LIQUEFYING THE GULF COAST

A CUMULATIVE IMPACT ASSESSMENT OF LNG BUILDOUT IN LOUISIANA AND TEXAS

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Cover photo by Julie Dermansky

Authors' Organizations

The Robert D. Bullard Center for Environmental and Climate Justice at Texas Southern University was launched to address long-standing issues of systemic inequality and structural racism that cause disproportionate pain, suffering, and death in Black communities and those of other people of color. Texas Southern University is a student-centered, comprehensive doctoral university committed to ensuring equality, offering innovative programs that are responsive to its urban setting, and transforming diverse students into lifelong learners, engaged citizens, and creative leaders in their local, national, and global communities.

The Environmental Studies Program at the University of Montana (EVST), founded in 1970, is one of the oldest programs of its kind in the country. Offering MS, BA, and BS degrees, student-centered EVST emphasizes interdisciplinary, community-engaged learning; promoting positive social change; and training the next generation of environmental leaders. The program offers focus areas of study and certificates in environmental justice, Indigenous knowledge and environmental sustainability, sustainable food systems, land and water conservation, and environmental writing.

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We extend gratitude to Dr. Beverly Wright, acclaimed environmental justice scholar, advocate, author, civic leader, professor of sociology, and founder and Executive Director of the Deep South Center for Environmental Justice. Dr. Wright uncovered concerns about LNG development among Louisiana environmental justice communities and helped empower community leaders in Plaquemines Parish, who contributed valuable insights to our case study of Plaquemines LNG. Dr. Wright also informed the structure of our case studies.

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Preface

This report represents a substantial endeavor aimed at providing a critical examination of the complex interplay between fossil fuel development, environmental justice, and climate justice in a region of the United States that has an enduring legacy of economic injustice and environmental racism. In recent years, the rapid expansion of liquefied natural gas (LNG) infrastructure along the Gulf Coast has raised significant concerns regarding the environmental and social consequences.

The numerous, extensive impacts and health and safety risks of LNG development are particularly concerning to historically-marginalized communities that have suffered from decades of pollution and ecological destruction from oil and gas and petrochemical industries—communities on the frontline of struggles for environmental justice, health, and safety. LNG development forces citizens and policymakers alike to consider its implications for a clean energy transition domestically and globally,

With these contexts in mind, we sought to analyze the fairness and adequacy of LNG export terminal siting decisions and approval processes, as well as community vulnerabilities and environmental and health impacts associated with LNG construction and operations. Our report offers a detailed assessment of the cumulative impacts of LNG facilities on the environment and fenceline communities who call this region home.

Using a multidisciplinary approach, our study delves into the myriad factors that shape the landscape of LNG development, including historical legacies, regulatory frameworks, economic considerations, and socio-political dynamics. Through a combination of quantitative analysis, qualitative research, and community engagement, we illuminate the often-hidden dimensions of environmental injustice and climate vulnerability faced by Gulf Coast communities.

We are acutely aware of the gravity of the issues explored within these pages and the profound implications of unrestrained LNG development for the Earth's climate and the health and well-being of affected populations. As such, we approached this work with a deep sense of responsibility and a commitment to amplifying the voices of those whose lives are most directly impacted by the decisions made in boardrooms and legislative chambers.

We extend our sincere gratitude to the individuals and organizations who have generously shared their time, insights, and lived experiences with us. Their invaluable contributions have enriched our understanding and enhanced the depth of our analyses.

We hope that this report will catalyze informed dialogue, policy reform, and further collective action aimed at advancing environmental and climate justice along the Gulf Coast and beyond. We invite readers to engage critically with the findings and recommendations presented herein and to join us in the ongoing pursuit of a more just, equitable, and sustainable future for all.

— Report authors, Robin Saha, Robert Bullard, and Liza Powers

Executive Summary

In the last several years, drilling in newer, as of yet mostly untapped, oil and gas formations in the United States—combined with the rise of "unconventional" extraction technologies, mainly hydraulic fracturing, or *fracking*—has led to a surplus of methane gas and the rapid expansion of so-called liquefied natural gas (LNG) export facilities. By 2022, the United States had become the largest global supplier of LNG (Kusnetz, 2023), rising for the first time to top Qatar in yearly exports. This growth has occurred without meaningful review of the industry's impacts on Environmental Justice (EJ) communities. Following the traditional fossil fuel playbook, sitings occur disproportionately in communities where people of color and those with low incomes live. These communities therefore experience the adverse impacts of LNG development but receive few, if any, of the benefits. Sitings also occur disproportionately in the Gulf South, particularly in Louisiana and Texas, where LNG growth outpaces regulation.

Figure ES.1 Petrochemical Industry Facilities in Port Arthur, Texas

Photo credit: Liza Powers. Flight provided by SouthWings Inc.

The Federal Energy Regulatory Commission (FERC), an independent agency, has primary authority for LNG siting approvals through licensing and permitting processes. FERC continues to authorize the buildout of LNG with little regard to environmental and climate justice implications. It completes environmental reviews using flawed and incomplete analysis, and even minimizes its own findings.

Communities of color and low-income communities have long endured systemic racism and other problems from the fossil fuel industry, yet FERC largely ignores this legacy and the concerns of communities living along the fence lines of LNG facilities. By rubber-stamping LNG proposals, FERC sanctions air, water, and land pollution, as well as damage to valuable coastal ecosystems.

This report analyzes the adequacy and fairness of LNG decision-making and permitting processes with the goal of informing community groups and other interested parties wishing to learn more about and challenge LNG development. We conclude that FERC's EJ analyses of LNG projects are highly flawed, incomplete, inaccurate, and misleading. This report also examines cumulative impacts associated with LNG infrastructure. We find that the impacts of LNG development are vast and significant, and adversely affect environmentally overburdened communities. We further conclude that LNG development is not in the public interest, that the impacts of LNG infrastructure on people and the planet are unacceptable, and that advancing environmental and climate justice requires FERC and other regulatory agencies to acknowledge the cumulative impacts of LNG and curtail new development entirely. Finally, this report makes recommendations to the Biden Administration, the Department of Energy (DOE), FERC, and other federal agencies, and it calls on Congress to act if those regulators do not.

Key Components of the Analysis

This study situates current LNG development within the historical context of fenceline communities and their long-standing struggles with petrochemical pollution. Fenceline communities are those that live immediately adjacent to highly polluting industries and facilities. These communities typically endure high levels of air, noise, and water pollution; adverse health impacts; excess traffic; risks of leaks and explosions; and depressed property values. We look at how the growth of the fossil fuel and petrochemical industries along the U.S. Gulf Coast has impacted the health, economy, and environment of these communities. We show how LNG development follows this same historical pattern, whereby communities of color are treated as "sacrifice zones"—places targeted by industry, where environmental hazards are increasingly concentrated and environmental protection is lacking.

We also take a hard look at FERC in particular. We look at the adequacy and accuracy of the methods and sources FERC uses to analyze EJ concerns. We assess the extent to which FERC follows federal guidelines and best practices in the environmental impact statements and environmental assessments that it uses to make licensing decisions. As shown in the map of the Gulf Coast below, this study looks at six LNG facilities in Louisiana and Texas that are either operational and expanding (Cameron LNG, Corpus Christi LNG, and Freeport LNG), under construction (Driftwood LNG and Plaquemines LNG), or proposed (Rio Grande LNG). We also examine the Freeport LNG Pretreatment Facility, located about 3 miles north of the Freeport LNG terminal.

Figure ES.2 Location of LNG Export Terminals Examined, in Operation, Proposed, or Under Construction in the Gulf South

Note: Operating terminals examined in this study are represented by green, red, and orange triangles; other LNG export facilities in operation, proposed, or under construction are indicated by black diamonds. Map by Naomi Yoder.

Noting that FERC does not conduct meaningful cumulative impact assessments of LNG, we conducted our own cumulative impact assessment. Since there is no standard federal guidance on how to conduct a cumulative impact assessment, we developed our own framework informed by government sources and academic literature.

Our cumulative impact assessment framework consists of five components. First, it examines preexisting pollution burdens and toxic hazards within 3 miles of LNG export facility property lines by using the U.S. Environmental Protection Agency's (EPA's) Environmental Justice Screening and Mapping Tool, EJScreen. It also assesses social and health vulnerabilities of LNG facility locations. This includes a rigorous quantitative EJ analysis, which uses U.S. Census Bureau block group data from the American Community Survey, 2017–2021, to compare estimates of the percentages of people of color and low-income populations living within 3 miles of each facility with the percentages of those populations in the states where these facilities are located, and in the entire nation.

Second, our framework examines health disparities of LNG facility locations by comparing Centers for Disease Control and Prevention (CDC) Population Level Analysis and Community Estimates (PLACES) health outcomes and prevention measures for census tracts surrounding LNG facilities in Louisiana and Texas with the same health measures for the respective states. We also analyze air toxics exposure levels at schools near the LNG facilities examined in this report.

The third and most in-depth component of our cumulative impact assessment examines the environmental impacts of LNG export facility construction and operation. Terminals typically include pretreatment facilities, liquefaction units (known as *trains*), large storage tanks of liquefied methane, work docks, ship berthing areas, loading and unloading facilities, power generators, and other ancillary equipment. Pile driving[1] and land conversion—including filling wetlands, dredging, and dispersal of legacy contamination—are among the most impactful activities associated with terminal construction and result in permanent destruction of natural resources. Impacts from terminal operations result from noise, air pollution, flaring, light pollution, routine spills, maintenance dredging, shipping, and other activities. Operations also pose risks of leaks and explosions due to extreme weather events, technological failures, and human error. These events and activities can result in disturbance, injury, and death to wildlife and broader damage to ecological systems, as well as impacts on human health, safety, and well-being.

We draw from various sources to assess the environmental impacts of LNG, including government documents, peer-reviewed literature, nongovernmental organization reports, news stories, and more. We examine impacts on soils and vegetation, water resources, wetlands, wildlife and fisheries, special status species, and air quality. However, to have a manageable scope, we do not cover impacts from gas wells, those from the vast network of pipelines that supply LNG export terminals, or impacts of LNG shipping. We recognize that this "upstream" network is extraordinarily detrimental to people and ecosystems as well, and we hope to see future studies analyze those facilities and activities in a similar manner.

The fourth component considers LNG technological failures, such as explosions, leaks, and spills, and the associated impacts on the health, safety, and welfare of fenceline communities. Specifically, we examine the risk multiplier of natural hazards triggering technological accidents (Natech)—that is, how natural hazards can cause technological failures, and specifically how sea level rise, storm surges, and flooding interact with and magnify LNG facility health and safety risks. We also examine the degree to which FERC considers Natech in its environmental reviews.

The fifth and final component of our cumulative impact assessment discusses the climate impacts of LNG development, which contribute to pushing global warming past safe thresholds for a habitable planet. We also call attention to FERC's abject failure to thoroughly consider climate impacts in its National Environmental Policy Act (NEPA) reviews (*Harvard Law Review*, 2022).

Finally, to shed light on the concerns, experiences, and struggles of LNG fenceline communities, we present two case studies. One is of Plaquemines LNG in Louisiana, which is under construction,

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[1] Pile driving entails driving metal pipes and interlocking metal sheets into the ground, ranging from 95 feet to 110 feet deep, to provide structural support for LNG storage tanks and docks, and to help slow erosion and ground subsidence.

and the other is of Freeport LNG in Texas, which is expanding. The case studies use in-depth interviews with community members; observations from attending several public meetings; and review of public comments, news articles, and court proceedings. The case studies provide valuable qualitative information on the human impacts of LNG development, government responses to community concerns, and community opposition, as well as an example of an explosion and shutdown resulting from both operator error and faulty training and procedures.

Our cumulative impact assessment reveals that LNG export facilities are neither safe nor clean for surrounding communities. Massive LNG development currently underway adds to the legacy of pollution problems, ecological destruction, and environmental injustices associated with the fossil fuel industry. Moreover, the environmental review process does not adequately consider EJ communities. FERC analyses are highly flawed and fail to utilize relevant federal guidelines and the latest EJ data tools. Of the seven LNG facilities we assessed, the majority are in EJ communities that are already overburdened with pollution and already suffer from environmental degradation and disproportionate health impacts. In addition, LNG export terminals are, by nature, built in coastal areas, since the premise of LNG is to produce energy for overseas transport. Coastal areas are prone to disasters and natural hazards that will worsen with climate change. Worsening climate change conditions also increase the risk of technological failures in these facilities over the coming decades. Existing LNG operations in the Gulf South are themselves a significant contributor to climate change. Yet nearly a dozen new export terminals are planned—and they will profoundly endanger local communities and the planet alike.

An Unjust Legacy of Environmental Assault on Frontline Communities from Oil and Gas Industries

The petrochemical industry has created decades of environmental injustices in the United States. In the Gulf South especially, the siting of oil and gas industries occurs around clusters of predominantly Black Americans, Hispanic Americans, Indigenouss, and lower-income communities—making permitting, siting, and operation major EJ issues. These communities along the fence lines ("fenceline communities") are already considered "sacrifice zones" (Bullard, 2011; Lerner, 2011). Communities are surrounded by hundreds of petrochemical facilities along the 85-mile stretch of Louisiana's so-called Cancer Alley, and disproportionately more such polluting facilities dot the coastal shoreline in vast chemical-industrial corridors spanning from southwest Louisiana to Port Arthur, Texas, and from the Houston Ship Channel to Freeport and Corpus Christi, Texas, then all the way to the Rio Grande Valley.

LNG development perpetuates sacrifice zones, in which new generations will experience pollution and environmental damage at a cost to their health, wealth, and well-being. Locations of LNG facilities tend to fall in areas that are disproportionately home to people of color and with low incomes, and where Jim Crow laws and more recent forms of discrimination in housing, education, employment, and transportation have marginalized populations. Redrawing of political districts continues to stifle residents' voting power.

