaping cold liquid, or both, if they are subject to such exposure. However, NFPA 59A (2001) does not provide the criteria for determining if they are subject to such exposure or the level of protection needed to protect the pipe supports against such exposures. In addition, NFPA 59A does not address cryogenic or structural protection of pressure vessels or other equipment.

To minimize the risk of low temperature spills causing structural supports and equipment from cooling below their minimum design metal temperature, Magnolia LNG should protect equipment and structural steel against cold shocks through selection of suitable materials of construction or by the application of cold proofing. In addition, Magnolia LNG would have spill containment systems surrounding cryogenic equipment and would generally locate cryogenic equipment away from process areas that do not handle cryogenic materials. Cryogenic protection must comply with NFPA 59A (2001), and should comply with other recommended and generally accepted good engineering practices, such as ISO 20088. Magnolia LNG indicated that there would be no change to the low temperature passive protection from the Magnolia LNG Project. However, it is unclear whether Magnolia LNG would include cryogenic spill protection. Given the potential consequences of a cascading event associated with

the Production Capacity Amendment, we recommend in section 4.3.5 that Magnolia LNG file drawings and specifications of the final design, for review and approval, for the structural passive protection systems to protect equipment and supports from low temperature releases. We also recommend in section 4.3.5 that Magnolia LNG file calculations or test results for the passive low temperature protection to demonstrate pressure vessels and structural supports would be protected from low temperature releases.

To minimize risk for flammable or toxic vapor ingress into buildings and combustion air intakes, Magnolia LNG previously committed to locating buildings away from process areas and proposes in the Production Capacity Amendment to relocate fired equipment and other ignition sources farther away and generally upwind from process areas. There is also an existing condition that Magnolia LNG conduct a technical review of facility, for review and approval, identifying all combustion/ventilation air intake equipment and the distances to any possible flammable gas or toxic release; and verify that these areas would be adequately covered by hazard detection devices that would isolate or shut down any combustion or heating ventilation and air conditioning equipment whose continued operation could add to or sustain an emergency.

To minimize the risk of a pool or jet fire from causing cascading damage, Magnolia LNG would generally locate flammable and combustible containing piping, equipment, and impoundments away from buildings and other process areas that do not handle flammable and combustible materials. Magnolia LNG previously demonstrated that the radiant heats from pool fires from the LNG storage tank outer containment walls and impoundments would have a minimal impact on most areas of the plant. A pool fire from the outer tank wall would result in less than 4,000 Btu/ft$^2$-hr in most other areas of the plant with the exception of Train 1 and the BOG compressors and LNG marine vessel. Fires within the other impoundments would be spaced such that there would be less than 4,000 Btu/ft$^2$-hr on any equipment. In addition, there is an existing condition on the Magnolia LNG Project that requires Magnolia LNG to specify passive fire protection be rated for a minimum of 2 hours and the passive mitigation measures be specified to reduce the likelihood of a BLEVE in the refrigerant area. Magnolia LNG would need to file drawings of the passive structural fire protection for review and approval for structural supports and equipment that could result in a failure when exposed to a pool or jet fire. In addition, Magnolia LNG would need to provide additional information on final design of these systems, for review and approval, where details are yet to be determined (e.g., calculation of structural fire protection materials, thicknesses, etc.) and where the final design could change as a result of these details or other changes in the final design of the project. We would assess whether passive fire protection is applied to pressure vessels and structural supports to facilities that could be exposed to radiant heats of 4,000 Btu/ft$^2$-hr or greater from fires with durations that could result in failures[26] and that they are specified in accordance with recommended and generally accepted good engineering practices with a fire protection rating commensurate to the exposure. The passive fire protection must comply with NFPA 59A (2001) per DOT PHMSA requirements, and should comply with API RP 2218; ISO 12944 and 22899; Underwriters Laboratories (UL) 1709; and other recognized and generally accepted good engineering practices per OSHA PSM requirements. There is also an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to demonstrate that passive protection is provided in areas where jet fires may result in offsite consequences. This would also be likely covered in the USDOT PHMSA LOD.

If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, Magnolia LNG would install structural cryogenic and fire protection according to its design, and there is an existing condition in the order for the Magnolia LNG Project that requires the facilities be subject to periodic inspections during construction to verify structural cryogenic and fire protection is properly installed in the field as designed prior to introduction of hazardous fluids. In addition, there is an

[26] Pool fires from impoundments are generally mitigated through use of emergency shutdowns, depressurization systems, structural fire protection, and firewater, while jet fires are primarily mitigated through the use of emergency shutdowns, depressurization systems, and firewater with or without structural fire protection.

existing condition in the order for the Magnolia LNG Project that requires the facilities be subject to regular inspections throughout the life of the facility to continue to verify that passive protection is being properly maintained. These conditions also extend to the Production Capacity Amendment.

**Firewater Systems**

FERC staff previously evaluated the adequacy of the general firewater or foam system coverage and verified the appropriateness of the associated firewater demands of those systems and worst-case fire scenarios to size the firewater and foam systems. Magnolia LNG previously provided firewater coverage drawings for the firewater monitors and fire hydrants, however, where coverage circles intersect pipe racks, large vessels or process equipment, the firewater coverage could be blocked, and the coverage circles should be modified to account for obstructions during the final design.

The authorized Magnolia LNG Project includes remotely operated firewater monitors, sprinkler systems, fixed water spray systems, and firewater hydrants and hoses for use during an emergency to cool the surface of storage vessels, piping, and equipment exposed to heat from a fire. Additionally, the previously authorized firewater hydrants and hoses would be installed with fog nozzles to mitigate dispersion of released anhydrous ammonia. Furthermore, Magnolia LNG previously committed to installing a deluge system on each of the two LNG storage tanks. These firewater systems would be designed, tested, and maintained to meet NFPA 59A (2001), 13, 14, 15, 20, 22, 24, and 25 requirements. There is also an existing condition on the previously authorized Magnolia LNG Project that requires Magnolia LNG to demonstrate that the water sparay and deluge systems would mitigate ammonia releases and should specify a minimum water density of 0.4 gpm per square foot and that Magnolia LNG provide calculations for firewater spray systems sized to provide cooling for mitigation of BLEVEs. Magnolia LNG would also provide high expansion foam for each LNG spill impoundment basin to reduce vaporization rates from LNG pools and would meet NFPA 59A (2001) and NFPA 11.

Magnolia LNG indicated that changes unrelated to the Production Capacity Amendment has increased the firewater demand from 3,000 gpm to 4,000 gpm, but was not able to provide calculations or updated firewater drawings. However, there is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to file additional information on the final design of these systems, for review and approval, where details are yet to be determined (e.g., manufacturer and model, nozzle types, etc.) and where the final design could change as a result of these details or other changes in the final design of the project. If the Production Capacity Amendment is authorized, the final design filings should reflect these changes. We would verify that the firewater demand and layout provides complete coverage of all equipment that could be exposed to a pool or jet fire and would be supplied with adequate firewater flows based on design densities sufficient to cool the exposed surfaces.

FERC staff also previously assessed whether the reliability of the firewater pumps, firewater source, and onsite storage volume would be appropriate. Magnolia LNG's authorized firewater loop would be supplied with firewater from two fire water storage tanks, and primary (electric) and backup (diesel) driven NFPA 20. There is an existing condition that Magnolia LNG include the water required for foam generation in calculating the total water required for 2 hours of supply. Additionally, Magnolia LNG would provide two more diesel driven firewater pumps, which draw their firewater from the Calcasieu River. The river water fire pumps are each sized to provide the firewater demand for the one LNG storage tank deluge system. While the firewater tanks is the primary source of water for the firewater loop, the system is designed with an interconnect allowing the river water pumps to supply the firewater loop. There is another existing condition that requires Magnolia LNG to specify a minimum of two firewater jockey pumps to be installed. We also recommend in section 4.3.5 that Magnolia LNG specify that the firewater flow test meter is equipped with a flow transmitter and that a pressure transmitter is installed upstream of the flow transmitter, which should both be connected to the Distributed Control System and recorded to keep a history of flow test data.

If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, Magnolia LNG would install the firewater and foam systems as designed. In addition, there is an existing condition in the order for the Magnolia LNG Project that requires the facilities be subject to periodic inspections during construction and that companies provide results of commissioning tests to verify the firewater and foam systems are installed and functional as designed prior to introduction of hazardous fluids. In addition, there is an existing condition in the order of the Magnolia LNG Project that requires the facilities be subject to regular inspections throughout the life of the facility to ensure firewater and foam systems are being properly maintained and tested. These conditions also extend to the Production Capacity Amendment.

#### *4.3.4.6 Geotechnical and Structural Design*

Magnolia LNG provided geotechnical and structural design information for its facilities to demonstrate the site preparation and foundation designs would be appropriate for the underlying soil characteristics and to ensure the structural design of the project facilities would be in accordance with federal regulations, standards, and recommended and generally accepted good engineering practices. The application focuses on the resilience of the project facilities against natural hazards, including extreme geological, meteorological, and hydrological events, such as earthquakes, tsunamis, seiche, hurricanes, tornadoes, floods, rain, ice, snow, regional subsidence, sea level rise, landslides, wildfires, volcanic activity, and geomagnetism.

**Geotechnical Evaluation**

FERC regulations under 18 CFR §380.12(h)(3) require geotechnical investigations to be provided. In addition, FERC regulations under 18 CFR §380.12(o)(14) require an applicant to demonstrate compliance with regulations under 49 CFR 193 and NFPA 59A. If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 and would be subject to USDOT PHMSA's inspection and enforcement programs. USDOT PHMSA regulations incorporate by reference NFPA 59A (2001). NFPA 59A (2001) section 2.1.4 requires soil and general investigations of the site to determine the design basis for the facility. However, no additional requirements are set out in 49 CFR 193 or NFPA 59A on minimum requirements for evaluating existing soil site conditions or evaluating the adequacy of the foundations, therefore FERC staff evaluated the existing site conditions, geotechnical report, and proposed foundations to ensure they are adequate for the LNG facilities as described below.

Magnolia LNG's proposed Production Capacity Amendment would not affect or change the validity of the geotechnical evaluation described in the EIS under Docket No. CP14-347-000. For further discussion on the Geotechnical Evaluation for the Magnolia LNG Project, refer to section 4.1 of the EIS filed under CP14-347-000.

