Federal Energy Regulatory Commission
Office of Energy Projects

December 2022

Cameron LNG, LLC **Docket No. CP22-41-000**

Cameron LNG Amended Expansion Project

Environmental Assessment

Cooperating Agencies

Washington, DC 20426

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

In Reply Refer To:
OEP/DG2E/Gas 1
Cameron LNG, LLC
Cameron LNG Amended Expansion Project
Docket No. CP22-41-000

TO THE INTERESTED PARTY:

The staff of the Federal Energy Regulatory Commission (FERC or Commission) has prepared an environmental assessment (EA) for the Cameron LNG Amended Expansion Project, proposed by Cameron LNG, LLC (Cameron LNG) in the above-referenced docket. Cameron LNG requests several design modifications and enhancements to the approved Cameron Expansion Project at its existing liquified natural gas (LNG) terminal located in Cameron and Calcasieu Parishes, Louisiana.

The EA assesses the potential environmental effects of the construction and operation of the Cameron LNG Amended Expansion Project in accordance with the requirements of the National Environmental Policy Act (NEPA). The FERC staff concludes that approval of the proposed project amendment, with appropriate mitigating measures, would not constitute a major federal action significantly affecting the quality of the human environment.

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

Cameron LNG proposes to amend its authorization under section 3 of the Natural Gas Act for the Cameron Expansion Project that was issued by the Commission on May 5, 2016 (Docket No. CP15-560-000). Specifically, Cameron LNG proposes to modify the approved Train 4 and perform associated design enhancements; and to no longer construct Train 5 or Tank 5. In addition, Cameron LNG proposes an additional design enhancement to allow for the capability to simultaneously load two LNG vessels at a rate of 12,000 cubic meters/hour at both the North and South Jetties. The proposed amendment is intended to increase the overall reliability and capacity of Train 4 and eliminate impacts from construction and operation of Train 5. The overall maximum production capacity of the Amended Expansion Project would be reduced from 9.97 to 6.75 million tonnes per annum.

The Commission mailed a copy of the *Notice of Availability* of the EA 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 EA is only

available in electronic format. It may be viewed and downloaded from the FERC's website (www.ferc.gov), on the natural gas environmental documents page (https://www.ferc.gov/industries-data/natural-gas/environment/environmental-documents). In addition, the EA may be accessed by using the eLibrary link on the FERC's website. Click on the eLibrary link (https://elibrary.ferc.gov/eLibrary/search), select "General Search" and enter the docket number in the "Docket Number" field (i.e. CP22-41-000). 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.

The EA is not a decision document. It presents Commission staff's independent analysis of the environmental issues for the Commission to consider when addressing the merits of all issues in this proceeding. Any person wishing to comment on the EA may do so. Your comments should focus on the EA's disclosure and discussion of potential environmental effects, reasonable alternatives, and measures to avoid or lessen environmental impacts. The more specific your comments, the more useful they will be. To ensure that the Commission has the opportunity to consider your comments prior to making its decision on this project, it is important that we receive your comments in Washington, DC on or before 5:00pm Eastern Time on **January 3, 2023**.

For your convenience, there are three methods you can use to file 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 FERC Online. This is an easy method for submitting brief, text-only comments on a project;

(2) You can also file your comments electronically using the eFiling feature on the Commission's website (www.ferc.gov) under the link to FERC Online. 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." You must select the type of filing you are making. If you are filing a comment on a particular project, please select "Comment on a Filing"; or

(3) You can file a paper copy of your comments by mailing them to the Commission. Be sure to reference the project docket number (CP22-41-000) on your letter. Submissions sent via the U.S. Postal Service must be addressed to: Kimberly D. Bose, Secretary, Federal Energy Regulatory Commission, 888 First Street NE, Room 1A, Washington, DC 20426. Submissions sent via any other carrier must be addressed to: Kimberly D. Bose, Secretary, Federal Energy Regulatory Commission, 12225 Wilkins Avenue, Rockville, Maryland 20852.

Filing environmental comments will not give you intervenor status, but you do not need intervenor status to have your comments considered. Only intervenors have the right to seek

rehearing or judicial review of the Commission's decision. At this point in this proceeding, the timeframe for filing timely intervention requests has expired. Any person seeking to become a party to the proceeding must file a motion to intervene out-of-time pursuant to Rule 214(b)(3) and (d) of the Commission's Rules of Practice and Procedures (18 CFR 385.214(b)(3) and (d)) and show good cause why the time limitation should be waived. Motions to intervene are more fully described at https://www.ferc.gov/how-intervene.

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 which 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 https://www.ferc.gov/ferc-online/overview to register for eSubscription.

TABLE OF CONTENTS

List of Tables

List of Figures

TECHNICAL ACRONYMS AND ABBREVIATIONS

2016 Order	Commission's May 5, 2016 Order in Docket No. CP15-560-000
AEGL	Acute Exposure Guideline Level
AGA	American Gas Association
Agreement	Paris Climate Agreement
AIChE	American Institute of Chemical Engineers
ALPEMA	Aluminum Plate-Fin Heat Exchanger Manufacturer's Association
AOI	Area of Impact
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
Bcf	billion cubic feet
BLEVE	boiling liquid expanding vapor explosion
BPVC	Boiler and Pressure Vessel Coded
Btu/ft^2-hr	British thermal units per square foot per hour
CAA	Clean Air Act
Cameron LNG	Cameron LNG, LLC
CCPS	Center for Chemical Process Safety
CCS	carbon capture and sequestration
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
Coast Guard	USCG
COTP	Captain of the Port
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
CPT	Cone penetration test
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE/FECM	U.S. Department of Energy Office of Fossil Energy and Carbon Management
E-DRIVE	Electric drive
EA	Environmental Assessment
EFG	end flash gas
EIS	Environmental Impact Statement
EJScreen	Environmental Justice Screening and Mapping Tool
ERPG	Emergency Response Planning Guidelines
ESA	Endangered Species Act
ESD	Emergency Shut Down
FEED	front end engineering design

FERC or Commission	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
Freeport LNG	Freeport LNG Development, L.P.
FSA	Facility Security Assessment
FSP	Facility Security Plan
FTA	free trade agreements
GHG	greenhouse gas
GIS	Geographic Information Systems
HAPs	hazardous air pollutants
HAZID	hazard identification
HAZOP	hazard and operability
HEI	Heat Exchanger Institute
HIPPS	high integrity pressure protection system
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
ISA	International Society for Automation
IWG	Interagency Working Group on the Social Cost of Greenhouse Gas
km	kilometers
LDEQ	Louisiana Department of Environmental Quality
LDWF	Louisiana Department of Wildlife and Fisheries
LFL	lower flammable limit
LNG	liquefied natural gas
LOD	Letter of Determination
LPG	liquefied petroleum gas
MCHE	main cryogenic heat exchanger
MEOW	maximum envelope of water
µg/m^3	microgram per cubic meter
Mph	miles per hour
MR	mixed refrigerant
MSU	Marine Safety Unit
MTPA	million tonnes per annum
MTSA	Maritime Transportation Security Act
NAAQS	National Ambient Air Quality Standards
NACE	National Association of Corrosion Engineers
NDCs	nationally determined contributions
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants for Source Categories
NFPA	National Fire Protection Association
NGL	natural gas liquids

NHTSA	National Highway Traffic Safety Administration
NNSR	Nonattainment New Source Review
NO_x	nitrogen oxides
NO_2	nitrogen dioxide
NOPSO	Notice of Proposed Safety Order
NOS	*Notice of Scoping Period Requesting Comments on Environmental Issues for the Proposed Cameron LNG Amended Expansion Project and Notice of Public Scoping Session*
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standards
NSR	New Source Review
OPP	Office of Public Participation
P&ID	piping and instrumentation diagrams
PFDs	process flow diagrams
PIPA	Pipelines and Informed Planning Alliance
PM_{10}	particles 10 micrometers in diameter and smaller
$PM_{2.5}$	particles 2.5 micrometers in diameter and smaller
Promising Practices	*Promising Practices for EJ Methodologies in NEPA Reviews*
PVB	pressure vessel burst
RESTORE	**R**estore **E**xplicit **S**ymmetry **T**o **O**ur **R**avaged **E**arth
RMP	Risk Management Plan
RPT	rapid phase transition
September 2015 EA	September 2015 Environmental Assessment for the Cameron LNG Expansion Project in Docket No. CP15-560-000
SFPE	Society of Fire Protection Engineers
SIL	significant impact levels
SO_2	sulfur dioxide
SSM	start-up, shutdown, and maintenance
TEMA	Tubular Exchanger Manufacturers Association
TWIC	Transportation Worker Identification Credential
UFL	upper flammable limit
UL	Underwriters Laboratories
USDOT PHMSA	U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGCRP	U.S. Global Change Research Program
VOC	volatile organic compounds
WSA	Waterway Suitability Assessment

A. PROPOSED ACTION

1.0 INTRODUCTION

On January 18, 2022, Cameron LNG, LLC (Cameron LNG) filed an application with the Federal Energy Regulatory Commission (FERC or Commission) in Docket No. CP22-41-000 for a limited amendment to the Commission's May 5, 2016 Order in Docket No. CP15-560-000 (2016 Order).[1] The 2016 Order authorized Cameron LNG to site, construct, and operate facilities at the site of the existing Cameron LNG liquefied natural gas (LNG) terminal in Cameron and Calcasieu Parishes, Louisiana, to provide additional natural gas processing, storage, and liquefaction capability (Expansion Project). The Expansion Project, as approved by the 2016 Order, authorized an increase to Cameron LNG Terminal's maximum natural gas liquefaction and export capabilities by 9.97 million tonnes per annum (MTPA), equivalent to 515 billion cubic feet (Bcf) per year, to a Terminal total of 24.92 MTPA.

In its amendment application, Cameron LNG requests to implement several design modifications and enhancements to reduce the overall greenhouse gas (GHG) emissions from the Expansion Project, allow for Cameron LNG to gain access to carbon capture and sequestration (CCS) facilities in the future, and to enhance the overall efficiency and productive capacity of the Expansion Project (Amended Expansion Project). In addition, Cameron LNG supplemented its application on March 18, 2022, by proposing an additional design enhancement to allow for the capability to simultaneously load two LNG vessels at a rate of 12,000 cubic meters/hour at both the North and South Jetties.

The Amended Expansion Project would consist of the following design enhancements of Train 4:

- add a feed gas booster compressor;
- add inlet gas propane refrigeration;
- use open art technology on natural gas liquid extraction process in lieu of a proprietary process;
- use a reduced temperature approach on air-cooled exchangers and add to the number of exchangers;
- add an end flash gas (EFG) cold recovery exchanger;
- add an EFG recycle compressor;
- replace the refrigerant compressor gas turbine drives with electric motor drivers;
- add hot oil heaters in lieu of the waste heat recovery units;
- add an enclosed ground flare as backup to thermal oxidizer to handle the acid gas stream;

[1] *Cameron LNG, LLC*, 155 FERC ¶ 61,141 (2016).

- add a tie-in on the thermal oxidizer acid gas feed line as pre-investment for the possibility of future carbon sequestration; and
- utility services would be dedicated to Train 4.

The Amended Expansion Project would also include relocating or no longer constructing (i.e., removing) the following facilities that were approved in the 2016 Order:

- removal of the approved liquefaction Train 5 and associated utilities;
- removal of the approved LNG storage Tank 5 (T-205);
- removal of the condensate storage tanks;
- removal of one boil-off gas compressor;
- removal of one emergency generator (now two instead of three); and
- relocation of the Entergy Switch Yard.

In addition, the proposed dual loading would include the following:

- upgrade one of the four LNG In-Tank Pumps in each LNG Storage Tank (the low capacity pump in each tank would be upgraded to match the three existing high-capacity pumps);
- addition of a parallel 1,800-foot-long 36-inch-diameter loading line to provide the system hydraulics necessary for the increased dual loading rate of up to 24,000 cubic meters/hour (the line would be added in existing pipe racks using interconnections to the existing loading header);
- addition of a new impoundment basin adjacent to the existing impoundment basin serving the loading area; and
- addition of a pre-investment tie-in on the acid gas feed line to the Thermal Oxidizers for Trains 1-3 to allow future connection to potential carbon sequestration facilities that may be developed in the area (similar to the pre-investment tie-in proposed for Train 4).

The design enhancements relate solely to the process equipment associated with Train 4. The piping, equipment, and safety features required for dual ship loading from the existing marine facilities at the Cameron LNG Terminal would not impact the marine environment. The proposed Amended Expansion Project would not result in an increase in the size and/or frequency of LNG vessel traffic that is reflected and currently approved in Cameron LNG's existing Waterway Suitability Assessment (WSA). Figure 1 shows the project location.

Figure 1: Project Site Map

We[2] prepared this environmental assessment (EA) in compliance with the requirements of the National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality's (CEQ) regulations for implementing NEPA (Title 40 of the Code of Federal Regulations [CFR], Parts 1500-1508 [40 CFR 1500-1508])[3], and the Commission's regulations for implementing NEPA (18 CFR 380).

FERC is the lead federal agency for authorizing LNG export facilities under the Natural Gas Act (NGA), and the lead federal agency for preparation of this EA, in accordance with NEPA (40 CFR 1501) and the Energy Policy Act of 2005. Consistent with NEPA (40 CFR 1501.6) and their respective responsibilities and regulations, the U.S. Department of Energy (DOE), U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (USDOT PHMSA), and the U.S. Coast Guard (USCG) participated as cooperating agencies in the preparation of this EA. Cooperating agencies have jurisdiction by law or special expertise with respect to the environmental impacts associated with Cameron LNG's proposal.

The assessment of environmental impacts is an integral part of the Commission's decision-making process to determine whether to authorize Cameron LNG's proposal. Our principal purposes in preparing this EA are to:

- identify and assess potential impacts on the natural and human environment that would result from the implementation of the proposed action;
- identify and recommend reasonable alternatives to avoid or minimize adverse environmental impacts;
- identify and recommend mitigation measures, as necessary, to minimize environmental impacts; and
- facilitate public involvement in the environmental review process.

2.0 PURPOSE AND NEED

The U.S. Environmental Protection Agency (USEPA) commented that the EA needed to state the purpose and need of the proposed project. Cameron LNG states the purpose and need for the Amended Expansion Project are the same as previously approved in the original Expansion Project. The previously approved Expansion Project would enable Cameron LNG to receive and liquefy additional quantities of domestic natural gas at the Cameron LNG Terminal for export to foreign markets. The purpose of the Expansion Project facilities was to permit additional gas to be received by pipeline at the Cameron LNG Terminal, to be liquefied and stored, and to be loaded from the LNG storage tanks onto vessels berthed at the terminal's existing marine facility. Cameron LNG proposes to amend the authorization to implement design enhancements to reduce the GHG emissions, increase the overall reliability and capacity

[2] "We," "us," and "our" refer to the environmental and engineering staff of the Office of Energy Projects.

[3] The EA was prepared consistent with the CEQ's April 20, 2022 final rule, National Environmental Policy Act Implementing Regulations Revisions (Final Rule, 87 FR 23453), that was effective as of May 20, 2022.

of Train 4, and allow for the capability to simultaneously load two LNG vessels. With the removal of Train 5, the overall maximum liquefaction and export capability of the Expansion Project would be reduced from 9.97 MTPA to 6.75 MTPA, sourced exclusively from Train 4, as amended in Cameron LNG's amendment application.

The Commission is an independent regulatory agency and conducts a complete independent review of project proposals, including an environmental review of proposed facilities. Under Section 3 of the NGA, FERC considers, as part of its decision to authorize natural gas facilities, all circumstances bearing on the public interest. Specifically, regarding whether to authorize natural gas facilities used for importation or exportation, FERC shall authorize the proposal unless it finds that the proposed facilities would not be consistent with the public interest.

The EA is not a decision-making document. The purpose of our environmental review is to evaluate and disclose the environmental impacts of Cameron LNG's Amended Expansion Project request, identify and assess reasonable alternatives, facilitate public involvement under NEPA, and identify and recommend specific mitigation measures to the Commission to avoid or minimize environmental impacts. This EA will aid the Commission in its decision-making process. The Commission will consider the findings of the EA, as well as non-environmental issues, in its review of the Amended Expansion Project.

3.0 PUBLIC PARTICIPATION AND COMMENT

On April 1, 2022, the Commission issued a *Notice of Scoping Period Requesting Comments on Environmental Issues for the Proposed Cameron LNG Amended Expansion Project and Notice of Public Scoping Session* (NOS). The NOS was published in the Federal Register and was mailed to federal, state, and local officials; agency representatives; affected landowners (as defined by the Commission's regulations); environmental and public interest groups; Native American Tribes; and local libraries and newspapers. This notice opened the scoping period for 30 days. We received comments in response to the NOS from the USEPA, U.S. Fish and Wildlife Service (USFWS), Louisiana Department of Wildlife and Fisheries (LDWF), Choctaw Nation of Oklahoma, Sierra Club and Healthy Gulf, **R**estore **E**xplicit **S**ymmetry **T**o **O**ur **R**avaged **E**arth (RESTORE), Southeast Laborers' District Council, Louisiana Bucket Brigade, Entergy Louisiana, and 352 individual form letters in opposition to the project. In addition, Cameron LNG provided a response to scoping comments. On April 26, 2022, FERC staff conducted a virtual public scoping session to provide an opportunity for the public to provide oral comments on environmental issues to be addressed in the EA. Two individuals and a representative from the Louisiana Environmental Action Network provided oral comments at the virtual scoping session. A transcript of the scoping session was entered into the public record for the Amended Expansion Project.[4] Comments received were in regard to purpose and need, air quality, climate change, hazardous materials, sensitive species, water resources, environmental justice, consultation with Tribal governments, cumulative impacts, alternatives, health, and safety. All substantive comments in regard to air quality, environmental justice,

[4] The transcript can be viewed on the FERC eLibrary under Accession Number 20220513-4000.

safety and reliability, climate change, and cumulative impacts are addressed in the relevant resource sections of the EA. Other comments are addressed below.

Purpose and Need

The Louisiana Bucket Brigade is opposed to all gas export terminals because the proposed terminals would sell American gas to foreign nations, including China and other geopolitical adversaries, and raise energy costs for U.S. consumers; and none would generate energy for consumption by American consumers. The Louisiana Bucket Brigade requests that the Commission deny permits for the construction of gas export terminals and halt the construction of facilities already permitted. As stated above, the EA is not a decision-making document. The purpose of our environmental review is to evaluate and disclose the environmental impacts of Cameron LNG's Amended Expansion Project, identify and assess reasonable alternatives, facilitate public involvement under NEPA, and identify and recommend specific mitigation measures to the Commission to avoid or minimize environmental impacts. This EA will aid the Commission in its decision-making process. The Commission will consider the findings of the EA, as well as non-environmental issues, in its review of the Amended Expansion Project.

Environmental Baseline

Entergy Louisiana supports Cameron's efforts to voluntarily reduce the GHG emissions and other impacts associated with its Expansion Project. Entergy Louisiana urges FERC staff to set the appropriate baseline, Cameron's construction of the Expansion Project as previously approved, when considering the environmental impacts of the Amended Expansion project. Entergy Louisiana also states that FERC staff should incorporate the net reduction in multiple environmental impacts into the EA. The Amended Expansion Project is described in section A.1, including the proposed facilities and proposed changes from the Expansion Project. As stated in section A.4, the environmental impacts for many resources remain unchanged from that analyzed in the September 2015 Environmental Assessment (September 2015 EA) for the Cameron LNG Expansion Project in Docket No. CP15-560-000, and are not addressed in this EA. Air quality and GHG emissions are discussed in sections B.2 and B.4.

Wildlife and Sensitive Species

The Louisiana Bucket Brigade is opposed to gas export terminals due to potential wildlife impacts. The environmental impacts for wildlife remain unchanged from that analyzed in the September 2015 Environmental Assessment (September 2015 EA) for the Cameron LNG Expansion Project in Docket No. CP15-560-000, and are therefore not addressed further in this EA.

The USFWS stated that the Amended Expansion Project facilities would be within the site of the existing Cameron LNG Terminal, and construction of the project would be wholly within the footprint authorized by the Commission for the Expansion Project; therefore, the USFWS had no comment. Based on the proposed location of the Amended Expansion Project activities (existing graveled area) and that there is no suitable habitat for any listed species, we

conclude that the Amended Expansion Project would have no effect on any federally listed species. Therefore, our Endangered Species Act (ESA) consultation is complete.

The LDWF stated that the proposed Amended Expansion Project would have no long-term adverse impacts on wetland functions and, therefore, LDWF has no objection. The LDWF also stated that the database indicates that the West Indian Manatee may occur in the surrounding waterbodies of the project area. There is no proposed work in waterbodies; therefore, the Amended Expansion Project would have no effect on this species. No other impacts on rare, threatened, or endangered species or critical habitats are anticipated from the proposed project.

Need for an Environmental Impact Statement

Entergy Louisiana supports FERC staff's decision not to prepare an environmental impact statement (EIS). The Sierra Club and Healthy Gulf stated that FERC must complete an EIS for the proposed Amended Expansion Project because of the changes in the Lake Charles area since the 2016 EA was issued for the Cameron LNG Expansion Project. These changes include a myriad of gas export terminals, as well as petrochemical and carbon sequestration facilities, including the proposed Hackberry CCS facility, LA Storage Hackberry Storage Project, Commonwealth LNG, Driftwood LNG, and CP2 LNG facilities. Sierra Club and Healthy Gulf also state that the potential environmental impacts indicate that an EIS is required, because the proposed Amendment is a new act in itself, which if granted, allows for design enhancements to Train 4, the abandonment of Train 5, and the simultaneous loading of LNG vessels; and the proposed Amended Expansion Project constitutes "a major Federal action," which would significantly affect the quality of the human environment because of climate concerns, air pollution, environmental justice communities, and vulnerable species in the area. Sierra Club and Healthy Gulf state that FERC must conduct an EIS in this instance rather than an EA because of the gravity of the requested Amended Expansion Project, which significantly changes the approved plans for the Expansion Project and renders the original calculations in the 2016 EA outdated. Environmental justice, air quality, and cumulative impacts are addressed in sections B.1, B.2, and B.4 below, respectively.

In regard to the need for an EIS, an EA is a concise public document for which a federal agency is responsible that serves to provide sufficient evidence and analysis for determining a finding of no significant impact. The Commission's regulations under 18 CFR 380.6(b) state: "If the Commission believes that a proposed action…may not be a major federal action significantly affecting the quality of the human environment, an EA, rather than an EIS, will be prepared first. Depending on the outcome of the EA, an EIS may or may not be prepared." In preparing this EA, we are fulfilling our obligation under NEPA to consider and disclose the environmental impacts of the Amendment. As noted above, this EA addresses the impacts that could occur should the Amended Expansion Project be approved and constructed. Based on our analysis, and the extent and content of comments received during the scoping period, we conclude in section D that the impacts associated with the Amended Expansion Project can be sufficiently mitigated to support a finding of no significant impact and, thus, an EA is warranted.

Sierra Club and Healthy Gulf also state that the Eastern black rail was not yet listed as a threatened bird species in 2016, and that if the Amended Expansion Project is approved, the cumulative impacts of the above listed facilities along with the Amended Expansion Project,

would drastically impact the Eastern black rail and its habitat. Sierra Club and Healthy Gulf state that given the elusive nature of the Eastern black rail, as well as potential habitat within the projects area, FERC should prepare an EIS and consult with the USFWS who should issue a Biological Opinion. As stated above, the Amended Expansion Project facilities would be within the site of the existing graveled/paved Cameron LNG Terminal, and construction of the project would be wholly within the footprint authorized by the Commission for the Expansion Project. Therefore, we conclude that the Amended Expansion Project construction and operation would have *no effect* on the Eastern black rail or any other species listed under the ESA, and no further ESA consultation is necessary for this project. Because the Amended Expansion Project would not impact wildlife, it would not have a cumulative impact with nearby projects. In addition, as stated above, the USFWS stated because the Amended Expansion Project facilities would be within the site of the existing Cameron LNG Terminal, and construction would be wholly within the footprint authorized by the Commission for the Expansion Project, it had no comment.

The USEPA recommended the FERC assess the regional master planning for energy needs. An individual also commented during the scoping session that FERC should conduct a programmatic EIS for LNG terminals in southwest Louisiana. We note the Commission does not have a program to direct the development of the natural gas industry's infrastructure, either on a broad regional basis or in the design of specific projects, and does not engage in regional planning exercises. As the Commission acts on individual applications, we provide a project-specific analysis here.

Cultural Resources

The USEPA recommended that FERC comply with Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments* (November 6, 2000), as applicable. The USEPA also recommended the environmental document describe the process and outcome of government-to-government consultation between the FERC and each of the Tribal governments affected by the proposed project, issues that were raised (if any), and how those issues were addressed in the selection of the proposed alternative. As the proposed amendment would occur within the authorized project area for the Cameron LNG Terminal and any ground disturbance would occur in a disturbed context, FERC determined that the Amended Expansion Project has no potential to affect historic properties. However, FERC sent the project NOS to six Tribes. In a letter sent to the Commission on April 29, 2022, the Choctaw Nation of Oklahoma requested to be a consulting party on the project and requested that they be sent the Geographic Information Systems (GIS) shapefiles of the project area and cultural resources survey reports for the project. As the project is entirely within the previously surveyed and authorized project area for the Cameron LNG Terminal, no additional surveys were conducted for the proposed Amended Expansion Project. On May 6, 2022, Cameron LNG provided the Tribe with the GIS shapefiles of the project area and the cultural resources survey report that was prepared for the Cameron Liquefaction Project.

Water Resources and Wetlands

The USEPA recommended that FERC comply with applicable Clean Water (i.e., Section 404 and Section 303(d)) and Safe Drinking Water Acts for the proposed project and include a

discussion in the environmental document. The USEPA also stated that if any portion of the proposed project includes construction activities that are not waived from National Pollutant Discharge Elimination System (NPDES) permitting, a construction general permit or other NPDES coverage from Louisiana Department of Environmental Quality may be required for stormwater discharges from construction and/or support activities. Table 1 below provides a list of known federal, state, and local permits for the Amended Expansion Project. Cameron LNG would be responsible for obtaining all permits and approvals required for the Amended Expansion Project, regardless of whether they appear in table 1. We note that a hydrostatic test water discharge permit is the only known water resources permit for this project at this time.

The Louisiana Bucket Brigade is opposed to LNG export terminals due to their potential for water pollution. The individual form letters stated that expanding the Cameron LNG terminal and adding CCS facilities would impact wetlands. However, the environmental impacts for water resources and wetlands remain unchanged from that analyzed in the September 2015 EA for the Cameron LNG Expansion Project in Docket No. CP15-560-000, and are therefore not addressed further in this EA.

Hazardous Waste

The USEPA recommended the environmental document address potential direct, indirect, and cumulative impacts of solid and hazardous waste from construction, maintenance, and operation of the proposed project. The USEPA recommends that the environmental document should identify projected solid and hazardous waste types, volumes, and expected storage, disposal, and management plans; address the applicability of state and federal hazardous waste requirements; and evaluate appropriate mitigation, including measures to minimize the generation of hazardous waste, including alternate industrial processes using less toxic materials to reduce the volume or toxicity of hazardous materials requiring management and disposal as hazardous waste. Cameron LNG would construct the Amended Expansion Project as described in its application, and our EA, for the Expansion Project (Docket No. CP15-560-000). There are no additional hazardous waste facilities as a result of this amendment. The Amended Expansion Project facilities would be within the site of the existing Cameron LNG Terminal; construction of the project would be wholly within the footprint authorized by the Commission for the Expansion Project. Cameron LNG would implement the measures in our *Upland Erosion Control, Revegetation, and Maintenance Plan* and *Wetland and Waterbody Construction and Mitigation Procedures*. In addition, Cameron LNG would follow its Environmental Plan, which addresses hazardous materials. If Cameron LNG encounters contaminated soils or hazardous waste during construction, it would implement its Unanticipated Hazardous Waste Discovery Plan.

Socioeconomics

The Louisiana Bucket Brigade is also opposed to gas export terminals due to loss of local industries. All facilities would be constructed within the existing terminal site. The environmental impacts for local industries remain unchanged from that analyzed in the September 2015 EA for the Cameron LNG Expansion Project in Docket No. CP15-560-000, and are therefore not addressed further in this EA.

The Southeast Laborers' District Council stated that the original construction of the Cameron LNG terminal was plagued by cost overruns, poor labor productivity, negative tax revenues, and the use of foreign workers displacing available local workers. The hiring practices of the applicant are not within the Commission's jurisdiction under the NGA. The facility must be constructed in accordance with the U.S. Department of Transportation's LNG facility safety standards in 49 CFR 193 which prescribes requirements for construction personnel qualifications, training, and performance evaluation. In addition, in section 3.2, we recommend that prior to commencement of service, Cameron LNG should develop procedures for offsite contractors' responsibilities, restrictions, monitoring, training, and limitations and for supervision of these contractors and their tasks by Cameron LNG staff.

Cameron LNG states that the construction workforce for the duration of the approximately 52-month Amended Expansion Project construction period would average approximately 1,500 workers per month with a peak workforce of 3,269. It estimates that approximately 30 percent of the construction workers would be local to the project area (Cameron and Calcasieu Parishes). Cameron LNG states that the construction personnel hired from outside the Amended Expansion Project area likely would be highly skilled mechanical, electrical, and instrumentation and control tradesmen.

As described in the September 2015 EA for the Cameron LNG Expansion Project in Docket No. CP15-560-000, the Expansion Project would utilize the construction workforce hired for the Liquefaction Project under Docket No. CP13-25-000 (peak construction workforce of 3,500 workers with an average workforce of about 2,300 workers per month.). The Amended Expansion Project peak workforce would be lower than the workforce analyzed for the Expansion Project; therefore, we conclude that environmental impacts for socioeconomics, including workforce, remain unchanged from that analyzed in the September 2015 EA for the Cameron LNG Expansion Project in Docket No. CP15-560-000, and are therefore not addressed further in this EA.

Carbon Capture and Sequestration Facilities

The individual form letters were opposed to Cameron LNG's expansion and addition of CCS facilities. The Sierra Club is opposed to the Amended Expansion Project and stated that FERC should analyze the impacts associated with the use of CCS in the Gulf Region. Sierra Club stated that CO_2 must be transported in a highly pressurized state, which can corrode steel, particularly in the presence of impurities, increasing the risk of leaks, fractures, and ruptures; CCS could stress water resources as the process of sequestering carbon requires cooling water; the more than 4,000 abandoned or orphaned oil and gas wells in the state can create pathways by which carbon can leak back into the atmosphere or into the aquifer; the use of CCS can prolong the use of the underlying facility (Cameron LNG) and lead to increased particulate matter; and pollutants other than carbon dioxide are not captured by CCS units. The individual form letters also stated opposition to Sempra's efforts to expand the Cameron LNG operations and add CCS facilities.

The Amended Expansion Project includes a pre-investment tie-in on the Thermal Oxidizer acid gas feed line for the possibility of future carbon sequestration. Cameron LNG states the CCS tie-in facilities proposed in the application are solely for the potential future use

of CCS, if such infrastructure is developed and assuming it is accessible to Cameron LNG both logistically and economically. Cameron LNG is not proposing to construct or operate CCS facilities in this amendment. Cameron LNG would need to file an application with the Commission for any future proposed CCS facilities within the terminal.

Sierra Club and Healthy Gulf state that FERC must consider the fact that Cameron LNG is owned by Sempra. Sempra is also the parent company of the proposed Hackberry CCS project, a carbon capture and sequestration facility; and FERC should evaluate the environmental effects of not only the Cameron LNG Amended Expansion Project, but also the proposed Hackberry CCS project because the proposed Amended Expansion Project provides CCS capabilities. As stated above, the Amended Expansion Project includes a tie-in on the Thermal Oxidizer acid gas feed line as pre-investment for the possibility of future carbon sequestration; Cameron LNG does not propose to construct or operate CCS facilities in the Amended Expansion Project. The Hackberry CCS Project includes a carbon sequestration well about 6 miles from the Cameron LNG terminal, a facility with boathouse and gangplank about 5 miles from the Cameron LNG terminal, a 16-inch-diameter suction pipeline that would connect with the Cameron LNG terminal, and a 12-inch-diameter injection pipeline which connects the well to the 16-inch-suction pipeline at the boathouse facility. Cameron LNG would need to file an application with the Commission for any future proposed CCS facilities that are within Commission jurisdiction. Cumulative impacts are addressed in section B.4.

Non-Compliance

A representative from the Louisiana Environmental Action Network commented during the scoping session that there are several non-compliance issues occurring with the current operations at the existing terminal, and these need to be addressed before moving forward with the Amended Expansion Project. Specifically, the representative stated there were unauthorized discharge events into the air, which the Louisiana Department of Environmental Quality referred to its enforcement division for violation, and wastewater discharge non-compliance which exceeded Cameron LNG's Louisiana Pollutant Discharge Elimination System (LPDES) permit limits. The Louisiana Department of Environmental Quality is the agency responsible for any violations to its air and LPDES permit and compliance. This EA analyzes the potential impacts of the Amended Expansion Project. We conduct environmental and engineering compliance inspections during construction, and we continue to conduct annual engineering safety inspections of the LNG terminal operations throughout the life of both the proposed project and the existing terminal.

Construction Dock

An individual stated concern during the scoping session in regard to the size of the construction dock shown in the appendix 1 site map. The construction dock was reviewed and approved in Docket No. CP13-25-000. No modifications to the construction dock are proposed for the Amended Expansion Project, and therefore will not be addressed further.

4.0 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Cameron LNG proposes design enhancements to Train 4 and dual LNG vessel loading, and no longer plans to construct Train 5 or Tank 5. The proposed Amended Expansion Project would not result in an increase in the size and/or frequency of LNG vessel traffic that is reflected and currently approved in Cameron LNG's existing WSA. The Amended Expansion Project facilities would be wholly within the footprint authorized by the Commission for the Expansion Project (Docket No. CP15-560-000).

Accordingly, the topics addressed in this EA include environmental justice, air quality, reliability and safety, cumulative impacts (including climate change), and alternatives. This EA describes the affected environment as it currently exists and the potential environmental consequences of the Amended Expansion Project.

The environmental impacts for the following resources remain unchanged from that analyzed in the September 2015 EA for the Cameron LNG Expansion Project in Docket No. CP15-560-000, and are therefore not addressed further in this EA:

- geology and soils;
- groundwater;
- surface water resources;
- wetlands;
- vegetation, wildlife, fisheries, and special status species;
- land use, recreation, and visual resources;
- socioeconomics;
- cultural resources; and
- noise (impacts would be less than those identified in CP15-560-000 and no new noise-sensitive areas have been identified).

COOPERATING AGENCIES

The DOE, USDOT PHMSA, and USCG participated as cooperating agencies in the preparation of the EA. Cooperating agencies have jurisdiction by law or special expertise with respect to environmental impacts involved with a proposal. The roles of the DOE, USDOT PHMSA, and USCG in the Amended Expansion Project review process are described below. The EA provides a basis for coordinated federal decision making in a single document, avoiding duplication in the NEPA environmental review process. In addition to the lead and cooperating agencies, other federal, state, and local agencies may use this EA in approving or issuing permits for all or part of the proposed amendment.

U.S. Department of Energy

Under Section 3 of the NGA, the DOE's Office of Fossil Energy and Carbon Management (DOE/FECM) is responsible for authorizing imports and exports of natural gas,

including LNG, from or to a foreign country. By law, under Section 3(c) of the NGA, applications to export natural gas to countries with which the United States has free trade agreements (FTA) requiring national treatment for trade in natural gas are deemed to be consistent with the public interest and authorization must be granted without modification or delay. In the case of applications to export LNG to countries with which the United States does not have an FTA requiring national treatment for trade in natural gas, and with which trade is not prohibited by U.S. law or policy (non-FTA countries), NGA Section 3(a) requires DOE to conduct a public interest review and grant authority to export unless it finds that the proposed exports would not be consistent with the public interest. Additionally, NEPA requires DOE to consider the environmental effects of its decisions regarding applications to export natural gas to non-FTA countries.

In response to applications submitted to DOE for the Expansion Project, on July 10, 2015, DOE issued Order No. 3680, authorizing Cameron LNG to export LNG to FTA countries in a volume equivalent to 515 Bcf/y of natural gas for a 20-year term. On July 15, 2016, DOE issued Order No. 3846, authorizing Cameron LNG to export LNG to non-FTA countries in a volume equivalent to 515 Bcf/y of natural gas for a 20-year authorization period (these volumes are not additive to one another). These authorization terms were subsequently extended through December 31, 2050.

U.S. Department of Transportation

The USDOT PHMSA has established the minimum federal safety standards for LNG facilities in compliance with Title 49 of the U.S. Code, Section 60101, et seq (49 USC 60101). Those standards are codified in 49 CFR 193 *Liquefied Natural Gas Facilities: Federal Safety Standards* and apply to the siting, design, construction, operation, maintenance, and security of LNG facilities. The National Fire Protection Association Standard 59A, *Standard for the Production, Storage, and Handling of Liquefied Natural Gas (2001 edition and portions of 2006 edition)*, is incorporated into these requirements by reference, with regulatory preemption in the event of conflict.

On February 11, 2004, the USDOT Research and Special Programs Administration (superseded by USDOT PHMSA), USCG, and 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. Under the Interagency Agreement, 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 USCG participate as cooperating agencies but remain responsible for enforcing their regulations covering LNG facility design, construction, and operation.

On August 31, 2018, FERC and USDOT PHMSA signed a memorandum of understanding (2018 MOU) to improve agency coordination on LNG project reviews and eliminate duplicated efforts. In the 2018 MOU, USDOT PHMSA agreed to issue a Letter of Determination (LOD) stating whether LNG facilities would be capable of complying with location criteria and design standards contained in 49 CFR 193 Subpart B.

In order to meet the USDOT PHMSA siting standards, Cameron LNG submitted engineering design documentation to USDOT PHMSA from January 2022 to October 2022, to demonstrate that the modifications associated with the Amended Expansion Project and marine transfer system comply with the siting requirements under Part 193, Subpart B. USDOT PHMSA's analysis and determination of the siting package will serve as one of the considerations for the Commission to deliberate in its decision to authorize or deny the Amended Expansion Project.

On October 26, 2022, USDOT PHMSA provided a LOD to FERC on the 49 CFR 193, Subpart B, regulatory requirements. The LOD concluded that the proposed siting of the Amended Expansion Project and marine dual loading system complies with the Federal Pipeline Safety Standards set forth in Part 193, Subpart B. If the project is subsequently modified so that it differs from the details provided in the documentation submitted to FERC and USDOT PHMSA, further review will be conducted by USDOT PHMSA.

U.S. Coast Guard

The USCG is the principal federal agency responsible for maritime safety, security, and environmental stewardship in U.S. ports and waterways. It is the federal agency responsible for assessing the suitability of the project waterways (defined as the waterways that begin at the outer boundary of the navigable waters of the U.S.) for LNG marine traffic. The USCG exercises regulatory authority over LNG facilities that affect the safety and security of port areas and navigable waterways under Executive Order 10173; the *Magnuson Act* (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). If the Amended Expansion Project is approved, the USCG would continue to exercise regulatory oversight of the safety and security of the LNG terminal facilities in compliance with 33 CFR 127.

Cameron LNG conferred with the USCG Marine Safety Unit (MSU) regarding their approved WSA. The Commander of the MSU advised Cameron LNG that since their Amended Expansion Project does not propose any changes to the size or frequency of LNG vessel traffic, no modifications to the WSA are required.

5.0 PERMITS, APPROVALS, AND REGULATORY CONSULTATIONS

Table 1 provides a list of known federal, state, and local permits for the Amended Expansion Project. The proposed Amended Expansion Project would not result in any construction or footprint changes which would affect the previously received environmental clearances and authorizations for the Terminal. Cameron LNG would be responsible for obtaining all permits and approvals required for the Amended Expansion Project.

In accordance with the 2007 Memorandum of Understanding between the FERC and the United States Department of Defense (DOD) (http://www.ferc.gov/legal/mou/mou-dod.pdf), the FERC sent a letter to the DOD on April 20, 2022 requesting their comments on whether the proposed Amended Expansion Project could potentially have an impact on the test, training, or operational activities of any active military installation. On June 21, 2022, the FERC received a response letter from the DOD Siting Clearinghouse stating that the proposed Cameron LNG

Amended Expansion Project would have a minimal impact on military training and operations conducted in the project area.

1.

Table 1
Anticipated Permits, Reviews, and Consultations for the Project

Agency	Permit/Approval/Consultation	Status
FERC	Application to Amend Certificate under Section 3 of the NGA (CP15-560-000, May 5, 2016)	Application filed on January 18, 2022.
DOE	Report expressing intent to request Partial Vacatur of Long Term, Multi-Contract Authorization to Export Natural Gas to Free Trade Agreement Countries DOE Order Nos. 3680 and 3680-A, pending FERC approval Report expressing intent to request Partial Vacatur of Long Term, Multi-Contract Authorization to Export Natural Gas to Non-Free Trade Agreement Countries under DOE Order Nos. 3846 and 3846-A (Note: the export volume of the Amended Expansion Project will not exceed export volumes previously authorized.)	Report filed February 18, 2022 (application not yet submitted to DOE). Report filed February 18, 2022 (application not yet submitted to DOE).
USEPA	Spill Prevention Control & Countermeasure (SPCC) Plan (Clean Water Act)	Construction SPCC to be prepared prior to construction. Operating SPCC to be updated prior to Train 4 In-Service.
USCG	Project Consultation	Correspondence September 10, 2021. Concurrence received September 15, 2021. No modifications to WSA required.
USDOT PHMSA	Project Consultation	The USDOT PHMSA submitted the LOD to the FERC on October 26, 2022, which found the proposed siting complies with the Federal Pipeline Safety Standards set forth in 49 CFR 193.
USDOT Federal Aviation Administration	Notification of Proposed Construction Possibly Affecting Navigable Air Space	Application will be submitted ~3 months prior to construction.

Louisiana Department of Environmental Quality Air Quality Division	Title V & PSD Air Permits	Application filed June 30, 2022.
Louisiana Department of Environmental Quality Water Quality Division	Hydrostatic Test Water Discharge General Permit LAG670000 (Note – this permit is only for construction related hydrostatic test discharges. Hydrostatic test discharges associated with facility operations are included in the LPDES permit.)	Will be acquired prior to construction.

B. ENVIRONMENTAL ANALYSIS

The following sections discuss the Amended Expansion Project's potential direct and indirect impacts on environmental resources, regulatory oversight, and engineering design. An impact would be considered significant if it would result in a substantial adverse change in the physical environment.

1.0 ENVIRONMENTAL JUSTICE

According to the USEPA, "environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." Fair treatment means that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, and commercial operations or policies (USEPA 2020). Meaningful involvement means:

1. people have an opportunity to participate in decisions about activities that may affect their environment and/or health;
2. the public's contribution can influence the regulatory agency's decision;
3. community concerns will be considered in the decision-making process; and
4. decision makers will seek out and facilitate the involvement of those potentially affected (USEPA 2020).

In conducting NEPA reviews of proposed natural gas projects, the Commission follows Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, which directs federal agencies to identify and address "disproportionately high and adverse human health or environmental effects" of their actions on minority and low-income populations (i.e., environmental justice communities).[5] Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*, also directs agencies to develop "programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts."[6] The term "environmental justice community" includes disadvantaged communities that have been historically marginalized and overburdened by pollution.[7] Environmental justice communities include, but may not be limited to minority populations, low-income populations, or indigenous peoples.[8]

Commission staff used USEPA's Federal Interagency Working Group on Environmental Justice & NEPA Committee's publication, *Promising Practices for EJ Methodologies in NEPA Reviews* (*Promising Practices*) (USEPA 2016), which provides methodologies for conducting

[5] Exec. Order No. 12,898, 59 Fed. Reg. 7629, at 7629, 7632 (Feb. 11, 1994).
[6] Exec. Order No. 14,008, 86 Fed. Reg. 7619, at 7629 (Jan. 27, 2021).
[7] *Id.*
[8] *See* USEPA, *EJ 2020 Glossary* (Aug. 18, 2022), https://www.epa.gov/environmentaljustice/ej-2020-glossary.

environmental justice analyses throughout the NEPA process for this project. Commission staff's use of these methodologies is described throughout this section.