Governmental agencies continue to grant permits in historically disempowered and disenfranchised communities. Residents closest to the fossil fuel and petrochemical industries pay the steepest cost to their quality of life and receive few benefits from the industry.

Fenceline communities and people of color experience adverse health effects, displacement, and declining property values. Black Americans and Hispanic Americans face more exposure to particulate matter and other toxic air hazards than the general population (Tessum et al., 2019). Additionally, fenceline community members are not guaranteed economic benefits such as job opportunities from the nearby proliferation of fossil fuel facilities ("buildouts"). Black Americans are largely excluded from employment in the petrochemical industry as they make up less than 10% of the total workforce and earn 23% less than White American workers (Tomaskovic-Devey, 2023). Black Americans hold less than 4% of jobs from the fracking industry (Farber, 2022). These are among the many ways fenceline communities experience environmental injustice from the petrochemical industry, including LNG facilities.

Figure ES.3 Petrochemical Industries Along the Houston Ship Channel

Photo credit: Splash247.com. Source: Scully (2015).

Government Permitting Uses Flawed Environmental Justice Analyses

Federal policy requires FERC to conduct EJ analyses of proposed LNG projects during a NEPA environmental review. In general, FERC EJ analyses ostensibly seek to determine if an EJ community exists in a project area and, if so, assess the potential for disproportionately high and adverse impacts on people of color and low-income populations. Such information, if done properly, should then be used to inform permitting decisions and mitigation measures such as community benefits. Unfortunately, EJ analyses are not done properly.

In its resource document *Promising Practices for EJ Methodologies in NEPA Reviews*, the EPA recommends (1) identifying the affected or potentially affected areas, that is, places where the impacts of a project are expected to occur; (2) identifying people of color and low-income populations in the affected area; and (3) comparing those population characteristics of the affected area to the characteristics of a reference community (U.S. Environmental Protection Agency, 2016). If a certain threshold of difference is reached, then EJ concerns exist that require mitigation or remedy.

Our review of FERC's EJ analyses found that they suffer from methodological weaknesses, including using outdated approaches that systematically fail to accurately or consistently identify areas affected or potentially affected by LNG facilities. In doing so, FERC's EJ analyses are not suited for reliably identifying communities with relatively higher proportions of people of color or with low-income populations. This results in flawed and misleading EJ analyses as shown in the summary table below.

Additionally, some of FERC's EJ analyses report percentages of people of color as simply "non-White" percentages as a whole, but do not break them out as percentages of individual racial and ethnic groups, potentially masking the presence of disproportionately high percentages of a specific historically disadvantaged group, such as Indigenous people. In 2021, FERC's flawed approach to conducting EJ analyses of LNG facilities earned unanimous rebuke from the Washington, D.C., Circuit Court (*Harvard Law Review*, 2022).

There is no excuse for these analytic shortcomings given the widespread availability of spatial analysis tools (e.g., geographic information systems) and the existence of well-known, accurate, and reliable methods that are widely used by other agencies, detailed in academic literature, and recommended in various federal technical documents (e.g., EPA, 2015). Furthermore, EJScreen, the Climate and Economic Justice Screening Tool (CJEST) from the White House Council on Environmental Quality, the CDC's Environmental Justice Index, and the CDC's PLACES Interactive Map dataset have all become available in recent years and allow nontechnical users to conduct basic EJ analyses and accurately identify EJ communities of concern, making use of those tools a seeming requirement. However, even FERC's most recent EJ analyses that we reviewed do not employ these tools. This is despite FERC's own guidance document, *Guidance Manual for Environmental Report Preparation*, recommending the use of the EPA's EJ Screen (Federal Energy Regulatory Commission, 2017).

Our review of FERC's EJ analyses also found that the commission seems to go out of its way to avoid finding or reporting affected EJ communities—that is, disproportionately high percentages of people of color or low-income populations living along the fence lines of LNG facilities. However, when it does find such a community, as in the case of Freeport LNG, FERC declares, without evidence, that the benefits of LNG development to local communities are an acceptable trade-off for the negative impacts. Implicit in this assertion is the premise that people of color and low-income communities do or should willingly accept risky, polluting industrial facilities in order to be economically uplifted. To EJ communities, this is a tired "economic blackmail" narrative, a false promise, and part of the mentality that justifies sacrifice zones and "toxic hot spots" as a necessary cost of doing business.

Table ES.1 Summary of Flaws with FERC EJ Analyses

FERC Environmental Review Document	LNG Facility Expansion	Methodological Flaws
Cameron LNG EIS (2014)	No	No EJ section
Cameron LNG EA (2016)	Yes	Failure to identify "affected area," failure to report any demographic data
Driftwood LNG EIS (2019)	No	Ill-defined "affected area," conflation of "affected area" with reference area comparison population (Calcasieu Parish), and failure to report percentages for specific racial/ethnic groups
Plaquemines LNG EIS (2019)	No	Ill-defined "affected area," conflation of "affected area" with reference area (Plaquemines Parish), and failure to make state comparison
Corpus Christi LNG EIS (2014)	No	Ill-defined "affected area" and failure to make state comparison
Corpus Christi LNG EA (2019)	Yes	Ill-defined "affected area," likely conflation of "affected area" with reference area (San Patricio County), and failure to make state comparison
Freeport LNG EIS (2014)	No	Ill-defined "affected area" and failure to report percentages for specific racial and ethnic groups
Freeport LNG EA (2018)	Yes	Ill-defined "affected area" and failure to report percentages for specific racial and ethnic groups
Rio Grande LNG EIS (2019)	No	Ill-defined "affected area" and failure to discuss findings in relation to a reference/comparison area

Note: EA = environmental assessment; EIS = environmental impact statement.

Source: Authors' analysis of FERC EJ analyses of six Gulf South LNG facilities

More often than not in the experience of many EJ communities, polluting industries generally avoid paying local taxes, and high-paying industry jobs do not go to locals, who instead tend to end up with lower-paying, more dangerous jobs, if any (Burnett, 2023; Drane, 2023a; Jones, 2023). Thus, in addition to lacking methodological rigor, FERC's EJ analyses exhibit a disturbing tone deafness and a general lack of understanding of common EJ community concerns and residents' lived experiences. In sum, FERC's approach to EJ with respect to LNG exhibits the hallmarks of institutional discrimination and environmental racism (Mohai & Saha, 2015a; Roberts et al., 2022).

Deficiencies of Cumulative Impact Assessment Used in Permitting for LNG

Although FERC's environmental reviews used in the permitting process cover a wide range of impacts, FERC fails to acknowledge the totality of those impacts. It does not conduct comprehensive cumulative impact assessments.[2] For example, FERC does not consider whether proposed export terminal locations are already overburdened with pollution and ecological damage. FERC does not screen for the presence of vulnerable populations, including children and persons with preexisting health conditions such as asthma, who are especially susceptible to toxic air pollution from LNG facilities. Thus, FERC's approach is not designed to determine whether environmental sacrifice zones already exist where new LNG facilities are proposed. The FERC environmental review process also fails to adequately consider or safeguard against the risks of accidents due to hurricanes and other named storms, especially important in light of a changing climate.

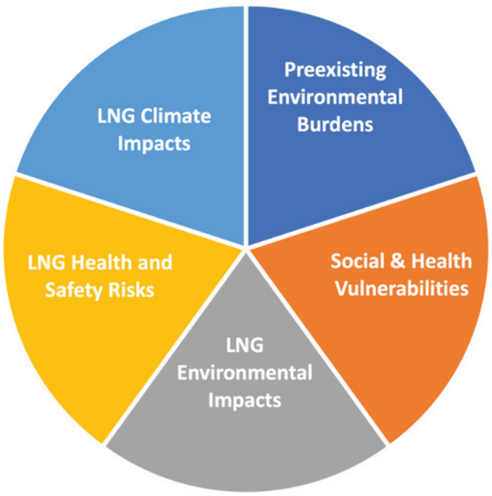
Cumulative Impact Assessment of LNG Facility Siting in Louisiana and Texas

By conducting a cumulative impact assessment of the seven LNG facilities located in Louisiana and Texas (see Chapter 5 of this report for the full presentation), our research indicates that LNG construction and operations cause unacceptable further harm to already overburdened places and populations. As noted above, this assessment is organized by five categories of data collection: (1) preexisting environmental burdens, (2) existing social and health vulnerabilities, (3) environmental impacts of LNG facilities' construction and operation, (4) LNG health and safety risks, and (5) LNG climate impacts.

Preexisting Environmental Burdens

Over the last 60 years, the Gulf Coast has experienced extensive environmental degradation from decades of canal building, river channelization, oil and gas development, petrochemical industrialization, agricultural land use, and urbanization. This development has ravaged the Gulf Coast's natural heritage; damaged fisheries; caused land subsidence; polluted land and water; and destroyed 50% of coastal wetlands that protect from storm surges, prevent coastal erosion, and provide life-sustaining ecosystem services on which

Figure ES.4 Cumulative Impact Assessment Framework



[2] According to the EPA, cumulative impact "refers to the total burden—positive, neutral, or negative—from chemical and non-chemical stressors and their interactions that affect the health, well-being, and quality of life of an individual, community, or population at a given point in time or over a period of time" (U.S. Environmental Protection Agency, 2022a, p. 1).

nationally prominent tourism, fishing, and recreational economies rely (Theriot, 2014). The ecological strain was significantly worsened by the 2010 BP *Deepwater Horizon* oil spill, which had devastating consequences for coastal resource–dependent communities. The effects of sea level rise and climate change already threaten the lives and lifeways of coastal residents, especially in resource-dependent communities (Yawn, 2020). Those are among the environmental burdens of Gulf Coast communities who rely on the Gulf for sustenance and who value and care for its ecological richness, many of whom are now confronting the added threats of LNG development.

Using EJScreen, our analysis of 3-mile areas around the six LNG facilities examined in our study found evidence of extensive existing pollution burdens (note that we excluded the Freeport Pretreatment Facility from this part of the analysis). EJScreen uses 13 environmental indicators that are relative measures of pollution exposures, such as air pollution, and proximity to environmental hazards, such as hazardous waste. EJScreen reports environmental indicator scores for areas of interest as percentiles. Percentiles describe a rank—that is, how an area of interest compares to the surrounding state or the nation on any one indicator. For example, if a census block group falls at the 79th percentile in its state for air pollution, that block group has worse air pollution than 79% of all the block groups in the entire state (the same principle applies to national comparisons).

The results overwhelmingly support the claim that communities surrounding LNG export terminals are already environmentally overburdened. We found that five of the six communities near our selected LNG facilities have environmental pollution burdens greater than the 75th percentile in relation to their respective states, the nation as a whole, or both. Four communities have pollution burdens above the 90th percentile. Individual EJScreen indicators reveal more evidence of the environmental burden. For example, Freeport LNG and Driftwood LNG have scores greater than the 90th percentile for their respective states and the nation for lifetime air toxics cancer risk and air toxics respiratory hazards, and Freeport LNG also exceeds the 95th percentile relative to Texas and/or the nation for proximity to hazardous waste facilities and wastewater discharges, as well as for facilities that the EPA requires to develop a risk management plan due to the presence of extremely hazardous substances.

These results are characteristic of the presence of the fossil fuel industry in the Gulf Coast. It is clear from this analysis that most of the time, LNG export terminals are placed in environmentally overburdened communities. The preexisting environmental stressors can affect a population's susceptibility to the additional environmental health risks of LNG development.

Existing Social and Health Vulnerabilities

Decades of research have shown that polluting industrial facilities more often than not target communities with more people of color and lower incomes for locations to operate in. These communities are socially and politically vulnerable because they are seen as paths of least resistance. The regulatory and policy mechanisms, and the environmental laws, that might otherwise be in place to protect these communities have been dismantled or suffer from lax enforcement. EJ communities often lack the social and political capital needed to participate in environmental permitting and stave off locally undesirable land uses (Mohai & Saha, 2015b). Race is a factor in social vulnerability because of environmental racism, which results in unequal consideration in siting and permitting decisions, industry environmental performance, and government protection. Race is among the social determinants of health—that is, race is one of the primary factors that affects both disease prevalence and susceptibility to environmental stressors (Braveman & Gottlieb, 2014). To make matters worse, members of EJ communities who want to leave the area also often lack the ability to "vote with their feet" by relocating to a safer place.

Using census block group data, we found disproportionately high percentages of people of color near the majority of the LNG facilities included in our analysis. Living within 3 miles of Freeport LNG in Texas and Plaquemines LNG in Louisiana are much higher percentages of Black Americans than the percentages of Black Americans in the states where these sites are located (23.1% versus 12.1%, and 71.7% versus 31.9%, respectively). Both LNG sites also have much higher percentages of Black Americans than the national average (12.6%). Corpus Christi LNG and Freeport Pretreatment Facility, both in Texas, have slightly higher percentages of Hispanic Americans than the state, whereas Freeport LNG and Rio Grande LNG, also in Texas, have much higher percentages of Hispanic Americans (62.8% and 85.7%, respectively) than both the state (39.8%) and the nation (18.4%). Rio Grande LNG, Freeport LNG, and Plaquemines LNG have higher percentages of lower-income populations than do their respective states, as does Plaquemines LNG in relation to the nation. Communities around Cameron LNG and Driftwood LNG, in rural Louisiana, are the only two study sites that were not shown to exhibit racial, ethnic, or socioeconomic disparities.