**Structural and Natural Hazard Evaluation**

FERC regulations under 18 CFR §380.12(m) require applicants address the potential hazard to the public from failure of facility components resulting from accidents or natural catastrophes, evaluate how these events would affect reliability, and describe what design features and procedures that would be used to reduce potential hazards. In addition, 18 CFR §380.12(o)(14) requires an applicant to demonstrate how they would comply with 49 CFR 193 and NFPA 59A. USDOT PHMSA regulations under 49 CFR 193 have some specific requirements on designs to withstand certain loads from natural hazards and also incorporates by reference NFPA 59A (2001 and 2006) and ASCE 7-05 and ASCE 7-93 via NFPA 59A (2001). NFPA 59A (2001) section 2.1.1 (c) also requires that Magnolia LNG to consider the plant site location in the design of the project, with respect to the proposed facilities being protected, within the limits of practicality, against natural hazards such as from the effects of flooding, storm surge,

and seismic activities. This would be covered in USDOT PHMSA's LOD on 49 CFR 193 Subpart B. However, the LOD would not cover whether the facility is designed appropriately against these hazards, which would be part of 49 CFR 193 Subpart C. Unlike other natural hazards, wind loads are covered in 49 CFR 193 Subpart B and would be covered in the LOD. If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 and would be subject to USDOT PHMSA's inspection and enforcement programs. The marine facilities would be subject to 33 CFR 127, which requires if the waterfront facility handling LNG is in a region subject to earthquakes, the piers and wharves must be designed to resist earthquake forces. In addition, USCG regulations under 33 CFR 127 incorporates by reference certain portions of NFPA 59A (1994) and ASCE 7-88 via NFPA 59A (1994). However, USCG regulations do not provide criteria for a region subject to earthquakes or the earthquake forces the piers and wharves are to withstand and NFPA 59A (1994) section referenced in 33 CFR 127 is for seismic design only and is applicable to stationary LNG containers, which would not be under 33 CFR 127. Therefore, we evaluated the basis of design for all facilities for all natural hazards under FERC jurisdiction, including those under USDOT PHMSA and USCG jurisdiction.

Magnolia LNG indicated that the authorized facilities would be designed and constructed to the requirements in the 2009 International Building Code (IBC) and ASCE7-05 seismic design. The standards require various structural loads to be applied to the design of the facilities, including live (i.e., dynamic) loads, dead (i.e., static) loads, and environmental loads. There are existing conditions in the order for the Magnolia LNG Project that require Magnolia LNG to file final design information (e.g., Civil/Structural drawings, specifications, and calculations) and associated quality assurance and control procedures with the documents reviewed, approved, and stamped and sealed by the professional engineer of record in Louisiana.

If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, Magnolia LNG would install equipment in accordance with its final design. In addition, there is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to file, for review and approval, settlement results during hydrostatic tests of the LNG storage containers and periodically thereafter to verify settlement is as expected and does not exceed the applicable criteria in API 620, 625, 653, and ACI 376.

Earthquakes, Tsunamis, and Seiche

FERC regulations under 18 CFR §380.12(h)(5) require evaluation of earthquake hazards based on whether there is potential seismicity, surface faulting, or liquefaction. Earthquakes and tsunamis have the potential to cause damage from shaking ground motion and fault ruptures. Earthquakes and tsunamis often result from sudden slips along fractures in the earth's crust (i.e., faults) and the resultant ground motions caused by those movements, but can also be a result of volcanic activity or other causes of vibration in the earth's crust. The damage that could occur as a result of ground motions is affected by the type/direction and severity of the fault activity and the distance and type of soils the seismic waves must travel from the hypocenter (or point below the epicenter where seismic activity occurs). The proposed Production Capacity Amendment would not alter the hazards of Earthquake, Tsunami, and Seiche to the facility. For further discussion on these hazards refer to sections 4.1.3.1 and 4.1.3.3 of the final EIS filed under CP14-347-000.

Hurricanes, Tornadoes, and other Meteorological Events

Hurricanes, tornadoes, and other meteorological events have the potential to cause damage or failure of facilities due to high winds and floods, including failures from flying or floating debris. The severity of these events are often determined on the probability that they occur and are sometimes referred

to as the average number years that the event is expected to re-occur, or in terms of its mean return/recurrence interval.

Magnolia LNG must meet 49 CFR §193.2067, under Subpart B, for wind load requirements. In accordance with the MOU, USDOT PHMSA will evaluate in its LOD whether an applicant's proposed project meets the USDOT PHMSA requirements under Subpart B. If the Production Capacity Amendment is authorized and the Magnolia LNG Project is constructed, the facilities would be subject to USDOT PHMSA's inspection and enforcement programs. Final determination of whether the facilities are in compliance with the requirements of 49 CFR 193 Subpart B would be made by USDOT PHMSA staff.

The proposed Production Capacity Amendment would not increase the potential to damage to the facility by hurricanes, tornadoes or other meteorological events. For further discussion of these hazards, see the final EIS filed under CP14-347-000, section 4.1.3.3.

#### *4.3.4.7 External Impact Review*

The Production Capacity Amendment would not change the proximity to any transportation routes, land use, and activities surrounding the LNG terminal site. However, there are some modifications that added and rearranged equipment. In addition, there would be an increase in consequences if piping or equipment is impacted. As a result, we re-evaluated the potential external impacts associated with all the equipment, including was is added and rearranged, for completeness.

To assess the potential impact from external events, FERC staff conducted a series of reviews to evaluate transportation routes, land use, and activities within the facility and surrounding the LNG terminal site, and the safeguards in place to mitigate the risk from events, where warranted. FERC staff coordinated the results of the reviews with other federal agencies to assess potential impacts from vehicles and rail; aircraft impacts to and from nearby airports and heliports; pipeline impacts from nearby pipelines; impacts to and from adjacent facilities that handle hazardous materials under the EPA's Risk Management Plan (RMP) regulations and power plants, including nuclear facilities under the Nuclear Regulatory Commission's regulations. Specific mitigation of impacts from use of external roadways, rail, helipads, airstrips, or pipelines are also considered as part of the engineering review done in conjunction with the NEPA review.

FERC staff uses a risk-based approach to assess the potential impact of the external events and the adequacy of the mitigation measures. The risk-based approach uses data based on the frequency of events that could lead to an impact and the potential severity of consequences posed to the LNG terminal site and the resulting consequences to the public beyond the initiating events. The frequency data is based on past incidents and the consequences are based on past incidents and/or hazard modeling of potential failures.

**Road**

FERC staff reviewed whether any truck operations would be associated with the project and whether any existing roads would be located near the site. FERC staff uses this information to evaluate whether the project and any associated truck operations could increase the risk along the roadways and subsequently to the public and whether any pre-existing unassociated vehicular traffic could adversely increase the risk to a project site and subsequently increase the risk to the public. In addition, if authorized and constructed, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 and would be subject to the USDOT PHMSA's inspection and enforcement programs. USDOT PHMSA regulations under 49 CFR §193.2155(a)(5)(ii), under Subpart C, require that structural members of an impoundment system must be designed and constructed to prevent impairment of the system's performance reliability and structural integrity as a result of a collision by or explosion of a tank

truck that could reasonably be expected to cause the most severe loading if the liquefaction facility adjoins the right-of-way of any highway. Similarly, NFPA 59A (2001), section 8.5.4, requires transfer piping, pumps, and compressors to be located or protected by barriers so that they are safe from damage by rail or vehicle movements. However, the USDOT PHMSA regulations and NFPA 59A (2001) requirements do not indicate what collision(s) or explosion(s) could reasonably be expected to cause the most severe loading. FERC staff evaluated consequence and frequency data from these events to evaluate these potential impacts.

FERC staff evaluated the risk of the truck operations based on the consequences from a release, incident data from the USDOT's Federal Highway Administration (FHWA), National Highway Traffic Safety Administration (NHTSA), and Pipeline and Hazardous Materials Safety Administration (PHMSA), EPA, NOAA, and other reports[27,28,29,30,31,32,33] and frequency of trucks and proposed mitigation to prevent or reduce the impacts of a vehicular incident.

Incident data from DOT FHWA, DOT NHTSA, and DOT PHMSA indicate hazardous material incidents are very infrequent (4e-3 incidents per lane mile per year) and nearly 75 to 80 percent of hazardous material vehicular incidents occur during unloading and loading operations while the other 20 to 25 percent occur while in transit or in transit storage. In addition, approximately 99 percent of releases are 1,000 gallons or less and catastrophic events that would spill 10,000 gallons or more make up less than 0.1 percent of releases. In addition, less than 1 percent of all reportable hazardous material incidents with spillage result in injuries and less than 0.1 percent of all reportable hazardous material incidents with spillage result in fatalities.

The EPA and NOAA report that 80 percent of fires that lead to container ruptures results in projectiles and that 80 percent of projectiles from liquefied petroleum gas (LPG) incidents, which constitute the largest product involved in BLEVEs, travel less than 660 feet. The EPA also reports that on average container ruptures would result in less than four projectiles for cylindrical containers and 8.3 for spherical vessels. FERC staff evaluated other reports that affirmed the EPA estimates based on data for approximately 150 experimental and accidental pressure vessel bursts (PVBs) and BLEVEs with approximately 683 total projectiles (4.6 average fragments per incident) that showed approximately 80 percent of fragments traveled 490 to 820 feet and within 6.25 times the estimated or observed fireball radius. The data also showed projectiles have traveled up to 3,900 feet for large LPG vessels and 1,200 feet for LPG rail cars. In all the documented cases, the projectiles traveled less than 15 times the fireball diameter, but one of the reports indicated up to 30 times the fireball diameter is possible albeit very rare.