Also as recommended by USEPA, Commission staff used USEPA's Environmental Justice Screening and Mapping Tool (EJScreen) as an initial step to gather information regarding minority and/or low-income populations; potential environmental quality issues; environmental and demographic indicators; and other important factors. USEPA recommends that screening tools, such as EJScreen 2.0, be used for a "screening-level" look and a useful first step in understanding or highlighting locations that may require further review.

1.1 Meaningful Engagement and Public Involvement

The CEQ's *Environmental Justice Guidance Under the National Environmental Policy Act (CEQ Environmental Justice Guidance)* (CEQ 1997) and *Promising Practices* recommend that federal agencies provide opportunities for effective community participation in the NEPA process, including identifying potential effects and mitigation measures in consultation with affected communities and improving the accessibility of public meetings, crucial documents, and notices.[9] They also recommend using adaptive approaches to overcome linguistic, institutional, cultural, economic, historical, or other potential barriers to effective participation in the decision-making processes of federal agencies. In addition, Section 8 of Executive Order 13985, *Advancing Racial Equity and Support for Underserved Communities Through the Federal Government*, strongly encourages independent agencies to "consult with members of communities that have been historically underrepresented in the Federal Government and underserved by, or subject to discrimination in, federal policies and programs."

There have been opportunities for public involvement during the Commission's environmental review processes. On March 31, 2022, the Commission issued a *Notice of Scoping Period Requesting Comments on Environmental Issues for the Proposed Cameron LNG Amended Expansion Project* (NOS).[10] The NOS was published in the Federal Register and was mailed to federal, state, and local officials; agency representatives; affected landowners; environmental and public interest groups; Native American Tribes; and local libraries and newspapers. Commission staff also included environmental justice stakeholders on the mailing list, as well as local churches, schools, community centers, retail establishments, public health clinics, and community groups to engage the environmental justice communities near the proposed project. This notice opened the scoping period for 30 days. On April 26, 2022, FERC staff conducted a virtual public scoping session to provide an opportunity for the public to comment on environmental issues to be addressed in the EA.

All documents that form the administrative record for these proceedings are available to the public electronically through the internet on the FERC's website (www.ferc.gov). Anyone may comment to FERC about the project, either in writing or electronically. All substantive environmental comments received prior to issuance of this EA have been addressed within this document.

[9] 1997 CEQ Guidance at 4.
[10] 87 Fed. Reg. 19,915

Regarding future engagement and involvement, in 2021, the Commission established the Office of Public Participation (OPP) to support meaningful public engagement and participation in Commission proceedings. OPP provides members of the public, including environmental justice communities, landowners, Tribal citizens, and consumer advocates, with assistance in FERC proceedings—including navigating Commission processes and activities relating to the project. For assistance with interventions, comments, requests for rehearing, or other filings, and for information about any applicable deadlines for such filings, members of the public are encouraged to contact OPP directly at 202-502-6592 or OPP@ferc.gov for further information.

FERC received comments on environmental justice from the USEPA and the Southeast Laborers' District Council. The USEPA recommends that the environmental document include an evaluation of minority and low-income populations in proximity to the geographic scope of the proposed project, use of available tools (i.e., EJ Screen Mapping Tool, U.S. Census Bureau, area knowledge) to identify and screen populations potentially impacted by the proposed project, and utilize *Promising Practices* for considering and analyzing minority and low-income populations. They further suggest that a demographics map depicting minority and low-income populations in proximity to the project area in relation to potential impacts should be included in the environmental document.

The USEPA also recommends that the Commission perform meaningful and comprehensive engagement with minority and low-income population and applicable stakeholders. Community engagement activities were previously described in this section. Additionally, the USEPA recommends the FERC discuss the cumulative impacts of approved projects; concurrently proposed projects; reasonably foreseeable planned actions on minority and low-income populations; and the short and long-term effects of the proposed project on the surrounding area. These comments are addressed below.

The Southeast Laborers' District Council states that the applicant should commit to hiring more local workers, including those from environmental justice communities. Cameron LNG estimates that approximately 30 percent of the construction workers would be local to the project area (Cameron and Calcasieu Parishes). As noted in section A.3 of this EA, the hiring practices of the applicant are not within the Commission's jurisdiction under the NGA.

1.2 Identification of Environmental Justice Communities

According to the CEQ's *Environmental Justice Guidance* and *Promising Practices*, minority populations are those groups that include: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic. Following the recommendations set forth in *Promising Practices*, FERC uses the **50 percent** and the **meaningfully greater analysis** methods to identify minority populations. Using this methodology, minority populations are defined in this EA where either: (a) the aggregate minority population of the block groups in the affected area exceeds 50 percent; or (b) the aggregate minority population in the block group affected is 10 percent higher than the aggregate minority population percentage in the county. The guidance also directs low-income populations to be identified based on the annual statistical poverty thresholds from the U.S. Census Bureau. Using *Promising Practices'* **low-income threshold criteria** method, low-income populations are identified as block groups

where the percent of low-income population in the identified block group is equal to or greater than that of the county.

Table 2 below identifies the minority populations (by race and ethnicity) and low-income populations within Louisiana, the parishes affected by the project (Calcasieu and Cameron), and census block groups[11] within 2 miles of the Cameron LNG Terminal. For the purposes of analyzing impacts on environmental justice communities, this EA considers a 2-mile area as the appropriate unit of geographic analysis. We believe the 2-mile radius is sufficiently broad considering that, with the exception of sulfur dioxide (SO_2) emissions during operation, all other resource impacts as a result of the amendment would be equal or less than the currently authorized Expansion Project, and considering the likely concentration of the minor SO_2 emission increase proximal to the aboveground facilities.[12] In addition, we believe the 2 mile radius is sufficient given that the Amended Expansion Project would result in reductions in nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM), volatile organic compounds (VOC), and hazardous air pollutants (HAPs) operational emissions when compared to the currently authorized Expansion Project.

To ensure we are using the most recent available data, we use U.S. Census American Community Survey[13] File# B03002 for the race and ethnicity data and Survey File# B17017 for poverty data at the census block group level. As presented in table 2 and depicted in figures 2 and 3, the U.S. Census Bureau American Community Survey census block group data show that there are minority and low-income communities within 2 miles of the proposed project facilities. The project is within Census Tract 32, Block Group 2 in Calcasieu Parish and Census Tract 9702.03, Block Group 1 in Cameron Parish. Census Tract 32, Block Group 2 in Calcasieu Parish does not meet the criteria as an environmental justice community. Census Tract 9702.03, Block Group 1 in Cameron Parish has a minority population level of 12.4 percent. This is meaningfully greater than the Cameron Parish reference value of 9.8 percent, and thus indicates the presence of an environmental justice community. This census block group also has low-income population of 8.3 percent, which is greater than the Parish level of 6.9 percent, also indicating the presence of an environmental justice community.

[11] Census block groups are statistical divisions of census tracts that generally contain between 600 and 3,000 people. U.S. Census Bureau. 2022. Glossary: Block Group. Available online at: https://www.census.gov/programs-surveys/geography/about/glossary.html#par_textimage_4. Accessed April 2022.

[12] Air emissions for SO_2, the only criteria pollutant that would increase, would not exceed the significant impact level; therefore, the project would not contribute to adverse ambient air quality impacts beyond the fence line.

[13] U.S. Census Bureau, American Community Survey 2021 ACS 5-Year Estimates Detailed Tables, File# B17017, Poverty Status in the Past 12 Months by Household Type by Age of Householder, https://data.census.gov/cedsci/table?q=B17017; File #B03002 Hispanic or Latino Origin By Race, https://data.census.gov/cedsci/table?q=b03002.

TABLE 2
Minority Populations by Race and Ethnicity and Low-Income Populations in the Project Area

	RACE AND ETHNICITY COLUMNS										LOW INCOME COLUMN
State/Parish	**White Alone Not Hispanic (percent)**	**African American (percent)**	**Native American/ Alaska Native (percent)**	**Asian (percent)**	**Native Hawaiian & Other Pacific Islander (percent)**	**Some Other Race (percent)**	**Two or more races (percent)**	**Hispanic or Latino (percent)**	**Total Minority[a] (percent)**		**Below Poverty Level (percent)**
Louisiana	58.3	32.0	0.5	1.7	0.0	0.3	2.0	5.2	41.7		18.0
Calcasieu Parish	66.9	25.0	0.2	1.5	0.0	0.1	2.3	3.8	33.0		15.8
Census Tract 18.03, Block Group 3	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		9.2
Census Tract 32, Block Group 2	95.6	0.0	0.0	0.3	0.0	0.0	2.0	2.0	4.5		14.3
Cameron Parish	90.2	1.5	0.6	0.4	0.0	0.0	2.7	4.6	9.8		6.9
Census Tract 9701.01, Block Group 2	99.9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1		**11.7**
Census Tract 9702.03, Block Group 1	87.6	0.0	0.0	0.0	0.0	0.0	0.0	12.4	**12.4**		**8.3**
Census Tract 9702.03, Block Group 2	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		**16.0**

Source: American Community Survey, 2016-2020, File # B01017 and File # B03002.
[a] "Minority" refers to people who reported their ethnicity and race as something other than non-Hispanic White.
Low-income or minority populations exceeding the established thresholds are indicated in red, bold type and shaded blue.

Figure 2 Minority Communities within 2 miles of the Project

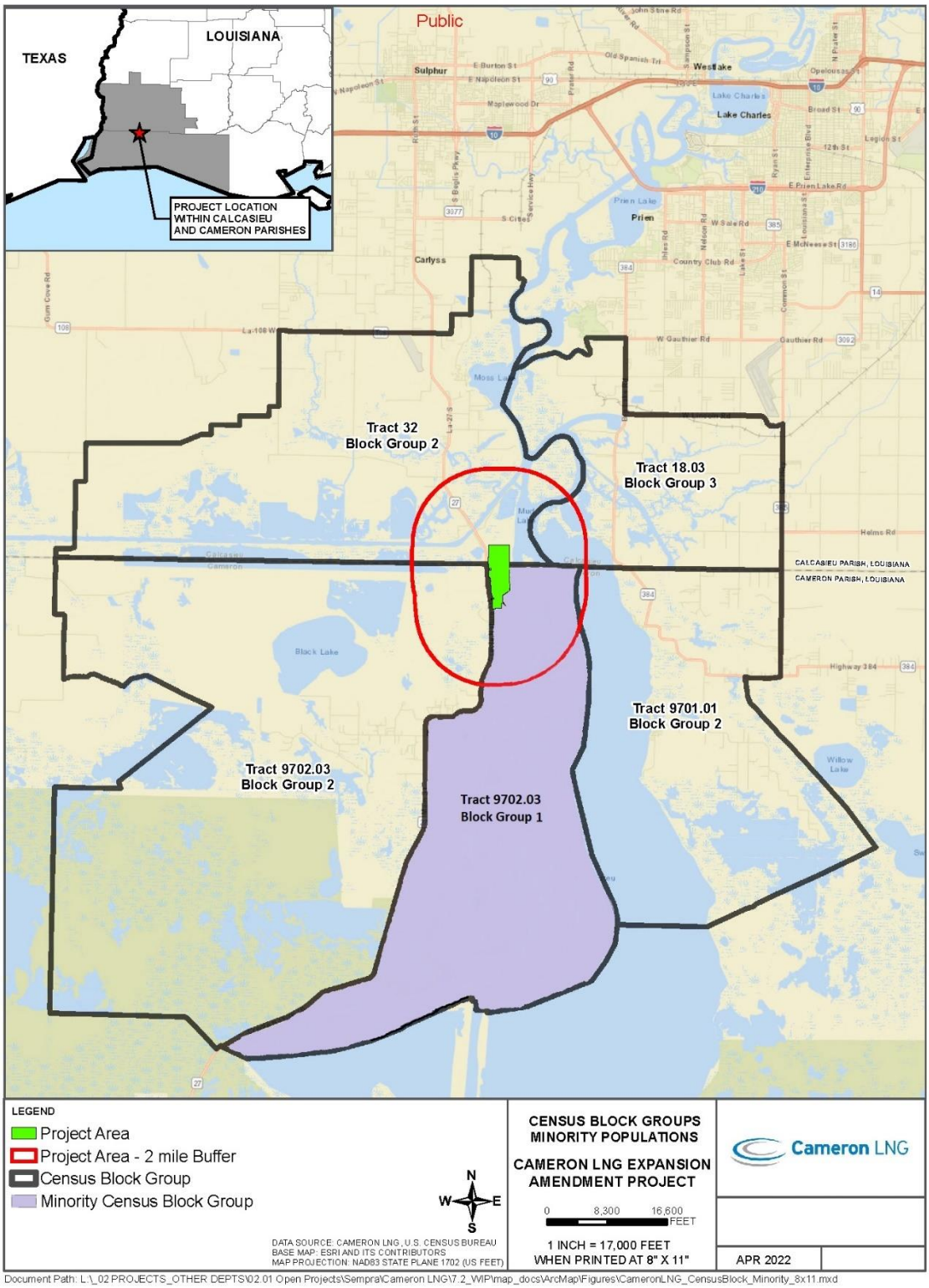
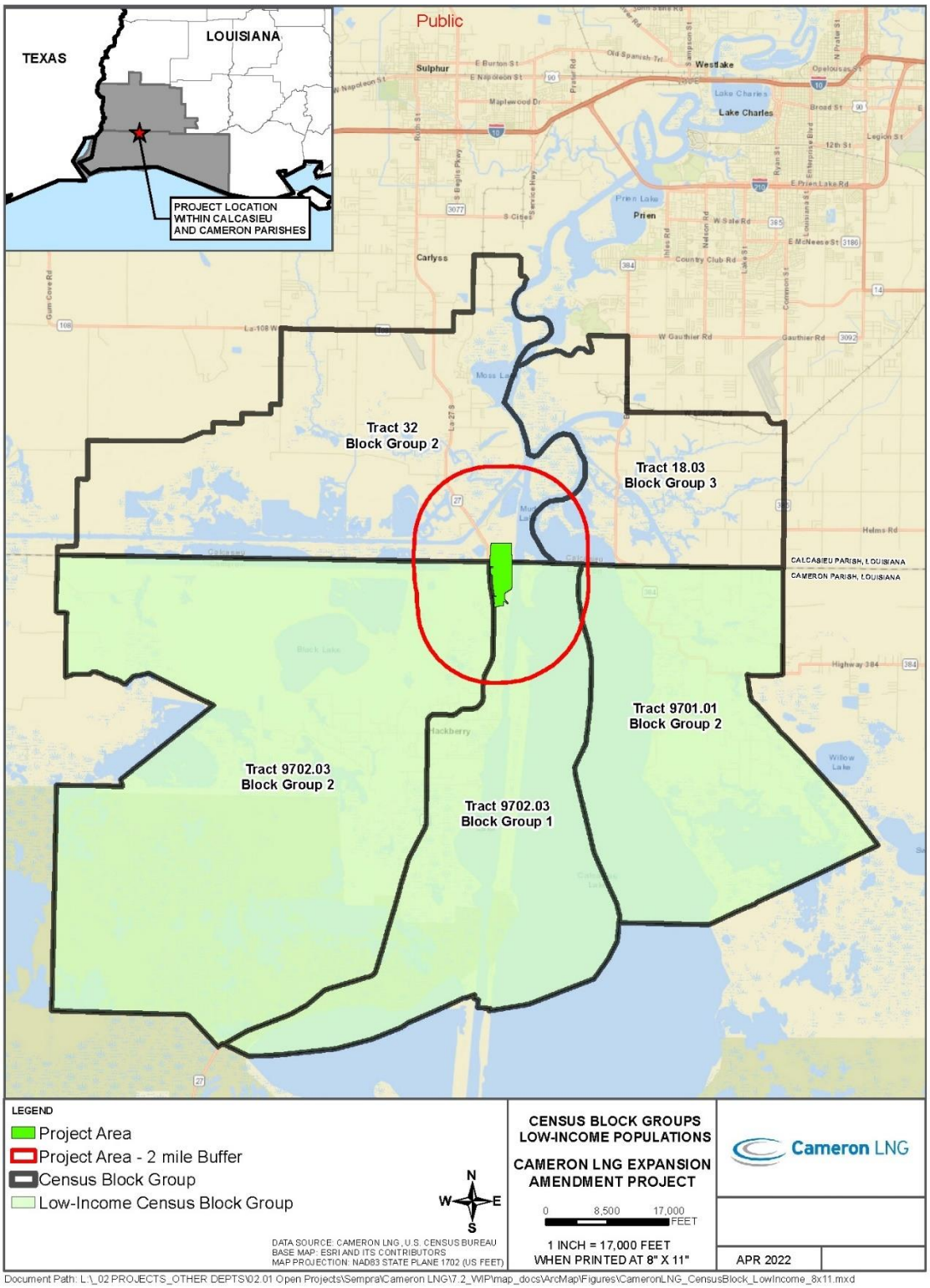


Figure 3 Low-Income Communities within 2 miles of the Project



Two other census block groups within 2-miles of the project in Cameron Parish meet the definition of an environmental justice community. In Census Tract 9701.01, Block Group 2, approximately 1.75-miles east of the project site, an estimated 11.7 percent of the population is below the poverty level. Census Tract 9702.03, Block Group 2 borders the western boundary of the project site and has its 16 percent of its population below the poverty level. These values are higher than the Cameron Parish reference value of 6.9 percent, and thus indicates the presence of an environmental justice community. Neither of the two census block groups in Calcasieu Parish affected by the project were identified as having minority or low-income populations; therefore, the census block groups in Calcasieu Parish are not discussed further in regard to environmental justice impacts.

In summary, three of the five census block groups within 2 miles of the project are environmental justice communities.

1.3 Impacts on Environmental Justice Communities

As previously described, *Promising Practices* provides methodologies for conducting environmental justice analyses. Issues considered in the evaluation of environmental justice include human health or environmental hazards; the natural physical environment; and associated social, economic, and cultural factors. Consistent with *Promising Practices* and Executive Order 12898, we reviewed the Amended Expansion Project to determine if its resulting impacts would be disproportionately high and adverse on minority and low-income populations and also whether impacts would be significant.[14] In addition, as previously stated in section B.1.2, the USEPA recommends that the EA include impacts on environmental justice communities from the project. This analysis is included in this section.

The Cameron LNG Terminal site is partly within Census Tract 9702.03, Block Group 1, which is defined as an environmental justice community. Additionally, Census Tract 9701.01, Block Group 2 and Census Tract 9702.03, Block Group 2 are within 2 miles of the terminal and have low-income populations higher than the Cameron Parish level, indicating that they are environmental justice communities.

As previously discussed, the Amended Expansion Project does not involve the construction of new facilities, only process equipment modifications to previously authorized facilities and the Amended Expansion Project would result in reductions in NO_x, CO, PM, VOC, and HAPs operational emissions when compared to the currently authorized Expansion Project. In addition, the proposed Amended Expansion Project would not result in an increase in the size and/or frequency of LNG vessel traffic. With the proposed Amended Expansion Project, the overall maximum productive capacity of the Expansion Project would be reduced from 9.97 MTPA to 6.75 MTPA. Accordingly, this EA describes the affected environment as it currently exists and the potential environmental consequences of the Amended Expansion Project on air quality and environmental justice communities.

[14] *See Promising Practices* at 33 (stating that "an agency may determine that impacts are disproportionately high and adverse, but not significant within the meaning of NEPA" and in other circumstances "an agency may determine that an impact is both disproportionately high and adverse and significant within the meaning of NEPA").

Factors that could affect environmental justice communities include impacts on air quality from production equipment modifications (see section B.2). Potentially adverse environmental effects on surrounding communities associated with the project, including environmental justice communities, would be minimized and/or mitigated. In general, the magnitude and intensity of the aforementioned impacts would be greater for individuals and residences closest to the project's facilities and would diminish with distance. These impacts are addressed in greater detail in the associated sections of this EA. Environmental justice concerns are not present for other resource areas such as geology, soils, groundwater, surface water quality, wetlands, fisheries, wildlife, traffic, socioeconomics, cultural resources, land use, visual, or noise due to the lack of impact the Amended Expansion Project would have on these resources.

Air Quality

The USEPA has promulgated the National Ambient Air Quality Standards (NAAQS) to protect human health and welfare. The NAAQS include primary standards, which are designed to protect human health, including the health of sensitive subpopulations such as children and those with chronic respiratory problems. The NAAQS also include secondary standards designed to protect public welfare, including economic interests, visibility, vegetation, animal species, and other concerns not related to human health. Areas meeting the NAAQS are termed attainment areas, and areas not meeting the NAAQS are termed nonattainment areas. Areas that have insufficient data to make a determination of attainment or nonattainment are unclassified or are not designated but are treated as being attainment areas for permitting purposes. The attainment designation of an area is determined on a pollutant-by-pollutant basis and for each established primary standard. All parishes in the project area are in attainment for criteria pollutants.

Cameron LNG completed air quality dispersion modeling for the Cameron LNG Terminal (including existing Trains 1-3 and the proposed Train 4) that demonstrated continued compliance with the NAAQS (see section B.2). As shown in table 5 and discussed further below in section B.3, the Amended Expansion Project would result in reductions of 85.7, 48.1, 83.6, 61.0, and 68.2 percent for NO_x, CO, PM, VOC, and HAPs, respectively, when compared to the currently authorized Expansion Project; there would be a minor increase (1.1 tpy) in SO_2 emissions. To determine the project's impact on air quality, an air pollutant dispersion model (model) was completed. A refined air impact modeling analysis was performed for the project emissions including other projects (or emissions sources) within 50 kilometers (km) of the project combined with background concentrations as recorded by the nearby Westlake, Louisiana monitor about 20 miles northeast. The model indicated that the maximum concentrations for each pollutant and averaging period were less than the significant impact level (SIL) for all pollutants with the exception of 1-hour nitrogen dioxide (NO_2). For 1-hour NO_2, a cumulative dispersion model was completed, which was performed for the project's emission sources and other projects (or emissions sources) within 50 kilometers (km) of the Cameron LNG Terminal, combined with background concentrations. The cumulative modeling for 1-hour NO_2 showed the combined emissions from background, amendment project sources, and other projects in a 50 km radius may result in potential exceedances of the 1-hour NO_2 at some receptor locations. However, the Cameron LNG Terminal's (Trains 1-3 and the proposed Train 4) contribution to

these potential modeled exceedances was less than the SIL at each location.[15] According to the USEPA and standard dispersion modeling protocol, if a project's contribution to a predicted cumulative exceedance is less than the SIL, the project would not likely contribute to adverse air quality impacts or result in an exceedance of the NAAQS. Based on the emissions estimates and modeling results, we conclude that air quality impacts from operation of project facilities would not result in a significant impact on local or regional air quality. Additional information on air quality is available in section B.2.0 below. Although the Cameron LNG Terminal's emissions would be in compliance with the NAAQS, and the NAAQS are designated to protect sensitive populations, we acknowledge that NAAQS attainment alone may not assure there is no localized harm to such populations due to project emissions of VOC, HAPs, as well as issues such as the presence of non-project related pollution sources, local health risk factors, disease prevalence, and access (or lack thereof) to adequate care. Overall, the construction and operational emissions from the project would not have significant adverse air quality impacts on the environmental justice populations in the project area. Air quality impacts are discussed in more detail in section B.2.

1.4 Environmental Justice Impact Mitigation

As described in *Promising Practices*, when an agency identifies potential adverse impacts it may wish to evaluate practicable mitigating measures. Cameron LNG has committed to several minimization and mitigation measures to reduce impacts on air quality. During construction, Cameron LNG would limit or mitigate fugitive dust emissions if necessary, by spraying water to dampen the surfaces of dry work areas and/or by the application of calcium chloride or other dust suppressants as needed. During operation Cameron LNG is proposing the use of ultra-low sulfur fuel, good combustion practices, and compliance with NSPS subpart IIII as BACT for reducing NO_x, CO, and VOC emissions from its internal combustion engines. Furthermore, one of Cameron LNG's purposes in proposing the Amended Expansion Project is to reduce the GHG emissions.

Mitigation measures would be implemented across the project area, including within the identified environmental justice communities. In section D of this EA, we conclude that if Cameron LNG operates the proposed facilities in accordance with its application and supplements, approval of the Amended Expansion Project would not constitute a major federal action significantly affecting the quality of the human environment.

1.5 Determination of Disproportionately High and Adverse Impacts on Environmental Justice Communities

As described throughout this EA, the proposed Amended Expansion Project would have limited impacts on the environment, and would result in a net reduction in air emissions that may affect individuals living in the vicinity of the Amended Expansion Project facilities, including environmental justice populations. As shown in table 5 and discussed further below in section B.3, the Amended Expansion Project would result in reductions of 85.7, 48.1, 83.6, 61.0, and

[15] The project's contribution to each potential exceedance and the exceedance location is available under accession no. 20220318-5069.

68.2 percent for NO_x, CO, PM, VOC, and HAPs, respectively, when compared to the currently authorized Expansion Project; there would be a minor increase (1.1 tpy) in SO_2 emissions. However, the dispersion modeling results indicate that the project's maximum concentrations for SO_2 would be less than the SIL; therefore, SO_2 emissions are not expected to result in adverse effects on ambient air quality. Given the air emission reductions and lack of impact on any other resources, we conclude that impacts associated with the Amended Expansion Project on environmental justice communities would not be disproportionately high and adverse. Operational project impacts on environmental justice communities associated with air emissions from operation of the Cameron LNG expansion would be lower than the currently authorized Expansion Project, meet applicable standards and guidelines, and would be less than significant. Environmental justice communities could experience impacts associated with GHGs due to the impacts of compound extreme events (such as simultaneous heat and drought, or flooding associated with high precipitation on top of saturated soils), which may exacerbate preexisting community vulnerabilities and have a cumulative adverse impact on environmental justice communities; however, the proposed amendment would reduce GHG emissions from the currently authorized Expansion Project.

In summary, as the Amended Expansion Project would result in a reduction of impacts on environmental justice communities, we find that the construction and operation of the Amended Expansion Project would not have disproportionately high and adverse impacts on environmental justice communities. In addition, impacts would not be significant.

2.0 AIR QUALITY

Local and regional air quality in the project area would potentially be affected by the Amended Expansion Project. This section characterizes the existing air quality and describes potential impacts the Amended Expansion Project may have on air quality regionally and locally. The USEPA commented that the EA should include a discussion of existing conditions, a quantification of emissions, an identification of emissions sources, and a Construction Emissions Mitigation Plan. These comments are addressed in the applicable sections below.

The term air quality refers to relative concentrations of pollutants in the ambient air. Pollutants of concern are primarily ground-level ozone (ozone), CO, NO_x, SO_2, and respirable and fine particulate matter (inhalable particulate matter with an aerodynamic diameter less than or equal to 10 microns [PM_{10}] and less than or equal to 2.5 microns [$PM_{2.5}$]). Ozone is not directly emitted into the atmosphere from an emissions source. Ozone develops as a result of a chemical reaction between NO_x and VOCs in the presence of sunlight.

As well as being the reactant to form ozone, VOCs are a subset of organic compounds that are emitted during fossil-fuel combustion and can cause a variety of health effects, from irritation to more serious health impacts.

The term "greenhouse gases" (GHG) refers to the gases and aerosols that occur in the atmosphere both naturally and as a result of human activities, such as the burning of fossil fuels. GHGs produced by fossil-fuel combustion are primarily carbon dioxide (CO_2), methane, and nitrous oxide. GHGs' status as a pollutant is not related to toxicity, as they are non-hazardous to

health at normal ambient concentrations. GHGs absorb infrared radiation in the atmosphere, and an increase in emissions of these gases is the primary cause of warming of the climatic system.[16]

Existing Air Quality

The Amended Expansion Project is proposed in Cameron and Calcasieu Parishes, Louisiana where the climate is humid and subtropical with long, hot summers and short, mild winters (USEPA, 2014). Proximity to the Gulf of Mexico and the Calcasieu River Ship Channel means that humidity in the project area is relatively high. Wind direction in the project area is dependent on the time of year. Spring and summer months experience winds coming from the south, whereas during the fall and winter months, wind direction is typically from the north or northeast. Over the course of the year, typical wind speeds vary from 1 mile-per-hour (mph) to 27 mph, with winds rarely exceeding 32 mph. The highest average monthly wind speed of 17 mph (moderate breeze) occurs around mid-February each year. The lowest average monthly wind speed of 8 mph (gentle breeze) occurs around early August, at which time the average daily maximum wind speed is 15 mph (moderate breeze).

The project area receives an annual average of 57.2 inches of rain. February is typically the driest month of the year with a monthly mean of 3.3 inches, whereas June tends to be the wettest month with a monthly mean of 6.1 inches. Snow events are rare, with an annual mean of 0.3 inch of snow, which is likely to occur in January or February. Temperatures range from a daytime average of 60.6 °F in February to 91.3 °F in August (NOAA, 2004).

The USEPA states that the environmental health and safety risks that may disproportionately affect children be identified and assessed. Ambient air quality is protected by the Clean Air Act (CAA) of 1970, as amended in 1977 and 1990. The USEPA oversees the implementation of the CAA and establishes NAAQS to protect human health and welfare (USEPA 2020).[17] NAAQS have been developed for seven "criteria air pollutants," including NO_2, CO, ozone, SO_2, $PM_{2.5}$, PM_{10}, and lead, and include levels for short-term (acute) and long-term (chronic) exposures. The NAAQS include two standards, which are primary and secondary. Primary standards establish limits that are considered to be protective of human health and welfare, including sensitive populations such as children, the elderly, and those with compromised respiratory function, i.e. asthmatics. Secondary standards set limits to protect public welfare, including protection against reduced visibility and damage to crops, vegetation, animals, and buildings (USEPA 2020). States have the authority to adopt ambient air quality standards if they are at least as stringent as the NAAQS. While states can promulgate more stringent standards than the NAAQS, the Louisiana Department of Environmental Quality (LDEQ) has adopted all NAAQS established by the USEPA.

The USEPA, and state and local agencies have established a network of ambient air quality monitoring stations to measure concentrations of criteria pollutants across the United

[16] Further information regarding GHGs and increasing levels of CO_2 can be found at https://www.epa.gov/climate-indicators

[17] The current NAAQS are listed on the USEPA's website at https://www.epa.gov/criteria-air-pollutants/naaqs-table.

States. The data are then averaged over a specific time period and used by regulatory agencies to determine compliance with the NAAQS and to determine if an area is in attainment (criteria pollutant concentrations are below the NAAQS), nonattainment (criteria pollutant concentrations exceed the NAAQS), or maintenance (area was formerly nonattainment and is currently in attainment). Calcasieu and Cameron Parishes are both currently in attainment with the NAAQS.

2.1 Federal Air Quality Requirements

The provisions of the CAA that are applicable to the Amended Expansion Project are discussed below.

Prevention of Significant Deterioration and New Source Review

Proposed new or modified air pollutant emission sources must undergo a New Source Review (NSR) prior to construction or operation. Through the NSR permitting process, federal and state regulatory agencies review and approve project emissions increases or changes, emissions controls, and various other details to ensure air quality does not deteriorate as a result of new or modified existing emission sources. The three basic categories of NSR permitting are Prevention of Significant Deterioration (PSD), Nonattainment New Source Review (NNSR), and minor source NSR. PSD, NNSR, and minor source NSR are applicable depending on the size of the proposed project, the projected emissions, and if the project is proposed in an attainment area or nonattainment/maintenance area. For the Amended Expansion Project, only PSD is applicable.

PSD regulations define a major source as any source type belonging to a list of named source categories that have a potential to emit 100 tons per year (tpy) or more of any regulated pollutant or 250 tpy for sources not among the listed source categories. These are referred to as the PSD major source thresholds. The existing Cameron LNG Terminal is a PSD major source; the Expansion Project was a major modification. As discussed further below, the Amended Expansion Project would require a modification to the existing PSD air quality permit and would result in a decrease in emissions from the currently authorized air permit.

Title V Permitting

Title V is an operating air permit program run by each state for each facility that is considered a "major source." The threshold for an air emission major source is 100 tpy for criteria pollutants (or lower as defined by nonattainment status), 10 tpy for any single HAP, and 25 tpy for total HAPs. The current Title V permit includes the Cameron LNG Terminal and the Expansion Project (inclusive of Trains 1 through 5). As such, a modification to the current Title V permit would be required to construct and operate the Amended Expansion Project. The Amended Expansion Project would result in a decrease in emissions from the currently authorized air permit.

New Source Performance Standards

The USEPA promulgates New Source Performance Standards (NSPS) for new, modified, or reconstructed stationary sources to control emissions to the level achievable by the best-

demonstrated technology for stationary source types or categories as specified in the applicable provisions. The NSPS also establish fuel, monitoring, notification, reporting, and recordkeeping requirements.

NSPS Subpart KKKK sets emission standards from new stationary combustion turbines. Subpart KKKK would apply to the existing turbines but not the electric-driven turbines proposed as part of the Amended Expansion Project.

The two emergency generators are subject to NSPS Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines.

The proposed hot oil heaters are subject to NSPS Subpart Dc – Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units.

The existing condensate storage tank is subject to NSPS Subpart Kb – Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984. This tank would be utilized for Train 4 condensate handling.

Cameron would be required to comply with all applicable requirements of these NSPS.

National Emission Standards for Hazardous Air Pollutants

The 1990 CAA amendments established a list of 189 HAPs, resulting in the promulgation of National Emission Standards for Hazardous Air Pollutants (NESHAP). The NESHAPs regulate HAP emissions from specific source types at major or area sources of HAPs by setting emission limits, monitoring, testing, record keeping, and notification requirements. NESHAPs Part 61 and Part 63 regulate HAP emissions from existing and new sources. The Amended Expansion Project would not result in the operation of any processes that are regulated by Part 61. Part 63 establishes standards for major HAP sources. The base Cameron Liquification Terminal (Trains 1-3) is a major source of HAPs and is subject to 40 CFR 63, Subpart EEEE, NESHAPS for Hazardous Air Pollutants, Organic Liquids Distribution (Non-Gasoline). The Amended Expansion Project would utilize the base facilities currently regulated under Subpart EEEE including the condensate handling. The condensate handling system would continue to comply with the applicable requirements of Subpart EEEE.

The proposed hot oil heaters are subject to NESHAP Subpart DDDDD – NESHAPs for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters. Cameron LNG would be required to comply with all applicable requirements of the NESHAPs.

General Conformity

The General Conformity Rule was developed to ensure that federal actions in nonattainment and maintenance areas do not impede states' attainment of the NAAQS. The General Conformity Rule is codified in 40 CFR 51, Subpart W and 93 Subpart B, *Determining Conformity of General Federal Actions to State or Federal Implementation Plans*. A conformity determination must be conducted by the lead federal agency if a federal action's unpermitted construction and/or operational activities are likely to result in generating direct and indirect

emissions that would exceed the conformity threshold (*de minimus*) levels of the pollutant(s) for which an area is in nonattainment or maintenance.

Conforming activities or actions should not, through additional air pollutant emissions:

- cause or contribute to new violations of the NAAQS in any area;
- increase the frequency or severity of any existing violation of any NAAQS; or
- delay timely attainment of any NAAQS or interim emission reductions.

The General Conformity Rule entails both an applicability analysis and a subsequent conformity determination, if applicable. The Amended Expansion Project would not result in an increase in construction emissions from those previously authorized in the Expansion Project; additionally, the project is in an attainment area. Therefore, a General Conformity Determination is not applicable.

CONSTRUCTION EMISSIONS

The USEPA commented that the EA should contain a draft Construction Emissions Mitigation Plan to reduce impacts associated with emissions of particulate matter and other toxics from any potential construction-related activities. The USEPA also comments that all applicable local, state, or federal requirements, including the certification of non-road engines in compliance with the USEPA Tier 4 regulations be included in the plan. The Expansion Project previously analyzed the construction emissions associated with the construction of Trains 4 and 5. As the scope has been reduced, the Amended Expansion Project would result in a reduction of construction-related emissions as analyzed and authorized previously in the Expansion Project. Therefore, construction emissions are not further quantified or analyzed here.

OPERATIONAL EMISSIONS

The Amended Expansion Project would involve removal of the authorized but not yet constructed Train 5, LNG Tank T-205, and the ancillary equipment associated with Train 5 and Tank T-205. The Amended Expansion Project would also implement final design changes to enhance the overall efficiency of Train 4, and would result in a reduction of emissions, including GHG emissions. The modifications of Train 4 include use of an electric-driven motor to replace the Frame 7 natural gas turbine drives, and tie-ins to allow the optionality of carbon sequestration of the acid gas from Train 4. The Amended Expansion Project would include feed gas treatment facilities, a heavy hydrocarbon removal unit, and a liquefaction unit. The feed gas treatment facilities would remove water, CO_2, hydrogen sulfide, and mercury. Condensate would be removed in the heavy hydrocarbon removal unit and stored for product sales in existing condensate storage tanks. The Amended Expansion Project would result in the following new and/or modified emission units:

- three hot oil heaters;
- an amine unit controlled by a thermal oxidizer with a back-up acid gas flare;
- two emergency generators;

- condensate loading and storage;
- diesel and amine storage, and
- a ground flare shared between all trains existing and proposed.

The ground flare would be utilized for normal routine operations and start-up, shutdown, and maintenance (SSM) activities. SSM emissions currently permitted for Trains 4 and 5 would be retained for the Amended Expansion Project for use with Train 4, as existing operations of Trains 1 through 3 indicate these emission would be necessary for Train 4. Two refrigeration turbines proposed with the Amended Expansion Project would be electric-driven and would not result in direct emissions. Table 3 shows the summary of proposed Train 4 emissions. The Amended Expansion Project would result in reductions of 85.7, 48.1, 83.6, 61.0 and 68.2 percent for NO_x, CO, PM, VOC, and HAPs, respectively, when compared to the currently authorized Expansion Project. SO_2 emissions would increase as a result of the Amendment Project, with an annual increase of 1.11 tons (or about 12 percent).

The USEPA states that the FERC should estimate GHG emissions from methane leakage and consider potential best management practices to reduce leakage of methane from the project. Methane emissions, as fugitive equipment leaks, are estimated in table 3 below. The USEPA also states that FERC should identify practicable mitigation measures to reduce GHG emissions for the project. As shown in table 4 below, carbon dioxide equivalents (CO_2e) emissions (inclusive of methane estimates) would be reduced by approximately 70 percent for direct source emissions (Scope 1). The Amended Expansion Project would result in combined onsite and purchased power emissions reductions of 36 percent compared to the Expansion Project (Scope 1 + Scope 2).

Table 3 Amended Train 4 Emissions							
	Pollutant Emissions (tpy)						
Emission Unit(a)	**NO_x**	**CO**	**SO_2**	**$PM_{10}/PM_{2.5}$**	**VOC**	**HAPs**	**CO_2e**
Refrigeration Compressor Turbines (4)	-	-	-	-	-	-	-
Hot Oil Heaters (3)	11.83	43.70	2.02	8.81	6.38	2.18	142,610
Acid Gas Flare	1.03	4.69	0.03	0.11	0.08	0.03	1,770
Train 4 Thermal Oxidizer	22.02	30.24	7.72	2.73	2.46	1.07	631,101
Low Pressure Flare	-	-	-	-	-	-	-
Ground Flare	11.31	51.58	0.52	1.24	5.61	0.66	19,485
Emergency Generators (2)	4.16	2.34	0.01	0.14	0.12	0.01	466
Emergency Fire Water Pumps (3)	-	-	-	-	-	-	-
Condensate Loading	-	-	-	-	1.41	-	-
Diesel Storage Tanks (2)	-	-	-	-	0.02	-	-
Amines Storage Tank	-	-	-	-	0.01	-	-
Fugitives	-	-	-	-	4.37	0.48	48
SSM Emissions	121.50	538.50	0.44	14.05	11.55	3.24	234,672
Total Amended Train 4 Emissions	**171.85**	**671.05**	**10.74**	**27.08**	**32.01**	**7.67**	**1,030,152**

(a) Condensate from the Train 4 process would be routed to the existing stabilized condensate product tanks. These tank emissions are routed to Trains 1 - 3 thermal oxidizers and is not a direct emission source that is listed in the air permit; however, they are listed in the air permit equipment list and regulatory section. Emissions resulting from Train 4 condensate would not change from what is currently permitted for the original Expansion Project.

Table 4 CO_2e Emissions (tpy)			
Emission Unit	**Authorized Expansion Facilities Trains 4 & 5**	**Authorized Expansion Facilities Train 4 Only**	**Amended Expansion Facilities Train 4 e-Drive**
Refrigeration Compressor Turbines (4)	2,178,200	1,089,100	-
Thermal Oxidizer CAP (Trains 4 & 5)	999,370	499,685	631,101
Low Pressure Flare	14,163	7,082	-
Ground Flare	19,652	9,826	19,485
Acid Gas Flare	-	-	1,770
Hot Oil Heater	-	-	142,610
Emergency Generators (3)	576	288	466
Emergency Fire Water Pumps (3)	78	39	-
Condensate Loading	-	-	-
Diesel Storage Tanks (2)	-	-	-
Fugitives	96	48	48
SSM Emissions	234,672	234,672	234,672
Total Emissions (Scope 1)	**3,446,807**	**1,840,740**	**1,030,152**
Reduction from currently authorized %	*A*	*B* 46.6% reduction *B vs A*	*C* 70.1% reduction *C vs A* 44% reduction *C vs B*
Purchase Power Emissions[3] (Scope 2)	**403,296 (154 MWh)[2]**	**201,648 (77 MWh)**	**743,740 (284 MWh)[1]**
Total Emissions (Scope 1 + Scope 2)	**3,850,103**	**2,042,387**	**1,773,892**

[1] Cameron LNG Train 4 E-Drive power load consumption – 284 MWe based on Train 4 Design Load List.
[2] Cameron LNG originally authorized Trains 4 & 5 power load consumption – 154 MWe (77 MWe per train) based on Trains 1 through 3 operations.
[3] Entergy Louisiana Projected 2027 Power Grid Emissions Profile – 595 lb CO_2/MWh plus 2.9 lb CO_2e/ MWh for CO2 equivalent for CH4 and N2O.