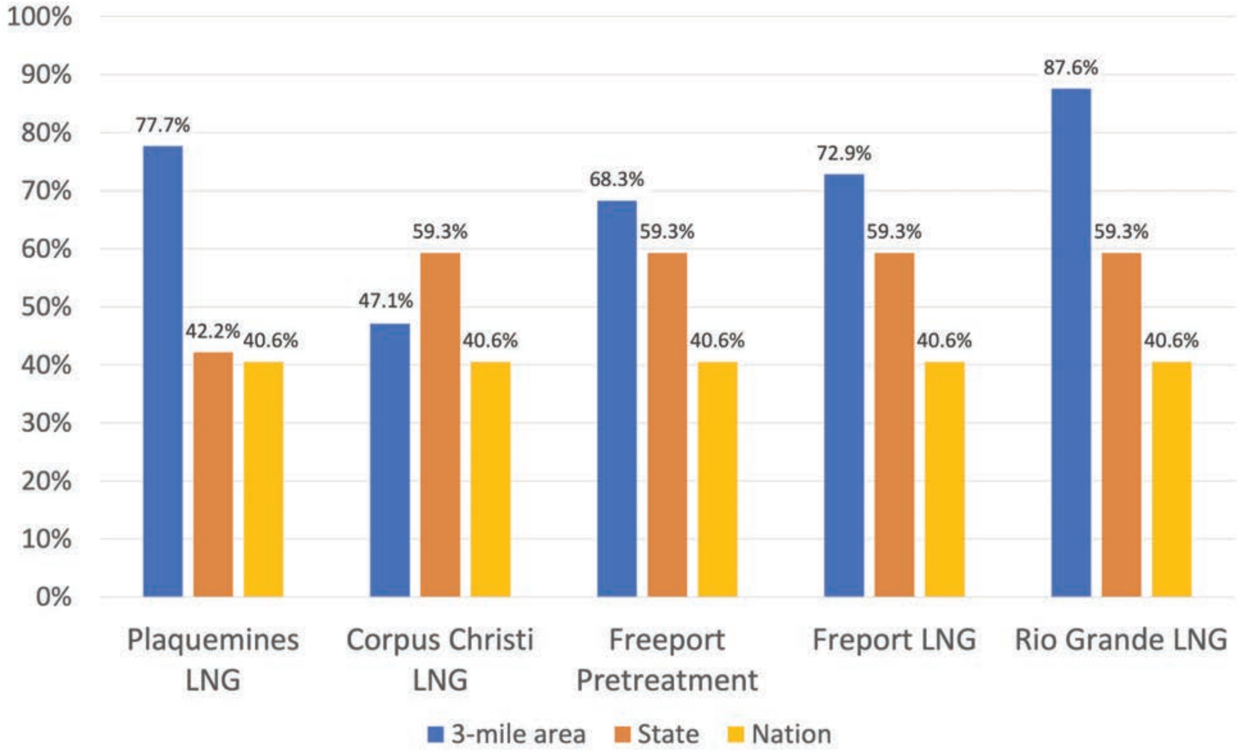
Overall, these results show that in Louisiana and Texas people of color and, to a lesser extent, low-income populations are disproportionately located in areas likely to be more adversely impacted by LNG facilities.

These results stand in contrast to FERC's EJ analyses and conclusions. They also add weight to the serious concerns already identified by affected communities, EJ advocates, the courts, and others about the methodological shortcomings of FERC's analyses and thus its ability to responsibly inform the public and to make sound permitting decisions.

Using CDC PLACES data, we also found health disparities in areas around LNG locations in Louisiana in terms of adult cancer, asthma, and obesity rates. LNG locations in Texas rank relatively highly for adult asthma and obesity as well. These high rankings for asthma prevalence in both states are especially concerning because they indicate increased susceptibility to LNG air pollution and likelihood of asthma hospitalizations and deaths.

Emissions from petrochemical facilities harm reproductive health, and Texas women have the highest maternal mortality rate in the country. Moreover, Black women in the state are twice as likely to die from pregnancy-related causes as White women (Johansen et al., 2019). Overall, Black Americans and Hispanic Americans as a whole are exposed to 1.54 times and 1.20 times more particulate matter, respectively, than the U.S. general population (Mikati et al., 2018). Studies have found a strong correlation between air pollution exposure and student health, school absences, and academic performance (e.g., Grineski et al., 2016).

Figure ES.5 Percentage of People of Color Living within a 3-Mile Radius of Selected LNG Export Terminals



Source: Authors' analysis using data from American Community Survey 5-Year Estimates (2016–2021), U.S. Census Bureau.

Children are also particularly vulnerable to toxic air pollution from petrochemical and other industries, due to their high metabolism, stage of physiological development, and time spent outdoors. Schools in Louisiana and Texas experience poorer air quality than schools nation-wide, with Louisiana schools 3.87 times greater and Texas schools 2.61 times greater than the national average (Political Economy Research Institute, 2023). Using the interactive Air Toxics at School Tool,[3] we found that school districts in close proximity to LNG facilities in Louisiana and Texas have higher rates of air toxics hazards than the national average. Four of the seven schools nearest to each of the LNG facilities examined have air toxics exposure levels above the 95th percentile for the nation, and four of these schools have more than 80% students of color. Schools located near Driftwood LNG and Freeport LNG have some of the highest levels of air toxics exposure in the country.

In sum, communities in the vicinity of the LNG facilities we examined have disproportionately high percentages of socially and politically vulnerable populations, as well as a high prevalence of adverse health conditions. The social and health vulnerabilities that this study has revealed are an important part of the cumulative environmental burden of LNG facilities.

[3] This interactive online tool, developed by the Political Economy Research Institute at the University of Massachusetts Amherst, allows users to examine industrial toxic air pollution levels at every K–12 and higher-education school in the United States. It is available at https://peri.umass.edu/air-toxics-at-school.

Figure ES.6 Wetlands Near the Cameron LNG Export Terminal Along the Calcasieu Shipping Channel, Hackberry, Louisiana

Photo Credit: Julie Dermansky.

Environmental Impacts of LNG

Our extensive review of the environmental impacts of LNG export terminals clearly shows the serious magnitude and scope of the environmental, health and safety, and quality of life burdens of LNG development in the Gulf South. The construction and operation of LNG facilities are heavily polluting, destroy and degrade sensitive ecological areas, and harm the species and human communities that rely on them. Specifically, we found that the six LNG facilities we examined

- sacrifice nearly 8 square miles (5,120 acres) of mostly undeveloped land, including wetlands and prime agricultural lands;
- destroy 1,100 acres of wetlands and marshlands of state and national significance in Louisiana, adding to major historical losses and coastal erosion loss estimated to cost $550 million annually by 2050;
- adversely impact local fishing industries worth $367 million in Louisiana in 2021;
- pose risks to fisheries through wetland destruction, erosion, ballast water discharge, cooling water intake, and pipeline construction;
- destroy imperiled plant communities and those of special concern, including a rare coastal clay dune habitat for the endangered ocelot and northern aplomado falcon near the Rio Grande LNG;

- harm numerous types of wildlife, including endangered species, special status species, migratory birds, and marine mammals;
- disrupt wildlife breeding, nesting, foraging, sheltering, and communication behaviors;
- risk introducing invasive species from ballast water discharges;
- entail leaks and spills of hazardous substances that threaten shallow groundwater areas and wash into waterways;
- require tens of millions of gallons of fresh water, in the case of Plaquemines LNG reducing water pressure for local residents and businesses;
- involve massive amounts of dredging (19.4 million cubic yards—enough to fill over four Superdomes) that degrades water quality, damages sea and estuarine bottom ecosystems, and risks remobilizing contaminated sediments;
- require disposal of dredging spoils that degrades water quality and damages commercial, recreational, and subsistence fisheries;
- pose other risks to fisheries from ballast water discharge and cooling water intake;
- work at cross purposes to the Mid-Barataria Sediment Diversion project, which is intended to restore wetlands and mitigate land loss;
- attempt to replace some destroyed wetlands with artificial ones that have lower ecological value and are poorly monitored; and
- degrade air quality and threaten the public health of fenceline communities by being
    - major sources of Clean Air Act (CAA)–designated "criteria air pollutants," including 10,382 tons of nitrogen oxides and 1,699 tons of particulate matter annually, with carrier vessels adding 10% more criteria air pollutants on top of those;
    - major sources of CAA-designated "hazardous air pollutants," collectively emitting 264 tons per year of substances including formaldehyde, benzene, toluene, ethylbenzene, and xylene, which are known carcinogens and respiratory, neuro-, organ, and reproductive toxins that are likely to have synergistic health effects;
    - violators of air permits, even those that already routinely exempt operators from emission standards during start-up, shutdown, and emergencies; and
    - sources of fugitive emissions, such as venting and illegal flaring resulting from both cost-cutting measures and lax monitoring and enforcement by state regulators.

Details about these impacts are provided in the body of this report using information from FERC's own environmental reviews supplemented by academic and gray literature. We conclude that environmental impacts on air and water quality, water resources, wildlife and aquatic species, and special status species are significant within each of those categories and in their totality. In making piecemeal licensing decisions, FERC fails to consider the cumulative impacts of LNG development as a whole, vulnerable populations, the preexisting environmental pollution burdens, and ecological damage in the Gulf South.

Figure ES.7 Flaring at Venture Global LNG facility, Cameron, Louisiana

Photo credit: John Allaire. Source: Louisiana Bucket Brigade (2023).

Climate Change Hazards and Technological Failures of LNG

Gulf Coast LNG facilities are in harm's way by virtue of their mandatory coastal location and the hazards of extreme weather and climate change, which can cause malfunctions, accidents, property damage, toxic exposures, and other problems resulting in harm to fenceline communities. The potential for serious accidents at LNG facilities due to natural hazards has not been adequately assessed by FERC, state or local officials, or the industry itself (van Heerden, 2022). LNG facility safety design and emergency procedures are regulated by federal agencies including EPA, FERC, the U.S. Coast Guard, and the U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA), as well as state utility regulatory agencies. However, LNG export facilities are exempt from most PHMSA safety programs (Pipeline and Hazardous Materials Safety Administration, 2023). Moreover, PHMSA continues to use safety guidelines adopted in 1980, long before LNG technology and export operations developed (Soraghan & Lee, 2022). Finally, LNG terminals are exempt from EPA risk management planning, yet the facilities store large quantities of highly combustible and explosive pressurized methane and refrigerant gasses.

Only three of the six facilities we examined (Corpus Christi, Freeport LNG, and Cameron LNG) are identified by FERC as being able to withstand a Category 5 hurricane. FERC's environmental reviews astonishingly dismiss the possibility of a Category 5 hurricane and are mostly silent on tornado hazards to LNG infrastructure. Using the Coastal Flood Exposure Mapper of the National Oceanic and Atmospheric Administration (NOAA), we found that Corpus Christi LNG and perhaps Freeport LNG are the only facilities that appear to be on high enough ground to avoid being substantially flooded by the storm surge from only a Category 3 hurricane. Furthermore, previous hurricanes have already disrupted LNG operations (see map below). In 2020, Hurricanes Laura and Delta caused operational suspensions for weeks at Cameron LNG. All three liquefaction trains at Freeport LNG went offline because of Hurricane Nicholas, which reached only Category 1 status, in 2021. A recent study counted 872 chemical facilities situated in areas vulnerable to hurricane activity along the Gulf Coast and identified 197 harmful compounds that had been released in 166 recorded extreme weather events (Warmington, 2022). LNG stands to add to those tallies.

Sea level rise associated with climate change will make LNG terminals increasingly vulnerable to storm surges and flooding. Sea level rise is accelerating and expected to continue to accelerate for the rest of this century and beyond. According to NOAA data, locations along the Gulf Coast have already experienced 24 inches of sea level rise since 1950, and levels continue to rise at least 1 inch per year (SeaLevelRise.org, 2022a, 2022b).

LNG facilities are prone to accidents and failures even without the added risk of extreme weather due to climate change. Accidents can result from cost-saving measures and human factors such as faulty equipment, operational errors, lack of maintenance or monitoring, and poor training. Such factors were involved in accidents at Freeport LNG in 2019 and again in 2021, resulting in a large release of fugitive emissions and a major explosion, respectively (Texas Commission on Environmental Quality, 2021; Foxhall & Buckley, 2022).