Unmitigated consequences under average ambient conditions from releases of 1,000 gallons through a 1-inch hole would result in distances ranging from 25 to 200 feet for flammable vapor dispersion, and 75 to 175 feet for jet fires. Unmitigated consequences under worst case weather conditions from catastrophic failures of trucks proposed at the site generally can range from 200 to 2,000

[27] FHWA, Office of Highway Policy Information, *Highway Statistics 2016*, https://www.fhwa.dot.gov/policyinformation/statistics/2016/, accessed March 2019.
[28] USDOT NHTSA, *Traffic Safety Facts Annual Report Tables*, https://cdan.nhtsa.gov/tsftables/tsfar.htm, accessed March 2019.
[29] USDOT PHMSA, Office of Hazardous Material Safety, *Incident Reports Database Search*, https://hazmatonline.phmsa.dot.gov/IncidentReportsSearch/Welcome.aspx, accessed March 2019.
[30] U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration, ALOHA®, User's Manual, The CAMEO® Software System, February 2007.
[31] Birk, A.M., BLEVE Response and Prevention Technical Documentation, 1995.
[32] American Institute of Chemical Engineers, Center for Chemical Process Safety, Guidelines for Vapor Cloud Explosion, Pressure Vessel Burst, BLEVE, and Flash Fire Hazards, Second Edition, 2010.
[33] Lees, F.P, Lees' Loss Prevention in the Process Industries: Hazard Identification, Assessment, and Control, Volume 2, Second Edition, 1996.

feet for flammable vapor dispersion, 275 to 350 feet for radiant heat of 5 kW/$m^2$ from jet fires, 800 to 1,050 feet to a 1 psi overpressure from a BLEVE, 850 to 1,500 feet for a heat dose equivalent to a radiant heat of 5 kW/$m^2$ over 40 seconds from 250 to 325 feet radii fireballs burning for 5 to 15 seconds from a BLEVE, and projectiles from BLEVEs possibly extending farther. Based on distribution function of the projectile distances, FERC staff estimate approximately 90 percent of all projectiles for a 10,000-gallon tanker truck would be within 0.5 mile and there is approximately a 1 percent probability they would extend beyond 1 mile and less than 0.1 percent probability they would extend 30 times the fireball diameter. These values are also close to the distances provided by the USDOT FHWA for designating hazardous material trucking routes (0.5 mile for flammable gases for potential impact distance) and USDOT PHMSA for emergency response (0.5 to 1 mile for initial evacuation and 1 mile for potential BLEVEs for flammable gases).

During startup and operation of the project, Magnolia would deliver several hazardous fluids to site via truck, including amine, nitrogen trucks, anhydrous ammonia, and diesel. The most frequent truck deliveries would occur during commissioning and startup activity at the site and would deliver refrigerants to load the liquefaction trains. The refrigerant deliveries would be repeated for the startup of each subsequent liquefaction train. Magnolia plans to utilize trucks to deliver LNG, up to 52 trucks per year. Henry Pugh Boulevard, which connects to Louisiana Highway 384, is located along the southern boundary of the facility property and would be used to access the Magnolia Project site. Henry Pugh Boulevard is a single lane bi-directional road with a 30 mph speed limit. The separation distance between Henry Pugh Boulevard and the project facilities that would contain hazardous fluids would be greater than 300 feet which would exceed the distances estimated for flammable vapor dispersion and radiant heat from an LNG truck 1-inch hole release. In addition, Magnolia LNG would install an 30-feet tall impervious barrier that would separate Henry Pugh Boulevard and the process equipment. FERC staff did not identify any other major highways or roads within close proximity to piping or equipment containing hazardous materials at the site that would not be protected by this separation distance and 30-feet tall barrier to raise concerns of direct impacts from a vehicle impacting the site.

The proposed Production Capacity Amendment does not greatly increase the refrigerant trucking or LNG trucking over the previously approved design. However, the proposed changes increase the consequences of a release. Therefore, we recommend in section 4.3.5 that Magnolia should file drawings of internal road vehicle protections, such as guard rails, barriers, and bollards to protect transfer piping, pumps, compressors, hydrants, monitors, etc. to ensure that they are located away from roadway or protected from inadvertent damage from vehicles. As a result, we conclude that the project would not pose a significant risk or significant increase in risk to the public due to vehicle impacts as a result of the potential consequences, incident data, frequency of trucks, proposed mitigation by Magnolia LNG, and additional mitigation measures proposed by FERC staff.

**Rail**

FERC staff reviewed whether any rail operations would be associated with the project and whether any existing rail lines would be located near the site. FERC staff uses this information to evaluate whether the project and any associated rail operations could increase the risk along the rail line and subsequently to the public and whether any pre-existing unassociated rail operations could adversely increase the risk to the Magnolia LNG site and subsequently increase the risk to the public. In addition, if authorized and constructed, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 and would be subject to the USDOT PHMSA's inspection and enforcement programs. USDOT PHMSA regulations under 49 CFR §193.2155(a)(5)(ii), under Subpart C, state that if the LNG facility adjoins the right-of-way of any railroad, the structural members of an impoundment system must be designed and constructed to prevent impairment of the system's performance reliability and structural

integrity as a result of a collision by or explosion of a train or tank car that could reasonably be expected to cause the most severe loading.

Section 8.5.4 of NFPA 59A (2001), incorporated by reference in 49 CFR 193, requires transfer piping, pumps, and compressors to be located or protected by barriers so that they are safe from damage by rail or vehicle movements. However, the USDOT PHMSA regulations and NFPA 59A (2001) requirements do not indicate what collision(s) or explosion(s) could reasonably be expected to cause the most severe loading. Therefore, FERC staff evaluated consequence and frequency data from these events to evaluate these potential impacts. FERC staff evaluated the risk of the rail operations based on the consequences from a release, incident data from the Federal Rail Administration (FRA) and PHMSA, and frequency of rail operations near the Magnolia LNG Project.

FERC staff evaluated the risk of the rail operations based on the consequences from a release, incident data from the DOT Federal Railroad Administration (FRA) and DOT PHMSA, and frequency of rail operations near the LNG Terminal site. Incident data from DOT FRA and DOT PHMSA indicates hazardous material incidents are very infrequent (6e-3 incidents per rail mile per year). In addition, approximately 95 percent of releases are 1,000 gallons or less, and catastrophic events that would spill 30,000 gallons or more make up less than 1 percent of releases. In addition, less than 1 percent of hazardous material incidents result in injuries and less than 0.1 percent of hazardous material incidents result in fatalities.

As previously discussed, the EPA and NOAA report that 80 percent of fires that lead to container ruptures results in projectiles and that 80 percent of projectiles from LPG incidents, which constitute the largest product involved in BLEVEs, travel less than 660 feet. The EPA also reports that on average container ruptures would result in less than four projectiles for cylindrical containers and 8.3 for spherical vessels. FERC staff evaluated other reports that affirmed the EPA estimates based on data for approximately 150 experimental and accidental PVBs and BLEVEs with approximately 683 total projectiles (4.6 average fragments per incident) that showed approximately 80 percent of fragments traveled 490 to 820 feet and within 6.25 times the estimated or observed fireball radius. The data also showed projectiles have traveled up to 3,900 feet for large LPG vessels and 1,200 feet for LPG rail cars. In all the documented cases, the projectiles traveled less than 15 times the fireball diameter, but one of the reports indicated up to 30 times the fireball diameter is possible albeit very rare.

Unmitigated consequences under average ambient conditions from releases of 1,000 gallons through a 1-inch hole would result in distances ranging from 25 to 200 feet for flammable vapor dispersion, and 75 to 175 feet for jet fires. Unmitigated consequences under worst-case weather conditions from catastrophic failures of rail cars containing various flammable products generally can range from 300 to 3,000 feet for flammable vapor dispersion, 450 to 575 feet for radiant heat of 5 $kW/m^2$ from jet fires, 1,225 to 1,500 feet to a 1 psi overpressure from a BLEVE, 1,250 to 2,100 feet for a heat dose equivalent to a radiant heat of 5 $kW/m^2$ over 40 seconds from 350 to 450 feet radii fireballs burning for 7 to 20 seconds from a BLEVE, and projectiles from BLEVEs possibly extending farther. Based on distribution function of the projectile distances, FERC staff estimate approximately 80 percent of all projectiles for a 30,000 gallon rail car would be within 0.5 mile and there is approximately a 5 percent probability they would extend beyond 1 mile and less than 0.1 percent probability they would extend 30 times the fireball diameter. These values are also close to the distances provided by USDOT PHMSA for emergency response (0.5 to 1 mile for initial evacuation and 1 mile for potential BLEVEs for flammable gases).

There would be no rail transportation associated with the project. The closest rail line spur would be located approximately 1,800 feet north of the project site. The spur is a single line railroad that services the Alcoa Petroleum coke plant and shipping terminal on the opposite side of the waterway.

Additionally, the project would install a 30-feet tall impervious barrier that would separate the spur and the process equipment.

Since the proposed Production Capacity Amendment does not increase the footprint of the facility, we conclude that the proposed project would not pose a significant risk or significant increase in risk to the public as a result of the proximity of the project to the rail lines.

**Air**

FERC staff reviewed whether any aircraft operations would be associated with the project and whether any existing aircraft operations would be located near the site. FERC staff uses this information to evaluate whether the project and any associated aircraft operations could increase the risk to the public and whether any pre-existing unassociated aircraft operations could adversely increase the risk to the project site and subsequently increase the risk to the public. In addition, if authorized and constructed, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 and would be subject to the USDOT PHMSA's inspection and enforcement programs. USDOT PHMSA regulations under 49 CFR §193.2155(b), Subpart C, require a LNG storage tank must not be located within a horizontal distance of one mile from the ends, or 0.25 miles from the nearest point of a runway, whichever is longer and that the height of LNG structures in the vicinity of an airport must comply with USDOT FAA requirements. In addition, FERC staff evaluated the risk of an aircraft impact from nearby airports.

Three mixed use aviation airports, Southland field, Lake Charles Regional Airport and Chennault International Airport, would be located approximately 5 miles northwest, 4.5 miles northeast, 12 miles northeast of the LNG terminal site, respectively. These are all farther than the 0.25-mile distance referenced in USDOT PHMSA regulations.

FAA regulations in 14 CFR 77 require Magnolia LNG to provide a notice to the FAA of its proposed construction. This notification should identify all equipment that are more than 200 feet above ground level or lesser heights if the facilities are within 20,000 feet of an airport (at 100:1 ratio or 50:1 ratio depending on length of runway) or within 5,000 feet of a helipad (at 100:1 ratio). In addition, mobile objects, including the LNG marine vessel that would be above the height of the highest mobile object that would normally traverse it would require notification to FAA.

The project would not include permanent structures that would be taller than 200 feet. Additionally, Magnolia LNG did submit a notice for temporary construction equipment, such as cranes, derricks, etc., which may be taller than permanent structures and would be used during construction of the Project.

In addition, FERC staff used DOE Standard 3014, Accident Analysis for Aircraft Crash into Hazardous Facilities, which utilizes a 22-mile threshold radius around the hazardous facility for consideration of hazards posed by airport and heliport operations to the project facilities. There are three mixed use airports (commercial, military, and general aviation) within the 22-mile radius. Per the DOE standard 3014, heliports need only be considered if there are local overflights associated with facility operations and/or area operations. The project site does not have an associated heliport. The total aircraft crash probabilities at the project site are calculated below the 3E-05 screening threshold.

Since the proposed Production Capacity Amendment does not increase the footprint of the facility or maximum heights of equipment, we conclude that the proposed project would not pose a significant risk or significant increase in risk to the public and the potential impact to the facility would be below the initial 3e-5 per year screening threshold identified for the process areas and the LNG storage tanks.