Table 5
Emissions Comparison
Expansion Project vs. Amended Expansion Project
Pollutant Emissions (tpy)

	NOx			CO			SO_2			PM10/PM2.5			VOC			HAPs		
Emission Unit[(a)]	**Auth[1]**	**Amd[2]**	**Delta**	**Auth[1]**	**Amd[2]**	**Delta**	**Auth[1]**	**Amd[2]**	**Delta**	**Auth[1]**	**Amd[2]**	**Delta**	**Auth[1]**	**Amd[2]**	**Delta**	**Auth[1]**	**Amd[2]**	**Delta**
Refrigeration Compressor Turbines	1,023.82	-	-1,023.82	623.28	-	-623.28	3.24	-	-3.24	146.08	-	-146.08	35.02	-	-35.02	19.53	-	-19.53
Hot Oil Heater	-	11.83	11.83	-	43.70	43.70	-	2.02	2.02	-	8.81	8.81	-	6.38	6.38	-	2.18	2.18
Thermal Oxidizer	29.99	22.02	-7.97	24.59	30.24	5.65	5.72	7.72	2.00	2.26	2.73	0.47	22.77	2.46	-20.31	3.06	1.07	-1.99
Low Pressure Flare	8.17	-	-8.17	44.43	-	-44.43	0.07	-	-0.07	0.89	-	-0.89	0.65	-	-0.65	0.01	-	-0.01
Ground Flare	10.84	11.31	0.47	58.99	51.58	-7.41	0.10	0.52	0.42	1.19	1.24	0.05	4.45	5.61	1.16	0.34	0.66	0.32
Acid Gas Flare	-	1.03	1.03	-	4.69	4.69	-	0.03	0.03	-	0.11	0.11	-	0.08	0.08	-	0.03	0.03
Emergency Generator (No. 1)	1.76	2.08	0.32	0.96	1.17	0.21	0.01	0.005	-0.005	0.06	0.07	0.01	1.76	0.06	-1.70	0.04	0.005	-0.035
Emergency Generator (No. 2)	1.76	2.08	0.32	0.96	1.17	0.21	0.01	0.005	-0.005	0.06	0.07	0.01	1.76	0.06	-1.70	0.04	0.005	-0.035
Emergency Generator (No. 3)	1.76	-	-1.76	0.96	-	-0.96	0.01	-	-0.01	0.06	-	-0.06	1.76	-	-1.76	0.04	-	-0.04
Emergency Fire Water Pumps	0.45	-	-0.45	0.39	-	-0.39	0.03	-	-0.03	0.03	-	-0.03	0.45	-	-0.45	0.12	-	-0.12
Condensate Loading	-	-	-	-	-	-	-	-	-	-	-	-	0.89	1.41	0.52	-	-	-
Diesel Storage Tanks (2)	-	-	-	-	-	-	-	-	-	-	-	-	0.02	0.02	-	-	-	-
Amines Storage Tank	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.01			
Fugitives	-	-	-	-	-	-	-	-	-	-	-	-	0.96	4.37	3.41	0.96	0.48	-0.48
SSM Emissions	121.50	121.50	-	538.50	538.50	-	0.44	0.44	-	14.05	14.05	-	11.55	11.55	-	-	3.24	3.24
Total Facility	**1,200.05**	**171.85**	**-1,028.20**	**1,293.06**	**671.05**	**-622.01**	**9.63**	**10.74**	**1.11**	**164.68**	**27.08**	**-137.60**	**82.04**	**32.01**	**-50.03**	**24.14**	**7.67**	**-16.47**

Notes:
[1]Auth – Authorized Emissions for the Expansion Project (CP15-560-000)
[2]Amd – Proposed Emissions for the Amended Expansion Project

2.1 Dispersion Modeling

The Sierra Club and Healthy Gulf state that FERC should ensure that the air emissions associated with the proposed Amended Expansion Project do not violate the NAAQS for NO_2 in the project area. Cameron LNG conducted an air quality analysis to evaluate the air quality impacts from the existing LNG Terminal (Trains 1-3) and the proposed design enhancements for the Amended Expansion Project of Train 4. Noting that the proposed amendment would reduce overall NO_x emissions from those currently approved, the air quality dispersion modeling was conducted to demonstrate continued compliance with the NAAQS using updated data on background concentrations and other emissions sources within 50 kilometers, combined with emissions from the existing LNG Terminal (Trains 1-3) and the proposed design enhancements of Train 4. The air quality analysis utilized USEPA's modeling protocol and was conducted in accordance with the LDEQ's Air Quality Modeling Procedures (August 2006).

Screening runs were conducted to determine whether the net emission increase of each pollutant from the LNG Terminal would potentially have significant impacts on air quality in the area surrounding the facility. Modeled concentrations are compared to the respective USEPA significant impact levels (SILs). If the modeled level is less than the SIL, then the impact is considered to be less than significant with respect to the NAAQS for that pollutant and further analysis is not required. If the modeled level is greater than the SIL, or if the SIL plus a relevant background concentration exceeds the corresponding NAAQS, then a refined model analysis is required. An Area of Impact (AOI) was established for any exceedance of the modeling SIL. The AOI is defined as a circular area whose radius is equal to the greatest distance from the source to the farthest receptor showing a concentration equal to the significance level during the screen model run. The refined analysis was performed using the American Meteorological Society/ Environmental Protection Agency Regulatory Model (AERMOD) version 21112 and incorporated projects (or emissions sources) within 50 km of the LNG Terminal for the 1-hour NO_2 NAAQS analysis. Off-site sources for the cumulative impact analyses were retrieved from the LDEQ permit inventory.

In addition to the permitted inventory of stationary emission sources, background concentrations from a representative monitor were entered into the model to determine total pollutant concentrations for comparison to the NAAQS. Due to the close proximity of the Westlake monitor (about 15 miles northeast from Cameron LNG) to immediately surrounding industry in the Lake Charles area, Cameron LNG selected the Westlake monitor to be representative of background concentrations. Cameron LNG states that use of the Westlake monitor, which is in the center of the heavily industrialized Lake Charles area, represents a conservative approach with possible over-predictions of concentrations as the Cameron LNG facility is in a rural area. Cameron LNG also considered the Westlake monitor to be representative of nearby industrial sources within 6-km of the monitor for the purposes of cumulative modeling for the 1-hour NO_2 NAAQS; therefore, industrial sources within 6-km of the monitor were included via the background monitor values and were not modeled as point sources.

The results indicated an exceedance of the 1-hour NO_2 NAAQS. In determining contributions to exceedances of the NAAQS for the 1-hour NO_2, the LNG Terminal's emissions

were compared to the cumulative impact concentrations for each receptor. The LNG Terminal's contribution to the maximum concentration modeled is 0.0007 microgram per cubic meter ($\mu g/m^3$). The maximum contribution from the LNG Terminal to any exceedance modeled is 3.35 $\mu g/m^3$, which is below the SIL of 7.5 $\mu g/m^3$. These results indicate that the LNG Terminal, inclusive of Trains 1 through 4, would not contribute significantly to any NAAQS exceedance.

3.0 RELIABILITY AND SAFETY

3.1 LNG Terminal

3.1.1 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 Cameron LNG Amended Expansion Project would be regulated by USDOT PHMSA, the USCG, and the FERC.

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 minimum 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 is subject to federal pipeline safety laws (49 U.S.C. 60101 et seq.), and 49 CFR 192. On August 31, 2018, USDOT PHMSA and FERC signed a memorandum of understanding (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 an LOD stating whether a proposed LNG facility would be capable of complying with the siting requirements in Subpart B of Part 193. The Commission committed to relying upon the USDOT PHMSA's determination in conducting its review of whether the facilities would be consistent with 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 project is authorized, constructed, and operated, LNG facilities, as defined in 49 CFR 193, would be subject to 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.

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) and requires each applicant to provide information on the reliability and safety of its facilities and engineering design, including how its proposed design would comply with USDOT PHMSA's requirements of 49 CFR 193. The level of detail necessary for the reliability, safety, and engineering information 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 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.[18] On June 23, 2022[19], the FERC received a response letter from the DOD Siting Clearinghouse stating that the Cameron LNG Amended Expansion Project would have a minimal impact on military training and operations conducted in the area.

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

Siting LNG facilities, as defined in 49 CFR 193, to ensure that the proposed site selection and location would not pose an unacceptable level of risk to the safety of plant personnel and the public is required by the USDOT PHMSA's regulations in 49 CFR 193 Subpart B. The Commission's regulations under 18 CFR § 380.12(o)(14) require Cameron LNG to identify how the proposed design complies with the siting requirements in USDOT PHMSA's regulations, including those 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 natural gas by pipeline subject to the federal pipeline safety laws and 49 CFR 192.[20]

The regulations in 49 CFR 193 Subpart B require the establishment of an exclusion zone surrounding an LNG facility in which an operator or government agency must exercise legal control over the activities where specified levels of thermal radiation and flammable vapors may occur in the event of a release for as long the facility is in operation. Approved mathematical models must be used to calculate the dimensions of these exclusion zones. The siting requirements specified in National Fire Protection Association (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 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).

[18] Memorandum of Understanding between the FERC and US DOD to ensure consultation and coordination on effect of LNG Terminals on Active Military Installations, https://www.ferc.gov/media/2007-mou-dod, access March 2022

[19] Letter from Scott E. Kiernan, DoD Siting Clearinghouse to Shannon Crosley, FERC. Accession No. 20220623-3053.

[20] 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.

- 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 hazardousfluids less than 70,000 gallons must be designed to withstand wind forces based on the applicablewind load data in American Society of Civil Engineers (ASCE) 7 (2005). All other LNG facilitiesmust 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 velocityand duration for a 10,000-year mean return interval.

As stated in 49 CFR § 193.2051, under Subpart B, LNG facilities must meet the siting requirementsof NFPA 59A (2001), Chapter 2, which include, but are not 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 anevaluation of potential incidents and safety measures incorporated in the design or operation of thefacility.
- NFPA 59A (2001) section 2.2.3.2 requires provisions to minimize the damaging effects of fire fromreaching 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) for ignition of a design spill and fire over an impounding area serving an LNG container from reaching beyond a property line that can be built upon.[21] 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 flammablemixture of vapors from a design spill from reaching a property line that can be built upon and thatwould 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 physicalfactors influencing LNG vapor dispersion.[22]
- NFPA 59A (2001) also specifies three radiant heat flux levels which must be considered for fire over impounding areas serving an LNG container for as long as the facility is in

[21] 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.

[22] 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).

operation. The Cameron LNG facility consists of three existing LNG storage tanks. The Expansion Project authorized under Docket No. CP15-560-000 included a new LNG storage tank. However, this Amended Expansion Project has removed the LNG storage tank from the scope of the application.

NFPA 59A (2001) requires the design spill be determined in accordance with table 2.2.3.5. For impounding areas serving only vaporization, process, or LNG transfer areas, the design spill is based on any single accidental leakage source. However, NFPA 59A (2001) does not define a single accidental leakage source. In order to clarifysingle accidental leakage source, USDOT PHMSA provides guidance on the determination of single accidental leakage sources on their website of frequently asked questions, which indicates the use of 2-inch-diameter holesin piping 6 inches in diameter or larger, full guillotine ruptures of piping less than 6 inches in diameter, and full guillotine ruptures of transfer hoses and single ply expansion bellows.[23]

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.[24]

In accordance with the August 31, 2018 MOU, USDOT PHMSA would issue an LOD to the Commission on the 49 CFR 193 Subpart B siting requirements. The LOD will provide USDOT PHMSA's analysis and conclusions regarding the proposed project's compliance with 49 CFR 193 Subpart B for the Commission to consider in its decision to authorize, with or without modification or conditions, or deny an application.

Because the Cameron LNG Expansion Project authorized under Docket No. CP15-560-000 predated the 2018 MOU, the Expansion Project's siting analysis was completed by FERC. However, the Amended Expansion Project has several process and design changes which necessitate the reevaluation of the compliance with siting requirements by USDOT PHMSA per the 2018 MOU. In addition, the Expansion Project authorized under Docket No. CP15-560-000 has several conditions which relate to the siting analysis conducted at that time. Because the Amended Expansion Project is subject to the USDOT PHMSA LOD process, there are conditions to the CP15-560-000 order which no longer apply, and we recommend the conditions in section 3.2 which should apply.

[23] USDOT PHMSA, LNG Plant Requirements, Frequently Asked Questions, https://www.phmsa.dot.gov/pipeline/liquified- natural-gas/lng-plant-requirements-frequently-asked-questions#ds1, accessed March 2022.

[24] 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 Feb. 2022.

3.1.1.2 USCG Safety Regulatory Requirements

The USCG exercises regulatory authority over LNG marine vessels under 46 CFR 154, which contains the United States safety standards for self-propelled LNG marine vessels transporting bulk liquefied gases and require documents to certify that the LNG marine vessel is designed and operating in accordance with both international standards and the U.S. regulations for bulk LNG marine vessels under 46 CFR 154. 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 Act (50 U.S.C. section 191); the Ports and Waterways Safety Act of 1972, as amended (33 U.S.C. section 1221, et seq.); and the Maritime Transportation Security Act (MTSA) of 2002 (46 U.S.C. section 701). The USCG is responsible for matters related to navigation safety, LNG marine vessel engineering and safety standards, and all matters pertaining to the safety of facilities or equipment located in or adjacent to navigable waters up to the last valve immediately before the receiving tanks. The USCG also has authority for LNG facility security plan review, approval, and compliance verification as provided in 33 CFR 105.

The USCG regulations in 33 CFR 127 apply to the marine transfer area of waterfront facilities between the LNG marine vessel and the last manifold or valve immediately before the receiving tanks. Title 33 CFR 127 applies to the marine transfer area for LNG of each new waterfront facility handling LNG and to new construction in the marine transfer areas for LNG of each existing waterfront facility handling LNG. The scope of the regulations include the design, construction, equipment, operations, inspections, maintenance, testing, personnel training, and firefighting of the marine transfer area of LNG waterfront facilities. The safety systems, including communications, emergency shutdown, gas detection, and fire protection, must comply with the regulations in 33 CFR 127. Under 33 CFR §127.019, the existing Cameron LNG facility has already submitted copies of its Operations and Emergency Manuals to the USCG Captain of the Port (COTP) for examination. The Amended Expansion Project proposes no changes to the berths, ship transit routes, or the maximum number of ship calls per year previously evaluated for the existing facility from Cameron LNG's existing WSA. As such, on September 15, 2021,[25] the USCG issued a letter which states Cameron LNG is not required to submit a new Letter of Intent because the components of Train 4 were outside the marine transfer area and modifications to the WSA were not required because the modifications would not increase the LNG vessel traffic beyond that approved in the 2006 WSA. Therefore, the ship transit, related hazards, and WSA are not under the scope of this project. However, the Amended Expansion Project proposes to modify its existing authorization, including increasing the liquefaction capacity of the fourth liquefaction train, and adding a second marine transfer line for dual simultaneous loading of two LNG marine vessels (including applicable USCG requirements), and eliminating the fifth liquefaction train and fifth LNG storage tank, which are discussed in subsequent sections.

[25] Accession Number 20220118-5208, Resource Report 11, Appendix A.11.

3.1.1.3 LNG Facility Security Regulatory Requirements

The security requirements for the proposed project are governed by 33 CFR 105 and 49 CFR 193 Subpart J - Security. Title 33 CFR 105, as authorized by the MTSA, and requires all terminal owners and operators to submit a Facility Security Assessment (FSA) and a Facility Security Plan (FSP) to the USCG for review and approval before commencement of operations of the proposed project facilities. The Cameron LNG facility is currently operating with a USCG approved FSP. Furthermore, for the proposed facilities, Cameron LNG has submitted an FSA and FSP to the USCG for review and approval.

In addition, an LNG facility regulated under 33 CFR 105 would be subject to the Transportation Worker Identification Credential (TWIC) Reader Requirements Rule issued by the USCG on August 23, 2016. 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 USCG's June 22, 2018 notice initially delayed the effective date to implement this rule to August 23, 2021. Subsequently, USCG's March 9, 2020 final rule further delayed the effective date to implement requirements for electronic inspections of TWICs for facilities that handle certain dangerous cargoes in bulk and transfer such cargoes from or to a vessel to May 8, 2023. Although the implementation of this rule has been postponed, the company should consider the rule when developing access control and security plan provisions for the facility.

Title 49 CFR 193 Subpart J also specifies security requirements for the onshore components of LNG facilities, as defined in 49 CFR 193, 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 project is authorized, constructed,and operated, it would be subject to the security requirements of 33 CFR 105 and 49 CFR 193 Subpart J and the respective USCG and USDOT PHMSA inspection and enforcement programs.

The Amended Expansion Project with the dual ship loading modification would be constructed entirely within the existing Cameron LNG site. The Cameron LNG site has numerous existing security features found throughout the entire plant, including its process and marine areas. However, the drawings for the fencing, closed-circuit television camera coverage, and lighting would need to be updated to show the proposed new facilities as well as access control locations (e.g., fencing, badging/screening) that separates the new facilities from the existing facilities. Therefore, we recommend in section 3.2 that Cameron LNG file security information documentation including the security fence, security camera, and intrusion detection drawings, and photometric analyses or equivalent and associated lighting drawings for the proposed new facilities. Further, Cameron 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 roadways or protected from inadvertent damage from vehicles. Additionally, during the Amended Expansion Project's construction, the primary security concern would be ensuring that the operational portions of the plant are secured from construction and contractor personnel. Cameron LNG

would finalize details during detailed design that prevents unauthorized personnel from entering the operational areas of the facility (e.g., installation of temporary fencing, security at ingress and egress points between the construction site and operational site, identification badging, etc.), and would develop plans to perform construction activities within a secure facility with respect to Cameron's existing USCG-approved Facility Security Plan. Therefore, we recommend in section 3.2 that Cameron LNG file, prior to initial site preparation, a construction site security plan that explains how it plans to restrict facility access of unauthorized personnel from entering the operational areas of the plant to perform construction activities within a secure facility with respect to the existing USCG approved Facility Security Plan, and includes procedures for controlling access during construction.

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.

3.1.2 FERC Engineering and Technical Review of the Preliminary Engineering Designs

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. The 1944 incident in Cleveland led to a fire that killed 128 people and injured 200 to 400 more people.[26] 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 evaluate the preliminary and final specifications for suitable materials of construction and for the design of spill containment systems that would properly contain a spill at the site.

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 gasvapors 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 theparticipation 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 evaluated the preliminary designs and we recommend in section 3.2 that Cameron 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

[26] 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.

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 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 evaluated the preliminary design 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. We recommend in section 3.2 that Cameron 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.[27] 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, there is an existing condition of the CP15-560-000 order authorizing the Expansion Project for the final design to include plans for clean-out, dry-out, purging, and tightness testing which should address the American Gas Association (AGA) Purging Principles and practices. We recommend the condition be revised as written in section 3.2 that prior to commissioning Cameron LNG provide a plan for purging, for review and approval, which addresses the requirements of the AGA 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 learnedfrom this and other past incidents. If a plan proposes the use of flammable

[27] 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.

mediums for cleaning, dry-outor 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*.

On June 8, 2022, a pipe rupture and subsequent fireball and fire occurred at Freeport LNG Development, L.P.'s (Freeport LNG) terminal near Quintana, Texas. On June 9, 2022, the USCG issued an order (2022-0074) to Freeport LNG suspending all transfer operations to or from any vessel. On June 30, 2022, USDOT PHMSA issued a Notice of Proposed Safety Order (CPF 4-2022-051-NOPSO) requiring Freeport LNG to take certain measures. In addition, on June 30, 2022, FERC issued a letter requiring Freeport LNG to receive written authorization before restarting any non-emergency operations in existing facilities, constructing new or modified facilities, and commissioning and placing any facilities back into service. Such authorization will only be granted following a determination that the facilities are fit for service and acceptable measures have been put into place to safely return facilities to operation. Lessons learned from the incident will also be applied to other facilities, as needed. There are existing conditions of the CP15-560-000 Order authorizing the Expansion Project, which in section 3.2 we recommend modifications to address some of the preliminary findings in this regard. Additionally, there is an existing condition of the CP15-560-000 Order authorizing the Expansion Project that requires Cameron LNG develop procedures for offsite contractors' responsibilities, restrictions, limitations, and supervision of these contractors by Cameron LNG staff. We recommend this condition be revised as written in section 3.2 and the procedures also address the offsite contractor: training; selection and evaluation; education of potential hazards related to their scope of work; access control and monitoring of contractor in facility process areas and buildings; safe work practices including lockout/tag out, confined space entry, work permits, hot work, opening process equipment or piping; control of process safety hazards including layer of protection identification for scope of work, abnormal condition recognition, re-instatement of layers of protection including bypasses (of both process piping/equipment and Distributed Control System (DCS)/Safety Instrumented System (SIS)/Fire and Gas System (FGS) alarms), isolations, and car-seals; emergency action plans including personnel accounting in the event of an emergency; and monitoring and evaluation of contractor's successful and safe completion of work and re-instatement of layers of protection.

There is an existing condition of the CP15-560-000 Order authorizing the Expansion Project that requires Cameron LNG provide updates to their operation, maintenance, and safety procedures for the Expansion Project. We recommend this condition be revised as written in section 3.2 that Cameron 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, we recommend in section 3.2 that Cameron 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 (BLEVE) from occurring.

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
- onsite and offsite emergency response, including hazard detection and control equipment, firewatersystems, and coordination with local, state, and federal emergency management officials and first responders, to mitigate the consequences of a release and prevent it from escalating to an event thatcould impact the public.

The inclusion of such protection systems or safeguards in a plant design can minimize the potentialfor 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 proposed project in final design if authorization is granted by the Commission.

The reliability of these layers of protection is informed by occurrence and likelihood of root causesand the potential severity of consequences based on past incidents and validated hazard modeling. As a result of the continuous engineering review, we recommend mitigation measures and continuous oversightto the Commission for consideration to include as conditions in the order. If a facility is authorized and recommendations are adopted as conditions to the order, FERC staff would continue its engineering review through final design, construction, commissioning, and operation.

Cameron LNG's Amended Expansion Project proposes to amend its Expansion Project authorized under Docket No. CP15-560-000. Specifically, Cameron LNG would only construct Train 4 (and not construct Train 5) and include associated design enhancements that would increase the liquefaction capacity of Train 4 to 6.75 MTPA. The design enhancements of Train 4 would replace the Frame 7 Gas Turbine drives with an electric driven ("E-Drive") motor and include tie-ins to allow future carbon capture and sequestration of the acid gas from Train 4. In addition, Cameron LNG no longer plans to construct a new LNG storage tank. The design enhancements relate solely to the process equipment associated with Train 4 and alter the existing marine facilities at the Cameron LNG Terminal to allow for dual ship loading. Additionally, Cameron LNG would install connections to facilitate a potential future carbon capture system which would sequester carbon dioxide removed from the Train 4 feed gas, as well as Trains 1-3. These changes and applicable regulatory requirements and FERC staff's preliminary engineering evaluation of these changes are discussed in subsequent sections.

Process Design

Title 49 CFR 193 and 33 CFR 127 has relatively minimal to no process design requirements. Title 49 CFR § 193.2703, under Subpart H, does require that persons used for the design have demonstrated competence by training or experience in the design of comparable components, and similar designer competence requirements exist in NFPA 59A (2001 and thereafter). There are some other general requirements for material compatibility, isolation valves, shutdown valves, emergency shutdown, and pressure relief valves, which we will describe in applicable descriptions of each major process system, however there is minimal to no specific requirements on the process design necessary to reliably and safely operate the LNG facilities. For example, most liquefaction technologies require the feed gas stream be pre-treated to remove components that could freeze out and clog the liquefaction equipment or would otherwise be incompatible with the liquefaction process or equipment, including mercury, hydrogen sulfide (H_2S), carbon dioxide, water, and heavy hydrocarbons. If water and carbon dioxide are not removed to certain concentrations, the downstream plate heat exchangers could clog and over-pressurize leading to a catastrophic failure of equipment. Or if mercury is not limited to certain concentrations, it can induce embrittlement and corrosion of downstream brazed aluminum heat exchangers resulting in a catastrophic failure of equipment. However, there are no requirements that water, carbon dioxide, or mercury be removed and applications have not always included these features. Therefore, FERC engineering staff evaluated the FEED process design information to better ensure that the LNG facilities would reliably and safely operate. As part of the process design review, FERC staff also evaluated the piping and instrumentation diagrams (P&ID) to verify equipment operating and design conditions consistent with the

process flow diagrams (PFD) and heat and material balances (HMB) and that adequate process monitoring, controls, and shutdowns are in place consistent with the operating and design conditions and that their reliability or redundancy is commensurate with potential consequences of failure. However, the FEED P&IDs are subject to changes in final design after additional details and engineering is conducted. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG provided updated PFDs, HMBs, and P&IDs. However, we recommend this condition be revised as written in section 3.2, that Cameron LNG provide updated PFDs, HMBs, P&IDs (including vendor P&IDs) reflective of the final design.

In addition, the margins between operating and design conditions would not be finalized until final design and many of the instrumentation and control set points would not be determined until final design. Therefore, we recommend in section 3.2 that Cameron LNG file the safe operating limits (upper and lower), alarm and shutdown set points for all instrumentation (e.g., temperature, pressures, flows, and compositions). Below we discuss each major system in the proposed LNG export terminal and specific requirements and recommendations applicable to those major systems based upon our process design review. USDOT PHMSA and USCG would be responsible for enforcing any of the applicable minimum federal requirements in their respective regulations. The process design of the Amended Expansion Project is largely unchanged from the previously authorized Cameron Expansion Project. However, changes to equipment selection would achieve a higher liquefaction rate. For completeness, a description of the complete process is provided below.

The inlet feed gas would first pass through an insulating kit, followed by an inlet gas coalescer to remove any solids and liquid droplets from the feed gas. After passing through the inlet coalescer, feed gas passes through a heat exchanger heated with hot oil. Next, inlet gas would pass through a high integrity pressure protection system (HIPPS) to protect process equipment from high pressures of the gas pipeline. The HIPPS would be located downstream of the feed gas pressure control and would consists of several pressure monitors and indicators that would automatically close a valve to shutdown the feed gas flow in the event two or more pressure monitor readings exceed their setpoint. The HIPPS setpoint would be lower than the design pressure of downstream equipment to prevent their over-pressurization of downstream equipment.

The inlet feed gas would be pressurized with a feed gas booster compressor above the pipeline pressure prior to entering feed gas pretreatment processes. The addition of the feed gas booster compressor was a change from the previously authorized Cameron Expansion project. Once the inlet gas is pressurized, the feed gas would enter the mercury removal system to reduce the mercury concentration. As noted, mercury removal is often specified to prevent mercury embrittlement and corrosion of downstream brazed aluminum heat exchangers.

After mercury removal, the feed gas would pass through a H_2S scavenger drum to remove bulk H_2S, and contact an amine-based solvent solution in the acid gas absorber column to remove any remaining H_2S and carbon dioxide (i.e., acid gas) present in the feed gas which is designed to prevent freezing in the liquefaction process that can lead to lesser performance, more frequent deriming (thawing and disposal of frozen components of the feed gas), or clogging of the downstream heat exchangers that if not derimed can lead to failure from over-pressurization.

Acid gas can also increase corrosion rates in certain common materials of construction, depending on pressure and concentration, such as carbon steel, used to handle the relatively warmer natural gas prior to the refrigeration and liquefaction of the natural gas. Once the acid gas components accumulate in the amine solution, the acid gas rich amine solution would be routed to an amine regenerator column that utilizes a reboiler. Contact with the reboiler discharge would regenerate the acid gas rich amine solution back to an acid gas lean amine solution by using heat to release the acid gas. The regenerated amine solution would be recycled back to the acid gas absorber column and the removed acid gas would be sent to a dedicated train 4 thermal oxidizer where carbon dioxide, trace amounts of H_2S, and trace amounts of hydrocarbons would be incinerated. As part of the Amended Expansion Project, Cameron LNG would install a connection point on the acid gas disposal line with double block and bleed valves and blind flange to facilitate a potential future connection to a carbon sequestration system for the train 4 acid gas system, as well as the train 1-3 acid gas system. In the event the train 4 thermal oxidizer is not available, the acid gas would be disposed of through a dedicated flare system. FERC staff noted that the design includes a swan neck upstream of the acid gas removal column to prevent backflow. Cameron LNG indicated that the swan neck was intended to prevent liquid backflow, and that the calculated liquid inventory determined the height of the swan neck. However, Cameron LNG did not provide documentation supporting the design basis of the swan neck. Therefore, we recommend in section 3.2 that Cameron LNG provide a check valve upstream of the acid gas removal column or provide a dynamic simulation that demonstrates that the swan neck would be sufficient for preventing backflow.

The feed gas that exits the acid gas absorber column would be cooled first through an aerial cooler and then a propane refrigerant package which would be added as part of the Amended Expansion Project. Then the feed gas would be routed to a knockout drum and coalescer where bulk water would be recovered and collected in a recovered water tank. After the knockout drum, any remaining water in the feed gas would be removed using regenerative molecular sieve beds. During the molecular sieve bed regeneration process, heated regeneration gas would release water from the molecular sieve beds. The three molecular sieve beds would operate in staggered adsorption and regeneration modes, such that the overall process would be continuous. Water collected during the molecular sieve regeneration process would be routed back to the acid gas absorber column as needed.

After water removal, the treated gas would flow to the natural gas liquids (NGL) extraction unit. Heavier hydrocarbons are removed to prevent them from freezing in the liquefaction process, which could lead to lower performance, more frequent deriming, or clogging of the downstream heat exchangers that if not derimed can lead to failure from over-pressurization. The NGL extraction unit would consist of a main cold box, a low temperature separator, and a demethanizer column with an overhead heat exchanger and a reboiler. First, the dry feed gas stream would be cooled in the main cold box, then sent to a low temperature separator where the feed gas would be separated from NGLs. The NGL stream exiting the low temperature separator would enter the demethanizer column near the middle. The demethanizer liquid bottoms would be sent to the condensate stabilization column. The condensate stabilization column and reflux accumulator vessel would separate the entering liquid stream into two streams: propane and ethane rich gas, which would be sent back into the feed gas stream downstream of the demethanizer, and hydrocarbon condensate, which would be sent to existing

storage tanks for truck loading. The flashed feed gas stream exiting the low temperature separator would enter the demethanizer column near the top. The purified gas would exit the top of the demethanizer column, where it would be used to cool upstream feed gas and would then be sent to propane precoolers before being liquefied in the main cryogenic heat exchanger (MCHE).

The liquefaction unit would consist of a MCHE, hydraulic turbine, end flash gas (EFG) knock-out drum, and EFG cold recovery exchanger. The feed gas from the propane precoolers would enter the MCHE and would be progressively cooled and liquefied as it passed through the exchanger. The LNG exiting the MCHE would be sent to a hydraulic turbine which would recover some energy from the high-pressure LNG exiting the MCHE. The low-pressure LNG exiting the hydraulic turbine would pass through the EFG knock-out drum where the vapors and liquids would be separated. The liquids would be pumped to the existing LNG storage tanks via a dedicated rundown line. The cold vapors from the EFG knock out drum would liquefy a slip stream of natural gas from the final propane precooler.

The Expansion Project authorized under Docket No. CP15-560-000 included several conditions specific to a new LNG storage tank. However, the Amended Expansion Project does not include a new LNG storage tank. Therefore, we make recommendations in section 3.2 which would replace the conditions from the CP15-560-000 Order.

To achieve the cryogenic temperatures needed to liquefy the natural gas stream in the above process, the feed gas would be cooled by a thermal exchange process driven by two separate closed loop refrigeration systems: a high purity propane refrigerant system; and a mixed refrigerant (MR) system. The mixed refrigerant would be comprised of a mixture of nitrogen, methane, ethylene, and propane. Methane would be provided from the treated dry feed gas stream entering the refrigeration process and the other refrigerants required for the liquefaction process would be delivered by truck and stored onsite for initial filling and, as needed, for make-up. Truck unloading facilities would be provided to unload make-up refrigerants. Individual dehydration vessels wouldbe provided for propane and ethylene.

Propane refrigerant would flow in parallel through the MR chillers and feed gas precoolers. In both the MR chillers and feed gas precoolers, the high-pressure propane would be let down in stages to cool the MR and feed gas. After the propane passes through all the MR chillers and feed gas precoolers, the warm low-pressure propane would be compressed with an electric driven compressor and cooled with aerial coolers before repeating the cycle.

MR would flow in MCHE tubesparallel with the feed gas, then would exit and reenter the MCHE and flow counter currently to the feed gason the shell side. As a result, all MR would exit the bundles at the outlet of the warm bundle as vapor, where it would then be compressed with an electric driven compressor, cooled, precooled with propane, and sent back to the liquefaction unit heat exchanger bundle. Under the authorized Cameron LNG Expansion Project, gas turbine drives were proposed for the compressor. However, under the Amended Expansion Project, Cameron LNG would switch to electric drivers. FERC staff evaluated the PFDs and HMBs to determine the liquefaction capacities relative to the requested capacity in the application. The amended application states that the maximum production capacity would be up to 6.75 MTPA. FERC staff reviewed the HMBs and note that only Average Gas Average Ambient cases were provided for the liquefaction systems which indicate a production lower

than 6.75 MTPA. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG file updated PFDs, HMBs, and P&IDs. However, we recommend this condition be revised as written in section 3.2 that Cameron LNG provide updated PFDs, HMBs, P&IDs and any other engineering documentation that demonstrates the design would be capable of liquefying natural gas and producing LNG for up to 6.75 MTPA export capacity.

As part of the Amended Expansion Project, Cameron LNG would add capabilities to simultaneously load two LNG carriers. To facilitate dual loading, Cameron LNG would replace one smaller LNG in-tank pump in each LNG storage tank with a larger capacity pump, add a parallel header such that the north and south jetty each have a dedicated header, in contrast to the existing arrangement where a single header supplies LNG from the LNG in-tank pump discharge to both the north and south jetty. Other modifications to facilitate dual loading are discussed in other sections.

Low pressure (boil-off gas) BOG generated from stored LNG (LNG is continuously boiling) and vapors returned during LNG marine vessel filling operations would be compressed and routed to the fuel gas system. NFPA 59A (2001) section 3.4.5 requires a BOG and flash gas handling system separate from pressure relief valves and that the BOG and flash gas discharge safely into the atmosphere or into a closed system and so that it cannot normally inspirate air during operation. The closed BOG system would prevent the release of BOG to the atmosphere and would be in accordance with NFPA 59A (2001). This would be an inherently safer design when compared to allowing the BOG to vent to the atmosphere. An additional BOG compressor would be installed since vapor returned from the ships during dual loading would increase the vapor routed to the BOG system. The vacuum relief valves on existing LNG storage tanks protect the tanks from possible vacuum scenarios from elevated flowrates from both the BOG compressor and LNG loading pumps. Since Cameron would increase the capacity of an in-tank pump, and add another BOG compressor, Cameron LNG conducted a preliminary review of the capacity of the existing vacuum relief valves and determined the existing size and quantity were sufficient. We recommend in section 3.2 that Cameron LNG file the final sizing calculations for the LNG storage tank vacuum relief valves to demonstrate the existing vacuum relief valves provide the relieving capacity necessary for the higher BOG and LNG pump flowrates.

The 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, tempered water supply, demineralized water, hot oil, nitrogen, diesel, and backup power.

Two flare systems would be designed to handle and control the vent gases from the process areas. The wet and dry, and spare flare would be routed to the existing ground flares located in a common area. The pressure relief valves, blowdown valves, and vent and flare systems were evaluated to ensure they were consistent with operating and design pressures and sizing scenarios that are consistent with NFPA 59A, API 520 and API 521. The safety relief valves would be designed to handle process upsets and thermal expansion. NFPA 59A (2001) section 6.8.2 requires thermal expansion relief valves be installed as required to prevent overpressure in any section of a liquid or cold vapor piping that can be isolated by valves. We recommend in section 3.2 that Cameron LNG provide updated P&IDs for review and approval.

FERC staff would coordinate any findings with USDOT PHMSA, which would be responsible for enforcement of the requirements in their regulations. In addition, due to the increased consequences for incidents involving the process vessels, and storage vessels that handle hazardous fluids and LNG, we recommend in section 3.2 that Cameron LNG provide spare pressure relief valves to provide overpressure protection for these vessels when a PSV is offline for testing or maintenance. However, relief valve sizing and hazard calculations would not be finalized until final design. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron 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 referenced and other recommended and generally accepted good engineering practices. We recommend in section 3.2 that this condition also extend to the Amended Expansion Project.

Power for the refrigerant compressors and other users would be sourced from the local electric utility. Back-up power would be provided by onsite diesel generators. A diesel storage tank would be provided to supply the emergency backup generator. Additionally, a battery back-up system would provide emergency power for essential services.

Hot oil would provide heat to the Inlet Gas Preheater, Amine Regenerator Reboiler, Regeneration Gas Heater, Demethanizer Reboiler, and Condensate Stabilization Reboiler. The hot oil would be heated by a natural gas fired heater. Previously, in the Expansion Project authorized under Docket No. CP15-560-000, hot oil would be heated from the gas turbine drive exhaust waste heat recovery system. However, the Amended Expansion Project would use electric compressor drives instead of installing gas turbine compressor drives. To fulfill the hot oil demand, gas fired hot oil heaters will replace the gas turbine exhaust waste heat recovery system. Air compressors would provide both instrument air and utility air to the facility. Trucks would fill a liquid nitrogen storage tank and vaporizers would supply high purity gaseous nitrogen for refrigerant make-up.

The failure of process equipment could pose potential harm if not properly safeguarded through the use of appropriate engineering controls and operation. Cameron LNG 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. Cameron LNG would design their control systems and human machine interfaces to the International Society for Automation (ISA) Standards 60.1, 60.4, and 60.6, and other standards and recommended practices. Cameron LNG did not indicate compliance with other good and recommended engineering practices such as ISA 5.3, 5.5, and 60.3. We recommend in section 3.2 that prior to introducing hazardous fluids Cameron LNG complete all pertinent acceptance tests associated with the DCS, SIS and FGS that demonstrates full functionality and operability of the systems. We recommend in section 3.2 that Cameron LNG file a complete codes and standards list prior to construction of final design. Cameron LNG indicates that an alarm management program in accordance with ISA Standard 18.2 would be in place to ensure the effectiveness of the alarms. Furthermore, there is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG specify an alarm management program. We recommend revising this condition as written in

section 3.2 that Cameron LNG develop the alarm management program consistent with ISA 18.2, and implement the alarm management program prior to introduction of hazardous fluids.

Operators would have the capability to act from the control room to mitigate an upset. Cameron LNG would develop facility operation procedures after completion of the final design; this timing is fully consistent with accepted industry practice. Title 49 CFR § 193.2503, under Subpart F, requires written operating procedures to provide safety during normal operation and in responding to abnormal operation, including, but not limited to monitoring operations, purging and inerting components, cooldown, startup and shutdown, liquefaction, transfer, and vaporization,as applicable, as well as recognizing abnormal operating conditions. Title 49 CFR § 193.2707, under Subpart H, requires the operator perform assigned functions only after they have demonstrated capability after they are trained in accordance with 49 CFR §193.2713 and §193.2717, experience related to the assigned function, and have acceptable performance on a proficiency test relevant to the assigned function. Otherwise, the operator or maintenance personnel must be accompanied and directed by an individual that has met those requirements. Title 49 CFR 193 Subpart G also contains requirements for maintenance, including written maintenance of components. In addition, 49 CFR §193.2017, under Subpart A, requires that operating and maintenance plans and procedures are reviewed and updated when a component is changed significantly or a new component is installed and at intervals not exceeding 27 months, but at least once every 2 calendar years. Title 33 CFR 127 also has similar requirements for written operations, training,and experience for persons in charge of shoreside transfer operations. Title 33 CFR §127.401 also requires that equipment be maintained in a safe condition. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG file updates to the operation, maintenance, and safety procedures to in include the Expansion Project Facilities. We recommend this condition be revised as written in section 3.2 that Cameron LNG provide more information, for review and approval on the operating and maintenance procedures, including safety procedures, hot work procedures and permits, and abnormal operating conditions procedures. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG provide detailed training logs prior to commissioning to demonstrate operating staff has completed the required training. We recommend this condition be revised as written in section 3.2, that prior to commissioning Cameron LNG provide detailed training logs which demonstrate operating, maintenance, and emergency response staff have completed the required training. We would evaluate these procedures in coordination with USDOT PHMSA and USCG 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, AGA, Purging Principles and Practices*, and NFPA 51B, *Standards for Fire Prevention During Welding, Cutting, and Other Hot Work*. We recommend in section 3.2 that prior to introduction of hazardous fluids, Cameron LNG should complete and document a pre-startup safety review to ensure that installed equipment meets the design and operating intent of the facility. In addition, there is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG file a car seal list consistent with P&IDs. We recommend this condition be revised as

written in section 3.2 that Cameron LNG also file its car seal philosophy and car seal program for its car-seals/locks for review and approval to address human factor considerations and improve facility safety and prevent incidents. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG tag and label instrumentation, valves, piping, and equipment. We recommend in section 3.2 that this condition also extends to the Amended Expansion Project.

In the event of a process deviation, emergency shutdown (ESD) valves and instrumentation wouldbe installed to monitor, alarm, shutdown, and isolate equipment and piping during process upsets or emergency conditions. NFPA 59A (2001) section 9.2.1 requires each LNG facility to incorporate an ESD system(s) that, when operated, isolates or shuts off a source of LNG, flammable liquid, flammable refrigerant, or flammable gas, and shutdown equipment whose continued operation could add to or sustainan emergency. The Amended Expansion Project would also 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. Safety-instrumented systems would comply with ISA Standard 84.00.01 and other recommended and generally accepted good engineering practices. We also recommend in section 3.2 that Cameron LNG 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.

ESD valves and other safety valves which isolate and depressurize a process in emergencies have a failsafe position. If the valve loses instrument air or control signal, the valve will resort to its position which shuts off the source of hazardous fluids or reduces the pressure of the hazardous fluids within the process. For instance, in the event of loss of instrument air or control signal, an ESD valve might failsafe to the closed position to shutoff the source of hazardous fluids to or from a vessel, while a blowdown valve would failsafe to the open position to reduce the vessel pressure. All process valves with a failsafe position rely on an electrical signal to an instrument air solenoid valve to keep the process valve in its non-failsafe position during normal operation. In the event of an emergency, that signal would change, and the valve would move to the failsafe position.

Failsafe valves are used in industries other than LNG, such as the nuclear power plant industry. Since the Browns Ferry Fire incident in 1975, the Nuclear Regulatory Commission (NRC) has supported testing to examine how electrical cabling commonly used for control and safety purposes would behave during fire exposure. This testing expanded in 2007 to 2012, including a series of testing and reports followed for alternating current (AC) and direct current (DC) circuits. The AC testing methods and results are described in the NRC report NUREG-6931, “Cable Response to Live Fire (CAROLFIRE)”, 2007. The DC testing methods and results are described in the NRC report NUREG-7100 “Direct Current Electrical Shorting in Response to Exposure Fire (DESIRRE-Fire): Test Results”, 2012. Probabilistic risks are described in NUREG-7150, Joint Assessment of Cable Damage and Quantification of Effects from FIRE (JACQUE-FIRE)”, 2012. The test results showed that fire exposed electrical cables could experience electrical shorts and faults which resulted in spurious action, meaning a valve

position could change from its failsafe position to its normal position. The test results also showed many different types of cables experienced spurious action within 20 minutes from the onset of the fire exposure, and some experienced the duration of the spurious action for over 20 minutes.

ESD valve closures, and other safety valves moving to and remaining in their failsafe position is a layer of protection LNG facilities utilize to mitigate hazardous fluid releases following accidents. In the event of a release and or fire which damages cabling used to control failsafe valves, spurious opening and closing of the valves could unexpectedly create situations which hamper the facility personal response to control the emergency. Therefore, we recommend in section 3.2 that Cameron LNG demonstrate electrical and control equipment which activate emergency systems be designed to withstand a 20-minute UL 1709 fire exposure or other approved equivalent.