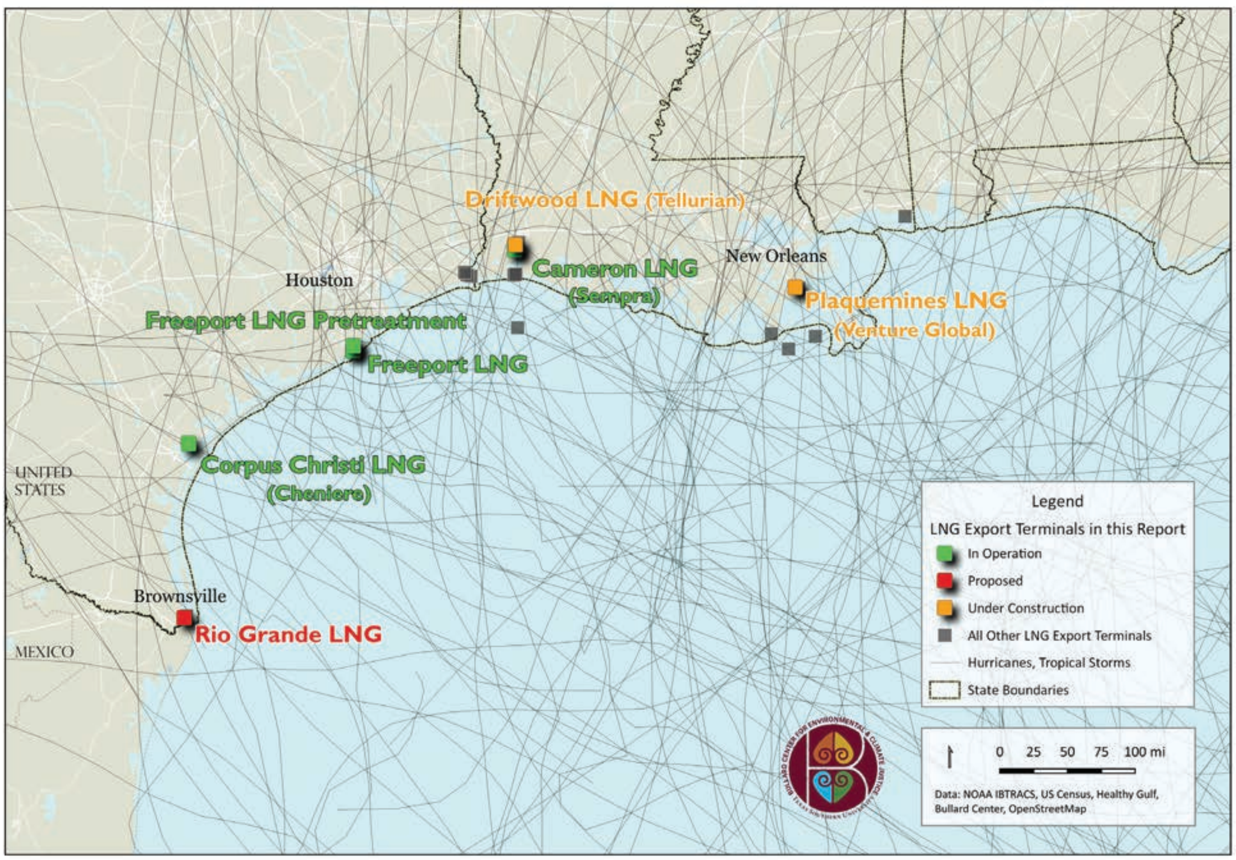
Freeport LNG reportedly had about 100 air permit violations that went unenforced, until finally the state fined the company only $9,000 (Ahmed, 2021a). When Cheniere's Corpus Christi LNG was finally found in violation of its air permit for prolonged, excessive flaring, rather than issue a fine, Texas regulators increased Cheniere's allowable emissions (Groom and Volcovici, 2022).

Our review of FERC's treatment of natural hazards and technological failures associated with LNG further highlights FERC's failure to assess the cumulative impacts of LNG export terminals. These terminals are especially susceptible to hurricanes, sea level rise and flooding, and failures of equipment and personnel. These hazards, along with lax enforcement of protective safety measures, illustrate the significant risk that LNG terminals pose to people and ecosystems. By not adequately evaluating natural hazards, FERC, PHMSA, and state agencies endanger fenceline communities and abrogate their responsibility to serve the public interest.

Climate Impacts of LNG Development

FERC has systematically overlooked the contribution to climate change made by individual LNG facilities, and it has not evaluated the cumulative impacts of existing LNG facilities or the overall buildout. In 2019, with regard to the FERC decision in favor of Plaquemines LNG, then FERC Commissioner Richard Glick stated, "Claiming that a project has no significant environmental impacts while at the same time refusing to assess the significance of the project's impact on the most important environmental issue of our time is not reasoned decision-making" (Glick, 2019). FERC's failure to seriously consider the climate impacts of LNG, including the social and environmental costs of LNG's greenhouse gas emissions, is yet another high-stakes failure to grapple with the cumulative impacts and injustices of LNG development.

Figure ES.8 Tracks of Named Storms That Made Landfall on the Gulf Coast, 1950–2021

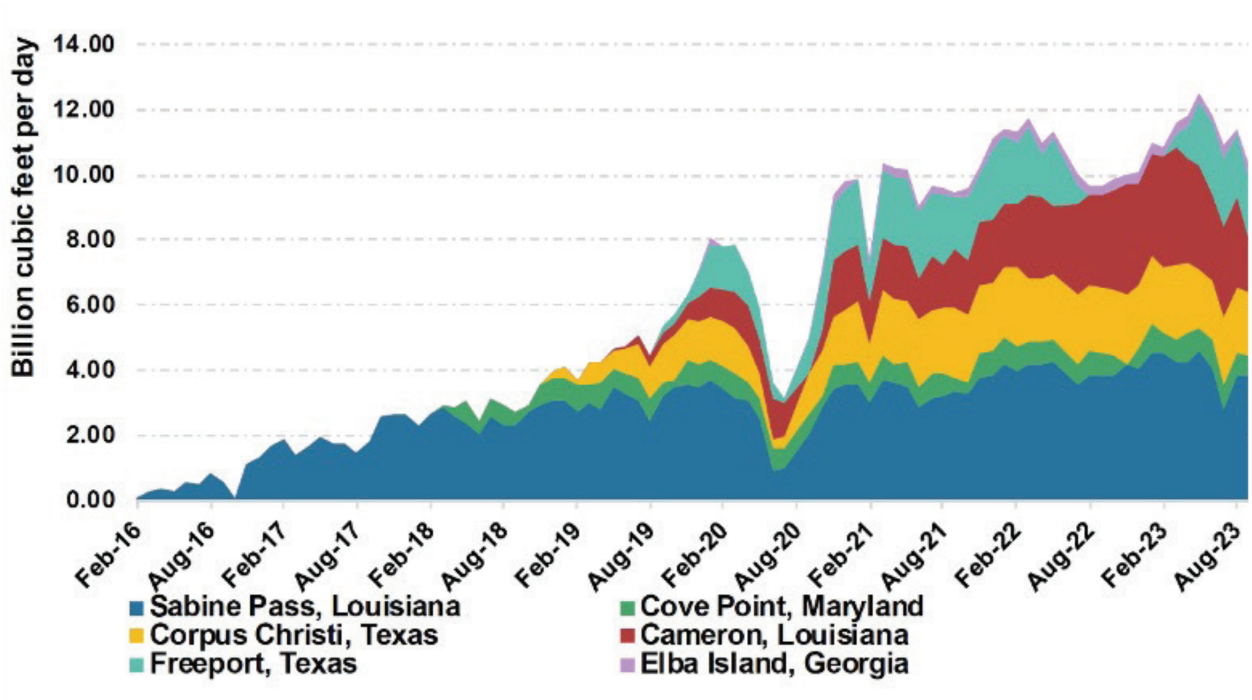


Note: Named storms include tropical cyclones—that is, tropical storms, tropical depressions, and hurricanes. There were 393 in total over the years mapped. Map by Naomi Yoder.

From 2021 to 2022, U.S. LNG exports increased 9%; they then rose another 15% in 2023, to 88.9 million metric tons (U.S. Energy Information Administration, 2023a; Williams, 2024a). A 2022 report found that if the gas industry succeeds in building all of its currently planned LNG facilities, LNG operations would emit an estimated 90 million tons of greenhouse gases yearly—the equivalent of 20 new coal-fired power plants or 18 million cars (Environmental Integrity Project, 2022a). The chart below shows the dramatic rise in U.S. monthly LNG exports from February 2016 to September 2023.

However, those estimates do not count life cycle emissions such as those from leaks, drilling, shipping, and end use. A 2023 report found that total life cycle emissions from existing LNG and current planned buildout would contribute an astronomical 222 metric tons of greenhouse gases per year—"equivalent to more than 90% of all the methane gas consumed by the U.S. power sector in 2021" (Ross & Zibel, 2023, p. 4).

Figure ES.9 U.S. Monthly LNG Exports by Terminal, February 2016–September 2023



Note: The Cameron, Louisiana, point of exit includes exports from Cameron LNG and Venture Global Calcasieu Pass LNG.
Source: U.S. Department of Energy (2023).

All of this stands in stark contrast to the international scientific community's call for emissions reductions to avert catastrophe. According to Climate Action Tracker's Warming Projections Global Update, the growth of LNG export facilities will prevent the world from meeting the Paris Agreement's 1.5 degrees Celsius global warming limit (Climate Action Tracker, 2022). According to the International Energy Agency, to avoid the worst effects of climate change, the world needs to dramatically slash demand for natural gas, bringing it down at least 20% by 2030 and 75% by 2050 (McGhee & Canary staff, 2023).

By accelerating climate change, the LNG boom gambles away our nation's future security and our planet's ability to sustain modern societies. It involves unjust trade-offs for providing cheap methane gas overseas and enriching the LNG and fracking industry. Meanwhile, energy costs rise and inflation stresses Americans' pocketbooks. LNG buildout liquidates the well-being of coastal communities and future generations for short-term profits. In these ways, LNG development fails to meet the public interest requirements of the Natural Gas Act. Finally, LNG buildout undermines the crucial work of making a just transition to cleaner, more sustainable energy systems.

Community Concerns and Opposition

Community opposition to LNG facility siting and operations in the Gulf South has been vigorous, sustained, and growing (DiSavino, 2017). Community members have organized, used EJ arguments, and participated in federal licensing and permitting processes by attending public hearings and submitting comments. They have lobbied local and state officials, demanded meetings with federal officials, held rallies and protests, led digital campaigns, garnered media attention, enlisted allies, gone to court, and more.

Figure ES.10 Environmental Justice Activist Roishetta Ozane (R) with Jane Fonda (L)

Photo credit: Julie Dermansky.

Community concerns are varied. Roishetta Ozane, a community organizer from Lake Charles, Louisiana, stresses the cumulative impact of existing petrochemical pollution, wetlands loss, and other environmental damages from four existing and proposed export terminals (Juhasz, 2021). Regarding the Rio Grande LNG, near Brownsville, the Carrizo/Comecrudo Tribe of Texas is concerned about the destruction of culturally and historically significant sites and a lack of consultation (Collier, 2019; Sierra Club, 2022a). Others in the affected areas are concerned about air quality impacts and harms to the local fishing and tourism industries (Sierra Club, 2022a).

In Plaquemines Parish, Louisiana, where an LNG facility is being built along the banks of the Mississippi River, Black American residents don't feel that they were adequately notified about or involved in the siting and permitting process. They are frustrated by the lack of government support and investment in emergency response and preparedness. They have been flooded more than five times since Hurricane Katrina, with many still living in Federal Emergency Management Agency (FEMA) trailers after the devastation of Hurricane Ida in 2021. They feel overwhelmed from rebuilding and trying to hold onto their disappearing land, while also trying to rebound the fishing economy after the 2010 *Deepwater Horizon* oil spill. Their concerns about the adequacy of the levy system and the potential for chemical runoff due to future flooding have gone unheeded (Sierra Club, 2022b).

In Freeport, Texas, community members have been resisting their polluting LNG neighbor since it began as an import facility in 2008. Having witnessed a fire at the facility years ago, they have long called for better safety regulation of the industry, which uses outdated rules established over 40 years ago, well before the rapid growth of LNG (Soraghan & Lee, 2022). The historically Black American neighborhood of East End in Freeport, Texas, is virtually gone. Most residents have been forced out by Port Freeport. Remaining residents' worst fears came to fruition when Freeport LNG experienced a major explosion in June 2022 that burned for 40 minutes and shut down the facility for 8 months (Baddour & Erdenesanaa, 2023).

In Corpus Christi, residents worry that the climate impacts of LNG development will worsen the frequent extreme weather they are already experiencing. Residents like Marlene Plua are still recovering from Hurricane Harvey in 2017 and Winter Storm Uri in 2021. The record-breaking heat in 2023 hit Hispanic communities hard, as many homes lack shade and are cooled only by window units (Ahmed, 2022a). Community members are frustrated that Corpus Christi LNG has received new permits to expand its operations, despite having a history of permit violations. Residents feel betrayed by the Texas Council of Environmental Quality for not holding the owners accountable (Ahmed, 2022a; Hinojosa, 2022).

Other communities have also found that LNG facilities are too often poorly operated and have persistent leaks, almost constant flaring, and permit violations, resulting from generally lax state monitoring and enforcement (Ahmed, 2021a; Bradstock, 2021; Columbus, 2023; Groom & Volcovici, 2022; Renaud, 2023; Vasudevan, 2022). LNG communities also commonly report a lack of transparency by government and industry as well as insufficient opportunities for public involvement during LNG permitting and siting (Columbus, 2023; Oldham, 2022; Renaud, 2023; We Act, 2022).

These communities want to encourage economic growth as long as it benefits their residents and does not endanger their health, well-being, and property values, or destroy the natural environment (Beaumont, 2023). They have achieved some success in opposing LNG development, though that has mostly occurred in northern states (Dick, 2022a; Waterkeeper Alliance, 2021). Local organizing, lobbying, and legal action by residents, along with robust media coverage, in Port St. Joe, Florida, resulted in Nopetro Energy pulling out of a planned small LNG project (Public Citizen, 2023). The Port Arthur Community Action Network successfully won an appeal of a decision by the Texas Commission for Environmental Quality that would have weakened emission control requirements for Port Arthur LNG (Baddour, 2023).

Figure ES.11 A flotilla Including Shrimping Boats in the Calcasieu River Protesting LNG Development in Calcasieu and Cameron Parishes, November 2022

Photo Credit: Carlos Silva and the Louisiana Bucket Brigade. Source: American Press Staff (2022).

Affected communities, along with state and national environmental organizations and in some cases joined by tribes, labor organizations, and public interest groups, have used litigation to challenge environmental review processes and try to stop LNG projects. Although their efforts have not halted projects, they have caused delays by requiring further environmental review and by having a chilling effect on financial investments in LNG projects.

In sum, LNG fenceline communities in the Gulf South have many diverse concerns about LNG development. Their concerns and grievances have been largely unheard by federal and state regulators and the LNG industry, and LNG development has gone on mostly unabated despite vigorous opposition.

Recommendations

Here we present recommendations for the Biden Administration, DOE and FERC, and PHMSA. Actions from all of these entities, as well as from state environmental regulatory agencies and investors, are essential to address the climate and environmental injustices of the current LNG buildout.