**Pipelines**

FERC staff reviewed whether any pipeline operations would be associated with the project and whether any existing pipelines would be located near the site. FERC staff uses this information to evaluate whether the project and any associated pipeline operations could increase the risk to the pipeline facilities and subsequently to the public and whether any pre-existing unassociated pipeline operations could adversely increase the risk to the project site and subsequently increase the risk to the public. If authorized and constructed, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 192 and 49 CFR 193 and would be subject to the USDOT PHMSA's inspection and enforcement programs. FERC staff evaluated the risk of a pipeline incident impacting the project and the potential of cascading damage increasing the risk to the public based on the consequences from a release, incident data from the USDOT PHMSA, and proposed mitigation to prevent or reduce the impacts of a pipeline incident from Magnolia LNG.

For existing pipelines, FERC staff identified an existing natural gas pipeline adjacent to the site on the southern boundary. This Kinder Morgan mainline would provide the gas to the facility for liquefaction. Additionally, there is a pipeline serving the Trunkline LNG facility and another serving the Alcoa facility, each of which approximately 0.5 miles from project site. FERC staff evaluated the potential risk from an incident from the pipeline and its potential impacts by considering the design and operating conditions and location of the pipeline. This pipeline would be located too far to impact the project site in the event of an incident.

Since the proposed Production Capacity Amendment does not increase the footprint of the facility, we conclude that the project would not significantly increase the risk to the public beyond existing risk levels that would be present from a pipeline leak or pipeline rupture worst-case event near the project site.

**Hazardous Material Facilities and Power Plants**

FERC staff reviewed whether any EPA RMP regulated facilities handling hazardous materials and power plants were located near the site to evaluate whether the facilities could adversely increase the risk to the project site and whether the project site could increase the risk to the EPA RMP facilities and power plants and subsequently increase the risk to the public.

There were no facilities handling hazardous materials or power plants identified adjacent to the site. The closest EPA RMP regulated facilities handling hazardous materials would be the Alcoa located approximately 0.5 miles away. The EPA RMP regulations require certain hazard distances to be calculated and a risk management plan to be developed commensurate with those consequences. The FERC, DOT PHMSA, and USCG regulated Trunkline LNG Terminal would also be approximately 0.5 miles away. The closest nuclear plant would be the River Bend Generating Station located approximately 125 miles away.

Since the proposed Production Capacity Amendment does not increase the footprint of the facility, we conclude that the project would not pose a significant increase in risk to the public or that the hazardous material facilities and power plants would not pose a significant risk to the project and subsequently to the public.

#### *4.3.4.8 Onsite and Offsite Emergency Response Plans*

Magnolia LNG would develop a comprehensive ERP with local, state, and federal agencies and emergency response officials to discuss the facilities. Magnolia LNG would continue these collaborative efforts during the development, design, and construction of the Magnolia LNG Project, as modified by the Production Capacity Amendment. The emergency procedures would provide for the protection of

personnel and the public as well as the prevention of property damage that may occur as a result of incidents. Magnolia LNG would also be required to provide appropriate personnel protective equipment to enable operations personnel and first responder access to the area.

As required by 49 CFR §193.2509, under Subpart F, Magnolia LNG would need to prepare emergency procedures manuals that provide for: a) responding to controllable emergencies and recognizing an uncontrollable emergency; b) taking action to minimize harm to the public including the possible need to evacuate the public; and c) coordination and cooperation with appropriate local officials. Specifically, 49 CFR §193.2509(b)(3), under Subpart F, requires "Coordinating with appropriate local officials in preparation of an emergency evacuation plan…," which sets forth the steps required to protect the public in the event of an emergency, including catastrophic failure of an LNG storage tank. USDOT PHMSA regulations under 49 CFR §193.2905, under Subpart J, also require at least two access points in each protective enclosure to be located to minimize the escape distance in the event of emergency.

33 CFR §127.307 also requires the development of emergency manual that incorporates additional material, including LNG release response and emergency shutdown procedures, a description of fire equipment, emergency lighting, and power systems, telephone contacts, shelters, and first aid procedures. In addition, 33 CFR §127.207 establishes requirements for warning alarm systems. Specifically, 33 CFR §127.207(a) requires that the LNG marine transfer area to be equipped with a rotating or flashing amber light with a minimum effective flash intensity, in the horizontal plane, of 5000 candelas with at least 50 percent of the required effective flash intensity in all directions from 1.0 degree above to 1.0 degree below the horizontal plane. Furthermore, 33 CFR §127.207(b) requires the marine transfer area for LNG to have a siren with a minimum 1⁄3- octave band sound pressure level at l meter of 125 decibels referenced to 0.0002 microbars. The siren must be located so that the sound signal produced is audible over 360 degrees in a horizontal plane. Lastly, 33 CFR §127.207(c) requires that each light and siren must be located so that the warning alarm is not obstructed for a distance of 1.6 km (1 mile) in all directions. The warning alarms would be required to be tested in order to meet 33 CFR 127. Magnolia LNG would be required to meet the warning alarms requirements specified in 33 CFR §127.207.

In accordance with the EPAct 2005, FERC must also approve an ERP covering the terminal and ship transit prior to construction. Section 3A (e) of the NGA, added by section 311 of the EPAct 2005, stipulates that in any order authorizing an LNG terminal, the Commission must require the LNG terminal operator to develop an ERP in consultation with the USCG and state and local agencies. The final ERP would need to be evaluated by appropriate emergency response personnel and officials. Section 3A (e) of the NGA (as amended by EPAct 2005) specifies that the ERP must include a Cost-Sharing Plan that contains a description of any direct cost reimbursements the applicant agrees to provide to any state and local agencies with responsibility for security and safety at the LNG terminal and in proximity to LNG marine vessels that serve the facility. The Cost-Sharing Plan must specify what the LNG terminal operator would provide to cover the cost of the state and local resources required to manage the security of the LNG terminal and LNG marine vessel, and the state and local resources required for safety and emergency management, including:

- direct reimbursement for any per-transit security and/or emergency management costs (for example, overtime for police or fire department personnel);
- capital costs associated with security/emergency management equipment and personnel base (for example, patrol boats, firefighting equipment); and
- annual costs for providing specialized training for local fire departments, mutual aid departments, and emergency response personnel; and for conducting exercises.

The cost-sharing plan must include the LNG terminal operator's letter of commitment with agency acknowledgement for each state and local agency designated to receive resources.

Magnolia LNG previously submitted a draft ERP for the Magnolia LNG Project to address emergency events and potential release scenarios. The ERP would include public notification, protection, and evacuation. Personnel training would include the characteristics, hazards, and response steps for an anhydrous ammonia release. As part of the FEED review, FERC staff previously evaluated the initial draft of the emergency response procedures to assure that it covers the hazards associated with the project. If the Production Capacity Amendment is authorized, the ERP would need to reflect the increase in potential hazards from releases. There is an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to provide additional information, for review and approval, on development of updated emergency response plans prior to initial site preparation. There is also an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to file three-dimensional drawings, for review and approval, which demonstrate there is a sufficient number of access and egress locations. Magnolia LNG would coordinate with local, state, and federal agencies on the development of an emergency response plan and cost sharing plan. The existing condition in the order for the Magnolia LNG Project also requires Magnolia LNG to provide periodic updates on the development of these plans for review and approval, and ensure they are in place prior to introduction of hazardous fluids. In addition, there is an existing condition in the order for the Magnolia LNG Project that requires the facilities be subject to regular inspections throughout the life of the facility and FERC staff would continue to require companies to file updates to the ERP as part of its normal inspection process. There is also an existing condition in the order for the Magnolia LNG Project that requires Magnolia LNG to report significant non-scheduled events, including safety-related incidents (e.g., hazardous fluid releases, fires, explosions, mechanical failures, unusual over pressurization, and major injuries) and security-related incidents (e.g., attempts to enter site, suspicious activities). These conditions also extend to the Production Capacity Amendment.

#### 4.3.5 Recommendations from FERC Preliminary Engineering and Technical Review

Based on our preliminary engineering and technical review of the reliability and safety of the Magnolia LNG Production Capacity Amendment, we recommend the following mitigation measures as conditions to any order authorizing the project. These recommendations would be implemented prior to construction of final design to enhance the reliability and safety of the facility and to mitigate the risk of impact on the public.

- **Prior to construction of final design, Magnolia LNG should file with the Secretary of the Commission (Secretary) documentation of consultation with USDOT PHMSA staff as to whether the use of drain valves to remove stormwater from curbed areas would meet USDOT PHMSA requirements.**

Information pertaining to the following specific recommendations should be filed with the Secretary for review and written approval by the Director of the Office of Energy Projects (OEP), or the Director's designee, within the timeframe indicated by each recommendation. Specific engineering, vulnerability, or detailed design information meeting the criteria specified in Order No. 833 (Docket No. RM16-15-000), including security information, should be submitted as critical energy infrastructure information pursuant to 18 CFR §388.113. See Critical Electric Infrastructure Security and Amending Critical Energy Infrastructure Information, Order No. 833, 81 Fed. Reg. 93,732 (December 21, 2016), FERC Stats. & Regs. 31,389 (2016). Information pertaining to items such as offsite emergency response, procedures for public notification and evacuation, and construction and operating reporting requirements would be subject to public disclosure. All information should be filed **a minimum of 30 days** before approval to proceed is requested.