In developing the FEED for the Amended Expansion Project, Cameron LNG conducted a Hazard Identification (HAZID) review of the project's preliminary design based on the proposed process flow diagrams and the plot plans. This is consistent with NFPA 59A (2019) which requires consideration of a process hazard analysis for the plant and site evaluation. A more detailed hazard and operability review (HAZOP) analysis would be performedby Cameron LNG during the final design to identify the major process hazards that may occur during theoperation 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. The HAZID conducted as part of the Amended Expansion project resulted in recommendations. We recommend in section 3.2 that Cameron should file information to demonstrate the EPC contractor has verified that all FEED HAZID recommendations have been addressed. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG file the HAZOP study, list of recommendations, and actions taken on those recommendations for review and approval. We recommend this condition be revised as written in section 3.2 to also provide justification for HAZOP recommendations which are not implemented. 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 same condition of the Expansion Project authorized under Docket No. CP15-560-000 also requires that Cameron LNG file the resolutions of the recommendations generated by the HAZOP review be provided for review and approval by FERC staff. Once the design has been subjected to a HAZOP review, the design development team would track, manage, and keep records of changes in the facility design, construction, operations, documentation, and personnel. Cameron 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. If our recommendations are adopted into the order, resolutions of the recommendations generated by the HAZOP review

would be monitored by FERC staff. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG file all changes to their FEED for review and approval by FERC staff. We recommend in section 3.2 that this condition also extends to the Amended Expansion Project. However, major modifications could require an amendment or new proceeding.

If the Project is authorized and constructed, Cameron LNG would install equipment in accordance with its design. We recommend in section 3.2 that project facilities be subject to construction inspections. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG provide, for review and approval, commissioning plans, procedures and commissioning demonstration tests that would verify the performance of equipment which we recommend in section 3.2 also extend to the Amended Expansion Project. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG provide an overall project schedule, including the commissioning plan. We recommend this condition be revised as written in section 3.2, that the schedule includes detailed stages of construction including initial site preparation, commissioning, and in-service plans. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG label piping fluid service and direction of flow in the field in addition to the pipe labeling requirements of NFPA 59A. We recommend this condition be revised as written in section 3.2 that in addition to the previous requirements, the piping labels also meet the standards of ASME A13.1. In addition, there is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG provide semi-annual reports that include abnormal operating conditions and planned facility modifications, and a condition that project 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 sendout conditions, do not exceed the original basis of design. We recommend in section 3.2 that these conditions also extend to the Amended Expansion Project.

Mechanical Design

Cameron LNG provided codes and standards for the design, fabrication, construction, and installation of piping and equipment and specifications for the facility. FERC staff generally agreed the design specifies appropriate materials of construction and ratings suited to the pressure and temperature conditions of the process design. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG file final specifications. We recommend revising this condition as written in section 3.2 to clarify the scope of those final specifications that Cameron LNG should provide for review and approval, and the specifications should include building specifications, mechanical specifications, electrical and instrumentation specifications, and security and fire safety specifications.

Piping must be designed, fabricated, assembled, erected, inspected, examined, and tested in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPVC), ASME Standard B31.3, as applicable, and all valves must meet ASME B31.3, B31.5, or API 6D, as applicable. In addition, Cameron LNG indicated they would also meet ASME Standards B36.10, and B36.19,as applicable. Valves and fittings would also be

designed to standards and recommended practices such as API Standards 594, 598, 600, 602, 607, 608, 609, and 623; ASME Standards B16.5, B16.9, B16.10, B16.20, B16.21, B16.25, B16.34, B16.36 and B16.47; and ISA Standards 75.01.01. Portions of the facility regulated under 33 CFR 127 for the marine transfer system, including piping, hoses, and loading arms should also be tested in accordance with 33 CFR §127.407. Pressure vessels must be designed, fabricated, inspected, examined, and tested in accordance with ASME BPVC Section VIII and per 49 CFR 193 Subparts C, D, and E and NFPA 59A (2001). There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG provide final design procedures for pressure/leak tests which address the requirements of ASME VIII and ASME B31.3. We recommend this condition be revised as written in section 3.2, that prior to commissioning Cameron LNG should file procedures for pressure/leak tests which address the requirements of ASME BPVC and ASME B31.3, and additionally provide a line list of pneumatic and hydrostatic pressures.

The Amended Expansion Project would include a Cold Flare knockout drum with flanged nozzles connecting to the flare header piping, and the plane of the flange face would be oriented vertically (the header piping being level to grade, and the plane of the flange face perpendicular to the header piping). With this orientation of the flange face, in the event of a small LNG flow which does not entirely fill the header, LNG would trickle along the bottom of the header, with cold vapor above the liquid space. While the vapor and liquid would be the same temperature, the LNG would absorb heat from the header piping at a faster rate than the vapor of equal temperature. The uneven cooling rates between the bottom and top of the flange could cause the flange to separate and leak LNG. Leaks on this same flange design and orientation has already been observed at the Cameron LNG Terminal more than once and a contributing cause may be the flange orientation. Other facilities have different flange orientations that would not lend itself for this differential cooling and have not been reported the same leaks that Cameron LNG has reported. The flare and associated auxiliaries (knock out drums, header piping, etc.) serve as the final safety layer for the process. Since the flare system provides that safety function, the system needs to reliably operate and not instigate other cascading safety issues. Therefore, we recommend in section 3.2 that Cameron LNG evaluate whether a different flange orientation would minimize these potential leaks without any other safety implications and, if so, the final design should reflect that different flange orientation. As part of this recommendation, we also recommend that if there are other safety implications that would prevent a different orientation that Cameron LNG should still provide an analysis demonstrating their proposed flare header connection to the knockout drum will not be susceptible to leaks from uneven cooling.

The Heat exchangers would be designed to ASME BPVC Section VIII standards; API Standards 660, 661, and 662 - Part II; the Tubular Exchanger Manufacturers Association (TEMA) standards; the Heat Exchanger Institute (HEI) standards; the American Society for Testing and Materials (ASTM) standards; and Aluminum Plate-Fin Heat Exchanger Manufacturer's Association (ALPEMA) guidelines. Rotating equipment would be designed to standards and recommended practices, such as API Standards 610, 613, 614, 617, 619, 670, 671, 672, 675, 676, and 682; and ASME Standards B73.1, and B73.2.

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 in accordance with API Standards 520, 521,526, 527, 537, and 2000; ASME Standard 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.

Although many of the codes and standards were listed as ones the project would meet, Cameron LNG did not reference all codes and standards that are recommended and generally accepted good engineering practices. Therefore, we recommend in section 3.2 that Cameron LNG provide the final specifications for all equipment and a summarized list of all referenced codes and standards for review and approval. If the project is authorized and constructed, Cameron 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. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project, which we also recommend in section 3.2 to extend to the Amended Expansion Project, requiring Cameron LNG file quality assurance and quality control plans for FERC staff review and approval to ensure construction work is being performed according to proposed Project specifications, procedures, codes, and standards. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG provide semi-annual reports that include equipment malfunctions and abnormal maintenance activities. In addition, there is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG be subject to inspections to verify that the equipment is being properly maintained during the life of the facility. We recommend in section 3.2 that these conditions also extend to the Amended Expansion Project.

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) requires 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 the incorporated by reference section 9.1.2 of NFPA 59A (2001), fire protection must be provided for all LNG facilities subject to Part 193 regulations 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 authorized, constructed, and operated, 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 ESD 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 project marine facilities would be subject to 33 CFR 127, which incorporates sections of NFPA 59A (2019), which have similar performance-based guidance. Therefore, FERC staff evaluated 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.

Cameron LNG 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 onsiteand offsite emergency response. We recommend in section 3.2 that Cameron 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 responseequipment, 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.

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.

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 period based upon demonstrable surveillance and shutdown provisions acceptable to the USDOT PHMSA. If authorized, constructed, and operated, 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. The impoundment system design for the marine facilities would be subject to the USCG's 33 CFR 127, which does not specify a spill or duration for impoundment sizing. 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. The Expansion Project authorized under Docket No. CP15-560-000 included an additional LNG storage tank and condensate storage tank. However, the Amended Expansion Project no longer includes an additional LNG storage tank and

condensate storage tank, and their spill containment systems are no longer necessary in the design.

Cameron LNG proposes to install curbing, paving, troughs, and trenches to direct potential hazardous liquid spills, involving LNG, refrigerant, heavy hydrocarbon, and other hazardous material releases to remote impoundment basins. Hazardous liquid spills in the Train 4 Liquefaction and Pretreatment areas would be directed to a remote impoundment east of the liquefaction blocks and south of the ground flares. The location of this impoundment is the same as the Expansion Project authorized under Docket No. CP15-560-000. A common pipe rack would connect Train 4 to the refrigerant storage area, condensate storage area, and LNG storage tanks. Spills from piping in this common pipe rack would be routed to existing impoundments. Cameron LNG provided dimensioned drawings of the Train 4 process impoundment. FERC staff verified the impoundment volume would contain a 10-minute spill of the maximum liquefaction rundown flow rate. FERC staff estimated the maximum inventory of piping which could spill into the impoundment and notes there is a large margin in the impoundment volume to contain 10-minutes of the maximum process flow plus an expected line inventory. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG provide the final spill containment system drawings with dimensions and slopes of curbing, trenches, and impoundments. We recommend this condition be revised as written in section 3.2 that Cameron LNG provide spill containment drawings, for review and approval before construction of final design, with dimensions, capacity calculations considering any foundations and equipment within the impoundments and down-comer sizing. Drawings should show containment for all hazardous fluids from the largest single line for 10 minutes, including de-inventory, or the maximum liquid from the largest vessel.

Spills from piping between the LNG storage tanks and LNG marine vessels would be collected in paved areas and routed to an existing LNG impoundment located south of the LNG storage tanks. The increased loading rate to allow dual ship loading would result in higher flowrates and higher volumes of potential spills in the marine transfer area. To account for the larger potential spills, Cameron LNG would expand the capacity of the marine transfer area impoundment to contain 10 minutes of maximum flow from all LNG in-tank pumps with pump runout, plus an expected line inventory volume. Cameron LNG provided a preliminary the line inventory and stated it would be confirmed during final design. FERC staff verified the proposed expansion to the marine transfer impoundment would contain 10 minutes of maximum flow and line inventory. Furthermore, FERC staff reviewed if the existing spill containment trenches in the marine transfer area could convey to the marine transfer area impoundment a larger flow associated with the increased ship loading rate. The existing spill collection trenches are within a large, curbed area situated beneath the marine transfer lines. FERC staff believes there is a potential the maximum flow from a marine transfer line guillotine break could overtop the existing trenches. However, the trenches are within a very wide curbed area which provides extra capacity to the spill conveyance system. FERC staff believes the worst-case spill would remain contained within the spill collection system; however, we recommend in section 3.2 that Cameron LNG provide spill containment drawings and capacity calculations for review and approval before construction of the final design.

The Amended Expansion Project would install piping and equipment to facilitate dual ship loading, including replacement of 1 in-tank pump in each LNG storage tank with a higher capacity pump and install a second parallel marine loading header. This change would result in a larger worst-case spill. Spills from piping on the LNG storage tank roof would be conveyed to grade level trenches via an existing down-comer. The existing down-comers are sized to convey single accidental leak sources. NFPA 59A-2001 Table 2.2.3.5 states that for containers with over-the-top fill, with no penetrations below the liquid level, the design spill is the largest flow from any single line that could be pumped into the impounding area with the container withdrawal pumps considered to be delivering at full rated capacity. FERC staff performed a spill sizing analysis on the existing tank's down-comer for a release from all in-tank pumps at the higher capacity and determined that the down-comer was adequately sized. However, Cameron LNG should demonstrate that the size of the existing down-comer is sufficient to convey the larger spill volume with the proposed larger in-tank pump. Therefore, we recommend in section 3.2 that Cameron LNG provide supporting documentation such as drawings and spill sizing calculations for the existing LNG storage tank spill collection system including down-comers, considering vapor formation rates, that demonstrates that the spill conveyance systems including their down-comers can handle a spill with the addition of a high-capacity in-tank pump in each LNG storage tank.

To facilitate dual ship loading, a new 36-inch-diameter marine loading line would be added parallel to the existing line connecting the LNG in-tank pump header to the north and south jetty loading lines. Portions of the new loading line are adjacent to the waterway, and LNG releases could potentially enter the waterway. When cryogenic fluids contact ambient temperature water, LNG can experience sudden and explosive rapid phase transitions (RPTs). RPTs could impact berthed carriers and marine docks and increase vapor dispersion distances. The existing marine transfer piping is pipe-in-pipe that would aid in preventing releases from entering the waterway. Cameron LNG indicated that in accordance with the siting analysis required in 49 CFR 193 Subpart B, a 2-inch release was modeled and would completely flash to vapor with no LNG expected to enter the waterway. However, there is a range of failures between a 2-inch hole and a guillotine failure of the 36-inch-diameter loading header which may result in LNG releases reaching the nearby water. Therefore, we recommend in section 3.2 that Cameron LNG determine whether a horizontal or tangential LNG release up to a full guillotine of the 36-inch-diameter loading line could enter the waterway and evaluate if additional mitigation such as barriers, shrouds, or a pipe-in-pipe design along this section of piping would prevent releases from reaching the waterway. Alternatively, if no mitigation measures are proposed to prevent releases from reaching the waterway for the new parallel loading line, a quantitative risk analysis should be provided per NFPA (2019) Section 19.6.1 and should also include; modeling that determines the probability of LNG releases resulting in rainout on the water surface, accounting for release size, direction, and discharge angle relative to the horizontal; calculates the distances to specified endpoints for potential hazards associated with LNG spills on water, with and without the estimated effect of RPTs accounting for weather data particularly wind speed and direction; and calculates the number of persons impacted by each release case accounting for as well as population distribution; and lastly comparing the results with tolerability criteria published by FERC and NFPA 59A. If results indicate a need to demonstrate risks are as low as reasonably practicable, analyses may need to demonstrate whether additional hazard detection or other layers of protection through a variance request

would be needed to demonstrate equivalency in reducing risk to public safety and to compensate for any releases that may not be captured by the spill containment.

For tanks and vessels outside of the Train 4 LNG or marine transfer conveyance systems, Cameron LNG proposes curbing and local impoundments to contain potential spills. Tanks and vessels with local impoundments include the Lean Amine Tank, Liquid Nitrogen Storage tanks, Hot Oil Expansion Drum, Diesel Storage tank, and the Wet and Dry flare KO Drums. Cameron LNG did not specify the dimensions of the containment system around the Hot Oil Expansion Drum, the Liquid Nitrogen Storage tanks, the Lean Amine Tank, or the Diesel Storage tank to confirm the containment system would contain the full contents of the tanks and vessels. The diesel storage area including its tank, pumps, and its impoundment were authorized in the Expansion Project under Docket No. CP15-560-000 and would be relocated to the north northwest by approximately 1000 feet. Furthermore, minor hose spills and drips in the diesel truck unloading area would be contained within the curbed area. Cameron LNG provided dimensions of the curbed area around the Dry and Wet Flare KO drums and stated the curbed area sizing case was the low liquid level for the Wet Flare KO drum. However, the Dry Flare KO drum is larger than the Wet Flare KO drum and the Dry Flare KO drum is sized to receive the full flow from the liquefaction rundown line in the event of a blocked outlet of the LNG product pumps and a resultant spill from this scenario would then overflow the spill containment. Therefore, we recommend in section 3.2 Cameron LNG provide spill containment system drawings with dimensions and slopes of curbing, trenches, impoundments, tertiary containment, and capacity calculations considering any foundations and equipment within impoundments, as well as the sizing and design of the down-comers. The spill containment drawings should show containment for all hazardous fluids including all liquids handled above 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.

Furthermore, for the new impoundment systems, Cameron LNG indicates that the stormwater pumps would be automatically operated by level control and interlocked using redundant low temperature detectors for LNG releases to prevent pumps from operating if hazardous material is present within this spill basin. Although stormwater removal pumps would be proposed for the large impoundment basins, curbed areas and dike walls would not have stormwater removal pumps installed. USDOT PHMSA's 49 CFR §193.2173 under Subpart C has requirements for stormwater removal from dikes and impoundments. Therefore, we recommend in section 3.2 that Cameron LNG provide correspondence from USDOT PHMSA on their plan to remove stormwater from curbed areas and dikes which would not have dedicated stormwater removal pumps. If authorized, constructed, and operated, final compliance with the requirements of 49 CFR 193 Subpart C, would be subject to USDOT PHMSA's inspection and enforcement programs.

If the project is authorized and constructed, Cameron LNG would install spill impoundments in accordance with its design 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 of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG be subject to regular inspections throughout the life of the facility to verify that impoundments are being properly maintained. We recommend in section 3.2 this condition also extends to the Amended Expansion Project.

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 authorized, constructed, and operated, 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 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. 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. We evaluated the spacing of buildings in line with AIChE CCPS, *Guidelines for Evaluating Process Plant Buildings for External Explosions and Fires*, API 752 and API 753, which provide guidance on identifying and evaluating explosion and fire impacts to buildings and occupants resulting from events external to the buildings, but found that some buildings were not adequately spaced from the process areas for a 1 pound per square inch (psi) overpressure, including the existing technology center and remote maintenance buildings. Therefore, we recommend in section 3.2 that Cameron LNG file a building siting assessment to ensure plant buildings that are occupied or critical to the safety of the LNG plant are adequately protected from potential hazards involving fires and vapor cloud explosions. In addition, FERC staff evaluated other hazards associated with releases and whether any damage would likely occur at other buildings or would result in cascading damage and found that no other buildings were located within the 1 psi overpressure and high radiant heat zones.

To minimize the risk of cryogenic spills causing structural supports and equipment from cooling below their minimum design metal temperature, Cameron 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 for LNG or be contained locally for liquid nitrogen. In addition, Cameron LNG would protect equipment and structural steel against cold shocks through selection of suitable materials of construction or by the application of cold spill protection for their Liquid Nitrogen Storage Area. As mentioned above, the Liquid Nitrogen Storage Area will have its own containment dike. Cameron LNG stated that all the structural supports exposed to liquid nitrogen will be either designed for that condition or be protected for the cryogenic exposure with adequate passive cryogenic protection, and that the design will be developed during the next detail phase of the project. We recommend in section 3.2 that Cameron LNG file drawings and specifications for structural passive protection systems to protect equipment and supports that could be exposed to cryogenic releases as well as file

calculations or test results that demonstrates equipment and supports are protected from cryogenic releases.

Cameron LNG would utilize liquid nitrogen to supply their nitrogen needs. However, unlike other cryogenic spills at the facility, spills in this area would be locally bunded in lieu of being conveyed away from equipment by trench systems. As such, cryogenic liquid nitrogen spills may cause thermal stress and damage to anything exposed to the cryogenic fluid, as well as presenting asphyxiation hazards to plan personnel. To mitigate liquid nitrogen spills, Cameron LNG would utilize procedures to respond to potential liquid nitrogen spills from nitrogen storage, truck unloading, and vaporization equipment. Response to spills would utilize trained and qualified personnel with the mandatory use of Self Contained Breathing Apparatus (SCBA) and other Personal Protective Equipment (PPE). Other mitigation methods would be used to prevent personnel contact with the spilled liquid, such as measures to control the nitrogen vapor cloud direction via a water curtain, and closing ventilation fresh air intakes on nearby equipment enclosures or buildings.

To minimize risk for flammable or toxic vapor ingress into buildings and from reaching areas that could result in cascading damage from explosions, Cameron LNG would generally locate buildings away from process areas and would locate fired equipment and ignition sources away from process areas. Cameron LNG would include flammable gas detection near HVAC air intake locations such that upon activation, the gas detectors would alert operators and the associated air intake would shut down. Further, we recommend in section 3.2 that Cameron LNG conduct a technical review of facility final design, 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. We recommend in section 3.2 that Cameron LNG Project facilities be subject to periodic inspections during construction, during which FERC staff can verify flammable/toxic gas detection equipment is installed in heating, ventilation, and air condition intakes of buildings at appropriate locations. In addition, we recommend in section 3.2 that Cameron LNG be subject to regular inspections throughout the life of the facilities where FERC staff can continue to verify that flammable/toxic gas detection equipment installed in building air intakes function as designed and are being maintained and calibrated.

To minimize overpressures from vapor cloud explosions, we evaluated how flammable vapors would be prevented from accumulating within confined areas. Cameron LNG would design for overpressures in accordance with API RP 752, ASCE 41088, and other recommended and generally accepted good engineering practices. Additionally, to minimize flammable vapors from reaching areas that could result in cascading damage from explosions, Cameron LNG proposed design of the process facilities minimizes confinement and congestion, including with the location of these facilities away from areas of confinement. In particular, flammable vapors from the process area would not likely accumulate within confined areas, such as underneath the existing LNG storage tanks because the proposed Train 4 area is located at a significant distance away from these tanks and the flammable vapors would dissipate while traveling over the approximate 4,600 feet distance. In addition, explosions in process areas were also evaluated

and demonstrated to not result in a 1 psi overpressure at the LNG storage tanks, control room, and administration, maintenance shop, and warehouse building also because they are located at significant distances away. While hazard modeling did show that the existing fire water tank and pumps are within the 1 psi overpressure contour for a worst case scenario involving an ignition of a vapor cloud release off the condensate line, overpressures were based on a worst case scenario using an overly conservative modeling approach with the actual overpressure to be likely much less than 1 psi and the pump and water tank should be able to withstand greater than 1 psi overpressures without structural failure.

To minimize the risk of pool fires from causing cascading damage, Cameron LNG would locate most of the spill impoundments to minimize radiant heat impacts on most plant areas. The liquefaction area LNG impoundment basin would be located away from process equipment and vessels. A fire from this liquefaction impoundment would result in radiant heats just under 10,000 Btu/ft^2-hr for a foam building. The Diesel Storage area is to be relocated to an isolated part of the plant and will also be located away from other process equipment and vessels. Thermal radiant heat modeling of a diesel pool fire, conservatively using liquefied methane as a fuel source, shows only equipment associated with the diesel storage tank are within 10,000 Btu/ft^2-hr zone, however this area does not have firewater protection. Additionally, a fire in the expanded marine transfer LNG impoundment basin would result in high radiant heats on a nearby BOG compressor added in the Amended Expansion Project, new foam building, and existing equipment and pipe racks. While the LNG impoundment basin would be served by high expansion foam and firewater, Cameron LNG has not yet demonstrated these systems sufficiently mitigate the hazard. Cameron has indicated that the details of the active and passive system protecting equipment and structures will be finalized in final design. Further discussions of these systems are discussed in 'Passive Low Temperature and Fire Protection' and 'Firewater Systems' sections of this document.

To minimize the risk of jet fires from causing cascading damage that could exacerbate the initial hazard, Cameron LNG would generally locate flammable and combustible containing piping and equipment away from buildings and process areas that do not handle flammable and combustible materials. FERC staff reviewed the jet fire scenarios and noted that none of the 1,600 Btu/ft^2-hr isopleth extended over or approached occupied buildings. However, some jet fire scenarios had 4,000 Btu/ft^2-hr or higher thermal fluxes that extended over most of Train 4 and significant parts of Train 3 and 2 as well as condensate storage area. Further, Cameron LNG stated that the additional loading line for dual ship loading would run parallel to the existing loading and its exclusion zone analysis for this new pipe is identical to the existing loading line. To mitigate these exposures, Cameron LNG would 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 section 3.2. In addition to the installation of firewater in the areas for exposure, Cameron LNG should relocate or design emergency equipment to withstand potential high heat flux during final design to ensure the availability of the equipment during an emergency. Therefore, we recommend in section 3.2 that Cameron LNG file a detailed quantitative analysis demonstrating that adequate mitigation would be provided for each significant component and emergency equipment within the 4,000 Btu/ft^2-hr zone from fires that could cause failure of the component.

FERC staff evaluated the spacing to determine if there could be cascading damage from impoundment and jet fires onto adjacent equipment, buildings, structures. To mitigate against high radiant heat on these equipment and structures, Cameron LNG utilizes thermal radiation mitigation measures to prevent cascading events in its design, including depressurizing valves on large volume lines, fire and gas detectors, fire proofing of structural steel columns supporting critical equipment, expansion foam systems, and fire monitors and hydrants. However, it has not yet been demonstrated that these efforts would provide sufficient protection and additional information would need to be provided in detailed design. Therefore, we recommend in section 3.2 that Cameron LNG provide final design of thermal mitigation measures, including depressurizing valves on large volume lines, fire and gas detectors, fire proofing of structural steel columns supporting critical equipment, expansion foam systems, and fire monitors and hydrants, for review and approval, to demonstrate cascading events would be mitigated. Further details on these systems are discussed in the sections 'Hazard Control', 'Passive Cryogenic and Fire Protection', 'Firewater' and 'Hazard Detection, Emergency Shutdown, and Depressurization Systems'.

If the project is authorized, Cameron LNG would finalize the plot plan, and we recommend in section 3.2 that Cameron LNG provide any changes for review and approval to ensure capacities andsetbacks are maintained. If the facilities are constructed, Cameron LNG would install equipment in accordance with the spacing indicated on the plot plans. We recommend in section 3.2 that Project facilities be subject to periodic inspections during construction for FERC staff to verify equipment is installed in appropriate locations and the spacing is met in the field. In addition, we also recommend in section 3.2 that Project facilities be subject to regular inspections throughout the life of the facilities to continue to verify that equipment setbacks from other equipment and ignition sources are being maintained during operations.

Ignition Controls

Cameron LNG 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 authorized, constructed, and operated, 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). NFPA 59A (2001) subsequently references NFPA 70 (1999) for installation of electrical equipment and wiring.

The area around the marine transfer line must comply with USCG regulations in 33 CFR 127 and incorporation of NFPA 70 (2020). However, 33 CFR 127 excludes NFPA 59A (2019) hazardous area classifications and NFPA 70 (2020) no longer contains hazardous area classification extents. Nonetheless, Cameron LNG's hazardous electrical classification drawings meet NFPA 59A (2001) and API RP 500 which stipulates the hazardous areas for marine loading areas.

Depending on the risk level, areas where electrical equipment would be located and wiring routed would either be unclassified, classified as Class 1 Division 1, or Class 1 Division 2.

Electrical equipment and wiring 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 evaluated Cameron LNG's electrical area classification drawings to determine whether Cameron LNG would meet these electrical area classification requirements and good engineering practices in NFPA 59A, 70, 497, and API RP 500. Cameron LNG meets NFPA 59A (2001), NFPA 70 (1999 and 2020), NFPA 497, and API RP 500.

If the project is authorized, Cameron LNG would finalize the electrical area classification drawings and would describe changes made from the FEED design. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG provide electrical area classification drawings. We recommend this condition be revised as written in section 3.2, that Cameron LNG file the final design of the electrical area classification drawings, including cross sectional drawings for review and approval. The drawings shall demonstrate compliance with NFPA 59A (2019 edition), NFPA 70 (2017 edition), NFPA 497 (2017 edition), and API RP 500 (3rd edition), or approved equivalents. In addition, the drawings shall include revisions to the electrical area classification design or provide technical justification that supports the electrical area classification of the following areas using most applicable API RP 500 figures (e.g., figures 20 and 21) or hazard modeling of various release rates from equivalent hole sizes and wind speeds (see NFPA 497 release rate of 1 lb-mole/minute). If facilities are constructed, Cameron LNG would install appropriately classed electrical equipment, and we recommend in section 3.2 that Project 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. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG be subject to regular inspections throughout the life of the facility, during which FERC staff can 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. We recommend in section 3.2 that this condition also extends to the Amended Expansion Project.

In addition, submerged pumps and instrumentation must be equipped with electrical process seals,and instrumentation in accordance with NFPA 59A (2001) and NFPA 70 (1999 and 2020). There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG 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 (1999 or 2020, as applicable). In addition, there is a recommendation in section 3.2 that Cameron LNG 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. Finally, there is a recommendation in section 3.2 that Project facilities be subject to regular inspections throughout the life of the facility to ensure electrical process seals for submerged pumps continue to conform to NFPA 59A and NFPA 70 and that air gaps are being properly maintained.

Hazard Detection, Emergency Shutdown, and Depressurization Systems

Cameron 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, and other recommended and generally accepted good engineering practices. Additionally, Cameron LNG would install an ESD system in accordance with NFPA 59A. The ESD shutdown would include failsafe, or fireproof, valves within 50 feet of the equipment they protect. ESD manual push buttons would be installed at least 50 feet from the equipment they serve. FERC staff reviewed the proposed location of ESD push buttons to verify that areas would have appropriate ESD button access. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG provide drawings showing the locations of the emergency shutdown buttons. We recommend in section 3.2 that this condition also extend to the Amended Expansion Project. In addition, we recommend in section 3.2 that Cameron LNG provide specifications, for review and approval, for the final design of fire safety specifications, including hazard detection, hazard control, and firewater systems. FERC staff would evaluate the specification for compliance with recommended and generally accepted good engineering practices for performance, and installation, operation, and maintenance of gas detectors such as ISA 12.13.01 and ISA 12.13.02, or equivalent.

FERC staff also 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). The proposed hazard detection design utilizes an array of point gas, open path, flame, and low temperature detectors to provide adequate coverage of process equipment containing flammable fluids. Furthermore, the alarm setpoints for these detectors are appropriate for the hazard they would detect. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG provide a fire protection evaluation. We recommend this condition be revised as written in section 3.2, that Cameron 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 consider the set points, voting logic, windspeeds, and wind directions.

Cameron LNG specified low oxygen detectors in the liquid nitrogen storage tanks and ambient vaporizers area in the Project drawings. The proposed alarm setpoints for these detectors would be appropriate for low oxygen detection.

Cameron LNG indicated that hydrogen detection would be installed in battery rooms to alarm and initiate mitigation actions in the event that ventilation equipment is not operating. Cameron LNG has committed to providing the locations of the hydrogen detectors, location drawings, and equipment lists during detailed engineering. Therefore, we recommend in section 3.2 that Cameron LNG file an analysis of the off gassing of hydrogen in battery rooms and ventilation calculations that limit concentrations below the lower flammable limit (LFL) (e.g.,

25-percent LFL) as well as provide hydrogen detectors that alarm and initiate mitigative actions or alarms in the event the ventilation equipment is not operating or functioning as designed.

FERC staff also reviewed the fire and gas cause and effect matrices to evaluate if the detectors that would initiate an alarm, shutdown, depressurization, or other action based on the FEED. The cause-and-effect matrices included all detector types and hazard detection devices. The hazard detection devices did specify the hazard detector device type, device tag number, voting logic, and set points that would initiate any type of action. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG provide, for review and approval, the cause-and-effect matrices for process instrumentation, fire and gas detection system, and emergency shutdown system. We recommend in section 3.2 that this condition also extends to the Amended Expansion Project. In addition, we recommend in section 3.2 that Cameron LNG provide additional information, for review andapproval, on the final design of all hazard detection systems (e.g., manufacturer and model, elevations, etc.)and hazard detection layout drawings.

If the project is authorized, constructed, and operated, Cameron LNG would install hazard detectors according to its final specifications and drawings, and we recommend in section 3.2 that Project facilities be subject to periodic inspections during construction to verify hazard detectors and ESD 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 of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG be subject to regular inspections throughout the life of the facility, during which FERC staff may verify hazard detector coverage and functionality is being maintained and are not being bypassed without appropriate precautions. We recommend in section 3.2 that this condition also extends to the Amended Expansion Project.

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 Standard 2510A; and other recommended and generally accepted good engineering practices. We evaluated the adequacy of the number and availability of handheld, wheeled, and fixed fire extinguishing devices throughout the site based on the FEED drawings. FERC staff also evaluated whether the spacing of the fire extinguishers would meet NFPA 10 and agent type and capacities meet NFPA 59A (2009 and later editions). Hazard control plans appeared to generally 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), except for the pipe rack where travel distances exceed the parameters in NFPA 10. NFPA 10 travel distances were generally met for other components that could pose an ordinary combustible hazard (Class A) or associated electrical (Class C) hazard for handheld extinguishers (75 feet).

While Cameron LNG indicated that buildings would be provided with handheld extinguishers to NFPA10 requirements, including placement at each entry/exit, hazard control drawings were not provided. However, Cameron LNG has committed to providing these documents in final design. Travel distances, installation heights, visibility, flow rate capacities,

and other requirements in accordance with NFPA 59A (2019 edition) or equivalent and NFPA 10 (2022 edition) or equivalent should be confirmed in final design and in the field where design details, such as manufacturer, obstructions, and elevations, would be better known. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG provide plan drawings and list of all extinguishers that show location, tag number, type, capacity, and equipment covered. However, we recommend this condition be revised as written in section 3.2, that Cameron LNG file the final design of these systems and demonstrated they meet NFPA 59A (2019 edition) or approved equivalent and NFPA 10 (2022 edition) or approved equivalent, for review and approval, where details are yet to be determined (e.g., manufacturer and model, elevations,flowrate, capacities, etc.) and where the final design could change as a result of these details or other changes in the final design of the Project.

In addition, we evaluated whether clean agent systems would be installed in all instrumentation buildings in accordance with NFPA 2001. Facilities associated with the Amended Expansion Project will be controlled from the existing Cameron LNG control room which is protected by a clean agent suppression system in accordance with NFPA 2001. Cameron LNG also indicated that clean agent fire suppression systems would serve remote instrument enclosures and CO_2 extinguishers would be provided in buildings containing electrical and electronic equipment.

If the Project is authorized, constructed, and operated, Cameron LNG would install hazard control equipment. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG 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 of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG be subject to regular inspections throughout the life of the facility to verify in the field that hazard control coverage is being properly maintained and inspected. We recommend in section 3.2 that these conditions also extend to the Amended Expansion Project.

Passive Low Temperature and Fire Protection

If low temperature 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.

USDOT PHMSA regulations incorporate NFPA 59A (2001) by reference in 49 CFR 193.2101 under Subpart C for design, 49 CFR 193.2301 under Subpart D for construction, 49 CFR 193.2401 under Subpart E for equipment, 49 CFR 193.2521 under Subpart F for operational records, and 49 CFR 193.2693 under Subpart G for maintenance records. 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 againstfire exposure, escaping cold liquid, or both, if they are subject to such exposure. We also note that 49 CFR 193.2801 under Subpart I for fire protection only incorporates sections 9.1 through 9.7 and 9.9 of NFPA 59A (2001), which requires an evaluation of methods necessary for protection of equipment and structures from effects of fire exposure but does not reference requirements for

passive cryogenic protection. However, NFPA 59A (2001) does not provide the criteria for determining if pipe supports, equipment, or structures are subject to such exposure or the level of protection needed to protect the pipe supports, equipment, or structures against such exposures. In addition, NFPA 59A does not address cryogenic or structural protection of pressure vessels or other equipment. Therefore, FERC staff evaluated whether passive low and fire protection would be applied to pressure vessels and structural supports to facilities that could be exposed to low temperature liquids (i.e., below the MDMT) or radiant heats of 4,000 Btu/ft^2-hr or greater from fires with durations that could result in failures.[28] In addition, FERC staff evaluated whether the passive protection would be specified in accordance with recommended and generally accepted good engineering practices, such as International Organization for Standardization (ISO) 20088, API 2001, API 2010A, API 2218, ASCE/Society of Fire Protection Engineers (SFPE) 29, ASTM E84, ASTM E2226, Institute of Electrical and Electronics Engineers (IEEE) 1202, ISO 22899, National Association of Corrosion Engineers (NACE) 0198, NFPA 58, NFPA 290, OTI 95 634, Underwriters Laboratories (UL) 723, UL 1709, and/or UL 2080, with a fire protection rating commensurate to the exposure.

To minimize the risk of cryogenic spills causing structural supports and equipment from cooling below their minimum design temperature, Cameron LNG would protect equipment and structural steel against cold shocks through selection of suitable materials of construction or by the application of cold proofing. In addition, Cameron LNG would have spill containment systems surrounding low temperature equipment and would generally locate low temperature equipment away from process areas that do not handle low temperature materials. However, the Liquid Nitrogen Storage Area will have its own containment dike. Cameron LNG stated that all the structural supports exposed to liquid nitrogen will be either designed for that condition or be protected for the cryogenic exposure with adequate passive cryogenic protection, and that the design will be developed during the next detail phase of the project. Cryogenic protection should comply with NFPA 59A (2001), ISO 20088, and other recommended and generally accepted good engineering practices. We recommend in section 3.2 that Cameron 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.

To minimize the risk of a pool or jet fire from causing cascading damage, Cameron 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. However, FERC staff identified equipment and structures exposed to radiant heats of 4,000 Btu/ft^2-hr or greater from pool fires which may result in failures. An LNG pool fire at the Marine Transfer Area impoundment basin would result in high radiant heats on a nearby new BOG compressor, new foam building, and elevated pipe racks. Cameron LNG provided drawings that show fire exposed areas, including equipment and components. However, passive protection was not always provided to areas which could cause cascading damage. Cameron LNG indicated that calculations demonstrating that passive protection will prevent cascading events such as BLEVE and pressure vessel burst would be performed in

[28] 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

detailed design. In addition, Cameron LNG indicated that calculations would be performed to prevent structural steel failure in the detailed design phase of the project. To mitigate against high radiant heat on these equipment, building, and structures, Cameron LNG should implement fire proofing of critical equipment and structural steel columns supporting critical equipment in addition to other thermal radiation mitigation measures to prevent cascading events in the design such as including depressurizing valves on large volume lines, fire and gas detectors, expansion foam systems, and fire monitors and hydrants. The structural fire protection design should comply with NFPA 59A (2001); API RP 2218; ISO 22899; UL 1709; and other recommended and generally accepted good engineering practices. Process equipment structural supports subject to pool and jet fires should have fire ratings of at least 2 hours, either per design or through the use of fireproofing. Fireproofing should be provided in accordance with the Fireproofing/Fire Insulation Specification. While the application makes reference to API 2218 in regard to fire proofing, API 2218 leaves it up to the owner and indicate details which would be resolved in final design. In addition, API 2218 requires structural fire protection in certain areas and also recommends fire envelopes be defined based on potential fire scenarios for defining where passive fire protection is needed. API 2218 recommends the use of UL 1709 for performance requirements of passive fire protection in areas that are determined to be subjected to pool fires and provides more limited guidance on defining what jet fire scenarios to consider or the performance requirements of passive fire protection. However, API 2218 does not define the pool fire or jet fire scenarios or the radiant heats to be used to determine the extent of passive fire protection. Therefore, we recommend in section 3.2 that Cameron LNG file drawings and specifications for the passive fire protection and calculations or test results (e.g., ISO 22899, NFPA 290, OTI 95 634, etc.) that demonstrate the effectiveness of the passive fire protection, where applicable. We also recommend in section 3.2 that passive protection be defined based on scenarios that could lead to offsite impacts or cascading damage and that structural supports may fail as low as 4,900 Btu/ft2-hr[29], and where pressurized equipment may fail as low as 4,000 Btu/ft^2-hr[30], while recognizing that pool fire tests under UL 1709 are for 65,000 Btu/ft2-hr

[29] FERC staff's heat impact preliminary analyses indicate most carbon structural steels (e.g., ASTM A36), will begin to have a noticeable loss of strength at 570°F (300°C), lose approximately one-third of strength at 840°F (450°C), and lose approximately one-half of strength at 1,000°F (540°C). These temperatures would correspond to black body radiant heats of approximately 2,000 Btu/ft2-hr (6.1 kW/m2), 4,900 Btu/ft2-hr (15.5 kW/m2), and 7,750 Btu/ft2-hr (24.5 kW/m2), respectively, and the latter radiant heats may correspond to when structural steel begins to exceed yield strengths and suffer possible structural damage based on allowable stress/strength designs in structural and mechanical design codes (e.g., ASCE 7, American Institute of Steel Construction 360, ASME B31.3, and ASME BPVC), which most commonly limit stresses to one-half to two-thirds of yield strength. In addition, these values are in line with NFPA 59A (2016 and 2019 editions) that recommend similar temperature and corresponding radiant heats for steel, ABS Consulting, *Consequence Assessment Methods for Incidents Involving Release from Liquefied Natural Gas Carriers, 2004* that reports long-term exposures at about 8,000 Btu/ft2-hr (25 kW/m2), steel surfaces experience serious dislocation as well as paint peeling, and structural elements undergo substantial deformation according to damage resulting from thermal radiation for various materials, and Sandia National Laboratories *Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water*, 2004, that reports durations of more than 10 minutes at approximately 12,000 Btu/ft2-hr causes temperatures to rise to 980°F (530°C) and result in a 25- to 40-percent loss in steel strength and damages structures.

[30] FERC staff recognize that pressurized equipment in accordance with ASME BPVC allows for pressure relief valves to pressures to rise to 1.2 times the design pressure, which would lower the pressure in the vessel to less than the bursting pressure of typically 3 to 4 times the design pressure, but adds stress to the equipment above normal design conditions and causes a reduction in temperature and subsequent reduction in radiant heat from 4,900

(2,000°F) in 5 minutes and a 1-hour duration, which would provide thicker passive protection than may be necessary to prevent failure in some areas and thinner passive protection than may be necessary to prevent failure in other areas. We also note the application of fireproofing is sometimes prescribed in API 2218 to be 20 to 40 feet high, which may be less than or more than a pool fire height or jet fire flame length. Therefore, we also recommend in section 3.2 that Cameron LNG file a detailed quantitative analysis to demonstrate that adequate mitigation would be provided for each significant component within the 4,000 Btu/ft2-hr zone from pool or jet fires that could cause failure of the component. The effectiveness of passive mitigation should be supported by calculations for the thickness limiting temperature rise, and active mitigation should be justified with calculations demonstrating flow rates and durations of any cooling water that would mitigate the heat absorbed by the vessel. In addition, we recommend in section 3.2 that Cameron LNG file the final design of these mitigation measures, for review and approval prior to construction of the final design, to demonstrate cascading events would be mitigated.

FERC staff also evaluated whether the design of transformers associated with the project would be consistent with NFPA 850. While Cameron LNG has proposed outdoor transformers it is unclear if the transformers would be fitted with spill containment or would meet the spacing and firewall requirements of NFPA 850. Therefore, we recommend in section 3.2 that Cameron LNG provide final datasheets for the transformers and transformer fluid and an analysis in accordance with NFPA 850 to justify the acceptability of the transfer spacing if fire or blast walls are not provided.

If the Project is authorized, constructed, and operated, Cameron LNG would install structural cryogenic and fire protection according to its design, and we recommend in section 3.2 that Project 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 existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG be subject to regular inspections throughout the life of the facility. We recommend in section 3.2 this condition applies to the Amendment project for FERC staff to continue to verify that passive protection is being properly maintained.

Firewater Systems

Firewater systems may be used to extinguish or mitigate impacts from fires by cooling surfaces exposed to the heat from a fire to prevent failure of structural supports of equipment and pipe racks. However, for LNG and other flammable liquids stored at low temperatures, firewater can cause the fire to grow larger due to the relatively warm water causing more of the flammable liquid to vaporize. Therefore, much of the firewater at a LNG terminal is used for exposure cooling purposes.

Cameron LNG would install firewater systems, including fixed and manually 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

to 4,000 Btu/ft2-hr for when pressurized equipment may fail. We also recognize that 4,000 Btu/ft2-hr is a commonly used endpoint in fire analyses.

exposed to heat from a fire. These firewater systems would be designed, tested, and maintained to meet NFPA 59A (2001), 13, 14, 15, 24, and 25 requirements. The firewater system would be installed as a loop to supply firewater to a user from multiple flow paths. Post indicator and sectional valves would be installed to isolate portions of the firewater loop out of service for maintenance. NFPA 24 (2013, 2016, 2019, 2022) section 6.6 requires sectional valves be provided on looped systems at locations within piping sections such that the number of fire protection connections between sectional valves does not exceed six.

FERC staff evaluated the adequacy of the general firewater system coverage to assess the appropriateness of the associated firewater demands of those systems for worst-case fire scenarios to size the firewater pumps as well as onsite firewater storage. While Cameron LNG would provide firewater systems, including remotely operated or self-oscillating and manually operated firewater monitors, sprinkler systems, fixed water spray systems, high expansion foam systems, as well as 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, based on our review, we noted various potential deficiencies.