Biden Administration

Adhere to global climate mitigation agreements

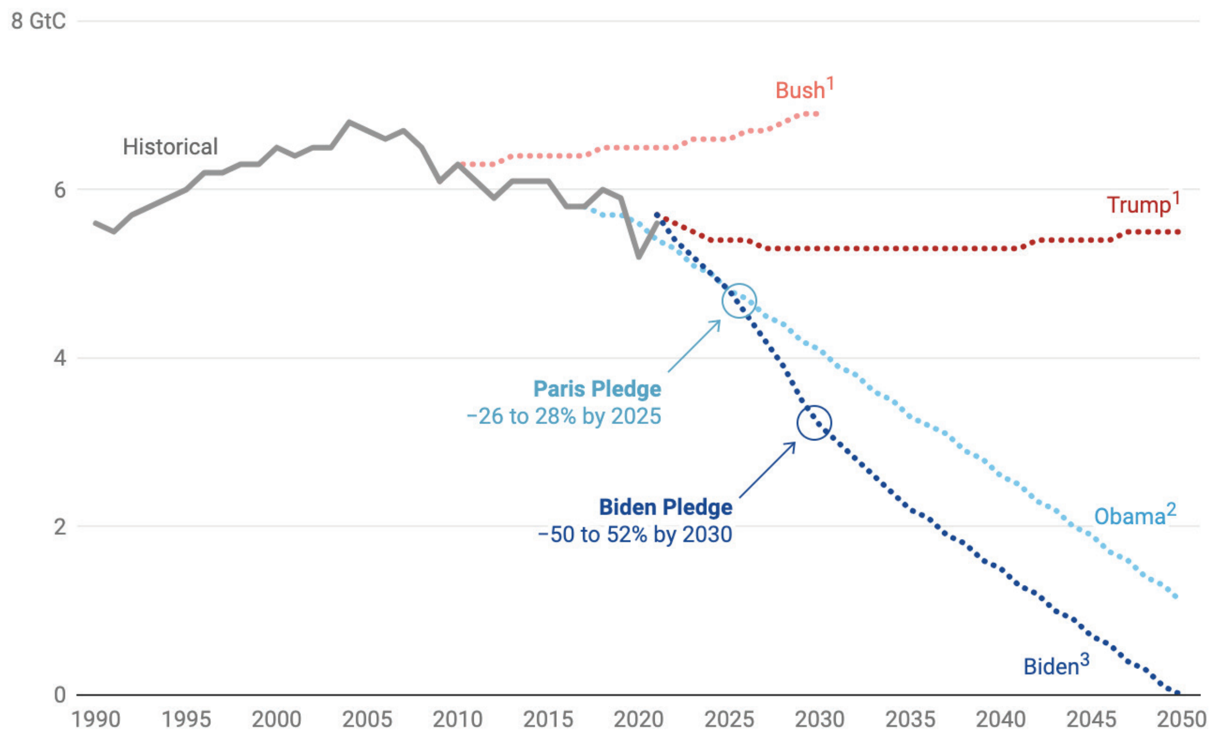
The Biden Administration's policy on LNG exports needs to comport with President Biden's commitments under the Paris Agreement to reduce the United States' greenhouse gas emissions by at least 26% by 2025 and 50% by 2030. LNG facilities that are currently under construction and approved will double the existing export capacity, and a single proposed project, Calcasieu Pass 2 (CP2) LNG in Louisiana, is estimated to emit 20 times the emissions of the recently approved Willow project, a massive oil development in Alaska (Gelles et al., 2023). According to a recent estimate, greenhouse gas emissions from LNG facilities—both those in operation and those currently being proposed—would emit the equivalent of 681 coal plants, or 548 million gasoline-powered cars, annually (Jealous, 2024).

An "all of the above" energy policy, and LNG development in particular, undermines the United States' Paris pledge and the current Administration's purported position as a global leader on climate change. The Administration's policy on LNG also must match its promises made under the Global Methane Pledge (GMP) of 2021. President Biden has taken initial steps to honor the GMP with a pause in the DOE's issuing of export licenses for LNG export terminals, announced January 26, 2024 (Lange, 2024). In considering whether to extend the pause indefinitely, a full accounting of life cycle methane and other planet-warming emissions from existing, approved, and proposed LNG development needs to be done.

Finalize the White House Council on Environmental Quality's National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change, and require its application to LNG licensing and environmental reviews

The White House Council on Environmental Quality (CEQ) released a draft/interim National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change in January 2023 (White House Council on Environmental Quality, 2023). As of March 2024, however, it had not yet been finalized. This needed guidance should be finalized so that agencies, FERC in particular, can adopt and implement it. The directive includes information on how to consistently quantify greenhouse gas emissions and account for their societal costs, that is, monetize their damages, in NEPA reviews (White House Council on Environmental Quality, 2023). It would also require accounting for projects' impacts on U.S. international climate commitments and making comparisons with substitutable projects, thereby informing the public and decision-makers of the trade-offs with and alternatives to LNG development. FERC should also issue supplemental environmental impact statements for all paused projects, such as CP2 LNG in Louisiana, using the new guidance. Such analyses are necessary for members of the public to judge for themselves whether LNG development serves the public interest.

Figure ES.12 Historical U.S. Annual Greenhouse Gas Pollution Levels and Projections Under Different Presidential Administrations, in Gigatons of Carbon Dioxide Equivalent, 1990–2050



[1] The Bush and Trump Administrations had no climate pollution reduction goals.

[2] The Obama Administration's goals required annual pollution reductions of 1.6% from 2016 to 2025.

[3] The Biden Administration's climate goals require annual pollution reductions of 6.0% from 2021 to 2030, indicating nearly four times more climate ambition than under President Obama.

Note: GtC = gigatons of carbon dioxide equivalent.

Source: Center for American Progress (2024).

Direct OMB and FERC to conduct a climate impact assessment of FERC's LNG licensing program

Under Executive Order 13990 (2021), Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis, the Office of Management and Budget (OMB) has been directed to work with agencies on programmatic climate impact assessments, beginning with measuring "baseline greenhouse gas emissions and [the] use the SC-GHG [social cost of greenhouse gases] to calculate the benefits and impacts of federal programs" (The White House, 2023). The White House should direct OMB and FERC to prioritize a climate impact assessment of FERC's LNG licensing program, including all existing, approved, and planned LNG projects in the United States and its territories.

Continue the pause on new LNG development until LNG impacts are comprehensively assessed and public interest determinations are made

The White House–directed pause on DOE licenses for LNG terminals exporting to non–free trade countries is a great stride in the right direction. The pause offers an opportunity to examine climate impacts such as the SC-GHG of LNG development, give due consideration to cleaner alternatives, assess cumulative impacts on frontline communities, and begin a transparent debate about whether LNG is in the public interest (Chang, 2024). The pause must remain in effect at least until a comprehensive climate impact assessment and public interest determinations are finalized. These reviews should also include input from the public as well as provide ample time for members of Congress to review them and comment. FERC should engage with the public by providing outreach and meetings in impacted EJ fenceline communities during the planning phases of an LNG climate impact assessment.

Fill FERC leadership roles with environmental justice champions

FERC currently has two vacant seats, and Commissioner Allison Clements, who is most aligned with EJ considerations, has announced she will not seek a second term (Morehouse, 2024). President Biden named Acting Chair Willie Phillips as chair in February 2024. Phillips has a more moderate record and tends to be inclined toward approving projects (Gardner, 2024). Due consideration and adherence to EJ principles in commission decision-making will occur only if EJ champions are appointed to leadership positions at FERC. Thus, vacancies need to be filled with people who understand EJ issues and support them.

Implement a rapid and just transition to clean energy

The transition from fossil fuel dependence to green energy must occur rapidly to reverse the climate emergency and the damage already exacted on our planet. It must also ensure environmental and energy justice for EJ communities that have been overlooked and overburdened by fossil fuel pollution for decades. This transition must also ensure universal access to affordable energy and focus on equitable measures so that public dollars for clean energy are not beneficial solely to wealthier and Whiter zip codes (Stamas, 2024). A just transition requires including EJ communities in the decision-making process and providing tools and resources for communities to shape their own clean energy future (Gaskin, 2024). The EPA's Environmental and Climate Justice Program, created by the Inflation Reduction Act, is one example of a program that needs to be expedited and run well. It "provides funding for financial and technical assistance to carry out environmental and climate justice activities to benefit underserved and overburdened communities" (U.S. Environmental Protection Agency, 2024). However, certain initiatives under the Bipartisan Infrastructure Law and the Inflation Reduction Act include significant funding for unproven and cost-inefficient solutions that will cause further harm, such as carbon capture and storage. These should be rolled back.

Department of Energy and Federal Energy Regulatory Commission

Recognize and confront fossil fuel racism

The DOE and FERC must recognize and confront past and present fossil fuel racism in Gulf Coast states, which is the result of systems of power and privilege that continue to protect and promote the production, processing, and distribution of fossil fuels at the expense of communities of color and less affluent communities—those who too often live in highly polluted, unsafe, and underserved sacrifice zones carved up by the fossil fuel and petrochemical industries (Donaghy et al., 2023). The DOE and FERC should acknowledge the systemic nature of fossil fuel racism and related institutional practices detailed in this report (see Chapters 2 and 3) and implement a policy prohibiting federal licenses for new fossil fuel facilities that will contribute to or reinforce discriminatory environmental burdens on communities of color. The DOE should go a step further and enact policies and programs that mitigate or remedy the environmental harms of LNG on historically and socially disadvantaged communities of color.

Prevent new sacrifice zones and additional environmental burdens in existing ones

Most U.S. LNG export facilities are clustered along the Gulf Coast amid communities predominantly of color and with low incomes. These communities have already been overburdened by existing fossil fuel industries and are also increasingly vulnerable to extreme weather events brought on by climate change. Overburdened communities, including ones at risk from climate-related hazards, should be protected from LNG development. Fenceline leaders that advocate for their communities have personal stories of health issues, displacement, and other harms from the presence of polluting industries. Yet their stories are overlooked as facilities continue to receive approval to build more infrastructure that further endangers these residents. The DOE and FERC should solicit and prioritize direct-from-community data in their permitting and licensing decisions (Federation of American Scientists, 2024).

Incorporate a more thorough cumulative impact assessment

Our cumulative impact study finds that the LNG industry poses significant harms and risks to vulnerable fenceline communities and to natural ecosystems that support local economies and cultural practices. FERC's NEPA reviews should incorporate cumulative impact assessments into environmental impact statements that provide more complete and accurate depictions of those harms and hazards. The commission has treated EJ, human health, and climate hazards with less importance than other environmental considerations, and this needs to change. FERC's cumulative impact assessment should examine existing environmental burdens as well as social and health vulnerabilities, including the health status of affected neighborhoods and the presence of populations susceptible to pollution, such as children, elderly, and those living in group homes. NEPA reviews also must carefully examine climate and other natural hazards.

Take community input seriously

The DOE and FERC should better incorporate community input throughout the permitting process. They should welcome and use direct-from-community information in the decision-making process. The process for community participation should ensure "procedural equity," that is, offer authentic community engagement (Minovi, 2024). Our review of years of environmental impact statements for LNG facilities turned up no clear examples of, or guidance for, FERC's use of public comments, community opposition, or EJ listening sessions to significantly alter permitting conditions—no matter how many public comments or how much testimony and community opposition. As it is being applied at FERC, the public comment process is merely a checkbox or rubber-stamping exercise, since it has little, if any, impact on the permitting outcomes.

Require improved EJ analysis in environmental reviews

The Natural Gas Act and NEPA stipulate that FERC conduct thorough environmental reviews for gas projects. However, FERC EJ analyses are inaccurate and unreliable. FERC uses outdated and inconsistent methods for identifying EJ communities and assessing potential EJ concerns. Therefore, FERC should establish new standards for conducting EJ analyses that are informed by federal guidance and technical documents, and that make use of established screening tools, such as EPA's EJScreen (White House Council on Environmental Quality, 1997; EPA, 2015). Such analysis should also employ health data from the CDC PLACES database. FERC should update its *Guidance Manual for Environmental Report Preparation* to require use of distance-based methods to define "affected areas," comparisons with multiple sites, and disaggregated reporting of data for people of color (e.g., by racial and ethnic subgroup) (Federal Energy Regulatory Commission, 2017). It should adopt a "most protective" standard of comparison like New Jersey's (New Jersey Department of Environmental Protection, 2022). FERC environmental reviews should provide evidence to support claims of job and economic benefits to areas most impacted by the pollution and the health and safety risks from LNG facilities, rather than making unfounded assumptions. FERC reviews should incorporate community voices and not speak for or on behalf of EJ communities about what is deemed acceptable (Bullard and Alston, 1990). Finally, FERC should provide training programs for its staff and project proponent contractors who conduct EJ analyses.

Adopt rigorous new standards for public interest determinations for LNG, and provide them for public input

The DOE should finalize its analysis to determine if LNG development is in the public interest. It should consider the cumulative impacts of LNG and the economic insecurity that it can cause due to rising energy bills. Special consideration should be given to the burden that rising domestic prices have on low-income communities. The DOE should also weigh the climate impact of LNG exports, including life cycle emissions and the social cost of carbon, as well as other ways that LNG buildout could harm the public interest in the short and long terms. Also, the DOE needs to provide transparency and verifiable standards when determining significant impacts. When defining public interest, the guidelines should include consideration of climate change, equity, and justice.