- **Prior to construction of final design, Magnolia LNG should include LNG tank fill flow measurement with a high flow alarm.**
- **Prior to construction of final design, Magnolia LNG should specify a discretionary vent valve on each LNG storage tank that is operable through the Distributed Control System with a car sealed open manual block valve provided upstream of the discretionary vent valve.**
- **Prior to construction of final design, Magnolia LNG should specify a means to prevent liquid flows to the BOG compressor (e.g., BOG suction/knock out drum with high alarm and high high level shutdown).**
- **Prior to construction of final design, Magnolia LNG should specify that anhydrous ammonia piping and piping nipples 2 inches nominal pipe size or less in diameter are to be no less than schedule 160 for carbon steel and no less than schedule 80S for stainless steel in accordance with ASME B36.10M and ASME B36.19M, respectively.**
- **Prior to construction of final design, Magnolia LNG should specify that anhydrous ammonia pressure vessels meet the minimum requirements for lethal service in accordance with ASME BPVC Section VIII.**
- **Prior to construction of final design, Magnolia LNG should specify that all piping containing anhydrous ammonia have 100 percent of all longitudinal, spiral, circumferential butt, socket, and fillet welds radiographed or ultrasonically tested in accordance with ASME B31.3.**
- **Prior to construction of final design, Magnolia LNG should specify that all pressure vessels containing anhydrous ammonia be subject to 100 percent non-destructive examination of both longitudinal/meridional and latitudinal/circumferential welds of hydraulic load bearing shells with curved surface in accordance with ASME BPVC Section VIII, Division 1.**
- **Prior to construction of final design, Magnolia LNG should file piping and instrument diagrams, specifications, and procedures that clearly show and specify the tie-in details required to safely connect subsequently constructed facilities with the operational facilities.**
- **Prior to construction of final design, Magnolia LNG should specify that the flammable and combustible gas detection and flame and heat detection systems should be in accordance with ISA 84.00.07 or equivalent methodologies and would need to demonstrate that 90 percent or more of releases (unignited and ignited) that could result in an off-site or cascading impact would be detected by two or more detectors and result in isolation and de inventory within 10 minutes. The analysis should take into account the set points, voting logic, wind speeds, and wind directions.**
- **Prior to construction of final design, Magnolia LNG should file drawings and specifications for the structural passive protection systems to protect equipment and supports from low temperature releases.**
- **Prior to construction of final design, Magnolia LNG should file calculations or test results for the structural passive protection systems to protect equipment and supports from low temperature releases.**
- **Prior to construction of final design, Magnolia LNG should specify that the firewater flow test meter is equipped with a transmitter and that a pressure transmitter is installed**

**upstream of the flow transmitter. The flow transmitter and pressure transmitter should be connected to the Distributed Control System and recorded.**

- **Prior to construction of final design, Magnolia LNG should file drawings of internal road vehicle protections, such as guard rails, barriers, and bollards to protect transfer piping, pumps, compressors, hydrants, monitors, etc. to ensure that they are located away from roadway or protected from inadvertent damage from vehicles.**

#### 4.3.6 Reliability and Safety Conclusions

As part of the NEPA review and NGA determinations, Commission staff assesses the potential impact to the human environment in terms of safety and whether the proposed facilities would operate safely, reliably, and securely.

As a cooperating agency, USDOT PHMSA assists the FERC by determining whether Magnolia LNG's proposed design would meet USDOT PHMSA's 49 CFR 193 Subpart B siting requirements. USDOT PHMSA will provide an LOD on the project's compliance with 49 CFR 193 Subpart B. This determination will be provided to the Commission in order to inform its decision on whether to authorize or deny the Production Capacity Amendment. If the Production Capacity Amendment is authorized and the Magnolia LNG Project and Production Capacity Amendment are constructed, the facilities would be subject to the USDOT PHMSA's inspection and enforcement program, and final determination of whether the facilities are in compliance with the requirements of 49 CFR 193 would be made by USDOT PHMSA staff.

As a cooperating agency, the USCG also assisted the FERC staff by reviewing the proposed LNG terminal and the associated LNG marine vessel traffic. The USCG reviewed a WSA submitted by Magnolia LNG that focused on the navigation safety and maritime security aspects of LNG marine vessel transits along the affected waterway. On February 12, 2015, the USCG issued an LOR that recommended the Calcasieu Shipping Channel be considered suitable for accommodating the type and frequency of LNG marine traffic associated with this project based on the WSA and in accordance with the guidance in the USCG's Navigation and Vessel Inspection Circular 01-11. If the Production Capacity Amendment is authorized and the Magnolia LNG Project and Production Capacity Amendment are constructed, the facilities would be subject to the USCG's inspection and enforcement program to ensure compliance with the requirements of 33 CFR 105 and 33 CFR 127.

FERC staff conducted a preliminary engineering and technical review of the Magnolia LNG Project design and the proposed modifications, including potential external impacts based on the site location. Based on this review, we recommended (and the FERC Commission mandated) a number of mitigation measures in Docket No. CP14-347-000, which will ensure continuous oversight prior to initial site preparation, prior to construction of final design, prior to commissioning, prior to introduction of hazardous fluids, prior to commencement of service, and throughout life of the facility to enhance the reliability and safety of the facility to mitigate the risk of impact on the public. As a result of the modified facilities and process conditions proposed in the amendment, we have made additional recommendations to further reduce the likelihood of an incident that could impact the public. With the incorporation of these mitigation measures and oversight, we conclude that the Magnolia LNG Project design would include acceptable layers of protection or safeguards that would reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public.

### 4.4 CUMULATIVE IMPACTS

We assessed cumulative impacts for the Magnolia LNG Project, including the development of the terminal site, in section 4.13 of the November 13, 2015 EIS for that project, under Docket No. CP14-347-000. The proposed Production Capacity Amendment does not change the site footprint and adds only

incremental facilities that would not affect any resource areas (other than minor impacts from air emissions and noise). Because these other resource areas would not be impacted by the Production Capacity Amendment, there would also be no cumulative impacts. We did not receive any comments regarding new (i.e., previously unaccounted for) projects in the general area that could contribute to cumulative impacts.

We have determined that the modeled air quality impacts from operation of the facility would be similar as those previously identified and would not result in any exceedances of the NAAQS. Also, the air permit issued by the Louisiana Department of Environmental Quality would not need to be revised, and the modeled air quality impacts from operation of the facility would be similar as those previously identified. Therefore, we conclude that any cumulative impacts on air quality would be minimal. Similarly, the elements of the Production Capacity Amendment would only add negligible noise in addition to the noise impacts already evaluated and assessed for cumulative impact. Thus, any cumulative impacts from noise would be minimal.

# 5.0 CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations in this draft supplemental EIS are those of the FERC environmental staff. Our conclusions and recommendations were developed with input from the USCG, USDOT PHMSA, and the DOE, as cooperating agencies.

We determined that the modifications associated with the Production Capacity Amendment, with the additional mitigation measures we recommend in the draft supplemental EIS (and presented below), would continue to avoid or reduce impacts to less than significant levels. This determination is based on our review of information filed by Magnolia LNG and further developed from data requests, scoping, literature research, and contacts with federal agencies. As part of our review, we developed specific mitigation measures that we determined would appropriately and reasonably reduce the environmental impacts resulting from construction and operation of the Production Capacity Amendment. Therefore, we are recommending that our mitigation measures be attached as conditions to any authorization issued by the Commission. If the Production Capacity Amendment is constructed and operated in accordance with applicable laws and regulations, the mitigation measures discussed in this supplemental EIS, and our recommendations, the project environmental impacts project would be reduced to less than significant levels.

## 5.1 FERC STAFF RECOMMENDED MITIGATION

If the Commission authorizes the Magnolia LNG Production Capacity Amendment, we are recommending that the following measures be included as specific conditions in the Commission's Order. We have determined that these measures would further mitigate the environmental impacts associated with the construction and operation of the Magnolia LNG Production Capacity Amendment. All of conditions of the Commission's April 15, 2016 authorization of the Magnolia LNG Project will apply to the amended facilities, if approved, and are therefore not repeated here.

1. Magnolia LNG shall follow the construction procedures and mitigation measures described in its application for the Production Capacity Amendment, and supplements (including responses to staff data requests), and as identified in the supplemental EIS, unless modified by the Order. Magnolia LNG must:

    a. request any modification to these procedures, measures, or conditions in a filing with the Secretary;

    b. justify each modification relative to site-specific conditions;

    c. explain how that modification provides an equal or greater level of environmental protection than the original measure; and

    d. receive approval in writing from the Director of OEP **before using that modification**.

2. The Director of OEP, or the Director's designee, has delegated authority to address any requests for approvals or authorizations necessary to carry out the conditions of the Order, and take whatever steps are necessary to ensure the protection of life, health, property, and the environment during construction and operation of the project. This authority shall allow:

    a. the modification of conditions of the Order;

    b. stop-work authority and authority to cease operation; and

c. the imposition of any additional measures deemed necessary to ensure continued compliance with the intent of the conditions of the Order as well as the avoidance or mitigation of unforeseen adverse environmental impact resulting from project construction and operation.

3. Magnolia LNG shall continue to comply with all environmental and engineering conditions set forth in the Appendix of the April 15, 2016 Order issued in Docket No. CP14-347-000.

4. **Prior to construction of final design**, Magnolia LNG shall file with the Secretary documentation of consultation with USDOT PHMSA staff as to whether the use of drain valves to remove stormwater from curbed areas would meet USDOT PHMSA requirements.

**Conditions 5 through 17 shall apply to the LNG terminal facilities. Information pertaining to the following specific conditions shall be filed with the Secretary for review and written approval by the Director of OEP, or the Director's designee, within the timeframe indicated by each recommendation. Specific engineering, vulnerability, or detailed design information meeting the criteria specified in Order No. 833 (Docket No. RM16-15-000), including security information, shall be submitted as critical energy infrastructure information pursuant to 18 CFR §388.113. See Critical Electric Infrastructure Security and Amending Critical Energy Infrastructure Information, Order No. 833, 81 Fed. Reg. 93,732 (December 21, 2016), FERC Stats. & Regs. 31,389 (2016). Information pertaining to items such as offsite emergency response, procedures for public notification and evacuation, and construction and operating reporting requirements are subject to public disclosure. All information shall be filed a minimum of 30 days before approval to proceed is requested.**

5. **Prior to construction of final design**, Magnolia LNG shall include LNG tank fill flow measurement with a high flow alarm.

6. **Prior to construction of final design**, Magnolia LNG shall specify a discretionary vent valve on each LNG storage tank that is operable through the Distributed Control System with a car sealed open manual block valve provided upstream of the discretionary vent valve.

7. **Prior to construction of final design**, Magnolia LNG shall specify a means to prevent liquid flows to the BOG compressor (e.g., BOG suction/knock out drum with high alarm and high high level shutdown).

8. **Prior to construction of final design**, Magnolia LNG shall specify that anhydrous ammonia piping and piping nipples 2 inches nominal pipe size or less in diameter are to be no less than schedule 160 for carbon steel and no less than schedule 80S for stainless steel in accordance with ASME B36.10M and ASME B36.19M, respectively.

9. **Prior to construction of final design**, Magnolia LNG shall specify that anhydrous ammonia pressure vessels meet the minimum requirements for lethal service in accordance with ASME BPVC Section VIII.

10. **Prior to construction of final design**, Magnolia LNG shall specify that all piping containing anhydrous ammonia have 100 percent of all longitudinal, spiral, circumferential butt, socket, and fillet welds radiographed or ultrasonically tested in accordance with ASME B31.3.

11. **Prior to construction of final design**, Magnolia LNG shall specify that all pressure vessels containing anhydrous ammonia be subject to 100 percent non-destructive examination of both

longitudinal/meridional and latitudinal/circumferential welds of hydraulic load bearing shells with curved surface in accordance with ASME BPVC Section VIII, Division 1.