As aforementioned, NFPA 59A (2001) section 9.1.2 requires a fire protection evaluation to be undertaken using sound fire protection engineering principles, analysis of local conditions, hazards within the facility, and exposure to or from other property to be considered in the evaluation in the determination of fire protection equipment, including fire protection water systems. While Cameron LNG indicated that preliminary calculations indicate firewater demand for Train 4 facilities would only require 5/8th of the total firewater capacity, they did not provide a preliminary firewater demand case that identifies the maximum anticipated firewater demands of the facility during a fire event. It is anticipated firewater demand was not supported by detailed quantitative justification and detailed qualitative descriptions of the firewater scenarios in which the demand case was based were not provided. In addition, Cameron LNG did not indicate whether total fire water demand accounts for large fires that may cause simultaneous use of different firewater systems as per NFPA 15. As such, Cameron LNG did not clearly demonstrate how the demand case accounts for impounded pool and jet fires. In response to these reviews, Cameron LNG committed to providing additional information on these analyses in final design. Therefore, FERC staff recommend in section 3.2 that Cameron LNG provide a detailed quantitative analysis to demonstrate that adequate mitigation would be provided for each significant component within the 4,000 Btu/ft2-hr zone from pool or jet fires that could cause failure of components within that radiant heat zone. In addition, we recommend in section 3.2 that Cameron LNG provide these details that are yet to be determined (e.g., defined fire cases, quantitatively supported demand case, etc.) and where the final design could change as a result of these details or other changes in the final design of the Project.

Further, reviews of impoundment fires from diesel, liquefaction, and marine impoundments each identified structures, vessels, and storage tanks which could cause cascading damage that could exacerbate the initial hazard. Radiant heat from a liquefaction impoundment fire would not affect equipment and piping, except for a building provided with the foam generation system for the liquefaction impoundment. Radiant heat effects from a diesel tank dike fire may be easily remedied with the addition of firewater coverage or relocating diesel storage tank and associated dike. The proximity of pressure vessels, equipment, piping,

buildings, and structures adjacent to marine transfer area impoundment may make the independent protection of these systems from high radiant heat levels by spacing alone infeasible. In areas where independent passive and active systems would independently protect equipment at risk from high radiant heat from pool fires from failure, the active protection system at the facility should have a reliability equivalent to a Safety Integrity Level 3 system. While Cameron LNG has indicated that it would install high-expansion foam to decrease the radiant heat from the liquefaction and marine impoundments, it has not demonstrated that the expansion foam would sufficiently reduce the high radiant heat on adjacent equipment and structures or demonstrate whether the addition of these systems would be in lieu or in addition to passive systems. Therefore, we recommend in section 3.2 that, for review and approval, prior to construction of the final design, Cameron LNG file details to demonstrate that equipment and structures would be protected from radiant heat levels above 4,000 Btu/ft2 which would cause failure of the component from a spill impoundment fire, by a system or multiple systems with a reliability equivalent to a Safety Integrity Level 3 system.

Further, reviews identified that the hydrants and monitors used for coverage would, in cases, be near the hazard and Cameron LNG has not demonstrated that the manual monitors and hydrants, including necessary extents of hoses, could be accessed in an emergency to provide the required coverage. This review may identify locations where the monitors should be automatically oscillating or remotely controlled. Cameron LNG confirmed that if firefighting equipment cannot be operated remotely during a fire event, the firewater design would account for the effects of radiant heat on persons which would need to access equipment during a fire event; however, Cameron LNG did not provide analyses demonstrating this capability. Therefore, we recommend in section 3.2 that Cameron LNG provide these details that are yet to be determined (e.g., monitor coverage distances, access during fire events, etc.).

The firewater system would be installed as a loop to supply firewater to a user from multiple flow paths. Post indicator and sectional valves would be installed to isolate portions of the firewater loop out of service for maintenance or damaged in an incident. NFPA 24 (2013, 2016, 2019, 2022) section 6.6 requires sectional valves be provided on looped systems at locations within piping sections such that the number of fire protection connections between sectional valves does not exceed six. The preliminary firewater design shows adequate placement of post indicator and sectional valves; however, Cameron LNG may need to amend the number of firewater users during final design. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG provide firewater system drawings. However, we recommend this condition be revised as written in section 3.2 that Cameron LNG provide plan drawings of the firewater loop which show the location of post indicator valves and sectionalvalves in accordance with NFPA 24 (2013 or thereafter) or approved equivalent.

Cameron LNG provided firewater coverage drawings for the firewater monitors, fire hydrants, and deluge systems. While general coverage was provided for the entire facility, no coverage was provided for the diesel storage area and associated equipment. New firewater piping may need to be added to supply the monitors and hydrants and other firewater users associated with the diesel storage area. Firewater drawings associated with Train 4 generally show that the firewater system would be isolatable by post-indicator valves to ensure that any

one section of the fire main can be taken out of service without affecting the supply of firewater to the rest of the network. However, where firewater monitor coverage circles intersect pipe racks, large vessels or process equipment, the firewater coverage could be blocked, and the number and location of firewater monitors and hydrants may need to be modified to account for obstructions and increase in firewater demand during the final design. Therefore, FERC staff recommends in section 3.2 that Cameron LNG file 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.), including that the drawings should demonstrate that each process area, fire zone, or other sections of piping with several users can be isolated with post indicator valves. Hydrants and monitors would be installed along the internal facility roads. However, documentation was not provided that indicated that bollards and guards for hydrants and monitors would be installed in close proximity to the roadways. We recommend in section 3.2 that Cameron LNG file additional information detailing the internal road vehicle protections not only for fire protection equipment, but for other plant equipment as well.

Cameron LNG is not proposing to install new firewater pumps or firewater storage tanks as part of the Amended Expansion project and will rely on the existing facility firewater pumps and sources. Therefore, FERC staff evaluated the adequacy of the existing firewater pumps and storage tank to provide the preliminary calculated firewater demand. The existing firewater system has three diesel driven firewater pump which draw their source from a firewater storage tank. The makeup water for the firewater storage tank comes from the municipal water supply, and an onsite groundwater well. The existing firewater system also has two backup diesel firewater pumps which draw their source from the Calcasieu ship channel in the event the primary firewater source is unavailable. FERC staff evaluated the capacity of the existing firewater storage tank and found it could supply two hours of firewater at the demand case preliminary flowrate, plus and an additional 1,000 gpm for hand hose allowance. Cameron LNG indicated a detailed firewater demand analysis will be performed in final design, and we recommend in section 3.2 that Cameron LNG file an updated fire protection evaluation, including firewater demand calculations, before construction of final design. Furthermore, we recommend in section 3.2 the Cameron LNG file drawings of the firewater system prior to construction. These recommendations would afford FERC staff the opportunity to verify the existing firewater storage tank has the capacity to provide the firewater demand before Cameron LNG begins construction of the Train 4 firewater systems.

There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG provide drawings of the location of firewater and foam systems, the coverage area of firewater users, as well as complete firewater pump acceptance test and firewater and hydrant coverage tests. We recommend in section 3.2 that these conditions also extend to the Amended Expansion Project. Cameron LNG would not install additional firewater pumps as part of the Amended Expansion Project, and Cameron LNG has not demonstrated that existing firewater capacity would sufficiently serve Train 4. There is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG provide firewater pump acceptance tests, and we recommend in section 3.2 that this condition also extend to the Amended Expansion Project. If the project is authorized and constructed, Cameron would finalize the firewater and foam system designs, which we recommend in section 3.2 that the final design be filed for FERC staff review and approval. If

the design is approved, Cameron LNG would install the firewater and foam systems as designed in accordance with their quality assurance and quality control procedures, which we recommend in section 3.2 be filed for FERC staff review and approval. We also recommend in section 3.2 that the facilities be subject to periodic inspections during construction by FERC staff, which would allow FERC staff to independently verify installation and construction of the firewater and foam systems. We also recommend in section 3.2 that Cameron LNG provide results of commissioning tests to verify the firewater and foam systems are installed and functional as designed prior to introduction of hazardous fluids, including firewater monitor and hydrant coverage tests to verify that actual coverage area from each monitor and hydrant matches the design coverage shown on facility plot plan(s). In addition, FERC staff recommends in section 3.2 that the Expansion facilities be subject to regular inspections throughout the life of the facility to ensure firewater and foam systems are being properly maintained and tested.

Geotechnical and Structural Design

Cameron LNG provided geotechnical and structural design information for its facilities to demonstrate if the site preparation and foundation designs would be appropriate for the underlying soil characteristics and to ensure that the structural design of the project facilities would be in accordance with Federal regulations, standards, 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, seiches, hurricanes, tornadoes, floods, rain, ice, snow, regional subsidence, sea level rise, landslides, wildfires, volcanic activities, and geomagnetism.

Geotechnical Evaluation

Applicants must provide geotechnical investigations under FERC regulations, 18 CFR 380.12(h)(3). 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 (2001). All facilities, once constructed, 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 forth 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 design to ensure they are adequate for the LNG facilities as described

The proposed Amended Expansion Project would be constructed entirely within the pre-existing Cameron LNG terminal located in Cameron and Calcasieu Parishes, Louisiana centrally located between the Gulf Intracoastal Waterway and the City of Hackberry, Louisiana. On May 5, 2016, FERC approved the Expansion Project under Docket No. CP15-560-000. Cameron LNG is proposing to amend the authorization under section 3 of the Natural Gas Act. Specifically, Cameron LNG is proposing to amend the authorization to construct Train 4 with modification and equipment and piping to load two vessels at the same time. Cameron LNG is no longer plans to construct Train 5 and the LNG storage tank authorized under CP15-560-000. During application phase of the Expansion Project, Cameron contracted Fugro to conduct

geotechnical investigation for the project site. FERC staff have reviewed the previously filed Expansion Project geotechnical investigation report to determine whether the existing geotechnical investigation would be sufficient for the proposed Amended Expansion Project.

The geotechnical investigation report contains a summary of field exploration, laboratory testing, and geotechnical recommendations for the design and construction of the proposed structures for the approved Cameron LNG Terminal Expansion. Fugro also evaluated the potential for growth faults. The geotechnical report explored subsurface conditions at LNG storage tank, Trains 4 and 5, and Utilities Area. However, the LNG storage tank and Train 5 were eliminated in the Amended Expansion project. Therefore, the geotechnical investigation for the storage LNG tank and Train 5 area would not be included herein. As presented in the geotechnical investigation report, Fugro completed field exploration activities for the Train 4 and utilities areas:1 boring and 6 cone penetration test soundings (CPTs) at the Train 4 area, and 2 CPTs at the utilities area. Based on the survey information obtained for the field exploration activities, the exiting site grade generally ranged from about El+12 ft to El+23 ft for the Train 4 area, and about El+2 ft to El +7 ft for the utilities area. The final site grading plan for both Train 4 and Utilities area would be at El+12 ft. Fugro performed settlement analysis of subgrade soils due to grade raise in the utilities area. Fugro indicated that the shallow foundations and grade-supported slabs may experience total and differential settlements on the order of maximum 3 inches in Train 4 area, and maximum 10 to 12 inches in utilities area. Hence, Fugro stated that the deep foundation should be used for majority of the structures in Train 4 area, lightly loaded and settlement insensitive structures can be supported by shallow foundations with minimum of 2 ft embedment after soil improvement for the area. For utilities area, deep foundation should be used for majority of the structures downdrag anticipated, lightly loaded and settlement insensitive structures can be supported on shallow foundation with minimum of 3 ft embedment. Fugro suggested installation of settlement monitoring program at the project site for at least 2 years after completion of construction. Due to wide range of settlements, we recommend in section 3.2 that prior to construction of final design, Cameron LNG should file with the Secretary: a) the finalized settlement monitoring program and procedure for the proposed project site; b) the total and differential settlement of final designed structures, systems, and components foundations for the proposed project site. These filings should be stamped and sealed by the professional engineer-of-record, registered in the State of Louisiana.

In addition, Fugro confirmed the absence of faulting with Train 4 area and utilities area in the fault study for the Expansion project. Fugro also performed soil corrosion tests for the proposed project. The laboratory tests results indicate the potential for corrosion due to chloride ion concertation is generally high to very high, and potential due to pH is mild. Based on the electrical resistivity results, the corrosion potential for buried steel is very high. The results of the sulfate ion concertation tests indicate that the potential for the degradation of concrete generally ranges from mild to severe at the site. Fugro recommend that corrosion engineers need to be consulted to recommend appropriate protective measures for the buried steel and concrete. Therefore, we recommend in section 3.2 that prior to construction of final design, Cameron LNG should file with the Secretary the finalized corrosion and prevention plan for any underground piping, structures, foundations, equipment, and components. The filing should be stamped and sealed by the professional engineer-of-record, registered in the State of Louisiana.

The results of Cameron's geotechnical investigation at the proposed project site indicated the subsurface conditions are generally suitable for the proposed Amended Expansion Project, if proposed site preparation foundation design, and construction methods are implemented appropriately. The Amended Expansion Project would not affect or change the validity of the geotechnical evaluation described in the Expansion Project EA under Docket No. CP15-560-000. If authorized and constructed, FERC staff would continue its review of the results of the geotechnical investigation to ensure facility foundation designs are appropriate prior to construction of final design and throughout the life of the facilities.

Structural and Natural Hazard Evaluation

FERC regulations under 18 CFR 380.12(m) requires applicants address the potential hazard to thepublic 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 would be usedto 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.[31] USDOT PHMSA regulations in 49 CFR 193 has specific requirements on designs to withstand certain loads from natural hazards and incorporates by reference NFPA 59A (2001 and 2006) and ASCE/SEI 7-05 for wind load data for shop fabricated containers of LNG or other hazardous fluids with a capacity of no more than 70,000 gallons. NFPA 59A (2001) section 2.1.1 (c) also requires Cameron LNG to consider the plant site location in the design of theProject 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. NFPA 59A (2001 edition) also incorporates ASCE 7-93, which contains design criteria for buildings and other structures, including natural hazards. However, USDOT PHMSA regulations do not specify the Occupancy Category that facilities must be designed to withstand. USDOT PHMSA's LOD on 49 CFR 193 Subpart B discusses Cameron LNG's proposed wind speed design and studies of site-specific natural hazards. If authorized, constructed, and operated, LNG facilities as defined in 49 CFR193 must comply with the requirements of 49 CFR 193 and would be subject to USDOT PHMSA's inspection and enforcement programs.

The marine transfer areas would be subject to 33 CFR 127, which requires that the piers and wharves are designed to resist earthquake forces, if the waterfront facility handling LNG is in a region subject to earthquakes. In addition, USCG regulations under 33 CFR 127 incorporates by reference certain portions of NFPA 59A (2019), including Chapter 10 and Chapter 12 that contain provisions for design against natural hazards. NFPA 59A (2019 edition) Chapter 10 requires piping be designed to withstand certain seismic events under limited parameters and Chapter 12 requires design seismic activity, including tsunami and wind, ice, flooding, including hurricane storm surge, and snow in accordance with ASCE 7 (2016 edition)

[31] FERC regulations do not specify what edition of NFPA 59A an applicant should demonstrate compliance with. In most applications, applicants have interpreted this as the edition(s) incorporated into DOT PHMSA regulations, which for this case would be the 2001 and 2006 editions at the time of application. Others have interpreted this as the NFPA 59A edition published at the time of application or another edition they intend on incorporating in addition to those incorporated into DOT PHMSA regulations.

Risk Category III. Cameron LNG clearly states that this Amended Expansion project does not include any marine infrastructure or dredging activities. In addition, Cameron LNG has committed to meeting NFPA 59A (2019) as incorporated by33 CFR 127 if needed.

Furthermore, we evaluated the basis of design for project facilities for all natural hazards under FERC jurisdiction, including those under USDOT PHMSA and USCG jurisdiction. Cameron LNG states that the project would be constructed to satisfy FERC and NFPA 59A requirements in accordance with the 2009 International Building Code (IBC), ASCE/SEI 7-05, and ASCE/SEI 7-10. These regulations and 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. FERC staff also evaluated whether the engineering design would withstand impacts from natural hazards, such asearthquakes, tsunamis, seiches, hurricanes, tornadoes, floods, rain, ice, snow, regional subsidence, sea levelrise, landslides, wildfires, volcanic activity, and geomagnetism.

If the proposed project is authorized, constructed, and operated, Cameron LNG would install equipment in accordance with its final design. In addition, there is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG condition that prior to construction of the final design, Cameron LNG should file with the Secretary the final design package (e.g., finalized civil design basis, criteria, specifications, structures and foundations drawings, and calculations, etc.) and associated quality assurance and quality control procedures with the documents reviewed, approved, and stamped and sealed by the professional engineer-of-record, registered in the State of Louisiana. We recommend in section 3.2 that this condition also extend to the Amended Expansion Project.

Earthquakes, Tsunamis, and Seiche

FERC regulations under 18 CFR 380.12(h)(5) require evaluation of earthquake hazards based onpotential 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). As previously mentioned, the proposed Amended Expansion Project would be constructed entirely within the pre-existing Cameron LNG terminal. The Amended Expansion Project would not alter the hazard of Earthquake, Tsunami, and Seiche to the facility. For further discussion on these hazards, refer to section 2.1.3 of the EA filed under CP15-560-000.

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. To assess the potential impact from hurricanes, tornadoes, and other meteorological events, Cameron LNG evaluated such events historically. The severity of these events is often determined on the probability that they occurand 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.

Because of its location, the project site would likely be subject to hurricane force winds during the life of the project. Cameron LNG states that all LNG facilities would be designed to withstand a sustained wind velocity of not less than 150 mph per 49 CFR §193.2067. Other structures and equipment wind speed design would comply with ASCE/SEI 7-10 requirements. A sustained wind speed of 150 mph is equivalent to a 183 mph 3-second gust wind speed at 33 feet (10 meters) above ground for Exposure C category, using the Durst Curve in ASCE/SEI 7-10 or using a 1.23 gust factor recommended for offshore winds at a coastline in World Meteorological Organization, *Guidelines for Converting between Various Wind Averaging Periods in Tropical Cyclone Conditions*. These wind speeds are equivalent to approximately 100,000-year mean return interval or 0.05 percent probability of exceedance in a 50-year period for the site, based on ASCE 7-22 wind speed return period conversions (ASCE 7 Hazard Tool). Per ASCE/SEI 7-10, the 183 mph 3-second gust wind speed equates to a strong Category 4 Hurricane using the Saffir-Simpson Hurricane Wind Scale (130-156 mph sustained wind speed).

Cameron LNG states that the Amended Expansion Project would meet 49 CFR § 193.2067, under Subpart B, for wind load requirements. In accordance with the 2018 MOU, USDOT PHMSA will evaluate in its LOD whether an applicant's proposed project meets the USDOT PHMSA requirements under Subpart B. If the Amended Expansion Project is authorized and 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. In addition, the Amended Expansion Project would not increase the potential damage to the facility by hurricanes, tornadoes or other meteorological events. If authorized and constructed, FERC staff would continue its review of finalized wind load design for the proposed project facilities. Therefore, we do not consider that construction or operation of the Amended Expansion Project would be significantly impacted by wind speed.

FERC staff evaluated historical tropical storm, hurricane, and tornado tracks in the vicinity of the project facilities using data from the Department of Homeland Security Homeland Infrastructure Foundation Level Data and NOAA Historical Hurricane Tracker.[32,33] Between 1863 and September 2021, there were 62 hurricanes and tropical storms that made landfall within 60 nautical miles of the Project site (NOAA, 2022), including numerical unnamed Hurricanes at Categories1, 2, and 3. Two unnamed Hurricanes in 1886 and 1918, Hurricane Rita in 2005, and Hurricane Audrey in 1957, which all made Hurricane Category 3 landfall within 60 nautical miles of Hackberry, Cameron Parish, Louisiana. Hurricane Laura in 2020 made Category 4 landfall within 60 nautical miles of Cameron LNG in Hackberry, Cameron Parish, Louisiana. Category 5 Hurricane Rita in 2005 was the most intense tropical cyclone on record in the Gulf of Mexico and the fourth-most intense Atlantic hurricane ever recorded. However, it

[32] Department of Homeland Security. Homeland Infrastructure Foundation Level Data: https://hifld-geoplatform.opendata.arcgis.com/. Accessed November 2022.

[33] NOAA. Historical Hurricane Tracker: https://coast.noaa.gov/hurricanes/. Accessed November 2022.

weakened to a Category 3 Hurricane with winds of 115 mph before making landfall in Johnson's Bayou, Louisiana, which is about 30 nautical miles from the Project site area. However, it produced significant storm surges, with maximum heights greater than 18 feet struct southwestern Louisiana, and coastal parishes experienced extensive damage. Category 5 Hurricane Katrina in 2005 was large and destructive. Yet, it weakened to Category 3 strength when it made its second landfall over southeast Louisiana. There is no known historic Category 5 Hurricane, which has made direct landfall within 60 nautical miles of the Project site area. Cameron LNG indicated that the maximum recorded rainfall in 24 hours is 16.9 inches and an annual rainfall of 54 inches. Cameron LNG states the project site would be designed with a 183 mph 3-second gust wind speed at 33 feet (10 meters) above ground for Exposure C category, and adequate site elevations to withstand Category 4 Hurricanes and 100-year and 500-year flood events.

Potential flood levels may also be informed from the FEMA Flood Insurance Rate Maps, which identify Special Flood Hazard Areas (base flood) that have a 1 percent probability of exceedance in 1 year to flood (or a 100-year mean return interval) and moderate flood hazard areas that have a 0.2 percent probability of exceedance in 1 year to flood (or a 500-year mean return interval). According to the FEMA National Flood Hazard Layer Viewer101[34], the North and West side of the facility are located in Zone AE, the East side facility is located in Zone X (other flood hazard) and coastal high hazard areas Zone VE (i.e., the land in the floodplain subject to a 1% or greater chance of flooding in any given year.) Zone VE, X and AE in the northwestern end of the project site with base flood elevation BFE at ranging approximately from +11 feet to +12 feet. Zones VE and AE are defined as Areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action. Zone X is defined as an Area along coasts subject to inundation by the 0.2-percent-annual-chance (or 500-year) flood event. We also recognize that a 500-year flood event has been recommended as the basis of design for critical infrastructure in publications, including ASCE 24, Flood Resistant Design and Construction. Cameron LNG states that the Amended Expansion Project would be designed to withstand a 100-year and 500-year return storm, rain, and associated storm surge event to ensure that internal flooding is of no consequence. The FEMA National Flood Hazard Layer will be reviewed to confirm the elevations of the site prior to final design.

We generally evaluate the design against a 500-year SWEL with a 500-year wave crest and sea level rise and subsidence. Using maximum envelope of water (MEOW) storm surge inundation maps generated from the Sea, Lake, and Overland Surge from Hurricanes model developed by NOAA National Hurricane Center, a 500-year event would equate to a Category 2 Hurricane and less than 3 feet MEOW. This is lower than indicated in the 500-year FEMA maps. In addition, while NOAA seems to provide higher resolution of topographic features, it limits its SLOSH maps to storm surge levels at high tide above 9 feet. As a result, FERC staff evaluated the storm surge against other sources using SLOSH maps that indicate an upper range of 8-12 feet MEOW for Category 2 Hurricanes, and also indicated 16-19 feet MEOW for Category 3 Hurricanes, 20-24 feet MEOW for Category 4 Hurricanes, and 25-30 feet MEOW for

[34] FEMA National Flood Hazard Layer Viewer: https://hazards-fema.maps.arcgis.com/apps/webappviewer. Accessed October 2022.

Category 5 Hurricanes, but note this does not seem to provide as high of a resolution of topographic features and may overpredict the storm surge. This data suggests that current Cameron LNG design may not withstand Category 3 or 4 Hurricane storm surge SWEL equivalent to 1,000- to 10,000-year mean return intervals. However, the Amended Expansion Project is within the existing project facility, at a site elevation of 12.5 feet above mean sea level with equipment point of supports at least 1 foot above the finished grade. Furthermore, Cameron LNG has committed to complete an updated storm surge analysis for the project. Therefore, we recommend in section 3.2 that prior to initial site preparation that Cameron LNG should file with the Secretary, an updated storm surge hazard analysis for review and approval that would demonstrate the facilities would be precluded from or withstand the 500-year mean recurrence interval flood event.

Landslides and other Natural Hazards

Landslides involve the downslope movement of earth materials under force of gravity due to naturalor human causes. Landslides in the United States occur in all 50 states. Cameron LNG states that there islittle likelihood that landslides or slope movement at the site would be a realistic hazard as the topographyacross the Project site is relatively flat. In addition, the proposed project is within the existing Cameron LNG facility. We reviewed the Cameron LNG geotechnical investigation reportand conclude the landslide would not be a significant risk for the proposed project site.

Wildfires are prevalent on the West Coast, especially in California, Alaska, and Hawaii. The proposed Project site is surrounded by the Calcasieu Ship Channel on the Eastern side and Gulf of Mexicoon the Southern side. There is no significant evidence that vegetation on the northern and western side of the plant would cause potential wildfires. Therefore, we conclude that it is unlikely that a wildfire would occur at the Project site. Volcanic activity is primarily a concern along plate boundaries on the West Coastand in Alaska and Hawaii. Based on FERC staff review of maps from USGS[35] and Department of Homeland Security[36] of the nearly 1,500 volcanoes with eruptions since the Holocene period (in the past 10,000 years) there has been no known active or historic volcanic activity closer than approximately 827 miles across the Gulf of Mexico in Puebla, Mexico.

Geomagnetic disturbances may occur due to solar flares or other natural events with varying frequencies that can cause geomagnetically induced currents, which can disrupt the operation of transformers and other electrical equipment. USGS[37] provides a map of geomagnetic

[35] United States Geological Survey, https://www.usgs.gov/programs/VHP, Accessed November 2022.

[36] Homeland Infrastructure Foundation-Level Data (HIFLD), https://hifld-geoplatform.opendata.arcgis.com/datasets/historical-significant-volcanic-eruption-locations, Accessed November 2022.

[37] United States Geological Survey. Magnetic Anomaly Maps and Data for North America, https://mrdata.usgs.gov/magnetic/map-us.html#home, Accessed November 2022.

disturbances intensitieswith an estimated 100-year mean return interval. The map indicates the Cameron LNG site could experience geomagnetic disturbances intensities of 50-70 nano-Tesla with a 100-year mean return interval. However, Cameron LNG would be designed such that if a loss of power were to occur the valves would move into a fail-safe position. In addition, Cameron LNG is an export facility that does not serve any U.S. customers.

External Impact Review

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 USEPA'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 theadequacy of the mitigation measures. The risk-based approach uses data based on the frequency of eventsthat could lead to an impact and the potential severity of consequences posed to the LNG terminal site andthe 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,constructed, and operated, LNG facilities as defined in 49 CFR 193, must comply with the requirements of49 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. The marine facilities subject to USCG regulations, including 33 CFR 127.101, incorporate NFPA 59A (2019) section 15.5.2.1, which requires arms, hoses, and piping be located on the dock or pier so that they are not exposed to damage from vehicular traffic or other possible cause of physical damage. However, the USDOT PHMSA and

USCG regulations and NFPA 59A (2001 and 2019) 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 DOT Federal Highway Administration (FHWA)[38], DOT National Highway Traffic Safety Administration (NHTSA)[39], USDOT PHMSA[40], USEPA, NOAA[41], and other reports[42,43,44], and frequency of trucks and proposed mitigation to prevent or reduce the impacts of a vehicular incident.

Incident data from USDOT PHMSA and estimated lane mileage from the FHWA and NHTSA, indicate hazardous material incidents are very infrequent (2e-3 incidents per lane mile per year) and nearly 75 percent of hazardous material vehicular incidents occur during unloading and loading operations while the other 25 percent occur while in transit or in transit storage. In addition, approximately 95 percent of hazardous liquid 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 USEPA 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 USEPA 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 USEPA estimates based on data for approximately 150 experimental and accidental pressure vessel bursts (PVBs) and BLEVEs with approximately 683 total

[38] FHWA, Office of Highway Policy Information, *Highway Statistics 2020*, https://www.fhwa.dot.gov/policyinformation/statistics/2020/, accessed March 2022

[39] NHTSA, *Traffic Safety Facts Annual Report Tables*, https://cdan.nhtsa.gov/tsftables/tsfar.htm, accessed March 2022.

[40] PHMSA, Office of Hazardous Material Safety, *Incident Reports Database Search*, https://hazmatonline.phmsa.dot.gov/IncidentReportsSearch/Welcome.aspx, accessed March 2022.

[41] U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration, ALOHA®, User's Manual, The CAMEO® Software System, February 2007.

[42] Birk, A.M., BLEVE Response and Prevention Technical Documentation, 1995.

[43] 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.

[44] Lees, F.P, Lees' Loss Prevention in the Process Industries: Hazard Identification, Assessment, and Control, Volume 2, Second Edition, 1996

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 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 DOT 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 normal operation of the project, Cameron LNG estimates 1 diesel truck would be needed at the site annually. Depending on nitrogen consumption, 7 liquid nitrogen trucks would be anticipated every 5 days. Cameron LNG estimates that Train 4 would need 3 condensate trucks per day. The most frequent truck deliveries would occur during commissioning and startup activity at the site and would deliver refrigerants to load the liquefaction trains. Cameron LNG does not plan to utilize any trucks to deliver LNG.

The public road, Louisiana Highway 27 (LA 27) runs north-south adjacent to the west side of the facility property, and the existing Cameron LNG site entrances on LA 27 would be used to access the Amended Cameron LNG Expansion Project site. LA 27 is a two-lane bi-directional route with a 55 mph speed limit. Neel-Schaffer, Inc's April 24, 2013 traffic study and a Traffic Management Plan subsequently developed, concluded no significant impacts on existing traffic conditions during construction or operation of the original Liquefaction Project under Docket No. CP13-25-000. The separation distance between LA 27 and the closest facilities associated with the Amended Expansion Project that would contain hazardous fluids are greater than 400 feet which exceeds the distances estimated for flammable vapor dispersion and radiant heat from a liquid hydrocarbon truck 1-inch hole release. The USDOT PHMSA's LOD on 49 CFR 193 Subpart B discusses multiple flammable vapor exclusion zones from release scenarios that would extend over LA 27. Actions to be taken for onsite and offsite protection would be described in more detail in the facility Emergency Response Plan. 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 raise concerns of direct impacts from a vehicle impacting the site. Therefore, 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 Cameron LNG, and additional mitigation measures proposed by FERC staff.

Rail

FERC staff reviewed whether any rail operations would be associated with the Project and whetherany existing rail lines would be located near the site. FERC staff uses this information to evaluate whetherthe Project and any associated rail operations could increase the risk along the rail line and subsequently tothe public and whether any pre-existing unassociated rail operations could adversely increase the risk to the Cameron LNG site and subsequently increase the risk to the public. In addition, if authorized, constructed,and operated, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193and would be subject to USDOT PHMSA's inspection and enforcement programs. The 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. The marine facilities subject to USCG regulations, including 33 CFR 127.101, incorporate NFPA 59A (2019) section 15.5.2.1, which requires arms, hoses, and piping be located on the dock or pier so that they are not exposed to damage from vehicular traffic or other possible cause of physical damage. However, the USDOT PHMSA and USCG regulations and NFPA 59A (2001 and 2019) 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 USDOT PHMSA, and frequency of rail operations nearby Cameron LNG.

FERC staff evaluated the risk of the rail operations based on the consequences from a release, incident data from USDOT PHMSA[45], and rail miles from DOT Bureau of Transportation Statistics[46]. Incident data from USDOT PHMSA and rail miles from DOT Bureau of Transportation Statistics indicates hazardous material incidents are very infrequent (7e-3 incidents per rail mile per year). In addition, approximately 95 percent of liquid 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

[45] PHMSA, Incident Statistics, https://www.phmsa.dot.gov/hazmat-program-management-data-and-statistics/data- operations/incident-statistics, Hazmat Incident Report Search Tool 2010 – 2020, accessed March 2022.

[46] DOT Bureau of Transportation Statistics, System Milage Within the United States, https://www.bts.gov/content/system-mileage-within-united-states, 2010 – 2020, Accessed March 2022.

result in hospital injuries and less than 0.1 percent of hazardous material incidents result in fatalities.

As previously discussed, the USEPA 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 USEPA also reports that on average container ruptures would result in less than four projectiles for cylindrical containers and 8.3 for sphericalvessels. FERC staff evaluated other reports that affirmed the USEPA 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, 1,225to 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 forinitial evacuation and 1 mile for potential BLEVEs for flammable gases).

The closest rail line would be the Lake Charles Harbor District Terminal Railroad approximately 4.6 miles northeast of the Cameron LNG terminal and separated by the Waterway. This is outside any of the potential unmitigated consequences under even worst-case weather conditions for the most severe catastrophic failures of rail cars. Therefore, FERC staff conclude there are no potential rail safety or reliability impacts of significance that railroad lines would pose due to vapor dispersion, fireball, jet fire, pool fire, BLEVE, or projectile hazard to the proposed project.

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, constructed, and operated, 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) under Subpart C state that an 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. In addition, the height of LNG structures in the vicinity of an airport must comply with DOT FAA requirements. In addition, FERC staff evaluated the risk of an aircraft impact from nearby airports.

Three mixed use aviation airports, Chennault International Airport, Lake Charles Regional Airport, and Southland Field Airport would be located 15 miles northeast, 7.8 miles northeast, and 5.0 miles northwest of the LNG terminal site, respectively.

Cameron LNG indicated that the Project would not include permanent structures that would be taller than 200 feet. DOT FAA regulations in 14 CFR 77 require Cameron LNG to provide a notice to the FAA of its proposed construction and 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. Cameron LNG would need to provide notice to DOT FAA for any temporary (construction) structures that would exceed permanent structure heights.

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. Based upon that review, the potential impact to the facility was above the initial 3e-5 per year screening threshold identified for the process areas. The potential consequences of such an incident at the process areas would likely result in a release and fire that would be within the existing hazard footprints already evaluated for a full impoundment fire that is sized for the largest spill in the process area. The existing hazard footprints indicate the 5 kW/m^2 radiant heat from such events would not extend beyond the property line that can be built upon. Therefore, based on the potential separation distance between the process equipment and the nearby airports, we conclude the risk of cascading impacts to the public due to airport impact would not be significant.

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 evaluatewhether 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. In addition, pipelines associated with this project must meet the USDOT PHMSA regulations under 49 CFR 192 as discussed in section 3.2. 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 Cameron LNG.

For existing pipelines, the Amended Expansion Project would receive natural gas through interconnections with other natural gas pipelines via the Cameron Interstate Pipeline and the Cameron Access Project Pipeline that provides feed gas to the site. FERC staff evaluated the potential risk from an incident from the pipelines and its potential impacts by considering the design and operating conditions and location of the pipeline. While these pipelines are associated with the Amended Expansion Project, they would not pose a significant risk or impact to the project site.

In addition, based on the potential likelihood of pipeline incidents and potential consequences from a pipeline incident, 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 USEPA RMP regulated facilities handling hazardous materials andpower 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 USEPA RMP facilities and powerplants and subsequently increase the risk to the public.

The Lake Charles LNG Facility is located about 4.25 miles away to the northeast on the other side of the Calcasieu River. The Venture Global Calcasieu Pass LNG facility is located approximately 18 miles to the south of the existing Cameron LNG facility. The closest USEPA RMP regulated facilities handling hazardous materials would be the Cameron Meadows Processing Facility located approximately 24.5 miles away and the Barracuda Plant located approximately 25 miles. The USEPA RMP regulations require certain hazard distances to be calculated and a risk management plan to be developed commensurate with those consequences. Based on this mitigation, 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.

Onsite and Offsite Emergency Response Plans

As part of its application, Cameron LNG indicated that the Project would develop a comprehensive ERP with local, state, and federal agencies and emergency response officials to discuss the Facilities. Cameron LNG would continue these collaborative efforts during the development, design, and construction of the Project. The emergency procedures would provide for the protection of personnel and the public as well as the prevention of property damage that may occur as a result of incidents at the Project facilities. The facility would also provide appropriate personal protective equipment to enable operations personnel and first responder access to the area.

As required by 49 CFR § 193.2509 under Subpart F, Cameron LNG would need to prepare emergency procedures that provide for: a) responding to controllable emergencies and recognizingan 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) 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. 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.

Title 33 CFR §127.307 also requires the development of an emergency manual that incorporates additional material, including LNG release response and emergency shutdown procedures, a description offire 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 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 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. Cameron 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 todevelop 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, such as:

- direct reimbursement for any per-transit security and/or emergency management costs (forexample, overtime for police or fire department personnel);
- capital costs associated with security/emergency management equipment and personnel base (forexample, 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.

Cameron LNG has an existing ERP to address emergency events and potential release scenarios. As part of our review, FERC staff evaluated elements of recommended and generally accepted good engineering practices for emergency response plans and resource requirements for cost-sharing plans, including, but not limited to:

- NFPA 1600, Standard on Continuity, Emergency, and Crisis Management;[47]
- NFPA 1616, Standard on Mass Evacuation, Sheltering, and Re-Entry Programs;[48]
- NFPA 1620, Standard for Pre-Incident Planning;[49]
- NFPA 470, Hazardous Materials and Weapons of Mass Destruction Standard for Responders;[50]
- NFPA 475 Recommended Practice for Organizing, Managing, and Sustaining a HazardousMaterials and Weapons of Mass Destruction Response Program.[51]

NFPA 1600 (2019 edition) provides provisions for the planning and design process of an emergency management program. NFPA 1600 section has the following provisions:

- Section 5.2.2 specifies a risk assessment to be conducted evaluating the likelihood and severity ofhazards, including accidental and intentional events that may result in hazardous material releases,explosions, and fires as well as consideration of specific causes and preceding events, such as geological events (e.g., subsidence, earthquakes, tsunamis, volcanic, etc.) and meteorological events (e.g., extreme temperatures, hurricanes, tornadoes, floods, snow and ice storms, andwildland fires, etc.) as discussed in previous sections.
- Section 5.2.2.2 specifies the vulnerability of people, property, operations, environment, and supplychain operations to be evaluated.
- Section 5.2.3 specifies the analysis of the impacts of the hazards identified in section 5.2.2 on the health and safety of persons in the affected area and personnel responding to the incident as well as impacts to properties, facilities, and critical infrastructure.
- Section 5.2.4 specifies an analysis of the escalation of impacts over time.

[47] Freely and publicly accessible to view in English and Spanish at NFPA, https://www.nfpa.org/codes-and-standards/all- codes-and-standards/list-of-codes-and-standards/detail?code=1600, accessed March 2022.

[48] Freely and publicly accessible to view in English only at NFPA, https://www.nfpa.org/codes-and-standards/all-codes- and-standards/list-of-codes-and-standards/detail?code=1616, accessed March 2022.

[49] Freely and publicly accessible to view in English only at NFPA, https://www.nfpa.org/codes-and-standards/all-codes- and-standards/list-of-codes-and-standards/detail?code=1620, accessed March 2022.

[50] Freely and publicly accessible to view in English only at NFPA, https://www.nfpa.org/codes-and-standards/all-codes- and-standards/list-of-codes-and-standards/detail?code=470, accessed March 2022.

[51] Freely and publicly accessible to view in English only at NFPA, https://www.nfpa.org/codes-and-standards/all-codes- and-standards/list-of-codes-and-standards/detail?code=475, accessed March 2022.

- Section 5.2.5 specifies evaluation of incidents that could have cascading impacts.
- Section 5.2.6 specifies the risk assessment to evaluate the adequacy of existing prevention and mitigation measures.

Chapter 6 covers the implementation of the plans, including health and safety of personnel, roles and responsibilities of internal and external entities, lines of authority, process for delegation of authority, liaisons with external entities, and logistics support and resource requirements.

- Section 6.3.1 specifies the implementation of a mitigation strategy that includes measures to limitor control the consequences, extent, or severity of an incident that cannot be prevented based on the results of hazard identification and risk assessment and analysis of impacts.
- Section 6.9.2 specifies that emergency response plans should identify actions to be taken to protectpeople, including people with disabilities and other access and functional needs.[52]
- Sections 6.6 and 6.9.4 stipulate an emergency response plan include warning, notification, and communication should be determined and be reliable, redundant, and interoperable and tested andused to alert stakeholders potentially at risk from an actual or impending incident.
- Section 6.8 specifies the development of an incident management system to direct, control, and coordinate response, continuity and recovery operations.
- Section 6.8.1 stipulates primary and alternate emergency operations centers be established capableof managing response, continuity, and recovery operations and may be physical or virtual.

In addition, NFPA 1600 Chapter 7 provides specifications for execution of the plan, Chapter 8 provides for training and education provisions, Chapter 9 provides for exercises and tests to be conducted periodically, and Chapter 10 provides for its continued maintenance and improvement.

NFPA 1616 (2020 edition) covers organizing, planning, implementing, and evaluating a program for mass evacuation, sheltering, and re-entry. Similar to NFPA 1600, NFPA 1616:

- Section 4.5 also requires similar hazard identification, risk assessment, and requirements analysisas NFPA 1600.

[52] NFPA 1600 defines “access and functional need” as ”Persons requiring special accommodations because of health, social, economic, or language challenges.”

- Section 5.1 also requires plans to address the health and safety of personnel including persons withdisabilities and access and functional needs.[53]
- Section 5.6 also requires a requirements analysis in sub-section 5.6.1 that is based upon the threat,hazard identification, and risk assessment. Sub-section 5.6.2(1) specifies the requirements analysis include characteristics of the potentially affected population, including persons with disabilities and other access and functional needs. In addition, sub-section 5.6.2(2) requires consideration of existing mandatory evacuation laws and expected enforcement of those laws. Sub-section 5.6.2(3) requires the requirements analysis to include characteristics of the incident that trigger consideration for evacuation based on weather, season, and environmental conditions, speed of onset, magnitude, location and direction, duration, resulting damages to essential functions, risk for cascading effects and secondary disasters, and capability of transportation routes and systems to transport life-sustaining materials (e.g., water, medical supplies, etc.) into the affected area.
- Section 5.6.3 requires the determination if evacuation or sheltering-in-place is appropriate to the situation and resources available based on 1) the anticipated impact and duration of the event, 2) the distance to appropriate sheltering facilities, 3) the availability of and access to transportation to those facilities, and 4) the ability to communicate with the affected population within the required timeframe.
- Section 5.6.4 requires 1) establishment of a single or unified command, 2) development of information system to notify public and provide an assessment of the time needed to reach peoplewith the information, 3) identification of appropriate sheltering facilities by location, size, types of services available, accessibility, and building safety, and 4) identification of the modes and routes for evacuee transportation and the time needed to reach them, sources of evacuee support services, and manpower requirements based on various potential shelters.
- Section 5.8 also has requirements for dissemination of information on evacuation, shelter in place,and re-entry before, during, and after an incident to personnel and to the public.
- Section 5.9 has requirements for warning, notification, and communication needs that are reliableand interoperable and redundant where feasible that takes into account persons with disabilities and other access and functional needs.

Similar to NFPA 1600, NFPA 1616 has requirements in Chapter 6 on Implementation, Chapter 7 on Training and Education, Chapter 8 on Exercises, and Chapter 9 on Program

[53] NFPA 1616 defines people with access and functional needs as "People with Access and Functional Needs" as "Persons with disabilities and other access and functional needs include those from religious, racial, and ethnically diverse backgrounds; people with limited English proficiency; people with physical, sensory, behavioral and mental health, intellectual, developmental and cognitive disabilities, including individuals who live in the community and individuals who are institutionalized; older adults with and without disabilities; children with and without disabilities and their parents; individuals who are economically or transportation disadvantaged; women who are pregnant; individuals who have acute and chronic medical conditions; and those with pharmacological dependency."

Maintenance and Improvement with additional specifics for mass evacuation, sheltering in place and re-entry.