Pipeline and Hazardous Materials Safety Administration

Increase oversight of operations and update safety regulations

LNG growth has outpaced the development of new safety regulations by PHMSA. For example, LNG terminals operate under PHMSA rules adopted in 1980, well before the LNG import facilities were retrofitted for exporting (Soraghan & Lee, 2022). The risks are even greater today, since export facilities are much larger than in the past and use heavier hydrocarbons (Englund, 2021). A 2014 explosion in Plymouth, Washington, a 2018 leak at Sabine Pass LNG in Louisiana, and a 2022 explosion at Freeport LNG in Texas are prime examples of why these rules should be updated. PHMSA announced its intention to update the LNG regulations several times in the last decade but has failed to follow through. Meanwhile, PHMSA relies on the industry to do its own safety monitoring, and it allowed Freeport LNG, after an 8-month shutdown, to resume operations under these outdated rules (Somasekhar, 2023). Currently, LNG facilities are exempt from developing EPA risk management plans, and they are not required to provide their emergency response plans to the public (Havens, 2022). The risk of a catastrophic event from a major hurricane, tornado, or flood has not been adequately evaluated. It is long overdue that PHMSA assess those risks, update its safety rules accordingly, and conduct its own safety inspections.

Commission a National Academies study

PHMSA, with support from the DOE, should commission a National Academies study to assess the safety of and risks from LNG operations. Officially, the National Academies of Sciences, Engineering, and Medicine is a congressionally chartered organization that provides independent, objective analysis and advice to the nation, helps solve complex problems, and informs public policy decisions. The National Academies recently released a report about the safety of transporting LNG by rail and another report on pipeline safety (National Academies, 2021, 2024). LNG safety experts have warned for several years that regulators do not adequately consider the worst-case scenarios (Mandel, 2016). An independent study of LNG safety risks from the nation's leading scientists and engineers is warranted and long overdue. This type of study should be commissioned immediately, before any other projects are granted a license.

Conclusion

LNG development is a serious environmental and climate justice issue. LNG development poses a clear and present danger to communities of color and low-income communities in the Gulf South, which are already overburdened by pollution and environmental degradation from decades of oil and gas development and petrochemical industry operations. LNG development adds to the cumulative environmental impacts on fenceline communities by worsening air quality, damaging coastal ecosystems, and imposing unacceptable health and safety risks, both those inherent in the technology and those worsened by chronic operational failures and lax enforcement.

These risks are exacerbated by climate change and have not been adequately assessed by the federal government during permitting or afterwards. The global climate change impacts of LNG are significant, have long-term implications, and are an important part of the cumulative impacts of LNG. However, the climate change implications of LNG—the costs of LNG carbon emissions and the distribution of those costs—have not been assessed or taken into account in federal decision-making on LNG. This omission runs counter to the Biden Administration's national and international commitments to address climate change.

Federal agencies responsible for regulation and oversight of LNG—particularly FERC, PHMSA, and the DOE—have much work to do to ensure environmental justice. They need to provide meaningful participation for affected communities during the environmental review and licensing processes. They need to conduct better EJ analyses. They need to fully assess and give due consideration to the cumulative impacts of LNG. They need to update safety regulations based on hazard assessments of LNG facilities in light of climate change and the expectation of more severe storms and associated flood hazards. The DOE needs to complete a public interest determination that takes environmental and energy justice, climate change—incorporating the social cost of carbon—and cumulative impacts seriously. Finally, Congress needs to monitor these efforts and must be prepared to step in to curtail the unchecked buildout of LNG infrastructure to protect the public interest.

Our cumulative impact assessment strongly suggests that LNG development is not in the national interest. It is most certainly not in the interest of EJ fenceline communities in the Gulf South, and it delays the necessary transition away from fossil fuels.

Chapter 1: Introduction

Despite significant improvements in environmental protections over the decades, millions of Americans still live in unsafe and unhealthy physical environments—places worsened and threatened by discriminatory land use and unfair permitting and industrial facilities. Our nation is not that far removed from decades-old practices of "dumping" pollution in communities inhabited by people of color and the poor, and even today, federal agencies continue to sanction permitting guidelines that push such facilities along the "path of least resistance" —into people of color and low-income communities.

It is no coincidence that the southern United States is the birthplace of both the modern Civil Rights Movement and the Environmental Justice Movement. The South is dramatically different from the rest of the country. The region has a unique history like no other part of the country—a legacy of slavery, Jim Crow segregation, racist land use planning and zoning codified in law, fierce resistance to civil rights and equal justice for all of its citizens, lax enforcement of environmental regulations, and aggressive tax breaks and "corporate welfare" programs that place profits over people (Bullard, 1990).

Environmental justice leaders early in the movement confronted environmental racism and waged a frontal assault on other systems that create and maintain inequality (Bullard, 1993a). Systemic racism has been and continues to be a major part of the American sociopolitical system. As a result, people of color find themselves at a disadvantage when it comes to environmental protections. Environmental racism is the culprit that creates separate and unequal outdoor built environments for people of color and for Whites. Environmental racism refers to "any policy, practice, or directive that differentially affects or disadvantages (whether intended or unintended) individuals, groups, or communities based on race or color" (Bullard, 1990, p. 98). Environmental racism combines with public policies and industry practices to provide benefits for Whites while shifting costs to people of color and is reinforced by government, legal, economic, political, and military institutions (Bullard 1993b).

The battle lines were drawn in "people versus pollution" conflicts decades ago in Louisiana and Texas—the leading oil-and-gas-producing states. Because people of color in these two states were subject to rigid segregation and often relegated to the "wrong side of the tracks"—or highway, river, or levee—they generally received less protection and more environmental pollution threats from the petrochemical industry (Bullard et al., 2011; Bullard & Wright, 2012).

The fight for environmental and climate justice is also a fight for economic justice. Louisiana and Texas provided fertile ground for "look-the-other-way" environmental policies. The two states are also known for aggressive corporate welfare giveaway tax breaks to the petrochemical industry (Burnett, 2023; Kelly, 2018). Studies show that ending giveaway tax breaks and industrial tax exemptions has not harmed local economies but actually brought in millions of dollars in new tax revenue (Muller, 2022; Sanzillo, 2022).

Lax enforcement of environmental regulations left the Gulf Coast region's air, water, and land one of the most industry-befouled in the nation. This pattern was uncovered in *Dumping in Dixie: Race, Class, and Environmental Quality* more than three decades ago (Bullard, 1990) and in *Unequal Protection: Environmental Justice and Communities of Color* (Bullard, 1994b).

All levels of government have failed our most vulnerable and at-risk communities. Government permitting agencies for the most part have managed, regulated, and distributed risks and normalized pushing pollution into poor and people of color communities (Bullard, 2005; Bullard et al., 2011, pp. 15–50; Bullard & Wright, 2012).

The common denominator in many of the environmental justice conflicts in the Gulf Coast region involves oil and gas and petrochemical facility permitting, siting, and operation. Communities of color and poor communities suffered the fate of becoming de facto pollution dumping grounds pre-1970, before the federal Environmental Protection Agency (EPA) was created and before major environmental regulations were put in place (Bullard, 2021). Ironically, many of these same communities continue to be targeted and dumped on after enactment of federal laws regulating permitting. The dumping of pollution did not stop—it was now regulated. Generally, fenceline communities do not vote or elect to be dumped on by waste facilities, oil and gas operations, chemical plants, and refineries.

And too often, land use decision-making encourages "clustering" of industrial facilities, creating an unlevel playing field for communities that already have multiple polluting facilities, making it easier to get another facility (Mohai and Saha, 2015b). Assessing the cumulative impacts has been a top priority of the environmental justice movement and overburdened communities for decades (Ellickson, 2022). Advocates have called for assessing cumulative impacts and the interplay between sociodemographic, environmental, and public health factors in the permitting of industrial facilities in environmental justice communities (Baptista et al., 2022).

Generally, government permitting has been slow to formalize cumulative impacts into rules, regulations, and decision-making. The EPA first developed guidelines on assessing cumulative impacts in 2003 in its *Framework for Cumulative Risk Assessment* (U.S. EPA, 2003). However, there is no standard guidance on how to conduct a cumulative impact assessment. In 2022, the EPA developed a draft cumulative impacts white paper after consulting its own program representatives and state, tribe, and community representatives, as well as previous cumulative impact recommendations from the National Environmental Justice Advisory Committee and the White House Environmental Justice Advisory Committee. The draft white paper was also reviewed internally by Office of Research and Development senior leadership as well as staff across EPA programs and regions (U.S. EPA, 2022a, p. i). In April 2022, the EPA's Office of General Counsel published *EPA Legal Tools to Advance Environmental Justice* (2022c), and in January 2023 it released *EPA Legal Tools to Advance Environmental Justice: Cumulative Impacts Addendum,* a collection of examples that the Agency's legal authorities might use to identify and address cumulative impacts through permitting, regulations, and grants in support of overburdened communities (U.S. EPA, 2023c).

In August 2022, the Centers for Disease Control and Prevention's Agency for Toxic Substances and Disease Registry released its Environmental Justice Index, which ranks each census tract in the nation on 36 environmental, social, and health factors compiled in a national environmental burden index. By taking into account social vulnerabilities and health susceptibilities to pollution, this index can be used as a tool to develop and evaluate public health interventions (Owusu et al., 2022). The Environmental Justice Index is also capable of identifying highly burdened census tracts in rural and urban areas.

Not having clear national laws and regulations on cumulative impact has allowed the Gulf Coast's poor communities and communities of color to become environmental "sacrifice zones" and pollution "hot spots" where residents live immediately adjacent to industries (Batson, 2022; Bullard, 2011; Danta, 2010; Johnston et al., 2020; Lerner, 2011; Moore, 2022; Singer, 2011; Union of Concerned Scientists & Texas Environmental Justice Advocacy Services, 2016).

A "toxic tour" of parishes along the Louisiana River gives one a clear picture of mostly Black residents living closest to the petrochemical plants along the 85-mile stretch of the winding Mississippi River from Baton Rouge to New Orleans—often referred to as the Louisiana Chemical Corridor or "Cancer Alley." This chemical corridor is the country's largest hot spot for toxic air and cancer risk (O'Leary, 2022) and has household poverty that is higher than the national average (Misick, 2022).

Poor neighborhoods with high levels of air pollution accounted for about 85 new cancer cases per year, according to a 2022 study (Misick, 2022). The average annual cancer rate in the state's poor neighborhoods with high levels of air pollution is 502 cases per 100,000 people, compared with the state's average of 480 cases per 100,000 people. Many of these cancer cases could be prevented by reducing pollution in sacrifice zone neighborhoods (O'Leary, 2022).

Similar environmental health threats exist for communities found adjacent to the 52-mile Houston Ship Channel (Houston Health Department, 2019; Lam et al., 2021; Miller et al., 2020; One Breath Partnership, 2021; U.S. Army Corps of Engineers, 2015), adjacent to "Refinery Row" in Corpus Christi (Lange, 2018), and in Port Arthur, Texas (Environmental Integrity Project, 2017). The Motiva plant in the West Port Arthur community is the largest oil refinery in North America. Yet Port Arthur is the poorest city in Texas (The Center Square, 2021). Where's the economic boom and prosperity? It's definitely not in Port Arthur.

The long-standing health threats that petrochemical plant pollution poses hit Black, Hispanic, and Indigenous communities hardest. These disparities were brought to light in ProPublica's *Poison in the Air* reporting on more than a thousand hot spots with cancer-causing air (Kofman & Song, 2022). Once again, the South stands out—but not in a good way. Almost all of the 20 hot spots with the highest levels of excess risk are in Southern states known for pro-business and anti-environmental regulations. A quarter of the top 20 worst hot spots are in Texas. Residents in census tracts where people of color make up the majority experience about 40% more cancer-causing industrial air pollution on average than tracts where the residents are mostly White. In predominantly Black census tracts, the estimated cancer risk from toxic air pollution is more than double that of majority-White tracts (Younes et al., 2021).

EPA administrator Michael Regan's "Journey to Justice" tour across the Gulf Coast in November 2021 made a stop in Louisiana's petrochemical corridor—also known as Cancer Alley. Administrator Regan also toured Houston communities to get an up-close, firsthand view of the pollution problems experienced by residents living on the fence line with petrochemical plants that line the Houston Ship Channel. The tours and deliberations with local environmental justice community leaders prompted the EPA administrator to launch a new Pollution Accountability Team to combat pollution hot spots that hit people of color and poor residents hardest (Baurick et al., 2019; Kofman & Song, 2022; Parker & Russell, 2021).

In January 2021, President Biden signed Executive Order 13985, "Advancing Racial Equity and Support for Underserved Communities Through the Federal Government," and Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad"—two executive orders designed to advance racial equity and support environmental and climate justice in underserved and overburdened communities (Exec. Order No. 13985, 2021; Exec. Order No. 14008, 2021). These two documents provide a framework for stimulating action across the federal government to address the cumulative impact of disproportionate exposures to pollution and environmental degradation that are exacerbated by racial, economic, and geographic factors and climate change (U.S. EPA, 2022a). The EPA defines *cumulative impact assessment* as "a process of evaluating both quantitative and qualitative data representing cumulative impacts to inform a decision" (U.S. EPA, 2022a, p, vii).

Communities do not become pollution dumping grounds, hot spots, sacrifice zones, or cancer alleys by accident or by choice. They are created from the interplay of government policy, planning, and finance—all factors that influence land uses, permitting, and facility siting (Mohai & Saha, 2015a). The end result is the concentration of polluting industries in people of color communities. Historical redlining is also implicated in segregating people and pollution. Racial redlining and discriminatory land use planning and infrastructure investments create "separate and unequal" communities whose residents receive unequal protection and where a proliferation of locally unwanted land uses—including petrochemical plants, refineries, and other oil and gas industries—spew toxins into residents' homes, schools, parks and playgrounds, and neighborhoods (Lane et al., 2022).