12. **Prior to construction of final design**, Magnolia LNG shall file piping and instrument diagrams, specifications, and procedures that clearly show and specify the tie-in details required to safely connect subsequently constructed facilities with the operational facilities.

13. **Prior to construction of final design**, Magnolia LNG shall specify that the flammable and combustible gas detection and flame and heat detection systems should be in accordance with ISA 84.00.07 or equivalent methodologies and would need to demonstrate that 90 percent or more of releases (unignited and ignited) that could result in an off-site or cascading impact would be detected by two or more detectors and result in isolation and de inventory within 10 minutes. The analysis must take into account the set points, voting logic, wind speeds, and wind directions.

14. **Prior to construction of final design**, Magnolia LNG shall file drawings and specifications for the structural passive protection systems to protect equipment and supports from low temperature releases.

15. **Prior to construction of final design**, Magnolia LNG shall file calculations or test results for the structural passive protection systems to protect equipment and supports from low temperature releases.

16. **Prior to construction of final design**, Magnolia LNG shall specify that the firewater flow test meter is equipped with a transmitter and that a pressure transmitter is installed upstream of the flow transmitter. The flow transmitter and pressure transmitter shall be connected to the Distributed Control System and recorded.

17. **Prior to construction of final design**, Magnolia LNG shall file drawings of internal road vehicle protections, such as guard rails, barriers, and bollards to protect transfer piping, pumps, compressors, hydrants, monitors, etc. to ensure that they are located away from roadway or protected from inadvertent damage from vehicles.

# APPENDIX A

DRAFT ENVIRONMENTAL IMPACT STATEMENT
DISTRIBUTION LIST

**Federal Agencies**

Advisory Council on Historic Preservation, DC
- Office of Federal Programs
  - Jaime Loichinger, Assistant Director, Federal Permitting

Council on Environmental Quality, DC
- Edward Boling, Associate Director for NEPA Oversight

Department of Agriculture, DC
- Conservation and Environmental Program Division, Farm Service Agency
  - Nell Fuller, National Environmental Compliance Manager
- Forest Service-Ecosystem Management Coordination
  - Joe Carbone, Assistant Director, NEPA
- Natural Resources Conservation Service
  - Andree DuVarney, National Environmental Coordinator

Department of Commerce, LA
- National Oceanic and Atmospheric Administration
  - Tim Osborn, Navigation Manager, Eastern Gulf
  - Richard Hartman, Team Leader

Department of Commerce, MD
- NOAA National Marine Fisheries Service
  - NOAA NEPA Coordinator

Department of Defense, DC
- DoD Siting Clearinghouse
  - Steve Sample, Office of the Assistant Secretary of the Army for Civil Works Assistant for Environment, Tribal & Regulatory Affairs
- Office of the Assistant Secretary of the Navy (Energy, Installations, and Environment)
- Office of the Deputy Assistant Secretary of the Air Force (Installations)
  - Liaison, DoD Siting Clearinghouse, SAF/IEI
- Office of the Deputy Assistant Secretary of the Army (Energy & Sustainability)
  - Liaison, DoD Siting Clearinghouse
- Office of the Deputy Under Secretary of Defense (Installations & Environment)
  - Chief, Mission Evaluation Branch
- U.S. Army Corps of Engineers, Planning and Policy Division

Department of Defense, LA
- U.S. Army Corps of Engineers
  - Calix MVN
  - Ed Creef, Environmental Resources Specialist
  - LTC Nathan Joseph, Deputy District Commander
  - Martin Mayer, Chief, Regulatory Branch
  - Tracy Falk, Project Manager - Calcasieu River
- U.S. Army Corps of Engineers, New Orleans District
  - Pete Serlo, Chief, Regulatory Division

Department of Energy, DC
- Office of Environmental Management

Mark Whitney, Principal Deputy Assistant Secretary
Office of Fossil Energy
Edward Le Duc, Supervisory Attorney
Office of NEPA Policy and Compliance
Brian Costner, Acting Director, OGC
Office of Oil & Natural Gas
Brian Lavoie
Office of Fossil Energy
Kyle Moorman, NEPA Compliance Officer
Division of Natural Gas Regulatory Activities
Amy Sweeney, Director

Department of Health and Human Services, DC
Mr. Everett Bole, CHMM, Chief Environmental Officer

Department of Homeland Security, DC
Customs and Border Protection
Christopher Oh, Branch Chief
U.S. Coast Guard, Commandant (CG-OES-4) Chief (Acting), Deepwater Ports Standards Division
Curtis E. Borland, Attorney/Advisor

Department of Homeland Security, LA
U.S. Coast Guard
CDR Darwin A. Jensen
LCDR Chris Rabalais
LT William Hickey

Department of Homeland Security, TX
U.S. Coast Guard
Capt. Jacqueline Twomey, Captain of the Port, Port Arthur, TX

Department of Human Health Services, GA
National Center for Environmental Health, CDC
Sharunda Buchanan, Director, Division of Emergency and Environmental Health Services

Department of Interior, CO
National Park Service
Patrick Walsh, Chief, Environmental Planning and Compliance Branch

Department of Interior, DC
Bureau of Indian Affairs
Terry L McClung, NEPA Coordinator

Bureau of Land Management, DC
FERC Contact

Department of Interior, LA
U.S. Fish and Wildlife Service, Lafayette Ecological Services Field Office
Jeff Welier, Field Supervisor

Department of Interior, TN
- Bureau of Indian Affairs
  - Harold Peterson, Natural Resources Officer

Department of Interior, VA
- Bureau of Indian Affairs
  - BJ Howerton
- Bureau of Ocean Energy Management
  - Dr. Jill Lewandowski, Chief, Division of Environmental Assessment
- Bureau of Safety and Environmental Enforcement
  - David Fish, Chief, Environmental Compliance Division
- US Geological Survey
  - Mark Leeper, Chief, Environmental Management Branch

Department of Justice, DC
- Environment and Natural Resources Division
  - NEPA Coordinator

Department of State, DC
- Bureau of Oceans & International Environmental & Scientific Affairs
  - Alexander Yuan, Foreign Affairs Officer

Department of Transportation, DC
- Office of Assistant Secretary for Transportation Policy
  - Camille Mittelholtz, Environmental Policy Team Coordinator
  - Helen Serassio, Senior Environmental Attorney Advisor
- Pipeline & Hazardous Materials Safety Administration
  - William Schoonover, Associate Administrator for Hazardous Materials Safety
- Pipeline & Hazardous Materials Safety Administration, Office of Pipeline Safety
  - Ahuva Battams, Attorney Advisor
  - Karen Lynch, Community Liaison Services Program Manager
  - Melanie Stevens, Attorney Advisor
  - Sentho White, Director, Engineering, and Research Division
- Surface Transportation Board
  - Victoria Rutson, Chief, Section of Environmental Analysis

Department of Transportation, TX
- Mary L. McDaniel, Director, PHMSA Southwest Region Office

Environmental Protection Agency, DC
- Office of Enforcement and Compliance Assurance
  - Lawrence Starfield, Assistant Administrator
- Office of Federal Activities
  - Susan E Bromm, Director

Environmental Protection Agency, TX
- Region 6
  - Cheryl Seager, Director, Enforcement, and Compliance Assurance Division
  - John Blevins, Director, Compliance Assurance, and Enforcement Division
  - Michael Jansky, Chief, Office of Planning and Coordination

Raul Gutierrez, Ph.D., Consultant

Housing and Urban Development Department, DC
Office of Environment and Energy
Danielle Schopp, Community Planner

Senate, DC
Energy and Natural Resources Committee
Lisa Murkowski, Chair

**Native American Tribes**

Alina J. Shively, Deputy Tribal Historic Preservation Officer, Jena Band of Choctaw Indians, LA
Bryant Celestine, Historic Preservation, Alabama Coushatta Tribe of Texas, TX
Cecilia Flores, Chairman, Alabama Coushatta Tribe of Texas, TX
Chief B. Cheryl Smith, Jena Band of Choctaw Indians, LA
Chief Phyllis J. Anderson, Mississippi Band of Choctaw Indians, MS
Clem Sylestine, Principal Chief, Alabama Coushatta Tribe of Texas, TX
David Sickey, Chairman, Coushatta Tribe of Louisiana, LA
Earl J. Barbry, Jr., THPO, Tunica-Biloxi Tribe of Louisiana, LA
Gary Batton, Chief, Choctaw Nation of Oklahoma, OK
Ian Thompson, Tribal Historic Preservation, Choctaw Nation of Oklahoma, OK
Johnna Fisher, Secretary, Tribal Historic Preservation, Jena Band of Choctaw Indians, LA
Kenneth Carleton, Tribal Historic Preservation Officer/Archaeologist, Mississippi Band of Choctaw Indians, MS
Kimberly Walden, THPO, Chitimacha Tribe of Louisiana, LA
Kyle Williams, Chairman, Alabama Coushatta Tribe of Texas, TX
Linda Langley, THPO, Coushatta Tribe of Louisiana, LA
Lindsey D. Bilyeu, Senior Section 106 Reviewer, Choctaw Nation of Oklahoma, OK
Marshall Pierite, Chairman, Tunica-Biloxi Tribe of Louisiana, LA
Melissa Darden, Chairman, Chitimacha Tribe of Louisiana, LA
Phil Cross, THPO, Caddo Nation, OK
Tamara Francis, Chairperson, Caddo Nation, OK

**Federal Representatives and Senators**

**Louisiana**
Senate
The Honorable Bill Cassidy
The Honorable Richard Shelby

House of Representatives
The Honorable Steven Scalise
The Honorable Cedric Richmond
The Honorable Ralph Abraham

**State Representatives and Senators**

**Louisiana**
Gov. John Bel Edwards, Governor
Billy Nungesser, Lieutenant Governor
Senator Dan Morrish
Senator Eric LaFleur
Senator Ronnie Johns
Representative A.B. Franklin
Representative Bernard LeBas
Representative Mark Abraham
Representative DeVillier
Representative Stephen Dwight
Representative Stuart Moss

**Alabama**
Kay Ivey, Governor

**State Agencies**

**Louisiana**

Coastal Protection and Restoration Authority
Chip Kline, Acting Chairman

Louisiana Department of Agriculture and Forestry
Michael G. Strain, Commissioner

Louisiana Department of Environmental Quality
Billy Eakin, Regional Manager

Louisiana Department of Conservation
Richard Leyoub, Commissioner

Louisiana Department of Culture, Recreation & Tourism
Dr. Charles McGimsey, State Archaeologist and Director