NFPA 1620 (2020 edition) specifies the characteristics of the facility and personnel onsite that should be within a pre-incident plan, such as emergency contact information, including those withknowledge of any supervisory, control, and data acquisition systems, communication systems, emergencypower supply systems, and facility access controls as well as personnel accountability and assistance for people with self-evacuation limits, means of egress, emergency response capabilities, spill containment systems, water supply and fire protection systems, hazardous material information (e.g., safety datasheets), special considerations for responding to hazardous materials (e.g., firewater may exacerbate LNG fires, BLEVE potential, etc.), and access to emergency action plans developed by the facility. Similar to NFPA 1600 and NFPA 1616, NFPA 1620 section 8.5.2 also addresses the implementation of an incident management system for the duration of the event and Chapter 10 establishes maintenance of a pre-incidentplan.

NFPA 1600, NFPA 1616, and NFPA 1620 provisions for threat, hazard identification, and risk assessment provisions and identification of resource requirements and gaps are also consistent with Department of Homeland Security FEMA's Comprehensive Preparedness Guide 101, Developing and Maintaining Emergency Operations Plans, Version 3.0, September 2021, and Comprehensive Preparedness Guide 201, Threat and Hazard Identification and Risk Assessment and Stakeholder Preparedness Review Guide, Third Edition, May 2018, and other FEMA guidance.

NFPA 470 covers the competencies and job performance requirements for emergency response personnel to incidents involving hazardous materials, including awareness level personnel (i.e., personnel onsite that would call for emergency responders and secure the scene), operations level responders (i.e., personnel responding to incident for implementing supporting actions to protection public), hazardous material technicians (i.e., personnel responding to incident for analyzing and implementing planned response), hazardous materials officers, hazardous materials safety officers, emergency medical services (EMS) personnel, incident commanders, and other specialist employees. The standard covers competencies and Job Performance Requirements (JPR), including the ability to identify hazardous material releases and hazardous materials involved and identifying surrounding conditions, such as topography, weather conditions, public exposure potential, possible ignition sources, land use and adjacent land use, overhead and underground wires and pipelines, rail lines, and highways, bodies of water, storm and sewer drains, and building information (e.g., ventilation ducts and air returns). Part of the standard also describes the ability and requirement to estimate potential outcomes in order to properly plan response strategies and tactics and selection and use of proper personnel protective equipment (PPE). Many of these provisions are similar and synergistic with NFPA 1600, NFPA 1616, and NFPA 1620.

NFPA 475 covers the organization, management, and sustainability of a hazardous material response program, including identifying facilities with hazardous materials, analyzing the risk of hazardousmaterial incidents, including identifying hazardous materials at each location, (e.g., quantity, concentration,hazardous properties, etc.), type and design of containers; surrounding population and infrastructure, including vulnerable populations and critical facilities

(e.g., schools, hospitals, businesses, etc.). NFPA 475 similar calls for analyzing the risk of an incident based on the consequences of a release and predictingits behavior and estimating the probability for an incident to take place and potential for cascading incidents. NFPA 475 Chapter 7 also has provisions for resource management, including the identification, acquisition,and management of personnel, equipment, and supplies to support hazardous material response programs. NFPA 475 Chapter 8 expands upon staffing requirements and use of different staffing models and Chapter9 expands upon training program with reference and similarities to NFPA 470.

In accordance with these recommended and generally accepted good engineering practices, FERC staff evaluated the potential impacts from incidents caused by a range of natural hazards, accidental events,intentional events, and potential for cascading damage at the LNG terminal. In addition, FERC staff identified potential emergency response needs based on the potential impacts to and characteristics of the population and infrastructure for potential intentional and accidental incidents along the LNG marine vessel route and at the LNG terminal. Consistent with these practices, FERC staff evaluated the potential hazards from incidents, the potential impacts to areas from incidents and the evaluation of characteristics of population, including those with potential access and functional needs, and infrastructure that require special considerations in pre-incident planning, including but not limited to:

- daycares;
- elementary, middle, and high schools and other educational facilities;
- elderly centers and nursing homes and other boarding and care facilities;
- detention and correctional facilities;
- stadiums, concert halls, religious facilities, and other areas of assembly;
- densely populated commercial and residential areas, including high rise buildings, apartments, and hotels;
- hospitals and other health care facilities;
- police departments, stations, and substations;
- fire departments and stations;
- military or governmental installations and facilities;
- major transportation infrastructure, including evacuation routes, major highways, airports, rail, and other mass transit facilities as identified in external impacts section; and
- industrial facilities that could exacerbate the initial incident, including power plants, water supply infrastructure, and hazardous facilities with quantities that exceed thresholds in USEPA RMP and/or OSHA PSM standards as identified in external impacts section.

Many of these facilities are also identified and defined in NFPA 101, Life Safety Code, and require emergency response plans themselves. NFPA 101 is currently used by every U.S.

state and adopted statewide in in 43 of the 50 states.[54] Louisiana currently adopts NFPA 101 (2015 edition) with amendments.[55,56] These areas are also similar to "identified sites" defined in 49 CFR 192 that define high consequence areas and those identified within Pipelines and Informed Planning Alliance (PIPA) for special land use planning considerations near pipelines.[57]

Potential Hazards

An incident can result in various potential hazards and are initiated by a potential liquid and/or gaseous release with the formation of vapor at the release location, as well as from any liquid that pooled. The fluid released may present low or high temperature hazards and may result in the formation of toxic orflammable vapors. The type and extent of the hazard will depend on the material released, the storage andprocess conditions, and the volumes and durations released.

Exposure to either cold liquid or vapor could cause freeze burns and depending on the length of exposure, more serious injury or death. However, spills would be contained to on-site areas and the cold state of these releases would be greatly limited due to the continuous mixing with the warmer air. The cold temperatures from the release would not present a hazard to the public, which would not have access to on-site areas. The cold temperatures may also quickly cool any materials contacted by the liquid on release, causing extreme thermal stress in materials not specifically designed for such conditions. These thermal stresses could subsequently subject the material to brittleness, fracture, or other loss of tensile strength and result in cascading failures. However, regulatory requirements and recommendations made herein would ensure that these effects would be accounted for in the design of equipment and structural supports.

A RPT can occur when a cryogenic liquid is spilled onto water and changes from liquid to gas, virtually instantaneously. Unlike an explosion that releases energy and combustion products from a chemical reaction, an RPT is the result of heat transferred to the liquid inducing a change to the vapor state. RPTs have been observed during LNG test spills onto water. In some test cases, the overpressures generated were strong enough to damage test equipment in the immediate vicinity of the LNG release point. The sizes of the overpressure events have been generally small and are not expected to cause significant damage. Six of the 18 Coyote spills produced RPT explosions. Most were early RPTs that occurred immediately with the spill, and some continued for the longer periods. Including RPTs near the end of the spills on three tests. LNG composition, water temperature, spill rate and depth of penetration all seem to play a role in

[54] NFPA, NFPA 101 Fact Sheet, https://www.nfpa.org/assets/files/AboutTheCodes/101/NFPA101FactSheet0809.pdf, accessed 2022-02-17.

[55] Up Codes, Louisiana Codes, https://up.codes/codes/louisiana, accessed 2022-02-17

[56] Louisiana Office of State Fire Marshal, Department of Public Safety and Corrections, Public Safety Services, Codes, Rules, and Laws Enforced by the Louisiana State Fire Marshal, http://sfm.dps.louisiana.gov/insp_crl.htm, accessed 2022-02-17.

[57] Pipelines and Informed Planning Alliance, Partnering to Further Enhance Pipeline Safety in Communities through Risk-Informed Land Use Planning, Final Report of Recommended Practices, https://primis.phmsa.dot.gov/comm/pipa/landuseplanning.htm, November 2010.

RPT development and strength. The maximum strength RPT yielded equivalent to up to 6.3 kg of TNT free-air point source at the maximum spill rate of 18 m^3/min (4,750 gpm). This would produce an approximate 1 psi overpressures less than 100 ft from the spill source. These events are typically limited to the area within the spill and are not expected to cause damage outside of the area engulfed by the LNG pool. However, a RPT may affect the rate of pool spreading and the rate of vaporization for a spill on water.

Vapor Dispersion

Depending on the size and product of the release, liquids may form a liquid pool and vaporize. Additional vaporization would result from exposure to ambient heat sources, such as water or soil. The vapor may form a toxic or flammable cloud depending on the material released. The dispersion of the vaporcloud will depend on the physical properties of the cloud, the ambient conditions, and the surrounding terrain and structures. Generally, a denser-than-air vapor cloud would sink to the ground and would travelwith the prevailing wind, while a lighter-than-air vapor cloud would rise and travel with the prevailing wind. The density will depend on the material releases and the temperature of the material. For example, an LNG release would initially form a denser than-air vapor cloud and transition to lighter-than-air vapor cloud as the vapor disperses downwind and mixes with the warm surrounding air. However, experimental observations and vapor dispersion modeling indicate an LNG vapor cloud would not typically be warm, or buoyant, enough to lift off from the ground before the LNG vapor cloud disperses below its lower flammable limit (LFL).

A vapor cloud formed following an accidental release would continue to be hazardous until it dispersed below toxic levels and/or flammable limits. Toxicity is primarily dependent on the airborne concentration of the toxic component and the exposure duration, while flammability of the vapor cloud is primarily dependent just on the concentration of the vapor when mixed with the surrounding air. In general, higher concentrations within the vapor cloud would exist near the spill, and lower concentrations would exist near the edge of the cloud as it disperses downwind.

Toxicity is defined by several 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. Other federal agencies, such as the DOE, USEPA, and NOAA, use AEGLs and ERPGs as the primary measure of toxicity.

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 USEPA 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 theyare more inclusive and provide toxicity levels at various exposure times (10 minutes, 30 minutes, 1 hour, 4hours, and 8 hours). The use of AEGLs is also preferred by the DOE and NOAA. Under the USEPA RMP regulations in 40 CFR 68, the USEPA currently requires the determination of distances to toxic concentrations based on ERPG-2 levels. 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. The USEPA provides ERPGs (1 hour) for a list of chemicals. These toxic concentration endpoints are comparable to AEGLs endpoints.

In addition, any non-toxic release that does not contain oxygen would be classified as simple asphyxiants and may pose extreme health hazards, including death, if inhaled in significant quantities withina limited time. Very cold vapors may also cause freeze burns. However, the locations of concentrations where cold temperatures and oxygen-deprivation effects could occur are greatly limited due to the continuous mixing with the warmer air surrounding the spill site. For that reason, exposure injuries from contact with releases of methane, nitrogen, and heavier hydrocarbons normally represent negligible risks to the public.

Flammable vapors can develop when a flammable material is above its flash point and concentrations are between the LFL and the upper flammable limit (UFL). Concentrations between the LFL and UFL can be ignited, and concentrations above the UFL or below the LFL would not ignite.

The extent of the affected area and the severity of the impacts on objects within a vapor cloud would primarily be dependent on the material, quantity, and duration of the initial release, the surrounding terrain, and the environmental conditions present during the dispersion of the cloud.

Flammable Vapor Ignition

If the flammable portion of a vapor cloud encounters an ignition source, a flame would propagate through the flammable portions of the cloud. In most circumstances, the flame would be driven by the heatit generates. This process is known as a deflagration, or a flash fire, because of its relatively short duration. However, exposure to a deflagration, or flash fire, can cause severe burns and death, and can ignite combustible materials within the cloud. If the deflagration in a flammable vapor cloud accelerates to a sufficiently high rate of speed, pressure waves that can cause damage would be generated. As a deflagration accelerates to super-sonic speeds, the large shock waves produced, rather than the heat, would begin to drive the flame, resulting in a detonation. The flame speeds are primarily dependent on the reactivity of the fuel,

the ignition strength and location, the degree of congestion and confinement of the area occupied by the vapor cloud, and the flame travel distance. Once a vapor cloud is ignited, the flame front may propagate back to the spill site if the vapor concentration along this path is sufficiently high to support the combustion process. When the flame reaches vapor concentrations above the UFL, the deflagration will transition to a pool or jet fire back at the source. If ignition occurs soon after the release begins, a fireball may occur near the source of the release and would be of a relatively short duration compared to an ensuing jet or pool fire. The extent of the affected area and the severity of the impacts on objects in the vicinity of a fire would primarily be dependent on the material, quantity, and duration of the fire, the surrounding terrain, and the environmental conditions present during the fire.

Overpressures

If the deflagration in a flammable vapor cloud accelerates to a sufficiently high rate of speed, pressure waves that can cause damage would be generated. As a deflagration accelerates to super-sonic speeds, large pressure waves are produced, and a shock wave is created. In this scenario, the shock wave, rather than the heat, would drive the flame, resulting in a detonation. Deflagrations or detonations are generally characterized as "explosions" as the rapid movement of the flame and pressure waves associatedwith them cause additional damage beyond that from the heat. The amount of damage an explosion causesis dependent on the amount the produced pressure wave is above atmospheric pressure (i.e., an overpressure) and its duration (i.e., pulse). For example, a 1 psi overpressure, often cited as a safety limit in NFPA 59A (2019 edition) and U.S. regulations, is associated with glass shattering and traveling with velocities high enough to lacerate skin.

Flame speeds and overpressures are primarily dependent on the reactivity of the fuel, the ignition strength and location, the degree of congestion and confinement of the area occupied by the vapor cloud, and the flame travel distance.

The potential for unconfined LNG vapor cloud detonations was investigated by the USCG in the late 1970s at the Naval Weapons Center in China Lake, California. Using methane, the primary component of natural gas, several experiments were conducted to determine whether unconfined LNG vapor clouds would detonate. Unconfined methane vapor clouds ignited with low-energy ignition sources (13.5 joules), produced flame speeds ranging from 12 to 20 mph. These flame speeds are much lower than the flame speeds associated with a deflagration with damaging overpressures or a detonation.

To examine the potential for detonation of an unconfined natural gas cloud containing heavier hydrocarbons that are more reactive, such as ethane and propane, the USCG conducted further tests on ambient-temperature fuel mixtures of methane-ethane and methane-propane. The tests indicated that the addition of heavier hydrocarbons influenced the tendency of an unconfined natural gas vapor cloud to detonate. Less processed natural gas with greater amounts of heavier hydrocarbons would be more sensitive to detonation.

Although it has been possible to produce damaging overpressures and detonations of unconfined LNG vapor clouds, the feed gas stream proposed for the project would have lower ethane and propane concentrations than those that resulted in damaging overpressures and detonations. The substantial amount of initiating explosives needed to create the shock initiation

during the limited range of vapor-air concentrations also renders the possibility of detonation of these vapors at an LNG plant as unrealistic. Ignition of a confined LNG vapor cloud could result in higher overpressures. To prevent such an occurrence, Cameron LNG would take measures to mitigate the vapor dispersion and ignition into confined areas, such as buildings. Cameron LNG would install hazard detection devices at all combustion and ventilation air intake equipment to enable isolation and deactivation of any combustion equipment whose continued operation could add to, or sustain, an emergency. In general, the primary hazards to the public from an LNG spill that disperses to an unconfined area, either on land or water, would be from dispersion of the flammable vapors or from radiant heat generated by a pool fire.

In comparison with LNG vapor clouds, there is a higher potential for unconfined propane clouds to produce damaging overpressures. This has been shown by multiple experiments conducted by the Explosion Research Cooperative to develop predictive blast wave models for low, medium, and high reactivity fuels and varying degrees of congestion and confinement. The experiments used methane, propane, and ethylene, as the respective low, medium, and high reactivity fuels. In addition, the tests showed that if methane, propane, or ethylene are ignited within a confined space, such as in a building, theyall have the potential to produce damaging overpressures.

Fires and overpressures may also cause failures of nearby storage vessels, piping, and equipment if not properly mitigated. These failures are often termed cascading events or domino effects and can exceed the consequences of the initial hazard. The failure of a pressurized vessel could cause fragments of material to fly through the air at high velocities, posing damage to surrounding structures and a hazard foroperating staff, emergency personnel, or other individuals in proximity to the event. In addition, failure ofa pressurized vessel when the liquid is at a temperature significantly above its normal boiling point could result in a boiling-liquid-expanding-vapor explosion (BLEVE). BLEVEs can produce overpressures whenthe superheated liquid rapidly changes from a liquid to a vapor upon the release from the vessel. BLEVEs of flammable fluids may also ignite upon its release and cause a subsequent fireball.

Potential Infrastructure Impacts from LNG facilities

Although the likelihood of incidents and the hazards described above are extremely low due to the mitigation required by regulations and recommendations made herein by FERC staff, the potential impacts from these hazards could impact onsite personnel and offsite public.[58]

FERC staff evaluated a range of releases to evaluate the potential impacts to populations and infrastructure within vicinity of the plant. Impacts would vary based on the initiating event and subsequent release characteristics (e.g., size, location, direction, process conditions, etc.), hazard (i.e., vapor dispersion,overpressures, fires, BLEVE and PVB), weather conditions, and surrounding terrain. Distances to radiantheats of 5 kW/m^2 (or approximately 1,600 BTU/ft^2-hr)

[58] Specific distances of potential impacts from incidents at a LNG terminal have not been provided at this time to try and balance the potential security interests in releasing such information. Specific distances for various hazards described would be provided in emergency response plans for reference and use by emergency responders, Further, potential hazards have been described and potential impacts to communities are disclosed to balance the importance of public disclosure and transparency on the balance of potentially releasing information that has not been previously released and could be used by intentional actors.

from fires produced by accidental and intentional acts could impact onsite personnel or offsite public. For example, Section 2.2.2.2 in NFPA 59A (2001), incorporated by reference in 49 CFR 193, requires spill containments, serving vaporization, process, or LNG transfer area, to contain liquid releases from 2-inch diameter holes and guillotine releases of pipingless than 6-inches in diameter. Additionally, USDOT PHMSA siting regulations for flammable vapor dispersion and thermal radiation exclusion zones limit the dispersion of flammable vapors and 1,600 BTU/ft^2-hr radiant heats from LNG pool fires in those spill containment systems in certain weather conditions from extending beyond the control of the operator or government agency and prevent it from extending onto areas accessible by the public. FERC staff also recommends spill containment systems be designed to capture all liquid from guillotine ruptures of the single largest line and largest vessel(s) to limit their pool spread and vaporization. This effectively limits the extent of the 1,600 BTU/ft^2-hr radiant heat from pool fires to onsite for even the largest releases from a single source and considerably reduces the dispersion distance of flammable and toxic vapors. FERC staff also recommends mitigation to prevent these larger releases from resulting in cascading damage. However, superheated and/or pressurized releases greater than those covered by the siting regulations can result in significant flashing and jetting that can lead to larger dispersion distances to flammable vapors. In addition, ignition of releases larger than those used inthe siting analyses can result in 1,600 BTU/ft^2-hr and 10,000 BTU/ft^2-hr radiant heats from jet and pool fires that extend offsite onto publicly accessible areas.

The infrastructure and communities that could be impacted by a fire with 10,000 BTU/ft^2-hr radiant heats extending offsite include a portion of Louisiana Highway 27 (LA 27), and several oil field pads south of the terminal property line. Cameron LNG owns the property along LA 27 adjacent to the facility, including the natural gas pipeline and utility right-of-way. Access to the maintain utilities in this right-of-way along LA 27 would be coordinated with Cameron LNG, and evacuation of utility workers in this area would be subject to the public evacuation procedures outlined in the emergency response plan. The infrastructure and communities that could be impacted by a fire with 1,600 BTU/ft^2-hr radiant heats extending offsite include additional portions of LA 27, more infrastructure associated with the oil field infrastructure and associated field office south of the terminal, and the previously mentioned infrastructure and communities within the 10,000 BTU/ft^2-hr radiant heats. The unignited vapor dispersion is extremely unlikely but, if it occurred, could extend farther offsite and could impact the following critical infrastructure: the Ellender bridge over the intercostal waterway, the Hackberry water treatment facility, Lake Charles LNG, the Department of Energy Strategic Petroleum Reserve west of Hackberry, the Hackberry Volunteer Fire Department, the Hackberry Recreation Center, the Hackberry Community Center, the Hackberry Rural Health Clinic, the Cameron Parish Sherriff Department's Hackberry office, and the Hackberry Volunteer Fire Department. The following communities within the extent of the unignited vapor release could also impact the following communities: multiple residential homes, multiple RV parks, several places of worship, the Hackberry High School, the Hackberry Branch Library, and a hotel. FERC staff did not locate any daycare facilities, or hospitals within the hazard footprints. FERC staff believes the distances used to evaluate the critical infrastructure and communities within the worst case vapor dispersion are conservative because the distances correspond to a catastrophic tank failure which is not part of the Amended Expansion Project application.

Potential Impacts to People with Access and Functional Needs and Environmental Justice Communities

FERC staff used EJScreen[59] as an initial screening tool to identify the potential impacts from incidents identified at the LNG terminal, including potential impacts to people with access and functional needs as defined in NFPA 1600 and 1616. Table 6 shows the resultant percentages of people with potential access and functional needs within these areas based on 2015-2019 U.S. Census Bureau, American Community Survey (ACS) as follows:[60]

TABLE 6
People with Access and Functional Needs within Potential Incident Impact Areas

Potential Incident Impact Area	Population Density (per sq. mile) a/	Households a/	Housing Units a/	Total Minority Population (percent) a, b/	Age 0-4 Population (percent) a/	Age 65+ Population (percent) a/	Linguistically Isolated Population (percent) a, c/	Household income less than $15,000 (percent)a/
10,000 BTU/ft^2-hr(LNG Terminal)	0	0	0	NA	NA	NA	NA	NA
1,600 BTU/ft^2-hr(LNG Terminal)	0	0	0	NA	NA	NA	NA	NA
Flammable Vapor Cloud (LNG Terminal)	28	737	1,111	5%	7%	13%	0%	3%

a/ American Community Survey, 2016-2020, ACE Estimates
b/ Total Minority Population is the percent of the population that is not categorized as "White Alone (not Hispanic or Latino)"
c/ Households in which no one 14 and over speaks English "very well" or speaks English only.

The worst-case distances from these potential incidents would potentially impact three block groups, two of which are considered environmental justice communities, as defined in the B.1 Environmental Justice Section. The block groups located with environmental justice communities that exceed the thresholds for minority and low income identified in B.1

[59] EPA, EJScreen, https://ejscreen.epa.gov/mapper/, Accessed October 2022.

[60] Based on EPA, EJScreen User Guide, 2022, the impact area would aggregate appropriate portions of the intersecting block groups, weighted by population, to create a representative set of data for the entire ring area, honoring variation and dispersion of the population in the block groups within it. For each indicator, the result is a population-weighted average, which equals the block group indicator values averaged over all residents who are estimated to be inside the impact area. A weight factor for each block group is determined by summing each block point population percentage for that block group. If the impact area touches part of a neighboring block group that contains no block points, nothing will be aggregated; if an impact area intersects a number of block groups, EJScreen indices will be aggregated within each block group based on the affiliated block points. The aggregation is done by using factor-weighted block points.

Environmental Justice Section would include Census Tract 9701.01, Block Group 2 and Census Tract 9702.03, Block Group 2 (based on the low-income threshold); and Census Tract 9702.03, Block Group 1 (based on the minority and low-income thresholds). Minority and low-income population percentages for these Census Tract Block Groups are provided in detail in section B.1 (Environmental Justice).

Should a catastrophic incident or other more likely emergency occur at the Cameron LNG Terminal or at the LNG marine vessel along its route, people with access and functional needs and environmental justice communities could experience significant public safety impacts and impacts on environmental justice communities would be disproportionately high and adverse as the impacts of such an accident would be predominately borne by environmental justice communities. However, Commission staff has determined that the risk (i.e., likelihood and consequence) of accidental and intentional events would be less than significant with implementation of the proposed safety and security measures recommendations. These measures further enhance the safety and security of the engineering design of the layers of protection for review subject to the approval by Commission staff and in accordance with recommended and generally accepted good engineering practices, which go above the minimum federal requirements that would also be required at the LNG terminal by USDOT PHMSA regulations under 49 CFR193 and USCG regulations under 33 CFR 127 and 33 CFR 105, such that they would further reduce the risk of incidents impacting the public to less than significant levels, including impacts to those with access and functional needs and environmental justice communities.

Emergency Response Plans and Mitigation

In order to mitigate these potential offsite risks, additional recommendations are made by FERC staff to further enhance the safety and security measures beyond that which would normally be required at the LNG terminal by the minimum standards for LNG safety promulgated in USDOT PHMSA regulations under 49 CFR 193 and USCG regulations under 33 CFR 127 and 33 CFR 105. We recommend the Emergency Response Plans consistent with the recognized and generally accepted good engineering practices for evacuating and sheltering in place, such as NFPA 1600, NFPA 1616, NFPA 1620, NFPA 470, and NFPA 475.

Commission staff determined that the risk of accidental and intentional events would be less than significant with implementation of the proposed safety and security recommendations that further enhance the safety and security measures that would be required at the LNG terminal by USDOT PHMSA regulations under49 CFR 193 and USCG regulations under 33 CFR 127 and 33 CFR 105. Furthermore, EPAct 2005 requires LNG terminal operator's Emergency Response Plan be developed in consultation with the USCG and State and local agencies and be approved by the Commission prior to final approval to begin construction. To satisfy this requirement, there is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG file updates to their ERP. FERC staff recommends this condition be revised as written in section 3.2 that prior to initial site preparation, Cameron LNG develop an ERP (including evacuation and any sheltering and re-entry) and coordinate procedures with the USCG; state, county, and local emergency planning groups; fire departments; state and local law enforcement; and other appropriate federal agencies. We also recommend this plan should be consistent with recommended and good engineering practices and based on

potential impacts and onsets of hazards from accidental and intentional events at the LNG terminal, including but not limited to a catastrophic failure of the largest LNG tank. We also recommend the plan address any special considerations and pre-incident planning for infrastructure and public with access and functional needs andshould include at a minimum:

a. materials and plans for periodic dissemination of public education and training materials for evacuation and/or shelter in place of the public within LNG terminal hazard areas;
b. plans to competently train emergency responders required to effectively and safely respond to hazardous material incidents including, but not limited to LNG fires and dispersion;
c. plans to competently train emergency responders to effectively and safely evacuate or shelter public within hazard areas from LNG terminal;
d. designated contacts with federal, state and local emergency response agencies responsible for emergency management and response within hazard areas from LNG terminal;
e. scalable procedures for the prompt notification of appropriate local officials and emergency response agencies based on the level and severity of potential incidents;
f. scalable procedures for mobilizing response and establishing a unified command, including identification, location, and design of any emergency operations centers and emergency response equipment required to effectively and safely to respond to hazardous material incidents and evacuate or shelter public within LNG terminal hazard areas;
g. scalable procedures for notifying public, including identification, location, design, and use of any permanent sirens or other warning devices required to effectively communicate and warn the publicprior to onset of debilitating hazards within hazard areas from LNG terminal;
h. scalable procedures for evacuating the public, including identification, location, design, and use ofevacuation routes/methods and any mustering locations required effectively and safely evacuate within hazard areasfrom LNG terminal; and
i. scalable procedures for sheltering the public, including identification, location, design, and use of any shelters demonstrated to be needed and demonstrated to effectively and safely shelter public prior to onset of debilitating hazards within hazard areas that may benefit from sheltering in place.

FERC staff recommends Cameron LNG notify FERC staff of all planning meetings in advance and should report progress on the development of its ERP at 3-month intervals. EPAct 2005 requires LNG terminal operators develop a cost-sharing plan to reimburse direct costs to state and local agencies. To satisfy this requirement, there is an existing condition of the CP15-560-000 order authorizing the Expansion Project that requires Cameron LNG file cost sharing plan that identifies the mechanisms for funding security/emergency management costs imposed on state and local agencies. FERC staff recommends this condition be revised as written in section 3.2, that in addition the Cost Sharing Plan that includes sustained funding of any requirement or resource gap analysis identified above to be needed and to effectively and safely evacuate and shelter public and required to effectively and safely respond to hazardous material incidents. We also recommend Cameron LNG to file for review and written approval Emergency Response Plans and any associated cost sharing plan provisions in coordination with federal, state, and local agencies for hazards that may reach State Highway 27. If the project is authorized and constructed, we would evaluate the ERP and Cost Sharing Plan in accordance with recommended and good engineering practices such as, but not limited to, NFPA 1600, NFPA 1616, NFPA 1620, NFPA 470 and NFPA 475, or equivalents.

Based on our preliminary analysis of the hazards from the LNG facilities, we recommend in section 3.2 that Cameron LNG provide additional information, for review and approval, on development of emergency response plans prior to initial site preparation. We also recommend in section 3.2 that Cameron LNG file three dimensional drawings, for review and approval, that demonstrate there is a sufficient number of access and egress locations. If this project is authorized, constructed, and operated, Cameron LNG would coordinate with local, state, and federal agencies on the development of an emergency response plan and cost sharing plan. We recommend in section 3.2 that Cameron LNG provide periodic updates on the development of these plans for reviewand approval, and ensure they are in place prior to introduction of hazardous fluids. In addition, we recommend in section 3.2 that project facilities be subject to regular inspections throughout the life of the facility and would continue to require companies to file updates to the ERP.

3.2 Recommendations from FERC Preliminary Engineering and Technical Review

Based on our preliminary engineering and technical review of the reliability and safety of the Amended Expansion Project, we recommend the following mitigation measures as conditions to any order authorizing the project. These recommendations would be implemented 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 the life of the facility to enhance the reliability and safety ofthe facility and to mitigate the risk of impact on the public.

1. **<u>Prior to construction of final design,</u> Cameron LNG should file with the Secretary consultation with USDOT PHMSA that determines whether the use of normally closed valves to remove stormwater from curbed areas would meet USDOT PHMSA regulations.**
2. **<u>Prior to construction of final design</u>, Cameron LNG should file with the Secretary the following information, stamped and sealed by the professional engineer-of-record, registered in the State of Louisiana, to ensure the facilities are protected for the life of the LNG terminal considering settlement, subsidence, and sea level rise:**
    a. **the finalized settlement monitoring program and procedures for the Project site; and**
    b. **the total and differential settlement of final designed structures, systems, and components foundations for the Project site; and**
3. **<u>Prior to construction of final design</u>, Cameron LNG should file with the Secretary the following information, stamped and sealed by the professional engineer-of-record, registered in the State of Louisiana:**
    a. **site preparation drawings and specifications;**
    b. **finalized civil design basis, criteria, specifications;**
    c. **LNG terminal structures, and foundation design drawings and calculations (including prefabricated and field constructed structures);**

d. seismic specifications for procured Seismic Category I equipment prior to the issuing of request for quotations;

e. quality control procedures to be used for civil/structural design and construction;

f. a determination of whether soil improvement is necessary to counteract soil liquefaction; and

g. the finalized corrosion control and prevention plan for any underground piping, structures, foundations, equipment, and components.

In addition, Cameron LNG should file, in its Implementation Plan, the schedule for producing this information.

Information pertaining to the following specific recommendations should 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, 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.

4. **Prior to initial site preparation, Cameron LNG should file an overall Project schedule, which includes the proposed stages of initial site preparation, construction, commissioning, and in-service plan relative to notice to proceed requests and related conditions.**

5. **Prior to initial site preparation, Cameron LNG should file a construction site security plan that explains how they plan to restrict facility access of unauthorized personnel from entering the operational areas of the plant to perform construction activities within a secure facility with respect to the existing USCG-approved Facility Security Plan.**

6. **Prior to initial site preparation, Cameron LNG should file quality assurance and quality control procedures for construction activities.**

7. **Prior to initial site preparation, Cameron LNG should file updated storm surge hazard analysis that would demonstrate the facilities would be precluded from or withstand the 500-year mean recurrence interval flood event.**

8. **Prior to initial site preparation, Cameron LNG should update the existing ERP (including evacuation and any sheltering and re-entry) to include the proposed facilities and coordinate procedures with the USCG; state, county, and local emergency planning groups; fire departments; state and local law enforcement; and other appropriate federal agencies. This plan should be consistent with recommended and good engineering practices and based on potential impacts and onsets of hazards from accidental and intentional**

events at the LNG terminal. This plan should address any special considerations and pre-incident planning for infrastructureand public with access and functional needs and should include at a minimum:

a. **materials and plans for periodic dissemination of public education and training materials for evacuation and/or shelter in place of the public within LNG terminal hazard areas;**

b. **plans to competently train emergency responders required to effectively and safely respond to hazardous material incidents including, but not limited to LNG fires and dispersion;**

c. **plans to competently train emergency responders to effectively and safely evacuate or shelter public withinhazard areas from LNG terminal;**

d. **designated contacts with federal, state and local emergency response agencies responsible for emergency management and response within hazard areas from LNG terminal;**

e. **scalable procedures for the prompt notification of appropriate local officials and emergency response agencies based on the level and severity of potential incidents;**

f. **scalable procedures for mobilizing response and establishing a unified command, including identification, location, and design of any emergency operations centers and emergency response equipment required to effectively and safely to respond to hazardous material incidents and evacuate or shelter public within LNG terminal hazard areas;**

g. **scalable procedures for notifying public, including identification, location, design, and use of any permanent sirens or other warning devices required to effectively communicate and warn the public prior to onset of debilitating hazards within hazard areas from LNG terminal;**

h. **scalable procedures for evacuating the public, including identification, location, design, and use of evacuation routes/methods and any mustering locations required effectively and safely evacuate public within hazard areas from LNG terminal; and**

i. **scalable procedures for sheltering the public, including identification, location, design, and use of any shelters demonstrated to be needed and demonstrated to effectively and safely shelter public prior to onset of debilitating hazards within hazard areas that may benefit from sheltering in place.**

Cameron LNG should notify the FERC staff of all planning meetings in advance andshould report progress on the development of its ERP at 3-month intervals.

9. **Prior to initial site preparation, Cameron LNG should file an updated Cost-Sharing Plan to include the proposed facilities and should identify the mechanisms for funding all Project-specific security/emergency management costs that would be imposed on state and local agencies. This comprehensive plan should include funding mechanisms for the capital costs associated with any necessary security/emergency management equipment and personnel base. This plan should include sustained funding of any requirement or resource gap analysis identified to effectively and safely evacuate and shelter public and to effectively and safely respond to hazardous material incidents consistent with**

recommended and good engineering practices. Cameron LNG should notify FERC staff of all planning meetings in advance and should report progress on the development of its Cost Sharing Plan at 3-month intervals.

10. **Prior to construction of final design of any permanent facilities, Cameron LNG shall file updated Emergency Response Plans and any associated Cost Sharing Plan provisions in coordination with federal, state, and local agencies for hazards that may reach State Highway 27, including identifying potential incidents, impact distances, and timing of the onset of hazards reaching State Highway 27, and measures to notify approaching highway traffic and evacuate persons from impacted areas as quickly as possible relative to the onset of hazards. The ERP and Cost Sharing Plans should discuss consideration of signage or equivalent, and maintenance thereof, to facilitate notification and evacuation.**
11. **Prior to construction of final design, Cameron LNG should file change logs that list and explain any changes made from the FEED provided in Cameron's application and filings. A list of all changes with an explanation for the design alteration should be provided and all changes should be clearly indicated on all diagrams and drawings**
12. **Prior to construction of final design, Cameron LNG should file information/revisions pertaining to Cameron LNG's response: Numbers 3, 6, 18, 24, 26, 28, 29, 33, 34, 40, 45, 46, 47, 50, 51, 55, 56, 57, 58, 79, and 80 of its June 27, 2022 filing, which indicated features to be included or considered in the final design.**
13. **Prior to construction of final design, Cameron LNG should file drawings of the security fence. The fencing drawings should provide details of fencing that demonstrates it is in accordance with NFPA 59A (2019 edition) and would restrict and deter access around the entire facility and has a setback from exterior features (e.g., power lines, trees, etc.) and from interior features (e.g., piping, equipment, buildings, etc.) that does not allow the fence to be overcome.**
14. **Prior to construction of final design, Cameron LNG should file security camera and intrusion detection drawings. The security camera drawings should show the locations, mounting elevation, areas covered, and features of each camera (e.g., fixed, tilt/pan/zoom, motion detection alerts, low light, etc.) and should provide camera coverage at access points and along the entire perimeter of the terminal with redundancies and camera coverage of the interior of the terminal to enable rapid monitoring of the terminal, and coverage within pretreatment areas, within liquefaction areas, within truck transfer areas, within marine transfer areas, and within buildings. The drawings should show or note the location and type of the intrusion detection and should cover the entire perimeter of the facility.**
15. **Prior to construction of final design, Cameron LNG should file photometric analyses or equivalent and associated lighting drawings. The lighting drawings should show the location, elevation, type of light fixture, and lux levels of the lighting system and should provide illumination along the perimeter of the terminal, process equipment, and along paths/roads of access and egress to facilitate security monitoring and emergency response operations in accordance with API 540 (4th edition) or approved equivalent and applicable federal regulations.**
16. **Prior to construction of final design, Cameron 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.

17. **Prior to construction of final design, Cameron LNG should file a plot plan of the final design showing all major equipment, structures, buildings, and impoundment systems.**
18. **Prior to construction of final design, Cameron LNG should file a building siting assessment to ensure plant buildings that are occupied or critical to the safety of the LNG plant are adequately protected from potential hazards involving fires and vapor cloud explosions.**
19. **Prior to construction of final design, Cameron LNG should file three-dimensional plant drawings to confirm plant layout for maintenance, access, egress, and congestion.**
20. **Prior to construction of final design, Cameron LNG should file up-to-date process flow diagrams (PFDs), heat and mass balances (HMBs), and piping and instrument diagrams (P&IDs) including vendor P&IDs. The HMBs should demonstrate a peak export rate of 6.75 MTPA. The P&IDs should include the following information:**
    a. **equipment tag number, name, size, duty, capacity, and design conditions;**
    b. **equipment insulation type and thickness;**
    c. **storage tank pipe penetration size and nozzle schedule;**
    d. **valve high pressure side and internal and external vent locations;**
    e. **piping with line number, piping class specification, size, and insulation type and thickness;**
    f. **piping specification breaks and insulation limits;**
    g. **all control and manual valves numbered;**
    h. **relief valves with size and set points; and**
    i. **drawing revision number and date.**
21. **Prior to construction of final design, Cameron LNG should file a car seal and lock philosophy and car seal and lock program, including a list of all car-sealed and locked valves consistent with the P&IDs. The car seal and lock program should include monitoring and periodically reviewing correct car seal and lock placement and valve position.**
22. **Prior to construction of final design, Cameron LNG should file P&IDs, specifications, and procedures that clearly show and specify the tie-in details required to safely connect subsequently constructed facilities with the operational facilities.**
23. **Prior to construction of final design, Cameron LNG should file information to demonstrate the EPC contractor has verified that all FEED HAZID recommendations have been addressed.**
24. **Prior to construction of final design, Cameron LNG should file a hazard and operability review of the final design P&IDs, a list of the resulting recommendations, and action taken on the recommendations. The issued for construction P&IDs should incorporate the**

hazard and operability review recommendations and justification should be provided for any recommendations that are not implemented.

25. **<u>Prior to construction of final design</u>, Cameron LNG should provide a check valve upstream of the acid gas removal column to prevent backflow or provide a dynamic simulation that shows that upon plant shutdown, the swan neck would be sufficient for this purpose.**

26. **<u>Prior to construction of final design</u>, Cameron LNG should file the safe operating limits (upper and lower), alarm and shutdown set points for all instrumentation (e.g., temperature,pressures, flows, and compositions).**

27. **<u>Prior to construction of final design</u>, Cameron LNG should file cause-and-effect matrices for the process instrumentation, fire and gas detection system, and emergency shutdown system. The cause-and-effect matrices should include alarms and shutdown functions, details of the voting and shutdown logic, and set points.**

28. **<u>Prior to construction of final design</u>, Cameron LNG should specify that all ESD valves are to be equipped with open and closed position switches connected to the Distributed Control System (DCS)/SIS.**

29. **<u>Prior to construction of final design,</u> Cameron LNG should demonstrate that all electrical, instrument, and control systems at the project, which activate emergency systems or are relied upon for isolation or shutdowns, will be designed to withstand a 20-minute fire exposure per Underwriters Laboratory 1709 (6th edition) or approved equivalent.**

30. **<u>Prior to construction of final design,</u> Cameron LNG should file the sizing basis of the LNG storage tank vacuum relief and pressure relief valves and demonstrate that adequate pressure and vacuum protection is maintained due to the proposed increased LNG in-tank pump capacity and additional BOG compressor.**

31. **<u>Prior to construction of final design</u>, Cameron LNG should file an up-to-date equipment list, process and mechanical data sheets, and specifications. The specifications should include:**

    a. **building specifications (e.g., control buildings, electrical buildings, compressor buildings, storage buildings, pressurized buildings, ventilated buildings, blast resistant buildings);**

    b. **mechanical specifications (e.g., piping, valve, insulation, rotating equipment, heat exchanger, storage tank and vessel, other specialized equipment);**

    c. **electrical and instrumentation specifications (e.g., power system, control system, safety instrument system [SIS], cable, other electrical and instrumentation); and**

    d. **security and fire safety specifications (e.g., security, passive protection, hazard detection, hazard control, firewater).**

32. **<u>Prior to construction of final design</u>, Cameron LNG should file a list of all codes and standards and the final specification document number where they are referenced.**

33. **<u>Prior to construction of final design,</u> Cameron LNG should evaluate whether a different flange orientation would minimize these potential leaks without any other safety implications and, if so, the final design should reflect that different flange orientation. If there are other safety implications that would prevent a different orientation, Cameron LNG should provide an analysis which demonstrates the dry flare header flanged**

connection to the dry flare knock out drum will not be susceptible to flange separation and leaking cause by uneven cooling.