These findings clearly demonstrate an urgent need for building cumulative impact assessment into permitting and environmental protection at the state and federal levels. However, states have been slow to act on cumulative impact assessment. New Jersey in September 2020 became the first state to pass a cumulative impact environmental justice law. New Jersey's Environmental Justice Law requires its Department of Environmental Protection to evaluate the environmental and public health impacts of facilities on overburdened communities when reviewing permit applications (New Jersey Department of Environmental Protection, 2020).

New York passed a state cumulative impact law in December 2022, becoming the second state requiring assessment of cumulative impacts affecting environmental justice communities before an environmental permit is issued or renewed (Schowalter & Rochlin, 2022). Neither Texas nor Louisiana has a cumulative impact law or an environmental justice law, yet these are the states that need them the most given the heavy pollution burden borne by communities located on the fence line of oil and gas industries, refineries, and petrochemical plants. The externalities of living next to fossil fuel facilities are not evenly spread in our society. Low-income communities and communities of color bear the brunt of oil and gas's negative impacts—creating environmental, climate, energy, economic, health, and racial justice concerns (Donaghy & Jiang, 2021).

A case in point is the rapid build-out of liquefied natural gas (LNG) export terminals in the Gulf Coast, especially in Texas and Louisiana, facilitated by Federal Energy Regulatory Commission (FERC) permitting policies that fail to seriously take environmental justice into account, a pattern documented more than three decades ago (Rozansky, 2022). FERC continues approving fossil fuel projects with little to no regard for systemic injustices. In March 2023, FERC unanimously approved four new gas projects. FERC's acting chair, Willie Phillips, explained that his goal is to get methane gas projects like these built (Osborne, 2023). Thus, the commission offers little more than pleasantries with regard to justice and equity as it races to approve more polluting facilities in Black, Indigenous, Latino, and other communities of color across the country. Nothing has changed. Frontline communities are still being sacrificed.

In March 2022, FERC proposed rules and guidance requiring the commission to consider new gas projects' effects on climate change and environmental justice. The effort barely lasted a month, as FERC caved to the fossil fuel industry and withdrew both (Phillips & Pager, 2022). FERC's quick retreat and silence since then speaks volumes about its commitment to justice. In a move to deflect public criticism, FERC hosted an Environmental Justice Roundtable in March 2023 "to better incorporate environmental justice and equity considerations into its decisions" (Federal Energy Regulatory Commission, 2023, para. 4). But the fact that the fossil fuel industry had almost as many participants as frontline communities reinforced the unlevel playing field between community and industry. FERC appointed the American Petroleum Institute and Cheniere Energy (one of the largest producers of methane gas in the world) as roundtable members. The fossil fuel industry has caused many of the environmental injustices in our country. True environmental justice would mean holding the industry accountable for treating fenceline communities as expendable sacrifice zones (Ward, 2021).

FERC refuses to acknowledge that our country is segregated, as is the fossil fuel industry's "bootprint." Race and class are tied to fossil fuel pollution, unequal protection, and vulnerability. Reducing environmental, health, economic, and racial disparities must be a real priority and not just empty words. FERC's failures over the years reveal that environmental justice is not embedded in FERC's decision-making. It is an afterthought or worse; it is a performance aimed at giving the appearance that FERC is rectifying its decades-long exacerbation of systemic racism and economic disenfranchisement.

Communities of color and low-income communities have long felt the adverse impacts of the fossil fuel industry and the climate crisis it has caused. However, most of those communities don't have a seat at FERC's Environmental Justice Roundtable even though roughly 20 new or expanded gas export facilities are slated to come online in communities across the Gulf Coast within the next decade.

In the city of Lake Charles, Louisiana, where roughly half of the 80,000 residents are Black, there are more than two dozen fossil fuel and petrochemical companies, including seven of Louisiana's worst polluters (Costley, 2023). The gas industry wants to build four new gas export terminals within roughly 5 miles of one another. And, true to form, in late 2022 FERC commissioners unanimously approved one of those gas export terminals despite the adverse climate and environmental justice impacts (Drane, 2022b).

Across the state border, Port Arthur, Texas, yields the highest rate of cancer risk caused by industrial air pollution in the United States—the air pollution emitted there is 190 times the EPA's acceptable risk (Shaw & Younes, 2021). The cancer mortality rate for Black people in the surrounding county is about 40% higher than the state rate (Greene & Kelderman, 2017). Undaunted, the fossil fuel industry plans to make Port Arthur one of the nation's largest gas export hubs in the country. In March 2023, a gas company announced it had reached final investment on one of the gas export terminals FERC approved (Kumar, 2023).

If FERC were taking environmental justice seriously, it would stop approving export gas projects immediately, once and for all. Federal energy regulators are making decisions about the future of fenceline communities and the well-being of the planet. Justice demands that they listen directly to, and learn from, the communities most impacted by their decisions.

Why an Environmental Justice LNG Export Terminal Study

In 2022, the United States became the world's number one exporter of liquefied natural gas, or LNG (Kusnetz, 2023). This milestone was reached despite the Biden administration's climate goals for reducing greenhouse gas emissions under the Inflation Reduction Act of 2022. The LNG industry output is expected to increase, not decrease. Increased domestic production of methane from shale formations (i.e., fracking) has led to a proliferation of proposals for LNG export terminals. LNG export projects are clustered in Louisiana and Texas—the epicenter of the proposed LNG export build-out. In *Gas Run Aground*, many of the proposed LNG terminals were found to be "sited in or near communities that are already facing compounding problems due to disasters, the long-ingrained impacts of systemic racism, and petrochemical facilities" (Rozansky, 2022, pp. 22–23).

Donaghy and Jiang (2021), in *Fossil Fuel Racism,* summarized the environmental, climate, and health benefits of stamping out racism and moving away from oil and gas:

> Tackling this fossil fuel racism would go a long way to address our present overlapping crises and correct the injustices that historically targeted communities have faced. A fossil

> fuel phaseout—an immediate halt to new extraction and infrastructure build-out and managed wind-down of existing production that prioritizes the needs of affected workers and communities—is necessary to end fossil fuel racism and fully address the public health, racial injustice, and climate crises. (p. 1)

The proliferation of LNG export terminal projects proposed for the Gulf Coast has set off environmental justice alarms—especially in Louisiana and Texas environmental justice communities. The Bullard Center for Environmental and Climate Justice at Texas Southern University was asked to assemble a team of researchers to examine the environmental justice implications of proposed and existing LNG projects.

Our report analyzes the fairness and adequacy of LNG export terminal siting decisions and approval processes, as well as community vulnerabilities and environmental and health impacts associated with LNG construction and operations. Our goals are to assist legal challenges and administrative appeals, support community action, inform FERC environmental review processes, and provide a set of federal policy recommendations to achieve environmental and climate justice goals.

Organization of the Report

This report is divided into seven chapters. Following this introductory chapter, Chapter 2 provides historical context of community struggles against fossil fuel pollution by providing an overview of the environmental justice movement, grassroots mobilization, and the fight against environmental racism. It also details gains made over the decades in getting the government to provide equal protection and equal enforcement of environmental laws and regulations to address the unequal burden borne by people of color communities and poor communities.

Chapter 3 examines the growth of the petrochemical industry in the U.S. Gulf Coast and the health, economic, and environmental impacts on the communities in which the industry is located—as well as the factors that contribute to heightened vulnerability. It also traces the decades-long application of an economic model and racial dynamics that concentrated petrochemical facilities near poor, mostly Black and Latino communities. Finally, the chapter examines how the more recent permitting, build-out, and operations of LNG export terminals in Louisiana and Texas continue the decades-old pattern of environmental injustice and environmental racism—stealing residents' transformative wealth (home and property values) and their health and well-being (elevated environmental health disparities). The blatant targeting of oil and gas projects in the Gulf Coast helped Louisiana and Texas become the epicenter for LNG projects and environmental justice, climate justice, and energy justice resistance in the Gulf South.

Chapter 4 provides a review of federal environmental justice guidelines and recommendations for conducting environmental justice analyses as well as best practices and review standards widely accepted in government and academia. Using a sample of six Gulf Coast LNG export terminals, those standards are then applied to critique environmental justice analyses conducted by FERC as part of federal environmental review and approval processes. Chapter 4 also examines the extent to which FERC considers cumulative impacts and concludes with 10 recommendations—policies and best practices that FERC should adopt to address shortcomings with its environmental justice and cumulative impact reviews under the National Environmental Policy Act.

Chapter 5 presents a cumulative environmental impact assessment for the same six LNG export facilities in Louisiana and Texas. Informed by relevant government reports and academic literature, a cumulative impact assessment (CIA) framework was developed and applied. It consists of an examination of (1) existing environmental pollution burdens in LNG fenceline communities; (2) existing social and health vulnerabilities, including a quantitative Environmental Justice analysis that uses rigorous distance-based methods; (3) environmental impacts of LNG facilities from their construction and operation, including impacts to soils and vegetation, water resources, wetlands, wildlife and fisheries, special status species, and air quality; (4) LNG health and safety risks, including those associated with climate change and extreme weather events; and (5) LNG climate impacts. In addition to using peer-reviewed studies, nongovernmental organization reports, and news stories, our CIA employs readily available government data sources that are not used in FERC environmental reviews, such as the U.S. EPA's Environmental Justice Screening Tool, EJScreen. The scope of the CIA primarily covers LNG export terminals, not the impacts of gas wells and pipelines that supply them or the carbon emissions of transportation and the consumer end of LNG. Although the cumulative impacts cataloged in Chapter 5 represent only part of LNG infrastructure, they are nevertheless vast and significant and also highlight the inadequacies of FERC's cumulative impacts assessments.

Chapter 6 provides highlights of public opposition and community concerns and a summary of oil, gas, and LNG litigation. It also presents two case studies that explore public concerns surrounding an operating LNG export terminal in Freeport, Texas, and an LNG export terminal in Plaquemines Parish, Louisiana, which is currently under construction. The cases were informed through site visits and interviews, which provide qualitative information on the human impacts of LNG development. The case studies illustrate how state and federal agencies ignored the concerns of LNG fenceline communities and describe how they, along with allied organizations, have worked to have their voices heard in LNG siting and permitting decisions.

Finally, Chapter 7 provides findings, conclusions, and actionable policy recommendations for FERC and other government regulators charged with permitting LNG export terminals and other petrochemical projects—with the goal of ensuring environmental and climate justice and equal protection and a just transition to a carbon-free economy.

Chapter 2: Evolution of the Environmental Justice Movement Over the Decades: From a Footnote to a Headline

Industrial pollution in the United States has followed the "path of least resistance," allowing neighborhoods that are home to low-income people and people of color to become environmental "sacrifice zones" and the "dumping grounds" for all kinds of health-threatening operations such as landfills, garbage dumps, incinerators, smelters, oil and gas pipelines, petrochemical plants, refineries, and a host of other noxious facilities (Bullard, 2000).

This chapter traces the foundation and early roots of the environmental justice movement in order to understand the contemporary struggles frontline communities are waging to protect their residents from the dangers of living near petrochemical plants. It also explores how the environmental justice framework has redefined environmentalism as practiced in the United States and challenged institutional racism and the dominant environmental protection paradigm.

The environmental justice movement emerged out of anti-racism struggles. The environmental justice framework rests on developing tools and strategies to eliminate unfair, unjust, and inequitable conditions and decisions. It also attempts to uncover the underlying assumptions that contribute to and produce inequality, including differences in exposure and treatment, as well as unequal protection. The framework brings to the surface the ethical, moral, and political questions of who gets what, when, why, and how much.

Environmental Justice Rooted in Civil Rights

The environmental justice movement has its roots in civil rights (Bryant & Hockman, 2005). The modern-day U.S. civil rights movement waged a frontal assault on various forms of structural racism that penetrated the daily lives of African Americans and other people of color in every institution in American society—from voting, housing, and education to employment, transportation, and public accommodations. Protesters—young and old—were beaten, hosed with water cannons, attacked with vicious police dogs, harassed, jailed, and some killed in their quest for justice and equal treatment. Yet they persisted in their intergenerational marathon quest (not a sprint) for equal justice.

Dr. Martin Luther King Jr. went to Memphis, Tennessee, in April 1968 on an environmental, economic, and racial justice mission—to support the 1,300 striking Black sanitation workers from Local 1733. The strike shut down garbage collection and sewer, water, and street maintenance. The Memphis struggle was much more than a garbage strike. Black sanitation workers were on strike because of unequal pay, discriminatory labor practices, and unsafe working conditions that resulted in disproportionately high numbers of injuries and deaths among the workers. They were also striking to be treated as men—with the same dignity and respect accorded White city workers (Honey, 2008).

Memphis was Dr. King's "last campaign." He was assassinated on April 4, 1968. Dr. King's legacy lives on even to this day and is an integral part of anti-racism movements around jobs, the environment, climate, health, transportation, land use, smart growth, and energy.

Environmental Justice in the 1970s and 1980s

A decade after Dr. King's death, garbage was the center of another civil rights struggle in Houston, Texas, where Black homeowners in 1979 took on a fight against the permitting and siting of a municipal landfill in a mostly Black middle-class suburban community. Residents and their attorney, Linda McKeever Bullard, filed *Bean v. Southwestern Waste Management Inc.*, the nation's first lawsuit challenging environmental racism using civil rights law (Bullard, 1983).

The Houston solid waste study used in *Bean v. Southwestern Waste Management* uncovered glaring waste facility permitting and siting disparities in the nation's fourth-largest city. The study found that five of five (100%) Houston-owned landfills and six of eight (75%) city-owned incinerators were located in Black neighborhoods, three of four (75%) privately owned landfills were located in Black neighborhoods, and more than 82% of waste disposed in Houston went to mostly Black neighborhoods, even though Blacks made up only 25% of the city's population. Although these statistics were startling, they were not sufficient to prove "intent" in federal court, and the landfill was built in 1979.