Louisiana Department of Environmental Quality
Bryan Johnston, Environmental Scientist Senior
Chuck Carr Brown, Secretary of LDEQ
Estuardo Silva, Waste Permits Division
Jamie Phillippe, Environmental Scientist Staff
Jenniffer Sheppard, Environmental Manager
Paul Miller, Spec. Assistant to the Secy.
Tegan Treadaway, Administrator, Air Permits

Louisiana Department of Natural Resources
Brent Campbell, Conservation / Engineering
Karl Morgan, Administrator
Kelley Templet, Office of Coastal Management / Mitigation
Michael Peikert, Conservation / Pipeline Division - Assistant Director

Ontario James, Office of Coastal Management / Permits
Regina Stone, Office of Coastal Management
Thomas Harris, Secretary

Louisiana Department of Transportation & Development
Shawn Wilson, Secretary

Louisiana Department of Wildlife & Fisheries
Chris Davis
Dave Butler, Permit Coordinator
Jack Montoucet, Secretary
Kyle Balkum, Biologist Director
Randy Myers, Assistant Secretary Wildlife
Patrick Banks, Assistant Secretary Fisheries
Thomas Hess, Program Manager

Louisiana Economic Development
Don Pierson, Secretary / Senior Director of Business Development

Louisiana Environmental Justice Program
Darryl Malek Wiley

Louisiana Office of Cultural Development
Kristin Sanders, State Historic Preservation Officer

Louisiana State Police
Col. Kevin W. Reeves, Superintendent
Sean LeFleur

Office of Coastal Protection and Restoration
Science Director

State of Louisiana
Jeff Landry, Attorney General
James Waskom, Governor's Office of Homeland Security & Emergency Preparedness

SW Region, Natural Resources - Fisheries
Kevin Savoie, Area Agent

**Alabama**
Secretary, Alabama Public Service Commission

**Parish Agencies**

Calcasieu Council on Aging
Rosalind Berry

Calcasieu Parish
Lynn Jones, Clerk of Court
Terry Welke, Coroner
Wendy Curphy Aguillard, Assessor

Calcasieu Parish Homeland Security and Emergency Preparedness
Dick Gremillion

Calcasieu Parish Police Jury
Brian Abshire, District 5
Bryan Beam, Administrator
Chris Landry, District 7
Elizabeth C. Griffin, District 3
Francis Andrepont, District 13
Guy Brame, District 8
Hal McMillin, District 14
Judd Bares, District 12
Kevin Guidry, District 9
Kevin White, District 1/ President
Les Farnum, District 15
Marshall Simien, Jr., District 2
Sandy Treme, District 11
Shalon Latour, District 10
Tony Guillory, District 4

Calcasieu Parish Public Schools
Karl Bruchhaus, Superintendent

Calcasieu Parish Sheriff Department
Kim Myers, Community/Media Relations Director
Tony Mancuso, Sheriff

Calcasieu Parish, Fourteenth Judicial District
John DeRosier, District Attorney

Cameron Parish Office of Emergency Preparedness
Danny Lavergne, Secretary

Cameron Parish Police Jury
Ryan Bourriaque, Administrator

Cameron Parish School Board
Charley Lemons, Superintendent

**Local Agencies**

Cameron Port
Clair Marceaux, Port Director

City of DeQuincy
Lawrence Henagan, Mayor

City of Lake Charles
Nic Hunter, Mayor
Shawn Caldwell, Police Chief

Johnnie Thibodeaux, Councilman, District F
John Leyoub, Councilman,District D,
Mark Eckard, Councilman, District G
Mary Morris, Councilwoman, District A
Rodney Geyen, Councilman, District C
Stuart Weatherford, Councilman, District E,
Luvertha August, Councilwoman, District B
Lynn Thibodeaux, Clerk of the City Council, Lake Charles

City of Sulphur
Mike Danahay, Mayor

Lake Charles Fire Department
Keith Murray, Fire Chief

Lake Charles Harbor & Terminal District
Carl J. Krielow, Commissioner
Channing Hayden, Director of Navigation and Security
Dudley Dixon, Commissioner
Elcie Guillory, Secretary/Treasurer, Commissioner
Mike Eason, Commissioner
Thomas L. Lorenzi, Commissioner
Walter Sanches, Commissioner
William Rase III, Executive Director

Lake Charles School Board
Aaron Natali, District 1
Alvin Smith, District 10
Annette Ballard, District 4
Billy Breaux, District 13
Bliss Bujard, District 11
Damon Hardesty, District 9
Dean Roberts, District 6
Desmond Wallace, District 14
Eric Tarver, District 8
Fred Hardy, District 2
Glenda Gay, District 3
John Duhon, District 15
Mack Dellafosse, Jr., District 7
Ron Hayes, District 5
Russell Castille, District 12

West Calcasieu Chamber of Commerce
Lena McArthur, Executive Director

West Calcasieu Port
E Lynn Hohensee, Port Director

**Libraries**

Crowley Headquarters, Acadia Parish Library, Crowley, LA
Carnegie Memorial Library, Calcasieu Parish Public Library, Lake Charles, LA
Central Library, Calcasieu Parish Public Library, Lake Charle, LA
DeQuincy Branch, Calcasieu Parish Public Library, DeQuincy, LA
Epps Memorial Branch, Calcasieu Parish Public Library, Lake Charles, LA
Fontenot Memorial Branch, Calcasieu Parish Public Library, Vinton, LA
Hayes Branch, Calcasieu Parish Public Library, Hayes, LA
Iowa Branch Calcasieu Parish Public Library Iowa LA
Maplewood Branch Calcasieu Parish Public Library Sulphur, LA
Moss Bluff Branch, Calcasieu Parish Public Library, Lake Charles, LA
Starks Branch, Calcasieu Parish Public Library, Starks, LA
Sulphur Regional Library, Calcasieu Parish Public Library, Sulphur, LA
Westlake Branch, Calcasieu Parish Public Library, Westlake, LA
Evangeline Parish Library, Ville Platte, LA
Southwest Louisiana Genealogical & Historical Library, Lake Charles, LA

**Newspapers**

Sulphur Daily News, Sulphur, LA
Ville Platte Gazette, Ville Platte, LA

**Landowners, Individuals, and Organizations**

3N75 Trust, Lake Charles, LA
Aaron Andrus, Seabulk Towing, Inc., Lake Charles, LA
Alan Basden, BASDEN AGENCIES INC, Lake Charles, LA
Alan Courmier, Moran-Gulf Shipping Agency, Sulphur, LA
Alfred Devall, Fausta Devall, Lake Charles, LA
Alirio Zambrano, CITGO Petroleum Corporation, Lake Charles, LA
Allan C. House, Lake Charles, LA
Alliance for Affordable Energy, New Orleans, LA
Amelia Nell Fuselier, Mitchell Fuselier, St. Martinville, LA
American Press, Lake Charles, LA
Andrew Guinn, Port Aggregates, Jennings, LA
Ann Crowe Lindsay, Lake Charles, LA
Audubon Louisiana, Baton Rouge, LA
Azima Benoit Granger, George Lee LaGrange, Jackson, AL
Barbara Jean Stevenson Levine, Potomac, MD
Bea Morrison Thibodeaux, Lake Charles, LA
Benson Lyons Palmer Jr., Cleveland, TX
Berna Dean Veillon Johnson et al, Lake Charles, LA
Billie Jewel Trahan Goux, John A. Trahan, Lake Charles, LA
Bob Emerson, Recon, Porter, TX
Bob Mayo, Mayo Realty Company Inc., Westlake, LA
Bobbi Zaunbrecher, American Red Cross of Southwest Louisiana, Lake Charles, LA
Bonnie Cashin Englert, Cashin Family Offices, Menlo Park, CA
Boyd Smith, Sulphur, LA
Boyer Properties, LLC, Lake Charles, LA
Brenda Sue Sumpter ET VIR, Sulphur, LA

Brett Palmer, Lake Charles Pilots, Lake Charles, LA
Brian Kennedy, Seabulk Towing, Inc., Lake Charles, LA,
Brian Tanner, 4-T Investments, Eunice, LA
Bruce Newsom, Natural Gas Pipeline Company of America LLC, Downers Grove, IL
Calcasieu Land & Minerals, LLC, Lake Charles, LA
Calcasieu League for Environmental Action Now, Lake Charles, LA
Cameron Boyd Barr, Hammond, LA
Capt. Charles Morrison, Lake Charles Pilots, Lake Charles, LA
Capt. Kurt Hallier, Marine Terminal Advisors-Commercial Marine Risk Management, ConocoPhillips, Houston, TX
Capt. Stephen Porter, Crowley Marine Services, Lake Charles, LA
Capt. Thomas Fanning, CITGO, Houston, TX
Carol Sonnier, Lake Charles, LA
Cary Ross McKee, Lake Charles, LA
Center for Biological Diversity, Tuscon, AZ
Charles Harper, CITGO, Lake Charles, LA
Charles William and Barbara Pizanie, Morris Revocable Living Trust, Lake Charles, LA
Charlie Atherton, Sulphur, LA
Clarence L. Cooper, Houston, TX
Clark Real Estate Enterprises, Inc., Lake Charles, LA
Clatrax, Inc., Lake Charles, LA
Cliff Kerr, Leucadia National Corporation, Katy, TX
Craig Messer, ISC Constructors, LLC, Beaumont, TX
Crowe Property Investments, LLC, Lake Charles LA
Crowley Marine Services, Lake Charles, LA
Crowley Post-Signal, Crowley, LA
Curtis Claude Benoit, Lafayette, LA
Curtis Conkle, Conroe, TX
Dalton Ray Sonnier, Eunice, LA
Dan Morrish, Vessel Traffic Information Services Lake Charles Pilots, Inc., Lake Charles, LA
Daniel Torres, Diocese of Lake Charles, Lake Charles, LA
D'Arcy Michael Cashin, Cashin Family Offices, Menlo Park, CA
Darryl Altalies, Ville Platte, LA
Dav Godsey, Dunham Price Group, LLC, Westlake, LA
Dave Benoit Estate, Judith B. Sonnier, Lake Charles, LA
Dave Trent, Lake Charles Pilots, Lake Charles, LA
David and Jean Harris, Lake Charles, LA
David Hardesty, Texas Gas Transmission, LLC, Owensboro, KY
David Tavares Andril, Vinson & Elkins LLP, Washington, DC
David Wayne Bertrand, Eunice, LA
David Wochner, K&L Gates, Washington, DC
Denise Durel, United Way of Southwest Louisiana, Inc., Lake Charles, LA
Dennis Odum, Panhandle Energy, Lake Charles, LA
Dennis Scott, Calcasieu Parish Police Jury, Lake Charles, LA
Don Darbonne, Dynamic Industries, Inc., Lake Charles, LA
Donald Laurent, Knights of Columbus, Lake Charles, LA
Donna Blackwell, LaGrange Turner, Jackson, AL
Doris Dey Taylor, San Antonio, TX
Elizabeth Ann Fontenot Oliver, Paul Chamerlain, Lake Charles, LA
Elizabeth Kade, Vinson & Elkins LLP, Washington, DC
Elliot Godwin, Erwin Heirs, Inc., Lake Charles, LA