34. **Prior to construction of final design, Cameron LNG should file an evaluation of emergency shutdown valve closure times. The evaluation should account for the time to detect an upset or hazardous condition, notify plant personnel, and close the emergency shutdown valve(s).**

35. **Prior to construction of final design, Cameron LNG should file an evaluation of dynamic pressure surge effects from valve opening and closure times and pump operations that demonstrate that the surge effects do not exceed the design pressures.**

36. **Prior to construction of final design, Cameron LNG should demonstrate that, for hazardous fluids, piping and piping nipples 2 inches 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.**

37. **Prior to construction of final design, Cameron LNG should file the sizing basis and capacity for the final design of the flares and/or vent stacks as well as the pressure and vacuum relief valves for major process equipment, vessels, and storage tanks.**

38. **Prior to construction of final design, Cameron LNG should specify the process vessels, and storage vessels for ethylene, propane, hot oil, and LNG are installedwith spare pressure relief valves to ensure overpressure protection during relief valve testingor maintenance.**

39. **Prior to construction of final design, Cameron LNG should file an updated fire protection evaluation of the proposed facilities. A copy of the evaluation, a list of recommendations and supporting justifications, and actions taken on the recommendations should be filed. The evaluation should justify the type, quantity, and location of hazard detection and hazard control, passive fire protection, emergency shutdown and depressurizing systems, firewater, and emergency response equipment, training, and qualifications in accordance with NFPA 59A (2001). The justification for the flammable and combustible gas detection and flame and heat detection systems should be in accordance with ISA 84.00.07 (2018 edition) or equivalent methodologies and would need to demonstrate 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. The justification for firewater should provide calculations for all firewater demands based on design densities, surface area, and throw distance as well as specifications for the corresponding hydrant and monitors needed to reach and cool equipment.**

40. **Prior to construction of final design, Cameron LNG should file spill containment system drawings with dimensions and slopes of curbing, trenches, impoundments, tertiary containment and capacity calculations considering any foundations and equipment within impoundments, as well as the sizing and design of the down-comers. The spill containment drawings should show containment for all hazardous fluids including all liquids handled above 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 not providing spill containment would not significantly increase the flammable vapor dispersion or radiant heat consequences of a spill.**

41. **<u>Prior to construction of final design</u>, Cameron LNG should specify remotely operated or automatic firewater monitors in areas that are inaccessible or difficult to access in the event of an emergency.**

42. **<u>Prior to construction of final design</u>, Cameron LNG should determine whether a horizontal or tangential LNG release up to a full guillotine of the 36-inch-diameter loading line could enter the waterway and evaluate if additional mitigation such as barriers, shrouds, or a pipe-in-pipe design along this section of piping would prevent releases from reaching the waterway. Alternatively, if no mitigation measures are proposed to prevent releases from reaching the waterway for the new parallel loading line, Cameron LNG should perform a quantitative risk analysis per NFPA (2019) Section 19.6.1 and also include; modeling that determines the probability of LNG releases resulting in rainout on the water surface, accounting for release size, direction, and discharge angle relative to the horizontal; calculates the distances to specified endpoints for potential hazards associated with LNG spills on water, with and without the estimated effect of RPTs accounting for weather data particularly wind speed and direction; and calculates the number of persons impacted by each release case accounting for as well as population distribution; and lastly comparing the results with tolerability criteria published by FERC and NFPA 59A.**

43. **<u>Prior to construction of final design</u>, Cameron LNG should file electrical area classificationdrawings, including cross sectional drawings. The drawings shall demonstrate compliance with NFPA 59A (2019 edition), NFPA 70 (2017 edition), NFPA 497 (2017 edition), and API RP 500 (3rd edition), or equivalents. In addition, the drawings shall include revisions to the electrical area classification design or provide technical justification that supports the electrical area classification of the following areas using most applicable API RP 500 figures (e.g., figures 20 and 21) or hazard modeling of various release rates from equivalent hole sizes and wind speeds (see NFPA 497 release rate of 1 lb-mole/minute).**

44. **<u>Prior to construction of final design,</u> Cameron LNG should file drawings and details of how process seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system meet the requirements of NFPA 59A (2001) or approved equivalents.**

45. **<u>Prior to construction of final design</u>, Cameron LNG should file details of an air gap or vent installed downstream of process seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system. Each air gap should vent to a safe location and be 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.**

46. **<u>Prior to construction of final design</u>, Cameron LNG should file analysis of the buildings containing hazardous fluids and the ventilation calculations that limit concentrations below the LFLs (e.g., 25-percent LFL), including an analysis of off gassing of hydrogen in battery rooms, and shall also provide hydrogen detectors that alarm (e.g., 20- to 25-percent LFL) andinitiate mitigative actions (e.g., 40- to 50-percent LFL) in accordance with NFPA 59A (2019 edition) and NFPA 70 (2017 edition), or equivalents.**

47. **<u>Prior to construction of final design</u>, Cameron LNG should file complete drawings and a list of the hazard detection equipment. The drawings should clearly show the location and**

elevation of all detection equipment as well as their coverage area. The list should include the instrument tag number, type and location, alarm indication locations, and shutdown functions of the hazard detection equipment.

48. **Prior to construction of final design, Cameron LNG should file a technical review of facility design that:**
    a. **identifies all combustion/ventilation air intake equipment and the distances to any possible flammable gas or toxic release; and**
    b. **demonstrates that these areas are adequately covered by hazard detection devices and indicates how these devices would isolate or shutdown any combustion or heating ventilation and air conditioning equipment whose continued operation could add to or sustain an emergency.**
49. **Prior to construction of final design, Cameron LNG should file a design that includes hazard detection suitable to detect high temperatures and smoldering combustion products in electrical buildings and control room buildings.**
50. **Prior to construction of final design, Cameron LNG should file an evaluation of the voting logic and voting degradation for hazard detectors.**
51. **Prior to construction of final design, Cameron LNG should file a list of alarm and shutdown set points for all hazard detectors that account for the calibration gas of the hazard detectors when determining the lower flammable limit set points for methane, ethylene, propane, isopentane, and condensate.**
52. **Prior to construction of final design, Cameron LNG should file a list of alarm and shutdown set points for all hazard detectors that account for the calibration gas of hazard detectors when determining the set points for toxic components such as condensate and hydrogen sulfide.**
53. **Prior to construction of final design, Cameron LNG should file a drawing showing the location of the emergency shutdown buttons, including, but not limited to the refrigerant storage, condensate storage, and LNG storage areas. Emergency shutdown buttons should be easily accessible, conspicuously labeled, and located in an area which would be accessible during an emergency.**
54. **Prior to construction of final design, Cameron LNG should file facility plan drawings and a list of the fixed and wheeled dry-chemical, hand-held fire extinguishers, and other hazard control equipment. Plan drawings should clearly show the location by tag number of all fixed, wheeled, and hand-held extinguishers and should demonstrate the spacing of extinguishers meet prescribed travel distances in NFPA 10 (2022 edition) or approved equivalent. The list should include the equipment tag number, type, capacity, equipment covered, discharge rate, and automatic and manual remote signals initiating discharge of the units and should demonstrate they meet NFPA 59A (2019 edition) or approved equivalent.**
55. **Prior to construction of final design, Cameron LNG should file drawings and specifications for the structural passive protection systems to protect equipment and supports from cryogenic releases.**

56. **<u>Prior to construction of final design</u>, Cameron LNG should file calculations or test results for the structural passive protection systems to protect equipment and supports from cryogenic releases.**

57. **<u>Prior to construction of final design</u>, Cameron LNG should file drawings and specifications for the structural passive protection systems to protect equipment and supports from pool and jet fires.**

58. **<u>Prior to construction of final design</u>, Cameron LNG should file a detailed quantitative analysis to demonstrate that adequate mitigation would be provided for each pressure vesselthat could fail within the 4,000 BTU/ft2-hr zone from a pool or jet fires; each critical structural component (including the LNG marine vessel) and emergency equipment item thatcould fail within the 4,900 BTU/ft2-hr zone from a pool or jet fire; and each occupied buildingthat could expose unprotected personnel within the 1,600 BTU/ft2-hr zone from a pool or jetfire. Trucks at truck transfer stations should be included in the analysis of potential pressurevessel failures, as well as measures needed to prevent cascading impact due to the 10-minutesizing spill at the marine area. Mitigation measures to protect the above facilities from radiant heat from a spill impoundment shall be demonstrated to have a reliability equivalent to a SIL 3 system. A combination of passive and active protection for pool firesand passive and/or active protection for jet fires should be provided and demonstrate the effectiveness and reliability. Effectiveness of passive mitigation should be supported by calculations or test results for the thickness limiting temperature rise over the fire duration,and active mitigation should be supported by reliability information by calculations or test results, such as demonstrating flow rates and durations of any cooling water would mitigatethe heat absorbed by the component. The total firewater demand should account for all components that could fail to a pool or jet fire.**

59. **<u>Prior to construction of final design</u>, Cameron LNG should file an evaluation and associated specifications, drawings, and datasheets for transformers demonstrating how it would prevent cascading damage of transformers (e.g., fire walls or spacing) in accordance with NFPA 850 (2015 edition) or equivalent.**

60. **<u>Prior to construction of final design</u>, Cameron LNG should file facility plan drawings showing the proposed location of the firewater and any foam systems. Plan drawings should clearly show the location of firewater and foam piping, post indicator and sectional valves, and the location and area covered by, each monitor, hydrant, hose, water curtain, deluge system, foam system, water-mist system, and sprinkler. The drawings should demonstrate that each process area, fire zone, or other sections of piping with several users can be isolated with post indicator or sectional valves. The firewater coverage drawings should illustrate firewater coverage by two or more hydrants or monitors accounting for obstructions (or deluge systems) for all areas that contain flammable or combustible fluids.**

61. **<u>Prior to commissioning,</u> Cameron LNG should file a detailed schedule for commissioning through equipment startup. The schedule should include milestones for all procedures and tests to be completed: prior to introduction of hazardous fluids and during commissioning and startup. Cameron LNG should file documentation certifying that each of these milestones has been completed before authorization to commence the next phase of commissioning and startup will be issued.**

62. **<u>Prior to commissioning,</u> Cameron LNG should file detailed plans and procedures for: testing the integrity of onsite mechanical installation; functional tests; introduction of hazardous fluids; operational tests; and placing the equipment into service.**

63. **<u>Prior to commissioning</u>, Cameron LNG should file the operation and maintenance procedures and manuals, as well as safety procedures, hot work procedures and permits, abnormal operating conditions reporting procedures, simultaneous operations procedures, and management of change procedures and forms.**

64. **<u>Prior to commissioning</u>, Cameron LNG should file a plan for clean-out, dry-out, purging, and tightness testing. This plan should address the requirements of the American Gas Association's Purging Principles and Practice, and should provide justification if not using an inert or non-flammable gas for clean-out, dry-out, purging, and tightness testing**

65. **<u>Prior to commissioning,</u> Cameron LNG should tag all equipment, instrumentation, and valves in the field, including drain valves, vent valves, main valves, and car-sealed or locked valves.**

66. **<u>Prior to commissioning</u>, Cameron LNG should file a plan to maintain a detailed training log to demonstrate that operating, maintenance, and emergency response staff have completed the required training.**

67. **<u>Prior to commissioning</u>, Cameron LNG should file the procedures for pressure/leak tests which address the requirements of ASME BPVC Section VIII (2017 edition) and ASME B31.3 (2016 edition). In addition, Cameron LNG should file a line list of pneumatic and hydrostatic test pressures.**

68. **<u>Prior to introduction of hazardous fluids</u>, Cameron LNG should complete and document a pre-startup safety review to ensure that installed equipment meets the design and operating intent of the facility. The pre-startup safety review should include any changes since the lasthazard review, operating procedures, and operator training. A copy of the review with a list of recommendations, and actions taken on each recommendation, should be filed.**

69. **<u>Prior to introduction of hazardous fluids,</u> Cameron LNG should complete and document all pertinent tests (Factory Acceptance Tests, Site Acceptance Tests, Site Integration Tests) associated with the DCS, SIS and FGS that demonstrates full functionality and operability of the system.**

70. **<u>Prior to introduction of hazardous fluids</u>, Cameron LNG should develop, file, and implement an alarm management program consistent with ISA 18.2 (2016 edition) or equivalent to reduce alarm complacency and maximize the effectiveness of operator response to alarms.**

71. **<u>Prior to introduction of hazardous fluids</u>, Cameron LNG should complete and document clean agent acceptance tests.**

72. **<u>Prior to introduction of hazardous fluids</u>, Cameron LNG should complete and document foam system and sprinkler system acceptance tests.**

73. **<u>Prior to introduction of hazardous fluids</u>, Cameron LNG should complete and document a firewater pump acceptance test and firewater monitor and hydrant coverage test. The actual coverage area from each monitor and hydrant should be shown on facility plot plan(s).**

74. **<u>After production of first LNG,</u> Cameron LNG should file weekly reports on the commissioning of the proposed systems that detail the progress toward demonstrating the facilities can safely and reliably operate at or near the design production rate. The reports should include a summary of activities, problems encountered, and remedial actions taken. The weekly reports should also include the latest commissioning schedule, including projected and actual LNG production by the liquefaction train, and the number of anticipated and actual LNG commissioning cargoes, along with the associated volumes loaded or unloaded. Further, the weekly reports should include a status and list of all planned and completed safety and reliability tests, work authorizations, and punch list items. Problems of significant magnitude should be reported to the FERC within 24 hours.**

75. **<u>Prior to commencement of service</u>, Cameron LNG should file a request for written authorization from the Director of OEP. Such authorization would only be granted following a determination by the USCG, under its authorities under the Ports and Waterways Safety Act, the Magnuson Act, the MTSA of 2002, and the Security and Accountability For Every Port Act, that appropriate measures to ensure the safety and security of the facility and the waterway have been put into place by Cameron LNG or other appropriate parties.**

76. **<u>Prior to commencement of service</u>, Cameron LNG should file any proposed revisions to the security plan and physical security of the plant.**

77. **<u>Prior to commencement of service</u>, Cameron LNG should label piping with fluid service and direction of flow in the field consistent with ASME A13.1 (2007 edition) or equivalent, in addition to the pipe labeling requirements of NFPA 59A (2001).**

78. **<u>Prior to commencement of service</u>, Cameron LNG should provide plans for any preventative and predictive maintenance program that performs periodic or continuous equipment condition monitoring.**

79. **<u>Prior to commencement of service</u>, Cameron LNG should develop procedures for offsite contractors' responsibilities, restrictions, monitoring, training, and limitations and for supervision of these contractors and their tasks by Cameron LNG staff. Specifically, the procedures should address:**

    a) **selecting a contractor, including obtaining and evaluating information regarding the contract employer's safety performance and programs.**

    b) **informing contractors of the known potential hazards, including flammable and toxic release, explosion, and fire, related to the contractor's work and systems they are working on.**

    c) **developing and implementing provisions to control and monitor the entrance, presence, and exit of contract employers and contract employees from process areas, buildings, and the plant.**

    d) **developing and implementing safe work practices for control of personnel safety hazards, including lockout/tagout, confined space entry, work permits, hot work, and opening process equipment or piping.**

    e) **developing and implementing safe work practices for control of process safety hazards, including identification of layers of protection in systems being worked**

on, recognizing abnormal conditions on systems they are working on, and re-instatement of layers of protection, including ensuring bypass, isolation valve, and car-seal programs and procedures are being followed.

f) developing and implementing provisions to ensure contractors are trained on the emergency action plans and that they are accounted for in the event of an emergency.

g) monitoring and periodically evaluating the performance of contract employers in fulfilling their obligations above, including successful and safe completion of work and re-instatement of all layers of protection.

In addition, we recommend that the following measures should apply <u>throughout the life of the Cameron LNG Amended Expansion Project.</u>

1. The facility should be subject to regular FERC staff technical reviews and site inspections on at least an <u>annual</u> basis or more frequently as circumstances indicate. Prior to each FERC staff technical review and site inspection, Cameron should respond to a specific data request including information relating to possible design and operating conditions that may have been imposed by other agencies or organizations. Up-to-date detailed P&IDs reflecting facility modifications and provision of other pertinent information not included in the semi-annual reports described below, including facility events that have taken place since the previously submitted semi-annual report, should be submitted.

2. <u>Semi-annual</u> operational reports should be filed with the Secretary to identify changes in facility design and operating conditions; abnormal operating experiences; activities (e.g., ship arrivals, quantity and composition of imported and exported LNG, liquefied and vaporized quantities, boil off/flash gas); and plant modifications, including future plans and progress thereof. Abnormalities should include, but not be limited to, unloading/loading/shipping problems, potential hazardous conditions from offsite vessels, storage tank stratification or rollover, geysering, storage tank pressure excursions, cold spots on the storage tank, storage tank vibrations and/or vibrations in associated cryogenic piping, storage tank settlement, significant equipment or instrumentation malfunctions or failures, non-scheduled maintenance or repair (and reasons therefore), relative movement of storage tank inner vessels, hazardous fluids releases, fires involving hazardous fluids and/or from other sources, negative pressure (vacuum) within a storage tank, and higher than predicted boil off rates. Adverse weather conditions and the effect on the facility also should be reported. Reports should be submitted <u>within 45 days after each period ending June 30 and December 31</u>. In addition to the above items, a section entitled "Significant Plant Modifications Proposed for the Next 12 Months (dates)" should be included in the semi-annual operational reports. Such information would provide the FERC staff with early notice of anticipated future construction/maintenance at the LNG facilities

3. Significant non-scheduled events, including safety-related incidents (e.g., LNG, condensate, refrigerant, or natural gas releases; fires; explosions; mechanical failures; unusual over pressurization; and major injuries) and security-related

incidents (e.g., attempts to enter site, suspicious activities) should be reported to the FERC staff. In the event that an abnormality is of significant magnitude to threaten public or employee safety, cause significant property damage, or interrupt service, notification should be made immediately, without unduly interfering with any necessary or appropriate emergency repair, alarm, or other emergency procedure. In all instances, notification should be made to the FERC staff within 24 hours. This notification practice should be incorporated into the liquefaction facility's emergency plan. Examples of reportable hazardous fluids-related incidents include:

a) fire;

b) explosion;

c) estimated property damage of $50,000 or more;

d) death or personal injury necessitating in-patient hospitalization;

e) release of hazardous fluids for 5 minutes or more;

f) unintended movement or abnormal loading by environmental causes, such as an earthquake, landslide, or flood, that impairs the serviceability, structural integrity, or reliability of an LNG facility that contains, controls, or processes hazardous fluids;

g) any crack or other material defect that impairs the structural integrity or reliability of an LNG facility that contains, controls, or processes hazardous fluids;

h) any malfunction or operating error that causes the pressure of a pipeline or LNG facility that contains or processes hazardous fluids to rise above its maximum allowable operating pressure (or working pressure for LNG facilities) plus the build-up allowed for operation of pressure-limiting or control devices;

i) a leak in an LNG facility that contains or processes hazardous fluids that constitutes an emergency;

j) inner tank leakage, ineffective insulation, or frost heave that impairs the structural integrity of an LNG storage tank;

k) any safety-related condition that could lead to an imminent hazard and cause (either directly or indirectly by remedial action of the operator), for purposes other than abandonment, a 20 percent reduction in operating pressure or shutdown of operation of a pipeline or an LNG facility that contains or processes hazardous fluids;

l) safety-related incidents from hazardous fluids transportation occurring at or en route to and from the LNG facility; or

m) an event that is significant in the judgment of the operator and/or management even though it did not meet the above criteria or the guidelines set forth in an LNG facility's incident management plan.

3.2.1 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, the DOT assists the FERC by determining whether Cameron LNG Project's proposed design would meet the DOT's 49 CFR 193 Subpart B siting requirements. On October 26, 2022, the PHMSA provided an LOD on the Project's compliance with 49 CFR 193 Subpart B. This determination is provided to the Commission as further consideration on the Commission's decision to authorize or deny the Project. If the Project is authorized, constructed, and operated, the facility would be subject to the DOT's inspection and enforcement program and final determination of whether a facility is in compliance with the requirements of 49 CFR 193 would be made by the USDOT PHMSA.

As a cooperating agency, the USCG also assisted the FERC staff by reviewing the proposed LNG terminal and the associated LNG marine vessel traffic. On September 8, 2021, the USCG issued a letter stating Cameron LNG does not need to submit a new Letter of Intent, nor submit a new WSA since ship traffic will not increase beyond the approved 2006 WSA. If the project is authorized, constructed, and operated, 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 Cameron LNG Project design, including potential external impacts based on the site location. Based on this review, we recommend a number of mitigation measures, which would 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. With the incorporation of these mitigation measures and oversight, FERC staff concluded that the Cameron LNG Project design would include acceptable layers of protection or safeguards that would reduce the risk of a potentially hazardous scenariofrom developing into an event that could impact the offsite public.

4.0 CUMULATIVE IMPACTS

In accordance with NEPA, we considered the cumulative impacts of the Amended Expansion Project and other projects or actions in the area. Cumulative impacts represent the incremental effects of the proposed action when added to other past, present, or reasonably foreseeable future actions.

The cumulative impact analysis generally follows the methodology set forth in relevant guidance from the CEQ and the USEPA and focuses on potential impacts from the proposed projects on resource areas or issues where incremental contributions would be potentially significant when added to potential impacts of other actions if they take place in the same general area over a given period of time. To avoid unnecessary discussions of insignificant impacts and

to adequately address and accomplish the purpose of this analysis, an action must meet the following criteria to be included in the cumulative impacts analysis:

- impact a resource area potentially affected by the project;
- cause this impact within all, or part, of the project's geographic scope; and
- cause this impact within all, or part, of the time span for the potential impact of the project.

This EA analyzes the Amended Expansion Project impacts on environmental justice, air quality, and reliability and safety. As described earlier in section A and B.2 of this EA, the Amended Expansion Project would not impact geology and soils; groundwater; wetlands; water resources; fisheries and marine mammals; special status species; vegetation and terrestrial wildlife (including threatened and endangered species); land use, recreation, traffic, or visual resources; socioeconomics; cultural resources; noise quality; or air emissions from construction. Therefore, cumulative impacts on these resources would not be realized and are not evaluated for cumulative impacts. Below, we assess the potential for cumulative impacts on air quality (operation) and environmental justice. The geographic scope used to assess cumulative impacts for each resource is discussed below in table 7.

Table 7
Geographic Scope for Cumulative Impact Analysis

Resource	Geographic Scope	Justification for Geographic Scope
Environmental Justice	Block groups affected by the project.	The geographic scope of potential impacts for environmental justice includes all block groups affected by the project.
Air Quality – Operation [a]	50 kilometers	We adopted the distance used by the USEPA for PSD permitting (40 CFR 51, appendix W)

[a] We note that GHGs do not have a localized geographic scope. GHG emissions from the Project combined with projects all over the planet lead to increased CO_2, methane, and other GHG concentrations in the atmosphere.

Projects Identified within the Geographic Scope

Table 8 identifies 13 present and reasonably foreseeable projects or actions that would occur within the Amended Expansion Project's geographic scope. These projects were identified during our review of publicly available information and information provided by Cameron LNG. We consider the existing operational terminal as part of the environmental baseline.

TABLE 8
Current or Reasonably Foreseeable Future Projects within 50 kilometers of the Amended Expansion Project

FERC Docket #	Project	Proponent	Parish	Distance from Project	Status	Potential Resources Cumulatively Affected
CP15-560	Cameron LNG Expansion Project	Cameron LNG	Cameron and Calcasieu Parishes, LA	Overlapping	Project as authorized is not yet constructed. This amendment is changing the Expansion Project facilities.	Environmental Justice, Air Quality
CP17-117	Driftwood LNG Project	Driftwood LNG LLC	Calcasieu Parish, LA	2 miles	Under construction.	Environmental Justice, Air Quality
CP14-347	Magnolia LNG and Lake Charles Expansion Projects	Magnolia LNG, LLC and Kinder Morgan Louisiana Pipeline LLC	Calcasieu Parish, LA	5 miles	Construction has not yet commenced.	Environmental Justice, Air Quality
CP21-44	Hackberry Storage Project	LA Storage, LLC	Cameron and Calcasieu Parishes, LA	Storage facility and compressor station: 5 miles Saltwater disposal wells component: less than 1 mile	LA Storage submitted its application to FERC on January 29, 2021. Order issued September 23, 2022.	Environmental Justice, Air Quality
CP14-119 CP14-120 CP14-122	Lake Charles Pipeline Modifications Project and Liquefaction Project	Trunkline Gas Company, LLC, Lake Charles LNG Company, LLC, and Lake Charles	Calcasieu Parish, LA	5 miles	Construction has not yet commenced.	Environmental Justice, Air Quality

TABLE 8 Current or Reasonably Foreseeable Future Projects within 50 kilometers of the Amended Expansion Project						
FERC Docket #	**Project**	**Proponent**	**Parish**	**Distance from Project**	**Status**	**Potential Resources Cumulatively Affected**
		LNG Export Company, LLC				
CP19-502	Commonwealth LNG Project	Commonwealth LNG, LLC	Cameron Parish, LA	18 miles	Commonwealth submitted its application to FERC on August 20, 2019. Order issued November 17, 2022.	Environmental Justice, Air Quality
CP15-550	Calcasieu Pass LNG Project	Venture Global Calcasieu Pass, LLC and TransCameron Pipeline, LLC	Cameron Parish, LA	18 miles	TransCameron placed its pipeline facilities into service on April 20, 2021. The Calcasieu Pass Terminal Project is still under construction, with some liquefaction facilities placed in commission in December 2021.	Environmental Justice, Air Quality
CP19-512	Cameron Extension Project	Texas Eastern Transmission LP	Cameron, Calcasieu, Jefferson Davis, and Beauregard Parishes, LA	19 miles	Construction is complete and project in service.	Environmental Justice, Air Quality

TABLE 8
Current or Reasonably Foreseeable Future Projects within 50 kilometers of the Amended Expansion Project

FERC Docket #	Project	Proponent	Parish	Distance from Project	Status	Potential Resources Cumulatively Affected
CP21-1	Compression Relocation and Modification Project	Golden Pass Pipeline LLC	Calcasieu Parish, LA Jefferson County, TX	17 miles	Golden Pass submitted its application to FERC on October 2, 2020. Order issued 10/20/22.	Environmental Justice, Air Quality
CP15-490-000 CP15-490-001 CP16-20-000	Delfin Onshore Port Facility	Delfin LNG LLC	Cameron Parish, LA	15 miles	Construction has not yet commenced.	Environmental Justice, Air Quality
CP20-68 CP20-70	Gulf Run Pipeline and Line CP Modifications Project	Enable Gulf Run Transmission, LLC (Gulf Run) and Enable Gas Transmission, LLC (EGT)	Calcasieu Parish, LA	22 miles from southern terminus of Gulf Run pipeline	Construction is ongoing.	Environmental Justice, Air Quality
CP22-21 CP22-22	CP2 LNG and CP Express Projects	Venture Global CP2 LNG, LLC and Venture Global CP Express, LLC	Jasper and Newton Counties, TX and Calcasieu and Cameron Parishes, LA	16 miles from terminal; 2 miles from pipeline	CP2 LNG and CP2 Express submitted its application to FERC on December 2, 2021. Authorization pending.	Environmental Justice, Air Quality
N/A	Hackberry Carbon Sequestration Project	Hackberry Carbon Sequestration, LLC	Cameron Parish, LA	Within and adjacent to terminal.	TotalEnergies has signed an agreement with Sempra Infrastructure, Mitsui & Co., Ltd. and Mitsubishi Corporation for the development of the	Environmental Justice, Air Quality

TABLE 8 Current or Reasonably Foreseeable Future Projects within 50 kilometers of the Amended Expansion Project						
FERC Docket #	**Project**	**Proponent**	**Parish**	**Distance from Project**	**Status**	**Potential Resources Cumulatively Affected**
					Hackberry Carbon Sequestration project at Cameron LNG terminal. USACE Permit MVN-2021-01265-WQQ. Notice issued January 17, 2022.	

RESTORE stated that the environmental document for this project should include major effects by associated projects directly serving the increased demands of the Hackberry LNG facility, including the Hackberry LA Storage Project (Docket Number CP21-44-000) and the Hackberry Carbon Capture and Sequestration Project. The USEPA also recommended the FERC disclose and consider as part of the cumulative impact analysis whether and how other approved projects, concurrently proposed projects, and reasonably foreseeable planned actions may contribute to potential significant or increased impacts; and FERC should identify impacts from potential interconnected projects. Cumulative impacts are addressed below, including the Hackberry LA Storage Project and Hackberry Carbon Capture and Sequestration Project.

Potential Cumulative Impact on Specific Resources within the Project Area

Environmental Justice

The USEPA recommends we discuss the cumulative impacts of approved projects; concurrently proposed projects; reasonably foreseeable planned actions on minority and low-income populations; and the short and long-term effects of the proposed project on the surrounding area.

The construction and operation of the Expansion Project (as approved in Docket No. CP15-560-000)would increase the atmospheric concentration of GHGs, in combination with past and future emissions from all other sources and would contribute incrementally to future climate change impacts; however, the proposed amendment evaluated herein would reduce the overall GHG emissions from the Expansion Project, and allow for Cameron LNG to gain access to carbon capture and sequestration facilities in the future. While, taken individually, the climate change impacts described below may be manageable for certain communities, the impacts of compound extreme events (such as simultaneous heat and drought, or flooding associated with high precipitation on top of saturated soils) may exacerbate preexisting community vulnerabilities and have a cumulative adverse impact on environmental justice communities. This EA is not characterizing the Amended Expansion Project's GHG emissions as significant or insignificant because the Commission is conducting a generic proceeding to determine whether and how the Commission will conduct significance determinations going forward.[61] GHG impacts, including cumulative GHG impacts, are discussed below. In conclusion, project impacts associated with operation of the Amended Expansion Project facilities within the geographic scope for environmental justice would include permanent impacts from operation on air quality; however, these impacts would be less than significant. With Cameron LNG's identified mitigation measures, as previously described, the impacts on these environmental justice communities associated with these resources would be less than significant.

The projects identified in table 8 are within either Calcasieu or Cameron Parish and involve operational sources of air emissions. These air emissions could act cumulatively with the air emissions of the Amended Expansion Project and affect the environmental justice census block groups in the vicinity of the proposed project. As discussed in section B.2 above, Cameron conducted an air quality analysis to evaluate the air quality impacts from the existing

[61] *Consideration of Greenhouse Gas Emissions in Natural Gas Infrastructure Project Reviews*, 178 FERC ¶ 61,108 (2022); 178 FERC ¶ 61,197 (2022).

LNG Terminal (Trains 1-3), the proposed design enhancements for the Amended Expansion Project, and other major sources in the proposed project area, including background ambient conditions.

Overall, the Amended Expansion Project would contribute atmospheric emissions of greenhouse gasses to the environment, but those emissions would be reduced by 70.1 percent from that previously approved by the Commission. Environmental justice communities could experience impacts associated with GHGs due to the impacts of compound extreme events (such as simultaneous heat and drought, or flooding associated with high precipitation on top of saturated soils), which may exacerbate preexisting community vulnerabilities and have a cumulative adverse impact on environmental justice communities. However, our analysis finds that operational impacts on environmental justice communities associated with air emissions meet applicable Clean Air Act standards and are less than significant.

Based on the emission reductions that would be achieved through the amendment's facility changes and design enhancements, we conclude the operation of the Amended Expansion Project would not have disproportionately high and adverse impacts on environmental justice communities and impacts would not be significant. The other projects listed in table 8 are also required to comply with all applicable federal air quality permitting programs. Compliance with the Clean Air Act would ensure that these projects would not cause or significantly contribute to an exceedance of the NAAQS and would not result in a significant impact on regional air quality, including in environmental justice communities in the region. Therefore, we conclude that impacts of the proposed amendment on environmental justice communities when added to identified past, present, and reasonably foreseeable projects would also not be significant.

Climate Change

Climate change is the variation in the Earth's climate (including temperature, precipitation, humidity, wind, and other meteorological variables) over time. Climate change is largely driven by accumulation of GHGs in the atmosphere due to the increased consumption of fossil fuels (e.g.,coal, petroleum, and natural gas) since the early beginnings of the industrial age and accelerating in the mid- to late-20th century.[62] The GHGs produced by fossil-fuel combustion are CO_2, methane, and nitrous oxide.

In 2017 and 2018, the U.S. Global Change Research Program (USGCRP) issued its *Climate Science Special Report: Fourth National Climate Assessment*, Volumes I and II.[63] This report and the recently released report by the Intergovernmental Panel on Climate Change, *Climate Chaange 2021: The Physical Science Basis*, states that climate change has resulted in a

[62] Intergovernmental Panel on Climate Change, United Nations, Summary for Policymakers of Climate Change 2021: The Physical Science Basis. (Valerie Masson-Delmotte et al., eds.) (2021), https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf (IPCC Report) at SPM-5. Other forces contribute to climate change, such as agriculture, forest clearing, and other anthropogenically driven sources

[63] U.S. Global Change Research Program. *Climate Science Special Report: Fourth National Climate Assessment, Volume 1, Chapter 3 Detection and Attribution of Climate Change* (2017), available at: https://science2017.globalchange.gov/downloads/CSSR2017_FullReport.pdf (accessed June 3, 2021).

wide range of impacts across every region of the country and the globe.[64] Those impacts extend beyond atmospheric climate change alone and include changes to water resources, agriculture, ecosystems, human health, and ocean systems.[65] According to the Fourth Assessment Report, the United States and the world are warming; global sea level is rising and oceans are acidifying; and certain weather events are becoming more frequent and more severe. These impacts have accelerated throughout the end of the 20th and into the 21st century.[66]

GHG emissions do not result in proportional local and immediate impacts; it is the combined concentration in the atmosphere that affects the global climate. These are fundamentally global impacts that feed back to local and regional climate change impacts. Thus, the geographic scope for cumulative analysis of GHG emissions is global rather than local or regional. For example, a project 1 mile away emitting 1 ton of GHGs would contribute to climate change in a similar manner as a project 2,000 miles distant also emitting 1 ton of GHGs.

Climate change is a global concern; however, for this analysis, we will focus on the existing and potential climate change impacts in the general project area. The USGCRP's Fourth Assessment Report notes the following observations of environmental impacts attributed to climate change in the Southeast region of the United States (USGCRP 2017, USGCRP 2018):

- the near decade of 2010 through 2017 has been warmer than any previous decade since 1920 for average daily maximum and average daily minimum temperature;
- since 1960, there have been lower numbers of days above 95°F compared to the pre-1960 period but during the 2010's the number of nights above 75°F has been nearly double the average over 1901 – 1960. The length of the freeze free season was 1.5 weeks longer on average in the 2010s compared to any other historical period on record;
- number of days with 3 or more inches of rain has been historically high over the past 25 years. The 1990s, 2000s, and 2010s rank first, third and second, respectively in number of events;
- summers have been either increasingly dry or extremely wet, depending on location;
- due to a combination of sea level rise and soil subsidence, approximately 2,000 square miles of land have been lost in Louisiana between 1932 and 2016, or about 23 square miles per year; and

[64] IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press.

[65] 6 IPCC Report at SPM-5 to SPM-10.

[66] See, e.g., USGCRP Report Volume II at 99 (describing accelerating flooding rates in Atlantic and Gulf Coast cities).

- in southeast Louisiana, relative sea level is rising at a rate of 1 to 3 feet per 100 years.

The USGCRP'S Fourth Assessment Report notes the following projections of climate change impacts in the proposed project's Southeast United States region with a high or very high level of confidence[67] (USGCRP, 2018):

- climate models project nighttime temperatures above 75°F and daytime maximum temperatures above 95°F become the summer norm. Nights above 80°F and days above 100°F, which are now relatively rare, would become common;
- lowland coastal areas are expected to receive less rainfall on average but experience more frequent intense rainfall events followed by longer drought periods;
- coastal areas along the Gulf of Mexico are flat; therefore, expected sea level rises may cause inundation in certain low lying areas;
- drought and sea level rise will create stressful conditions for coastal trees that are not adapted to higher salinity levels;
- other coastal species may also be stressed by sea level rise and warmer temperatures, prompting migration out of the area; and
- tropical storms and hurricanes may become more intense.

It should be noted that while the impacts described above taken individually may be manageable for certain communities, the impacts of compound events (such as simultaneous heat and drought, or flooding associated with high precipitation on top of saturated soils) can be greater than the sum of the parts.

The USEPA commented that FERC should estimate and analyze potential upstream and downstream GHGs to fully disclose the estimated direct and indirect emissions, broken out by GHG type, associated with the proposed action. The courts have explained that because the authority to authorize LNG exports rests with DOE, NEPA does not require the Commission to consider the upstream or downstream GHG emissions that may be indirect effects of the export itself when determining whether the related LNG export facility satisfies section 3 of the NGA.[68] Furthermore, the amendment would reduce the overall maximum production capacity of the

[67] The report authors assessed current scientific understanding of climate change based on available scientific literature. Each "Key Finding" listed in the report is accompanied by a confidence statement indicating the consistency of evidence or the consistency of model projections. A high level of confidence results from "moderate evidence (several sources, some consistency, methods vary and/or documentation limited, etc.), medium consensus." A very high level of confidence results from "strong evidence (established theory, multiple sources, consistent results, well documented and accepted methods, etc.), high consensus." https://science2017.globalchange.gov/chapter/front-matter-guide/

[68] See Freeport, 827 F.3d at 46-47; see also Sierra Club v. FERC, 867 F.3d 1357, 1373 (D.C. Cir. 2017) (Sabal Trail) (discussing Freeport).

Expansion Project from 9.97 MTPA to 6.75 MTPA. Nevertheless, NEPA requires that the Commission consider the direct GHG emissions associated with a proposed LNG export facility.[69]

The GHG emissions associated with the Amended Expansion Project were identified and quantified in section B.2 of the EA. Emissions of GHGs are typically expressed in terms of CO_2e.[70] The previously approved Expansion Project included construction and operational emissions associated with Trains 4 and 5 and Tank 5. As the scope has been reduced and Train 5 and Tank 5 removed, the Amended Expansion Project would result in a reduction of construction and operational emissions. However, to contextualize the direct emissions of the Amended Expansion Project, below we provide further discussion below regarding Train 4's direct GHG emissions of 934,802 metric tons per year of CO_2e emissions (1,030,152 tpy of CO_2e), which represents an approximate 70 percent reduction of CO_2e emissions from the authorized Expansion Facilities (Trains 4 and 5). Estimates for operational emissions are based on the potential to emit (100 percent utilization), where the facilities are operated at maximum capacity for 365 days/year, 24 hours/day.

Operation of Train 4, as amended in this proceeding, would increase the atmospheric concentration of GHGs, in combination with past and future emissions from all other sources globally and would contribute incrementally to future climate change impacts. To assess impacts on climate change associated with the project, Commission staff considered whether it could identify discrete physical impacts resulting from the project's GHG emissions or compare the project's GHG emissions to established targets designed to combat climate change. To date, Commission staff have not identified a methodology to attribute discrete, quantifiable, physical effects on the environment resulting from the project's incremental contribution to GHGs. Without the ability to determine discrete resource impacts, Commission staff are unable to assess the Amended Expansion Project's contribution to climate change through any objective analysis of physical impact attributable to the Amended Expansion Project. Additionally, Commission staff have not been able to find an established threshold for determining the Amended Expansion Project's significance when compared to established GHG reduction targets at the state or federal level. Ultimately, this EA is not characterizing the Amended Expansion Project's GHG emissions as significant or insignificant because the Commission is conducting a generic proceeding to determine whether and how the Commission will conduct significance determinations going forward.[71] However, as we have done in prior NEPA analyses, we disclose the project's GHG emissions in comparison to national and state GHG emission inventories.

[69] See Freeport, 827 F.3d at 41, 46.

[70] GHG gases are converted to CO_2e by means of the global warming potential, the measure of a particular GHG's ability to absorb solar radiation as well as its residence time within the atmosphere, consistent with the USEPA's established method for reporting GHG emissions for air permitting requirements that allows a consistent comparison with federal regulatory requirements.

[71] Consideration of Greenhouse Gas Emissions in Natural Gas Infrastructure Project Reviews, 178 FERC ¶ 61,108 (2022); 178 FERC ¶ 61,197 (2022).

The USEPA comments that FERC should avoid percentage comparisons between project-level and national emissions, which inappropriately diminish the significance of project-level GHG emissions. The Commission has found the comparison useful in providing context. In order to provide context of the Amended Expansion Project's emissions on a national level, we compare Train 4's GHG emissions to the total GHG emissions of the United States as a whole. At a national level, 5,222.4 million metric tons of CO_2e were emitted in 2020 (inclusive of CO_2e sources and sinks) (USEPA 2022). Operation of Train 4, as amended in this proceeding, could potentially increase CO_2e emissions based on the national 2020 levels by 0.018 percent. However, as noted above, the net result of the proposed amendment is an approximate 70 percent reduction of CO_2e emissions from the authorized Expansion Facilities (Trains 4 and 5).

The USEPA stated that FERC should include a detailed discussion of the Amended Expansion Project's GHG emissions in the context of state, regional, and national GHG emissions reduction goals. On January 20, 2021, President Biden announced that the U.S. will rejoin the Paris Climate Agreement (Agreement), enabling the United States to be a party to the Agreement on February 19, 2021. The Agreement aims to limit global warming to well below 2 degrees Celsius, and preferably to 1.5 degrees Celsius, compared to pre-industrial levels.[72] On April 20, 2021, the United States submitted a plan for climate action known as nationally determined contributions (NDCs) that communicate actions to reduce GHG contributions in order to reach the goals of the Agreement. Based on this NDC, the United States established an United States economy-wide target of reducing net GHG emissions by 50-52 percent below 2005 levels by 2030.[73] Commission staff are unable to determine how or if the Amended Expansion Project fits into the United States' NDC.

In order to provide context of the Amended Expansion Project emissions on a state level, we compare the Train 4's GHG emissions to the state GHG inventories. At the state level, energy related CO_2 emissions in Louisiana were 183.3 million metric tons of CO_2 in 2020.[74] GHG emissions in Louisiana would result from the Train 4's operational emissions; no end-use is expected in Louisiana as the liquefied natural gas would be exported from the United States. Operation of Train 4, as amended in this proceeding, could potentially increase state GHG emissions by 0.5 percent. However, as noted above, the net result of the proposed amendment is an approximate 70 percent reduction of CO_2e emissions from the authorized Expansion Facilities (Trains 4 and 5).

[72] Additional information is available at https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

[73] The United States of America Nationally Determined Contribution (Apr. 20, 2021), *available at* https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/United%20States%20of%20America%20First/United%20States%20NDC%20April%2021%202021%20Final.pdf (accessed May 17, 2022).

[74] U.S. Energy Information Administration, *Table 1, State Energy-Related Carbon Dioxide Emissions by Year, Unadjusted.: Louisiana* (October 11, 2022), https://www.eia.gov/environment/emissions/state/ (accessed November 18, 2022).

To evaluate the Train 4's operational emissions in the context of Louisiana's GHG reduction goals, we compare the GHG emissions to Louisiana's climate targets. The state of Louisiana established executive targets in 2020 to reduce net GHG emissions 26 to 28 percent by 2025 and 40 to 50 percent by 2030, compared to 2005 levels. The targets also aim for net-zero GHG emissions by 2050. Direct GHG emissions from the operation of Train 4 would represent 0.9 percent of Louisiana's 2030 projected GHG emission levels, assuming the reductions from 2005 levels summarized above (the Amended Expansion Project is not anticipated to go into service until 2027).[75]

The USEPA states that FERC should use the social cost of GHG estimates to monetize net climate damages of GHG emissions from the Amended Expansion Project. The social cost of GHGs is an administrative tool intended to quantify, in dollars, an estimate of long-term damage that may result from future emissions of CO_2, nitrous oxide, and methane. We include a disclosure of the social cost of GHGs associated with the reasonably foreseeable emissions from Train 4, as amended, using the calculations described below.[76] We note there is pending litigation challenging federal agencies' use of the Interagency Working Group on the Social Cost of Greenhouse Gas' (IWG) interim values for calculating the social cost of GHGs.[77] In addition, the CEQ noted that it is working with representatives of the GHG IWG to develop additional guidance regarding the application of the SCC tool in federal decision-making processes, including in NEPA analyses.[78] The Commission has not determined which, if any, modifications are needed to render the SCC tool useful for project-level analyses.[79]

As both the USEPA and CEQ participate in the IWG, Commission staff used the methods and values contained in the IWG's current draft guidance but note that different values will result from the use of other methods.[80] Accordingly, we calculated the social cost of CO_2, nitrous

[75] *Id*. Louisiana's CO_2 emissions in 2005 were 201.9 million metric tons per the 2022 table referenced above; therefore, we consider the 2030 GHG emission target to be 100.95 million metric tons.

[76] *See also Vecinos*, 6 F.4th at 1329-30.

[77] *Missouri v. Biden*, 8th Cir. No. 21-3013; *Louisiana v. Biden*, No. 21-cv-1074-JDC-KK (W.D. La). On February 11, 2022, the U.S. District Court for the Western District of Louisiana issued a preliminary injunction limiting federal agencies' employment of estimates of the social costs of GHGs and use of the IWG's interim estimates. On March 16, 2022, the U.S. Court of Appeals for the Fifth Circuit issued a stay of the district court's preliminary injunction, finding among other things that the federal agency respondent's continued use of the interim estimates was lawful. *Louisiana v. Biden*, No. 22-30087 (5th Cir. Mar. 16, 2022).

[78] Council on Environmental Quality's May 27, 2021 Comments filed in Docket No. PL18-1-000, at 2.

[79] See Order Issuing Certificates and Approving Abandonment, 178 FERC ¶ 61,199 (2022) at fn 141.