Emmet J. Cashin III, Cashin Family Offices, Menlo Park, CA
Environmental Defense Fund, New York NY
Ernest F. Clooney Jr., Lafayette, LA
Evelyn Devall Reed, Hackberry, LA
First Church of Christ, Lake Charles, LA
Fox29, Lake Charles, LA
Frank LaBarbera, Vessel Traffic Service, Lake Charles, LA
Frazier King, Jr., Panhandle Energy Pipelines, Houston, TX
Fred Borel, Louisiana Wildlife Federation, Lake Charles, LA
Fred Eason, OSRV Gulf Coast Responder, Lake Charles, LA
Fundi Mwamba, Total Gas & Power NA, Houston, TX
Gayle Brothers, LLC, Lake Charles, LA
George Mowbray, Lake Charles Pilots, Lake Charles, LA
George Swift, Southwest Louisiana Economic Development Alliance, Lake Charles, LA
Glenda Benoit Oliver, Lake Charles, LA
Glenn C. House Jr. ET AL, Houston, TX
Gloria Lone Kiplinger Brown ET AL, Lake Charles, LA
Grace Davison, Lake Charles, LA
Gulf Coast Environmental Labor Coalition, Metairie, LA
Gulf Restoration Network, New Orleans, LA
Halco-Kisatchie Properties, Inc., Jennings, LA
Harbor Docking & Towing, Lake Charles, LA
Hayward Martin, Delta Chapter, Sierra Club, Lafayette, LA
Heather Jabusch, Wingate Hotel, Sulphur, LA
Helen Clooney Humphrey EST, Mountain View, AR
Hottel Family Partnership, Stonington, CT
Howard Wayne Granger, Lawrence Granger Estate, Westlake, LA
Imperial Calcasieu Museum, Lake Charles, LA
Jack Gray, Gray Law Firm, Lake Charles, LA
James Ducote, Cheniere LNG, Inc., Cameron, LA
James Moriarty, Locke Lord LLP, Washington, DC
James Ray Clooney III, Lake Charles, LA
James Richard Smith, Eunice, LA
James T. Quinn, Sulphur, LA
Janet Mayo, Brooklyn, NY
Jats Real Estate, LLC, Lake Charles, LA
Jay Kumar, Wingate by Windham, Sulphur, LA
Jeffrey Brightwell, Trunkline LNG, Lake Charles, LA
Jennie Sue Pearson ET AL, Frederick, MD
Jeremie Wayne Veillon, Eunice, LA
Jim Stark, GICA (Gulf Intracoastal Canal Association), New Orleans, LA
Joe Devall, Devall Towing, Sulphur, LA
John Alford, Moreno Group LLC, Broussard, LA
John Arthur Fleig, Sulphur, LA
John F. Hennessey ET AL, Sulphur, LA
John L. LeBlanc, Lake Charles Harbor & Terminal District, Lake Charles, LA
John LeBlanc, Lake Charles Harbor & Terminal District, Lake Charles, LA
John Lemeur, Lorrain Jackson, Hamilton, OH
Joseph B. Powell ET AL, J. Brent Powell, Lafayette, LA
Joseph David Painter, Lake Charles, LA
Kathryn House, Lake Charles, LA

Ken Rodericks, CITGO - Lake Charles, Lake Charles, LA
Kerry Arthur House, Lake Charles, LA
Kevin Anthony and Anita Richard, Eunice, LA
King Minerals, LLC, Lake Charles, LA
Kisatchie Title Management, Inc., Jennings, LA
KPLC-TV, Lake Charles, LA
Larry DeRoussel, Lake Area Industry Alliance, Lake Charles, LA
Lena Benoit King, Michelle Koonce, Lake Charles, LA
Lois Meril Cassidy Benoit ET AL, Lake Charles, LA
Louisiana Bucket Brigade, New Orleans, LA
Lyles Budden, CSRS, INC, Baton Rouge, LA
Mack Whittaker, Alcoa Carbon Products, Lake Charles, LA
Maj. David Craddock, Salvation Army, Lake Charles, LA
Maria Kyres Pavlou, Natural Gas Pipeline Company of America LLC, Downers Grove, IL
Marine Spill Response Corp., Lake Charles, LA
Mario Espinosa, CDI Engineering Solutions, Baton Rouge, LA
Marjorie Nalley Campbell, Bossier, LA
Mark Nelson, Sempra Energy, Houston, TX
Mark Pippin, Inchcape Shipping Services, Lake Charles, LA
Mary Beth Russell, Houston, TX
Mary Leonise Broussard Perrin, Lafayette, LA
Matt Young, Lake Charles, LA
Michael Measells, Vessel Traffic Service, Port Arthur, TX
Michael Orr, Louisiana Environmental Action Network, Baton Rouge, LA
Michael Pincus, Van Ness Feldman, LLP, Washington, DC
Michael T. Langston, Panhandle Energy Pipelines, Houston, TX
MJL Louisiana, LLC, San Rafael, CA
Montell USA, Inc., Lake Charles, LA
Murphy and Rosette Bellard, Lake Charles, LA
Nancy Tugwell, Lake Charles, LA
Natalie Lewis Miciotto, Shreveport, LA
Natalie Peyronnin, CPRA, Baton Rouge, LA
Natalie Rogers Murphy, Camillus, NY
Natural Resources Defense Council, New York, NY
Necil Benoit LeBouef, Brenda Foreman, Vinton, LA
Neil Clark, Environmental Response Services, Lake Charles, LA
Niels Aalund, West Gulf Maritime Association, Houston, TX
Niels Lyngso, West Gulf Maritime Association, Houston,TX
Nimesh Zaver, Hotels of Lake Charles, Sulphur, LA
Oscar J. Colletta, Dorothy Colletta House, Lake Charles, LA
Patsy Calhoun, Boudreau-Calhoun LLC, Lake Charles, LA
Patrick Fusilier, Eunice, LA
Pauline Sonnier, Landry Granger Estate, Orange, TX
Philip Anthony Gayle ET AL, W.J. Gayle and Sons, Lake Charles, LA
Pine Island Oil Corporation, Lake Charles, LA
Powell Land Holdings, LLC  Lake Charles, LA
Prairie Land Company, Lake Charles, LA
R Brooks Fleig, Catherine Fleig Sharpe, Sulphur, LA
Ralph Clements, Dynamic Industries, Inc., Lake Charles, LA
Randy Deshotel, Clerk of Court, Ville Platte, LA
Randy Oakley, Cameron LNG, LLC, Hackberry, LA

Ray Sonnier, Lake Charles, LA
Raymond Klumpp, Eunice, LA
Raymond Klumpp Farms, Inc., Eunice, LA
Reynolds Metals, Lake Charles, LA
Reynolds Metals Co. Alcoa Inc., Pittsburgh, PA
Rhonda Colletta, Holiday Inn Express, Sulphur, LA
Richard Michael Farley, Farley Testamentary Trusts ET AL, Houston, TX
Richard Ortego, LEEVAC, Lake Charles, LA
Rick Jacob, the Nature Conservancy - Southwest Louisiana, Lake Charles, LA
Rick Richard, Empire of the Seed, Lake Charles, LA
Robert Barousse, Clerk of Court, Crowley, LA
Robert Francis Christin Attorney, Van Ness Feldman, LLP, Washington, DC
Robert O. Gayle, Louisiana Farm and Lovestock Co., Lake Charles, LA
Ryan Talbott, Alleghany Defense Project, Portland, OR
Scott Hancock, Trunkline LNG Company LLC, Lake Charles, LA
Sheron Faulk, Ship to Shore, Lake Charles, LA
Sierra Club Delta Chapter, Lafayette, LA
Simon and Sonja Davidson, Lake Charles, LA
Stephen Brown III, Lake Charles, LA
Stephen Veatch, Panhandle Energy Pipelines, Houston, TX
Steve Newman, CITGO Houston, TX
Steve Trahan, Cameron LNG, Hackberry, LA
Steven Couch, Trunkline LNG, Lake Charles, LA
Terri Angelini, PPG Chlor-Alkali & Derivatives, Lake Charles, LA
Terry Fontenot, Jr., Eunice, LA
Thomas Barr IV Louisiana Properties, LLC Sag Harbor, NY
Thomas McClelland, Eunice, LA
Thomas Raymond Howell Jr. ET AL, Berkeley, CA
Tim Guinn, Port Aggregates, Jennings, LA
Tom Miller, Lake Charles, LA
Tony Colletta, CLM Equipment Co., Inc, Sulphur, LA
Tower Land Company, LLC, Lake Charles, LA Vernon W. Humphrey ET AL, Mountain View, AR
Trunkline LNG Co., Property Tax Dept., Houston, TX
Union of Concerned Scientists, Cambridge, MA
Venco, Lake Charles, LA
Vito A. Tramonte, Sulphur, LA
Wilda Rose K. Fontenot, Eunice, LA
Willie Tempton, Conoco Phillips, Westlake, LA
Willis Noland Testamentary Trust ET AL, Lake Charles, LA
Winifred Vetha Adkins Hutchinson, Clif Walters, Dallas, TX
Winston Ebarb, CITGO, Houston, TX
Winston Frey, et ux, Eunice, LA

# APPENDIX B

REFERENCES

Federal Energy Regulatory Commission, 2015. Magnolia LNG and Lake Charles Expansion Projects *Final Environmental Impact Statement*. Docket Nos. CP14-347-000 and CP14-511-000. Available at https://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=14044067.

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# APPENDIX C

LIST OF PREPARERS

**Swearingen, David – Project Manager**
M.S., Marine Biology, 1996, University of North Carolina, Wilmington
B.S., Zoology, 1992, Louisiana State University

**Yuan, Julia – Document Management/Production**
M.P.S., Natural Resources Management, 2003, College of Environmental Science and Forestry, State University of New York
B.S., Environmental Biology/Forestry, 1999, College of Environmental Science and Forestry, State University of New York

**Lesser, John – LNG Reliability and Safety**
B.S., Mechanical Engineering, 2010, Pennsylvania State University

**Tomasi, Eric – Air Quality and Noise**
B.S., Aerospace Engineering, 1994, Boston University