[80] *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990*, Interagency Working Group on Social Cost of Greenhouse Gases, United States Government, February 2021 (IWG Interim Estimates Technical Support Document).

oxide, and methane. For the analysis, staff assumed discount rates of 5%, 3%, and 2.5%,[81] assumed the Amended Expansion Project will begin service in 2027 and that the Amended Expansion Project's emissions would be at a constant rate throughout the life of a generic 20-year contract. Noting these assumptions, the emissions from operation of Train 4 are calculated to result in a total social cost of GHGs equal to $217,000,964, $852,484,124, and $1,299,767,679 respectively (all in 2020 dollars).[82] Using the 95th percentile of the social cost of GHGs using the 3% discount rate,[83] the total social cost of GHGs from the project is calculated to be $2,593,955,983 (in 2020 dollars).

Air Quality – Operations

Project operation would contribute cumulatively to air pollutant levels in combination with other projects nearby identified in table 8 as part of the cumulative impact analysis. However, as summarized in section B.2, the Amended Expansion Project would result in reductions of 85.7, 48.1, 83.6, and 61.0 percent for NO_x, CO, PM, and VOC, respectively, when compared to the currently authorized Expansion Project. Based on the emissions reductions, we conclude that the Amended Expansion Project would not result in significant cumulative impacts on regional air quality.

[81] IWG Interim Estimates Technical Support Document at 24. To quantify the potential damages associated with estimated emissions, the IWG methodology applies consumption discount rates to estimated emissions costs. The IWG's discount rates are a function of the rate of economic growth where higher growth scenarios lead to higher discount rates. For example, IWG's method includes the 2.5% discount rate to address the concern that interest rates are highly uncertain over time; the 3% value to be consistent with Office of Management and Budget Circular A-4 (2003) and the real rate of return on 10-year Treasury Securities from the prior 30 years (1973 through 2002); and the 5% discount rate to represent the possibility that climate-related damages may be positively correlated with market returns. Thus, higher discount rates further discount future impacts based on estimated economic growth. Values based on lower discount rates are consistent with studies of discounting approaches relevant for intergenerational analysis. *Id.* at 18-19, 23-24.

[82] The IWG draft guidance identifies costs in 2020 dollars. *Id*. at 5 (Table ES-1).

[83] This value represents "higher-than-expected economic impacts from climate change further out in the tails of the [social cost of CO_2] distribution." *Id*. at 11. In other words, it represents a higher impact scenario with a lower probability of occurring.

C. ALTERNATIVES

In accordance with NEPA and Commission policy, we identified and evaluated alternatives to the Amended Expansion Project to determine whether they would be reasonable and environmentally preferable to the proposed action. These alternatives include the No Action Alternative. Because the proposed Amended Expansion Project does not involve any change in the previously authorized LNG terminal site, we did not evaluate any site alternatives.

NEPA requires the Commission to consider and evaluate the No-Action Alternative. According to CEQ guidance, in instances involving federal decisions on proposals for projects, no-action would mean the proposed activity would not take place and the resulting environmental effects from taking no-action would be compared with the effects of permitting the proposed activity. Further, the No-Action Alternative provides a benchmark for decisionmakers to compare the magnitude of environmental effects of the proposed activity and alternatives.

We have prepared this EA to inform the Commission and stakeholders about the expected impacts that would occur if the Amendment were constructed and operated. Under the No-Action Alternative, the Amended Expansion Project would not be authorized and Cameron LNG would construct the Expansion Project as previously approved in the Commission's May 2016 Order in Docket No. CP15-560-000. This would include construction and operation of Train 4, Train 5, and Tank 5, with LNG production capacity at 24.92 MTPA. Cameron LNG would not have authorization to implement design enhancements to reduce the GHG emissions from, and increase the overall reliability and capacity of, Train 4, and would not have the capability for dual loading of LNG vessels at both the North and South Jetties. The Commission, in its order, will ultimately determine if the Amended Expansion Project meets the public interest standard in section 3 of the NGA and could choose the No-Action Alternative.

Sierra Club and Healthy Gulf stated that FERC should consider further electrification of components as an alternative when reviewing the proposed Amended Expansion Project. An individual also commented at the scoping session that FERC should review the alternative of an electric turbine system. Cameron LNG's Amended Expansion Project already proposes electrification via the installation of E-Drives in lieu of gas turbine drives in Train 4. As a result, the Amended Expansion Project would result in reductions of 85.7, 48.1, 83.6, and 61.0 percent for NOx, CO, PM, and VOC, respectively, when compared to the currently authorized Expansion Project. See section B.2 for more information on air quality.

Therefore, we conclude that the proposed action is the preferred alternative to meet the Amended Expansion Project's objectives.

D. CONCLUSIONS

Based on the analysis in this EA, we have determined that if Cameron LNG constructs and operates the Amended Expansion Project in accordance with its application and supplements, approval would not constitute a major federal action significantly affecting the quality of the human environment. We recommend that the Order contain a finding of no significant impact and include the following mitigation measures listed below as conditions to any authorization the Commission may issue. The below recommended conditions are intended to replace the environmental and engineering conditions of the Commission's 2016 Order in Docket No. CP15-560-000, in their entirety.

1. Cameron LNG shall follow the construction procedures and mitigation measures described in its application and supplements and as identified in the EA, unless modified by the Order. Cameron LNG must:

    a. request any modification to these procedures, measures, or conditions in a filing with the Secretary of the Commission (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 the Office of Energy Projects (OEP), or the Director's designee, **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 operation.

3. **Prior to any construction,** Cameron LNG shall file an affirmative statement with the Secretary, certified by a senior company official, that all company personnel, environmental inspectors (EI), and contractor personnel will be informed of the EI's authority and have been or will be trained on the implementation of the environmental mitigation measures appropriate to their jobs **before** becoming involved with construction and restoration activities.

4. The authorized facility locations shall be as shown in the EA, as supplemented by filed alignment sheets. **As soon as they are available, and before the start of construction,** Cameron LNG shall file with the Secretary any revised detailed survey maps/sheets at a

scale not smaller than 1:6,000 with station positions for the facility authorized by the order. All requests for modifications of environmental conditions of the order or site-specific clearances must be written and must specify locations designated on these alignment maps/sheets.

5. Cameron LNG shall file with the Secretary detailed maps/sheets and aerial photographs at a scale not smaller than 1:6,000 identifying all facility relocations, staging areas, pipe storage yards, new access roads, and other areas that would be used or disturbed that have not been previously identified in filings with the Secretary. Approval for use of each of these areas must be explicitly requested in writing. For each area, the request must include a description of the existing land use/cover type, documentation of landowner approval, whether any cultural resources or federally listed threatened or endangered species would be affected, and whether any other environmentally sensitive areas are within or abutting the area. All areas shall be clearly identified on the maps, or aerial photographs. Each area must be approved in writing by the Director of OEP, or the Director's designee, **before construction in or near that area**.

   This requirement does not apply to extra workspace allowed by the Commission's *Upland Erosion Control, Revegetation, and Maintenance Plan*. Examples of alterations requiring approval include all facility location changes resulting from:

   a. implementation of cultural resources mitigation measures;
   b. implementation of endangered, threatened, or special concern mitigation measures;
   c. recommendations by state regulatory authorities; and
   d. agreements with individual landowners that affect other landowners or could affect sensitive environmental areas.

6. **Within 60 days of the authorization and before construction begins**, Cameron LNG shall file an Implementation Plan with the Secretary for review and written approval by the Director of OEP, or the Director's designee. Cameron LNG must file revisions to the plan as schedules change. The plan shall identify:

   a. how Cameron LNG will implement the construction procedures and mitigation measures described in its application and supplements (including responses to staff data requests), identified in the EA, and required by the order;
   b. how Cameron LNG will incorporate these requirements into the contract bid documents, construction contracts (especially penalty clauses and specifications), and construction drawings so that the mitigation required at each site is clear to onsite construction and inspection personnel;
   c. the number of EIs assigned, and how the company will ensure that sufficient personnel are available to implement the environmental mitigation;
   d. company personnel, including EIs and contractors, who will receive copies of the appropriate material;
   e. the location and dates of the environmental compliance training and instructions Cameron LNG will give to all personnel involved with construction and

restoration (initial and refresher training as the Amended Expansion Project progresses and personnel change);

f. the company personnel (if known) and specific portion of Cameron LNG's organization having responsibility for compliance;
g. the procedures (including use of contract penalties) Cameron LNG will follow if noncompliance occurs; and
h. for each discrete facility, a Gantt or PERT chart (or similar project scheduling diagram), and dates for:

(1) the completion of all required surveys and reports;
(2) the environmental compliance training of onsite personnel;
(3) the start of construction; and
(4) the start and completion of restoration.

7. Cameron LNG shall employ at least one EI during construction of the Amended Expansion Project. The EI shall be:

a. responsible for monitoring and ensuring compliance with all mitigation measures required by the order and other grants, permits, certificates, or other authorizing documents;
b. responsible for evaluating the construction contractor's implementation of the environmental mitigation measures required in the contract (see condition 6 above) and any other authorizing document;
c. empowered to order correction of acts that violate the environmental conditions of the order, and any other authorizing document;
d. a full-time position, separate from all other activity inspectors;
e. responsible for documenting compliance with the environmental conditions of the order, as well as any environmental conditions/permit requirements imposed by other federal, state, or local agencies; and
f. responsible for maintaining status reports.

8. Beginning with the filing of its Implementation Plan, Cameron LNG shall file updated status reports with the Secretary on a **monthly** basis until all construction and restoration activities are complete. Problems of a significant magnitude shall be reported to the FERC **within 24 hours.** On request, these status reports will also be provided to other federal and state agencies with permitting responsibilities. Status reports shall include:

a. an update on Cameron LNG's efforts to obtain the necessary federal authorizations;
b. the construction status of the Amended Expansion Project, work planned for the following reporting period, and any schedule changes for stream crossings or work in other environmentally-sensitive areas;
c. a listing of all problems encountered, contractor nonconformance/deficiency logs, and each instance of noncompliance observed by the EI during the reporting period (both for the conditions imposed by the Commission and any

environmental conditions/permit requirements imposed by other federal, state, or local agencies);

d. a description of the corrective and remedial actions implemented in response to all instances of noncompliance, nonconformance, or deficiency;
e. the effectiveness of all corrective and remedial actions implemented;
f. a description of any landowner/resident complaints which may relate to compliance with the requirements of the order, and the measures taken to satisfy their concerns; and
g. copies of any correspondence received by Cameron LNG from other federal, state, or local permitting agencies concerning instances of noncompliance, and Cameron LNG's response.

9. Cameron LNG must receive written authorization from the Director of OEP, or the Director's designee, **before commencing construction** of any Amended Expansion Project facilities. To obtain such authorization, Cameron LNG must file with the Secretary documentation that it has received all applicable authorizations required under federal law (or evidence of waiver thereof).

10. Cameron LNG must receive written authorization from the Director of OEP, or the Director's designee, **prior to introducing hazardous fluids into the Amended Expansion Project facilities**. Instrumentation and controls, hazard detection, hazard control, and security components/systems necessary for the safe introduction of such fluids shall be installed and functional.

11. Cameron LNG must receive written authorization from the Director of OEP, or the Director's designee, **before placing into service** the Amended Expansion Project facilities. Such authorization will only be granted following a determination that the facilities have been constructed in accordance with the Commission's approval, can be expected to operate safely as designed, and the rehabilitation and restoration of areas affected by the Amended Expansion Project are proceeding satisfactorily.

12. **Within 30 days of placing the authorized facilities in service**, Cameron LNG shall file an affirmative statement with the Secretary, certified by a senior company official:

a. that the facilities have been installed in compliance with all applicable conditions, and that continuing activities will be consistent with all applicable conditions; or
b. identifying which of the conditions in the order Cameron LNG has complied with or will comply with. This statement shall also identify any areas affected by the Amended Expansion Project where compliance measures were not properly implemented, if not previously identified in filed status reports, and the reason for noncompliance.

13. Cameron LNG shall file a full load noise survey with the Secretary **no later than 60 days** after placing Train 4 into service. If a full load noise survey is not possible, Cameron LNG shall file an interim survey at the maximum possible load and provide the full load survey **within six months**. If the noise attributable to operation of all the equipment at the Cameron LNG Terminal, under interim or full load conditions, exceeds a day/night sound level of 55 decibels on the A-weighted scale at any nearby noise sensitive area, Cameron LNG shall file a report on the changes that are needed and shall install the additional noise controls to meet the level **within one year** of the in-service date. Cameron LNG shall confirm compliance with the above requirement by filing a second noise survey with the Secretary **no later than 60 days** after it installs the additional noise controls.

14. **Prior to construction of final design**, Cameron LNG shall file with the Secretary consultation with USDOT PHMSA that determines whether the use of normally closed valves to remove stormwater from curbed areas would meet USDOT PHMSA regulations.

15. **Prior to construction of final design**, Cameron LNG shall file with the Secretary the following information, stamped and sealed by the professional engineer-of-record, registered in the State of Louisiana, to ensure the facilities are protected for the life of the LNG terminal considering settlement, subsidence, and sea level rise:

    a. the finalized settlement monitoring program and procedures for the Project site; and
    b. the total and differential settlement of final designed structures, systems, and components foundations for the Project site; and

16. **Prior to construction of final design**, Cameron LNG shall file with the Secretary the following information, stamped and sealed by the professional engineer-of-record, registered in the State of Louisiana:

    a. site preparation drawings and specifications;

    b. finalized civil design basis, criteria, specifications;

    c. LNG terminal structures, and foundation design drawings and calculations (including prefabricated and field constructed structures);

    d. seismic specifications for procured Seismic Category I equipment prior to the issuingof request for quotations;

    e. quality control procedures to be used for civil/structural design and construction;

    f. a determination of whether soil improvement is necessary to counteract soil liquefaction; and

    g. the finalized corrosion control and prevention plan for any underground piping, structures, foundations, equipment, and components.

In addition, Cameron LNG shall file, in its Implementation Plan, the schedule for producing this information.

Information pertaining to the following specific recommendations 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 would be subject to public disclosure. All information shall be filed a minimum of 30 days before approval to proceed is requested.

17. **Prior to initial site preparation**, Cameron LNG shall file an overall Project schedule, which includes the proposed stages of initial site preparation, construction, commissioning, and in-service plan relative to notice to proceed requests and related conditions.

18. **Prior to initial site preparation**, Cameron LNG shall file a construction site security plan that explains how they plan to restrict facility access of unauthorized personnel from entering the operational areas of the plant to perform construction activities within a secure facility with respect to the existing USCG-approved Facility Security Plan.

19. **Prior to initial site preparation**, Cameron LNG shall file quality assurance and quality control procedures for construction activities.

20. **Prior to initial site preparation**, Cameron LNG shall file updated storm surge hazard analysis that would demonstrate the facilities would be precluded from or withstand the 500-year mean recurrence interval flood event.

21. **Prior to initial site preparation**, Cameron LNG shall update the existing ERP (including evacuation and any sheltering and re-entry) to include the proposed facilities and coordinate procedures with the USCG; state, county, and local emergency planning groups; fire departments; state and local law enforcement; and other appropriate federal agencies. This plan shall be consistent with recommended and good engineering practices and based on potential impacts and onsets of hazards from accidental and intentional events at the LNG terminal. This plan shall address any special considerations and pre-incident planning for infrastructureand public with access and functional needs and shall include at a minimum:

    a. materials and plans for periodic dissemination of public education and training materials for evacuation and/or shelter in place of the public within LNG terminal hazard areas;

b. plans to competently train emergency responders required to effectively and safely respond to hazardous material incidents including, but not limited to LNG fires and dispersion;

c. plans to competently train emergency responders to effectively and safely evacuate orshelter public withinhazard areas from LNG terminal;

d. designated contacts with federal, state and local emergency response agencies responsible for emergency management and response within hazard areas from LNG terminal;

e. scalable procedures for the prompt notification of appropriate local officials and emergency response agencies based on the level and severity of potential incidents;

f. scalable procedures for mobilizing response and establishing a unified command, including identification, location, and design of any emergency operations centers andemergency response equipment required to effectively and safely to respond tohazardous material incidents and evacuate or shelter public within LNG terminal hazard areas;

g. scalable procedures for notifying public, including identification, location, design, and use of any permanent sirens or other warning devices required to effectively communicate and warn the public prior to onset of debilitating hazards within hazard areas from LNG terminal;

h. scalable procedures for evacuating the public, including identification, location, design, and use of evacuation routes/methods and any mustering locations required effectively and safely evacuate public within hazard areas from LNG terminal; and

i. scalable procedures for sheltering the public, including identification, location, design, and use of any shelters demonstrated to be needed and demonstrated to effectively and safely shelter public prior to onset of debilitating hazards within hazard areas that may benefit from sheltering in place.

Cameron LNG shall notify the FERC staff of all planning meetings in advance and shall report progress on the development of its ERP **at 3-month intervals**.

22. **Prior to initial site preparation**, Cameron LNG shall file an updated Cost-Sharing Plan to include the proposed facilities and shall identify the mechanisms for funding all Project-specific security/emergency management costs that would be imposed on state and local agencies. This comprehensive plan shall include funding mechanisms for the capital costs associated with any necessary security/emergency management equipment and personnel base. This plan shall include sustained funding of any requirement or resource gap analysis identified to effectively and safely evacuate and shelter public and to effectively and safely respond to hazardous material incidents consistent with recommended and good engineering practices. Cameron LNG shall notify FERC staff of all planning meetings in advance and shall report progress on the development of its Cost Sharing Plan at **3-month intervals**.

23. **Prior to construction of final design of any permanent facilities**, Cameron LNG shall file updated Emergency Response Plans and any associated Cost Sharing Plan provisions in coordination with federal, state, and local agencies for hazards that may reach State Highway 27, including identifying potential incidents, impact distances, and timing of the onset of hazards reaching State Highway 27, and measures to notify approaching highway traffic and evacuate persons from impacted areas as quickly as possible relative to the onset of hazards. The ERP and Cost Sharing Plans shall discuss consideration of signage or equivalent, and maintenance thereof, to facilitate notification and evacuation.

24. **Prior to construction of final design**, Cameron LNG shall file change logs that list and explain any changes made from the FEED provided in Cameron's application and filings. A list of all changes with an explanation for the design alteration shall be provided and all changes shall be clearly indicated on all diagrams and drawings

25. **Prior to construction of final design**, Cameron LNG shall file information/revisions pertaining to Cameron LNG's response: Numbers 3, 6, 18, 24, 26, 28, 29, 33, 34, 40, 45, 46, 47, 50, 51, 55, 56, 57, 58, 79, and 80 of its June 27, 2022 filing, which indicated features to be included or considered in the final design.

26. **Prior to construction of final design**, Cameron LNG shall file drawings of the security fence. The fencing drawings shall provide details of fencing that demonstrates it is in accordance with NFPA 59A (2019 edition) and would restrict and deter access around the entire facility and has a setback from exterior features (e.g., power lines, trees, etc.) and from interior features (e.g., piping, equipment, buildings, etc.) that does not allow the fence to be overcome.

27. **Prior to construction of final design**, Cameron LNG shall file security camera and intrusion detection drawings. The security camera drawings shall show the locations, mounting elevation, areas covered, and features of each camera (e.g., fixed, tilt/pan/zoom, motion detection alerts, low light, etc.) and shall provide camera coverage at access points and along the entire perimeter of the terminal with redundancies and camera coverage of the interior of the terminal to enable rapid monitoring of the terminal, and coverage within pretreatment areas, within liquefaction areas, within truck transfer areas, within marine transfer areas, and within buildings. The drawings shall show or note the location and type of the intrusion detection and shall cover the entire perimeter of the facility.

28. **Prior to construction of final design**, Cameron LNG shall file photometric analyses or equivalent and associated lighting drawings. The lighting drawings shall show the location, elevation, type of light fixture, and lux levels of the lighting system and shall provide illumination along the perimeter of the terminal, process equipment, and along paths/roads of access and egress to facilitate security monitoring and emergency response operations in accordance with API 540 (4th edition) or approved equivalent and applicable federal regulations.

29. **Prior to construction of final design**, Cameron 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.

30. **Prior to construction of final design**, Cameron LNG shall file a plot plan of the final design showing all major equipment, structures, buildings, and impoundment systems.

31. **Prior to construction of final design**, Cameron LNG shall file a building siting assessment to ensure plant buildings that are occupied or critical to the safety of the LNG plant are adequately protected from potential hazards involving fires and vapor cloud explosions.

32. **Prior to construction of final design**, Cameron LNG shall file three-dimensional plant drawings to confirm plant layout for maintenance, access, egress, and congestion.

33. **Prior to construction of final design**, Cameron LNG shall file up-to-date process flow diagrams (PFDs), heat and mass balances (HMBs), and piping and instrument diagrams (P&IDs) including vendor P&IDs. The HMBs shall demonstrate a peak export rate of 6.75 MTPA. The P&IDs shall include the following information:

    a. equipment tag number, name, size, duty, capacity, and design conditions;

    b. equipment insulation type and thickness;

    c. storage tank pipe penetration size and nozzle schedule;

    d. valve high pressure side and internal and external vent locations;

    e. piping with line number, piping class specification, size, and insulation type and thickness;

    f. piping specification breaks and insulation limits;

    g. all control and manual valves numbered;

    h. relief valves with size and set points; and

    i. drawing revision number and date.

34. **Prior to construction of final design**, Cameron LNG shall file a car seal and lock philosophy and car seal and lock program, including a list of all car-sealed and locked valves consistent with the P&IDs. The car seal and lock program shall include monitoring and periodically reviewing correct car seal and lock placement and valve position.

35. **Prior to construction of final design**, Cameron LNG shall file P&IDs, specifications, and procedures that clearly show and specify the tie-in details required to safely connect subsequently constructed facilities with the operational facilities.

36. **Prior to construction of final design**, Cameron LNG shall file information to demonstratethe EPC contractor has verified that all FEED HAZID recommendations have been addressed.

37. **Prior to construction of final design,** Cameron LNG shall file a hazard and operability review of the final design P&IDs, a list of the resulting recommendations, and action taken on the recommendations. The issued for construction P&IDs shall incorporate the hazard and operability review recommendations and justification shall be provided for any recommendations that are not implemented.

38. **Prior to construction of final design**, Cameron LNG shall provide a check valve upstreamof the acid gas removal column to prevent backflow or provide a dynamic simulation that shows that upon plant shutdown, the swan neck would be sufficient for this purpose.

39. **Prior to construction of final design**, Cameron LNG shall file the safe operating limits (upper and lower), alarm and shutdown set points for all instrumentation (e.g., temperature,pressures, flows, and compositions).

40. **Prior to construction of final design**, Cameron LNG shall file cause-and-effect matrices for the process instrumentation, fire and gas detection system, and emergency shutdown system. The cause-and-effect matrices shall include alarms and shutdown functions, details of the voting and shutdown logic, and set points.

41. **Prior to construction of final design**, Cameron LNG shall specify that all ESD valves are to be equipped with open and closed position switches connected to the Distributed Control System (DCS)/SIS.

42. **Prior to construction of final design,** Cameron LNG shall demonstrate that all electrical, instrument, and control systems at the project, which activate emergency systems or are relied upon for isolation or shutdowns, will be designed to withstand a 20-minute fire exposure per Underwriters Laboratory 1709 (6^{th} edition) or approved equivalent.

43. **Prior to construction of final design**, Cameron LNG shall file the sizing basis of the LNG storage tank vacuum relief and pressure relief valves and demonstrate that adequate pressure and vacuum protection is maintained due to the proposed increased LNG in-tank pump capacity and additional BOG compressor.

44. **Prior to construction of final design**, Cameron LNG shall file an up-to-date equipment list,process and mechanical data sheets, and specifications. The specifications shall include:

    a. building specifications (e.g., control buildings, electrical buildings, compressor buildings, storage buildings, pressurized buildings, ventilated buildings, blast resistant buildings);

    b. mechanical specifications (e.g., piping, valve, insulation, rotating equipment, heat exchanger, storage tank and vessel, other specialized equipment);

    c. electrical and instrumentation specifications (e.g., power system, control system, safety instrument system [SIS], cable, other electrical and instrumentation); and

    d. security and fire safety specifications (e.g., security, passive protection, hazard detection, hazard control, firewater).

45. **Prior to construction of final design**, Cameron LNG shall file a list of all codes and standards and the final specification document number where they are referenced.

46. **Prior to construction of final design**, Cameron LNG shall evaluate whether a different flange orientation would minimize these potential leaks without any other safety implications and, if so, the final design shall reflect that different flange orientation. If there are other safety implications that would prevent a different orientation, Cameron

LNG shall provide an analysis which demonstrates the dry flare header flanged connection to the dry flare knock out drum will not be susceptible to flange separation and leaking cause by uneven cooling.

47. **Prior to construction of final design**, Cameron LNG shall file an evaluation of emergency shutdown valve closure times. The evaluation shall account for the time to detect an upset or hazardous condition, notify plant personnel, and close the emergency shutdown valve(s).

48. **Prior to construction of final design**, Cameron LNG shall file an evaluation of dynamic pressure surge effects from valve opening and closure times and pump operations that demonstrate that the surge effects do not exceed the design pressures.

49. **Prior to construction of final design**, Cameron LNG shall demonstrate that, for hazardous fluids, piping and piping nipples 2 inches 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.

50. **Prior to construction of final design**, Cameron LNG shall file the sizing basis and capacity for the final design of the flares and/or vent stacks as well as the pressure and vacuum relief valves for major process equipment, vessels, and storage tanks.

51. **Prior to construction of final design**, Cameron LNG shall specify the process vessels, and storage vessels for ethylene, propane, hot oil, and LNG are installedwith spare pressure relief valves to ensure overpressure protection during relief valve testingor maintenance.

52. **Prior to construction of final design**, Cameron LNG shall file an updated fire protection evaluation of the proposed facilities. A copy of the evaluation, a list of recommendations and supporting justifications, and actions taken on the recommendations shall be filed. The evaluation shall justify the type, quantity, and location of hazard detection and hazard control, passive fire protection, emergency shutdown and depressurizing systems, firewater, and emergency response equipment, training, and qualifications in accordance with NFPA 59A (2001). The justification for the flammable and combustible gas detection and flame and heat detection systems shall be in accordance with ISA 84.00.07 (2018 edition) or equivalent methodologies and would need to demonstrate 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 shall take into account the set points, voting logic, wind speeds, and wind directions. The justification for firewater shall provide calculations for all firewater demands based on design densities, surface area, and throw distance as well as specifications for the corresponding hydrant and monitors needed to reach and cool equipment.

53. **Prior to construction of final design**, Cameron LNG shall file spill containment system drawings with dimensions and slopes of curbing, trenches, impoundments, tertiary containment and capacity calculations considering any foundations and equipment within impoundments, as well as the sizing and design of the down-comers. The spill containment drawings shall show containment for all hazardous fluids including all liquids handled above 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 not providing spill containment would not significantly increase the flammable vapor dispersion or radiant heat consequences of a spill.

54. **Prior to construction of final design**, Cameron LNG shall specify remotely operated or automatic firewater monitors in areas that are inaccessible or difficult to access in the event of an emergency.

55. **Prior to construction of final design**, Cameron LNG shall determine whether a horizontal or tangential LNG release up to a full guillotine of the 36-inch-diameter loading line could enter the waterway and evaluate if additional mitigation such as barriers, shrouds, or a pipe-in-pipe design along this section of piping would prevent releases from reaching the waterway. Alternatively, if no mitigation measures are proposed to prevent releases from reaching the waterway for the new parallel loading line, Cameron LNG shall perform a quantitative risk analysis per NFPA (2019) Section 19.6.1 and also include; modeling that determines the probability of LNG releases resulting in rainout on the water surface, accounting for release size, direction, and discharge angle relative to the horizontal; calculates the distances to specified endpoints for potential hazards associated with LNG spills on water, with and without the estimated effect of RPTs accounting for weather data particularly wind speed and direction; and calculates the number of persons impacted by each release case accounting for as well as population distribution; and lastly comparing the results with tolerability criteria published by FERC and NFPA 59A.

56. **Prior to construction of final design**, Cameron LNG shall file electrical area classificationdrawings, including cross sectional drawings. The drawings shall demonstrate compliance with NFPA 59A (2019 edition), NFPA 70 (2017 edition), NFPA 497 (2017 edition), and API RP 500 (3rd edition), or equivalents. In addition, the drawings shall include revisions to the electrical area classification design or provide technical justification that supports the electrical area classification of the following areas using most applicable API RP 500 figures (e.g., figures 20 and 21) or hazard modeling of various release rates from equivalent hole sizes and wind speeds (see NFPA 497 release rate of 1 lb-mole/minute).

57. **Prior to construction of final design**, Cameron LNG shall file drawings and details of how process seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system meet the requirements of NFPA 59A (2001) or approved equivalents.

58. **Prior to construction of final design**, Cameron LNG shall file details of an air gap or vent installed downstream of process seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system. Each air gap shall vent to a safe location and be equipped with a leak detection device that shall continuously monitor for the presence of a flammable fluid, alarm the hazardous condition, and shut down the appropriate systems.

59. **Prior to construction of final design**, Cameron LNG shall file analysis of the buildings containing hazardous fluids and the ventilation calculations that limit concentrations below the LFLs (e.g., 25-percent LFL), including an analysis of off gassing of hydrogen

in battery rooms, and shall also provide hydrogen detectors that alarm (e.g., 20- to 25-percent LFL) andinitiate mitigative actions (e.g., 40- to 50-percent LFL) in accordance with NFPA 59A (2019 edition) and NFPA 70 (2017 edition), or equivalents.

60. **Prior to construction of final design**, Cameron LNG shall file complete drawings and a list of the hazard detection equipment. The drawings shall clearly show the location and elevation of all detection equipment as well as their coverage area. The list shall include the instrument tag number, type and location, alarm indication locations, and shutdown functions of the hazard detection equipment.

61. **Prior to construction of final design**, Cameron LNG shall file a technical review of facilitydesign that:

    a. identifies all combustion/ventilation air intake equipment and the distances to any possible flammable gas or toxic release; and

    b. demonstrates that these areas are adequately covered by hazard detection devices and indicates how these devices would isolate or shutdown any combustion or heating ventilation and air conditioning equipment whose continued operation could add to or sustain an emergency.

62. **Prior to construction of final design**, Cameron LNG shall file a design that includes hazard detection suitable to detect high temperatures and smoldering combustion products in electrical buildings and control room buildings.

63. **Prior to construction of final design**, Cameron LNG shall file an evaluation of the voting logic and voting degradation for hazard detectors.

64. **Prior to construction of final design**, Cameron LNG shall file a list of alarm and shutdown set points for all hazard detectors that account for the calibration gas of the hazard detectors when determining the lower flammable limit set points for methane, ethylene, propane, isopentane, and condensate.

65. **Prior to construction of final design**, Cameron LNG shall file a list of alarm and shutdown set points for all hazard detectors that account for the calibration gas of hazard detectors when determining the set points for toxic components such as condensate and hydrogen sulfide.

66. **Prior to construction of final design,** Cameron LNG shall file a drawing showing the location of the emergency shutdown buttons, including, but not limited to the refrigerant storage, condensate storage, and LNG storage areas. Emergency shutdown buttons shall be easily accessible, conspicuously labeled, and located in an area which would be accessible during an emergency.

67. **Prior to construction of final design**, Cameron LNG shall file facility plan drawings and alist of the fixed and wheeled dry-chemical, hand-held fire extinguishers, and other hazard control equipment. Plan drawings shall clearly show the location by tag number of all fixed, wheeled, and hand-held extinguishers and shall demonstrate the spacing of extinguishers meet prescribed travel distances in NFPA 10 (2022 edition) or approved equivalent. The list shall include the equipment tag number, type, capacity, equipment covered, discharge rate, and automatic and manual remote signals initiating discharge of the units and shall demonstrate they meet NFPA 59A (2019 edition) or approved equivalent.

68. **Prior to construction of final design**, Cameron LNG shall file drawings and specificationsfor the structural passive protection systems to protect equipment and supports from cryogenic releases.

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

70. **Prior to construction of final design**, Cameron LNG shall file drawings and specificationsfor the structural passive protection systems to protect equipment and supports from pool and jet fires.

71. **Prior to construction of final design**, Cameron LNG shall file a detailed quantitative analysis to demonstrate that adequate mitigation would be provided for each pressure vesselthat could fail within the 4,000 BTU/ft2-hr zone from a pool or jet fires; each critical structural component (including the LNG marine vessel) and emergency equipment item thatcould fail within the 4,900 BTU/ft2-hr zone from a pool or jet fire; and each occupied buildingthat could expose unprotected personnel within the 1,600 BTU/ft2-hr zone from a pool or jetfire. Trucks at truck transfer stations shall be included in the analysis of potential pressurevessel failures, as well as measures needed to prevent cascading impact due to the 10-minutesizing spill at the marine area. Mitigation measures to protect the above facilities from radiant heat from a spill impoundment shall be demonstrated to have a reliability equivalent to a SIL 3 system. A combination of passive and active protection for pool firesand passive and/or active protection for jet fires shall be provided and demonstrate the effectiveness and reliability. Effectiveness of passive mitigation shall be supported by calculations or test results for the thickness limiting temperature rise over the fire duration,and active mitigation shall be supported by reliability information by calculations or test results, such as demonstrating flow rates and durations of any cooling water would mitigatethe heat absorbed by the component. The total firewater demand shall account for all components that could fail to a pool or jet fire.

72. **Prior to construction of final design**, Cameron LNG shall file an evaluation and associated specifications, drawings, and datasheets for transformers demonstrating how it would prevent cascading damage of transformers (e.g., fire walls or spacing) in accordance with NFPA 850 (2015 edition) or equivalent.

73. **Prior to construction of final design**, Cameron LNG shall file facility plan drawings showing the proposed location of the firewater and any foam systems. Plan drawings shall clearly show the location of firewater and foam piping, post indicator and sectional valves, and the location and area covered by, each monitor, hydrant, hose, water curtain, deluge system, foam system, water-mist system, and sprinkler. The drawings shall demonstrate that each process area, fire zone, or other sections of piping with several users can be isolated with post indicator or sectional valves. The firewater coverage drawings shall illustrate firewater coverage by two or more hydrants or monitors accounting for obstructions (or deluge systems) for all areas that contain flammable or combustible fluids.

74. **Prior to commissioning**, Cameron LNG shall file a detailed schedule for commissioning through equipment startup. The schedule shall include milestones for all procedures and

tests to be completed: prior to introduction of hazardous fluids and during commissioning and startup. Cameron LNG shall file documentation certifying that each of these milestones has been completed before authorization to commence the next phase of commissioning and startup will be issued.

75. **Prior to commissioning,** Cameron LNG shall file detailed plans and procedures for: testing the integrity of onsite mechanical installation; functional tests; introduction of hazardous fluids; operational tests; and placing the equipment into service.

76. **Prior to commissioning**, Cameron LNG shall file the operation and maintenance procedures and manuals, as well as safety procedures, hot work procedures and permits, abnormal operating conditions reporting procedures, simultaneous operations procedures, and management of change procedures and forms.

77. **Prior to commissioning**, Cameron LNG shall file a plan for clean-out, dry-out, purging, and tightness testing. This plan shall address the requirements of the American Gas Association's Purging Principles and Practice, and shall provide justification if not using an inert or non-flammable gas for clean-out, dry-out, purging, and tightness testing

78. **Prior to commissioning,** Cameron LNG shall tag all equipment, instrumentation, and valves in the field, including drain valves, vent valves, main valves, and car-sealed or locked valves.

79. **Prior to commissioning**, Cameron LNG shall file a plan to maintain a detailed training logto demonstrate that operating, maintenance, and emergency response staff have completed the required training.

80. **Prior to commissioning**, Cameron LNG shall file the procedures for pressure/leak tests which address the requirements of ASME BPVC Section VIII (2017 edition) and ASME B31.3 (2016 edition). In addition, Cameron LNG shall file a line list of pneumatic and hydrostatic test pressures.

81. **Prior to introduction of hazardous fluids**, Cameron LNG shall complete and document a pre-startup safety review to ensure that installed equipment meets the design and operating intent of the facility. The pre-startup safety review shall include any changes since the lasthazard review, operating procedures, and operator training. A copy of the review with a list of recommendations, and actions taken on each recommendation, shall be filed.

82. **Prior to introduction of hazardous fluids**, Cameron LNG shall complete and document all pertinent tests (Factory Acceptance Tests, Site Acceptance Tests, Site Integration Tests) associated with the DCS, SIS and FGS that demonstrates full functionality and operability of the system.

83. **Prior to introduction of hazardous fluids**, Cameron LNG shall develop, file, and implement an alarm management program consistent with ISA 18.2 (2016 edition) or equivalent to reduce alarm complacency and maximize the effectiveness of operator response to alarms.

84. **Prior to introduction of hazardous fluids**, Cameron LNG shall complete and document clean agent acceptance tests.

85. **Prior to introduction of hazardous fluids**, Cameron LNG shall complete and document foam system and sprinkler system acceptance tests.

86. **Prior to introduction of hazardous fluids**, Cameron LNG shall complete and document a firewater pump acceptance test and firewater monitor and hydrant coverage test. The actual coverage area from each monitor and hydrant shall be shown on facility plot plan(s).

87. **After production of first LNG**, Cameron LNG shall file weekly reports on the commissioning of the proposed systems that detail the progress toward demonstrating the facilities can safely and reliably operate at or near the design production rate. The reports shall include a summary of activities, problems encountered, and remedial actions taken. The weekly reports shall also include the latest commissioning schedule, including projected and actual LNG production by the liquefaction train, and the number of anticipated and actual LNG commissioning cargoes, along with the associated volumes loaded or unloaded. Further, the weekly reports shall include a status and list of all planned and completed safety and reliability tests, work authorizations, and punch list items. Problems of significant magnitude shall be reported to the FERC within 24 hours.

88. **Prior to commencement of service**, Cameron LNG shall file a request for written authorization from the Director of OEP. Such authorization would only be granted following a determination by the USCG, under its authorities under the Ports and Waterways Safety Act, the Magnuson Act, the MTSA of 2002, and the Security and Accountability For Every Port Act, that appropriate measures to ensure the safety and security of the facility and the waterway have been put into place by Cameron LNG or other appropriate parties.

89. **Prior to commencement of service**, Cameron LNG shall file any proposed revisions to the security plan and physical security of the plant.

90. **Prior to commencement of service**, Cameron LNG shall label piping with fluid service and direction of flow in the field consistent with ASME A13.1 (2007 edition) or equivalent, in addition to the pipe labeling requirements of NFPA 59A (2001).

91. **Prior to commencement of service**, Cameron LNG shall provide plans for any preventativeand predictive maintenance program that performs periodic or continuous equipment condition monitoring.

92. **Prior to commencement of service**, Cameron LNG shall develop procedures for offsite contractors' responsibilities, restrictions, monitoring, training, and limitations and for supervision of these contractors and their tasks by Cameron LNG staff. Specifically, the procedures shall address:

    a) selecting a contractor, including obtaining and evaluating information regarding the contract employer's safety performance and programs.

    b) informing contractors of the known potential hazards, including flammable and toxic release, explosion, and fire, related to the contractor's work and systems they are working on.

    c) developing and implementing provisions to control and monitor the entrance, presence, and exit of contract employers and contract employees from process

areas, buildings, and the plant.

d) developing and implementing safe work practices for control of personnel safety hazards, including lockout/tagout, confined space entry, work permits, hot work, and opening process equipment or piping.

e) developing and implementing safe work practices for control of process safety hazards, including identification of layers of protection in systems being worked on, recognizing abnormal conditions on systems they are working on, and re-instatement of layers of protection, including ensuring bypass, isolation valve, and car-seal programs and procedures are being followed.

f) developing and implementing provisions to ensure contractors are trained on the emergency action plans and that they are accounted for in the event of an emergency.

g) monitoring and periodically evaluating the performance of contract employers in fulfilling their obligations above, including successful and safe completion of work and re-instatement of all layers of protection.

In addition, we recommend that the following measures shall apply <u>throughout the life of the Cameron LNG Amended Expansion Project.</u>

93. The facility shall be subject to regular FERC staff technical reviews and site inspections on at least an **annual** basis or more frequently as circumstances indicate. Prior to each FERC staff technical review and site inspection, Cameron shall respond to a specific data request including information relating to possible design and operating conditions that may have been imposed by other agencies or organizations. Up-to-date detailed P&IDs reflecting facility modifications and provision of other pertinent information not included in the semi-annual reports described below, including facility events that have taken place since the previously submitted semi-annual report, shall be submitted.

94. **Semi-annual** operational reports shall be filed with the Secretary to identify changes in facility design and operating conditions; abnormal operating experiences; activities (e.g., ship arrivals, quantity and composition of imported and exported LNG, liquefied and vaporized quantities, boil off/flash gas); and plant modifications, including future plans and progress thereof. Abnormalities shall include, but not be limited to, unloading/loading/shipping problems, potential hazardous conditions from offsite vessels, storage tank stratification or rollover, geysering, storage tank pressure excursions, cold spots on the storage tank, storage tank vibrations and/or vibrations in associated cryogenic piping, storage tank settlement, significant equipment or instrumentation malfunctions or failures, non-scheduled maintenance or repair (and reasons therefore), relative movement of storage tank inner vessels, hazardous fluids releases, fires involving hazardous fluids and/or from other sources, negative pressure (vacuum) within a storage tank, and higher than predicted boil off rates. Adverse weather conditions and the effect on the facility also shall be reported. Reports shall be submitted **within 45 days after each period ending June 30 and December 31**. In addition to the above items, a section entitled "Significant Plant Modifications Proposed for the Next 12 Months (dates)" shall be included in the semi-annual operational reports. Such

information would provide the FERC staff with early notice of anticipated future construction/maintenance at the LNG facilities.

95. Significant non-scheduled events, including safety-related incidents (e.g., LNG, condensate, refrigerant, or natural gas releases; fires; explosions; mechanical failures; unusual over pressurization; and major injuries) and security-related incidents (e.g., attempts to enter site, suspicious activities) shall be reported to the FERC staff. In the event that an abnormality is of significant magnitude to threaten public or employee safety, cause significant property damage, or interrupt service, notification shall be made **immediately**, without unduly interfering with any necessary or appropriate emergency repair, alarm, or other emergency procedure. In all instances, notification shall be made to the FERC staff **within 24 hours**. This notification practice shall be incorporated into the liquefaction facility's emergency plan. Examples of reportable hazardous fluids-related incidents include:

a) fire;

b) explosion;

c) estimated property damage of $50,000 or more;

d) death or personal injury necessitating in-patient hospitalization;

e) release of hazardous fluids for 5 minutes or more;

f) unintended movement or abnormal loading by environmental causes, such as an earthquake, landslide, or flood, that impairs the serviceability, structural integrity, or reliability of an LNG facility that contains, controls, or processes hazardous fluids;

g) any crack or other material defect that impairs the structural integrity or reliability of an LNG facility that contains, controls, or processes hazardous fluids;

h) any malfunction or operating error that causes the pressure of a pipeline or LNG facility that contains or processes hazardous fluids to rise above its maximum allowable operating pressure (or working pressure for LNG facilities) plus the build-up allowed for operation of pressure-limiting or control devices;

i) a leak in an LNG facility that contains or processes hazardous fluids that constitutes an emergency;

j) inner tank leakage, ineffective insulation, or frost heave that impairs the structural integrity of an LNG storage tank;

k) any safety-related condition that could lead to an imminent hazard and cause (either directly or indirectly by remedial action of the operator), for purposes other than abandonment, a 20 percent reduction in operating pressure or shutdown of operation of a pipeline or an LNG facility that contains or processes hazardous fluids;

l) safety-related incidents from hazardous fluids transportation occurring at or en route to and from the LNG facility; or

m) an event that is significant in the judgment of the operator and/or management

even though it did not meet the above criteria or the guidelines set forth in an LNG facility's incident management plan.

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