The *Bean* case was important for developing the legal theory of environmental justice as a civil rights issue, and the Houston case study laid the foundation for research mapping (before geographic information systems [GISs]) of waste facility siting by race and poverty status. These important milestones occurred in 1979, before there was an environmental justice movement.

The national environmental justice movement in the United States was born in mostly African American, rural, and poor Warren County, North Carolina, in the early 1980s after the state made the decision to dispose of 30,000 cubic yards of illegally dumped soil contaminated with polychlorinated biphenyls (PCBs) in the tiny town of Afton (Bullard, 2000). The PCB landfill was forced on the tiny Afton community—more than 84% of the community was Black in 1982—helping trigger the national environmental justice movement.

Protests ensued—resulting in more than 500 arrests. The hazardous waste landfill later became the most recognized symbol of environmental injustice in the country. Despite the stigma, Warren County also became a symbol of the environmental justice movement. By 1993, the facility was failing, with 13 feet of water trapped in the landfill (Exchange Project, 2006). And for a decade community leaders pressed the state to clean up the leaky landfill site.

The Warren County PCB landfill site was not geologically the most suitable because the water table at the landfill is very shallow, only 5 to 10 feet below the surface, and is where the residents of the community get their drinking water from local wells. Even the head of the Environmental Protection Agency's (EPA's) hazardous waste implementation branch at the time, William Sanjour, questioned the siting decision. The decision made more political sense than environmental sense (United Press International, 1982). In the end, the siting decision was less about the science of toxicology or hydrology, and more about political science and sociology. While the "midnight dumpers" were fined and jailed, the innocent Afton community was handed a 21-year sentence of living in a toxic-waste prison (McGurty, 2007, p. 4).

The Warren County protests provided the impetus for a 1983 U.S. Government Accountability Office (GAO) study: *Siting of Hazardous Waste Landfills and Their Correlation with Racial and Economic Status of Surrounding Communities* (U.S. GAO, 1983). That study found that three out of four of the off-site, commercial hazardous waste landfills in EPA Region 4 (which includes Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee) happened to be located in predominantly African American communities, although African Americans made up only 20% of the region's population. More importantly, the protesters put "environmental racism" on the map.

The disturbing findings from the GAO report led Dr. Benjamin Chavis of the United Church of Christ Commission for Racial Justice to produce a national study on race and waste. And in 1987, the Commission for Racial Justice released its study *Toxic Wastes and Race in the United States* (United Church of Christ, 1987). The Warren County protests provided the impetus for this report, the first national study to correlate waste facility sites and demographic characteristics (Commission for Racial Justice, 1987). The 1987 report found race to be the most significant variable in predicting where hazardous waste facilities were located—more powerful than household income, the value of homes, and the estimated amount of hazardous waste generated by industry. The *Toxic Wastes and Race* study was revisited in 1994 and 2007. The 1994 update found people of color were 47% more likely to live near a hazardous waste facility than White Americans (Goldman & Fitton, 1994). In *Toxic Wastes and Race at Twenty: 1987–2007*, 56% of the residents living within a 3-kilometer radius of the nation's permitted hazardous waste facilities were people of color; people of color made up 69% of the residents living near two or more permitted hazardous waste sites; and race was still the most powerful predictor of where permitted hazardous waste facilities were located (Bullard et al., 2007).

Environmental Justice Research and Movement Building—the 1990s

In 1990, *Dumping in Dixie: Race, Class, and Environmental Quality* was the first book to chronicle environmental injustice, environmental racism, and the convergence of two major movements—the civil rights and environmental movements—into the environmental justice movement

(Bullard, 1990). The book also highlighted African American environmental activism in the South, the same region that gave birth to the modern civil rights movement. *Dumping in Dixie* documented the racial dynamics involved in the location and permitting of municipal landfills, hazardous waste sites, incinerators, lead smelters, refineries, and chemical plants. The book provided clear examples of "Environmental Racism 101" and was adopted as a textbook by dozens of U.S. colleges and universities.

The grassroots environmental justice movement began to grow and come into its own in the early 1990s. The impetus for this growth centered around grassroots activism, the redefinition of environmental rights and civil rights, alliances and coalitions, community-driven research, forums and conferences, and the First National People of Color Environmental Leadership Summit held in October 1991. The summit was attended by more than 1,000 individuals from every U.S. state and at least a half dozen foreign countries. Summit delegates adopted the 17 Principles of Environmental Justice (*The Principles of Environmental Justice,* 1991). By the time the June 1992 United Nations Rio Earth Summit started, the Principles of Environmental Justice had been distributed and translated into a half dozen languages.

The federal EPA took action on environmental justice concerns in 1990 only after extensive prodding from grassroots environmental justice activists, educators, and academics who called themselves the "Michigan Group," named for environmental justice leaders who wrote letters and were successful in meeting with EPA administrator William Reilly and his senior staff.

These meetings resulted in some key first steps in advancing environmental justice at the EPA, including the creation of the Office of Environmental Equity. And in 1992, under the George H. W. Bush administration, the EPA published *Environmental Equity: Reducing Risk for All Communities,* one of the first federal reports to acknowledge the fact that people of color and low-income populations shouldered greater environmental health risks than society as a whole (U.S. EPA, 1992). The U.S. EPA (1998) defined *environmental justice* as 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, including racial, ethnic, or socio-economic groups should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies. (p. 2)

The EPA did not invent environmental justice. Environmental justice leaders had their own definition of the term. Environmental justice embraces the principle that all people and communities are entitled to equal protection under our laws relating to the environment, health, employment, education, housing, transportation, and civil rights (Bullard, 1993a). For decades, hundreds of communities across the nation used a variety of tactics to confront environmental injustice (Agyeman et al., 2003; Bullard, 1987, 1990, 1993a, 1994a, 2000, 2007; Bullard et al., 2004).

Much of the environmental justice mobilization in the 1990s was still at the community, city, county, and state level. However, environmental justice eventually reached the White House. In 1994, President William J. Clinton issued the executive order "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (Exec. Order No. 12898, 1994). This policy attempted to address environmental injustice within existing federal laws and regulations. It also reinforced Title VI of the Civil Rights Act of 1964, which prohibits discriminatory practices in programs receiving federal funds, and put the spotlight back on the National Environmental Policy Act (NEPA), a law that set policy goals for the protection, maintenance, and enhancement of the environment. NEPA's goal is to ensure for all Americans a safe, healthful, productive, and aesthetically and culturally pleasing environment. NEPA requires federal agencies to prepare a detailed statement on the environmental effects of proposed federal actions that significantly affect the quality of human health.

The 1994 executive order called for improved methodologies for assessing and mitigating impacts, assessing health effects from multiple and cumulative exposures, collecting data on low-income and minority populations that may be disproportionately at risk, and assessing impacts on subsistence fishers and consumers of wild game. It also encouraged participation of the impacted populations in the various phases of assessing impacts—including scoping, data gathering, considering alternatives, analysis, mitigation, and monitoring. Present at the executive order signing in the Oval Office of the White House were cabinet officials, four members of Congress, four grassroots environmental justice leaders, a lawyer, and two sociologists.

In 1999, environmental justice leaders were successful in getting the National Academy of Sciences Institute of Medicine to examine environmental justice and health in the United States. The resulting study concluded that government, public health officials, and the medical and scientific communities need to place a higher value on the problems and concerns of environmental justice communities (Institute of Medicine, 1999). The study also confirmed what most environmental justice leaders and communities have known for decades: Communities of color and low-income communities are exposed to higher levels of pollution than the rest of the nation, and they experience certain diseases in greater numbers than more affluent, White communities.

In the United States, all communities are not created equal. If a community happens to be poor, working class, or inhabited largely by people of color, it generally receives less protection. Historically, exploitation of land and exploitation of people are highly correlated. Environmental decision-making operates at the juncture of science, economics, politics, special interests, and ethics. Environmental justice leaders were seeking to prevent environmental threats before they occurred (Bullard, 1993b, pp. 319–335). On the other hand, the federal EPA manages, regulates, and distributes risks (Bullard et al., 2011, pp. 15–50).

The environmental justice framework challenges the dominant environmental protection paradigm that largely institutionalizes unequal enforcement; trades human health for profit; places the burden of proof on the "victims" and not the polluting industry; legitimates human exposure to harmful chemicals, pesticides, and hazardous substances; promotes "risky" technologies; exploits the vulnerability of economically and politically disenfranchised communities; subsidizes ecological destruction; creates an industry around risk assessment and risk management; delays cleanup actions; and fails to develop pollution prevention as the overarching and dominant strategy (Bullard, 1994a).

Growing grassroots community resistance emerged in response to practices, policies, and conditions that residents judged to be unjust, unfair, and illegal. Environmental justice leaders were demanding that the EPA provide equal protection for all and enforce the laws and regulations regardless of race, color, national origin, or income. They were demanding an end to environmental racism—racial discrimination in the application of environmental laws and regulations.

The EPA is mandated to enforce the nation's environmental laws and regulations equally across the board (Collins, 2005). It is also required to protect all persons who live in the United States, not just individuals or groups who can afford lawyers, lobbyists, and experts. Environmental protection is a right, not a privilege reserved for a few who have the means to "vote with their feet" and escape or fend off environmental stressors (Bullard, 2005, p. 20).

Most Americans do not live, work, play, or attend schools next door to petrochemical plants, refineries, or liquefied natural gas terminals. Nevertheless, residents who do live adjacent to such polluting industries constitute a special population that deserves special attention. These industrial facilities are not randomly scattered across the American landscape. They are often clustered in industrial sacrifice zones (Lerner, 2011). However, many are located in or adjacent to residential areas—many with no buffer except for metal chain-link fences. One need not be a rocket scientist to know chain-link fences do not block health-threatening pollution from reaching nearby residents.

Companies operating industrial facilities are required to obtain permits from state and sometimes federal environmental agencies, and conform to local land use regulations. However, even when operated according to accepted specifications, industrial facilities can have adverse impacts on nearby residents when leaks, explosions, and accidents occur. Indeed, industrial facilities, in some cases, have posed serious safety risks to health, property, and quality of life (Baibergenova et al., 2003; Bullard et al., 2008; Dolk et al., 1998; Edelstein, 2004; Elliot et al., 1993; Fielder et al., 2000; Gerschwind et al., 1992; Nelson et al., 1992; Vrijheid et al., 2002). As a result of these threats, public opposition to industrial permitting and facility siting over the years has been nearly universal, especially for high-profile facilities such as oil and gas projects and petrochemical plants (Bullard et al., 2008; Saha & Mohai, 2005).

The 1990s saw a record number of communities of color "racially profiled" and targeted for polluting operations. Industry ramped up pressure on the federal and state governments to approve the siting of polluting industrial facilities in communities that were home to people of color, and it funded research to obscure the widespread practice of discriminatory siting (Mohai & Saha, 2007, 2015a, 2015b; Roberts & Toffolon-Weiss, 2001). Communities all across the country resisted this toxic assault. Nevertheless, most of those resisting were still vulnerable to industrial facility siting because of their limited financial, scientific, technical, political, and legal resources (Cole & Foster, 2001; Lerner, 2011; Taylor, 1998). People of color environmental justice organizations and networks were still small and underfunded, with only a handful having paid staff. Generally, communities with the greatest needs have the fewest resources and least organizational capacity to effectively fend off environmental assaults.

The 1990s also ushered in university-based environmental justice centers. The first five environmental justice centers were all located at historically Black colleges and universities (HBCUs) in the South. It was no accident that the first environmental justice center, the Deep South Center for Environmental Justice at Xavier University, was located in New Orleans and that three of the five centers were located in Gulf South states. The other four environmental justice centers were located at Clark Atlanta University in Atlanta, Georgia; Texas Southern University in Houston, Texas; Florida A&M University in Tallahassee, Florida; and Hampton University in Hampton, Virginia. Although housed at HBCUs, the centers provided foundational research, policy formulation, expert testimony, community engagement, technical assistance, and advocacy support to environmental justice groups and communities well beyond their African American constituencies and regions.

New Technology, New Research, and New Community Science—the 2000s

The 2000s ushered in new technological advances that offered tremendous benefits to the environmental justice movement and frontline communities. A record number of grassroots leaders from low-wealth, people of color, and Indigenous communities were able to gain access to new computing and communications technology and the Internet, which enabled them to better connect with their constituencies and allies, and access government data. New funding opportunities from private foundations meant that more grassroots community groups and their leaders gained access to cell phones, GISs and other spatial mapping tools, community-based participatory research, community science, and multistakeholder networks, including community university partnerships and collaborations (Cole & Foster, 2001).

These technological and organizational advances empowered many historically underserved and "invisible" communities to organize, to form community–university partnerships and consortia (e.g., the HBCU-CBO Gulf Coast Equity Consortium, bringing together HBCUs and community-based organizations; the HBCU Climate Change Consortium), to engage in research, and to formulate policy themselves. New community GIS mapping tools allowed environmental justice leaders to map spatial inequality by census tract, neighborhood, and zip code.

Zip code is still the most powerful predictor of health and well-being. All zip codes are not created equal. Wealth and health are correlated. The new mapping tools allowed grassroots groups to map pollution and externalities; it also allowed them to map and "follow the dollars" by displaying resource allocation disparities. It is no accident that the poorest people in the United States have the worst health and live in zip codes with the most degraded environments. Poverty is not random, and neither is prosperity. Economic prosperity is concentrated in America's elite zip codes. New jobs are concentrated in the economy's best-off zip codes, leaving one of every four new jobs for the bottom 60% of zip codes (Hart, 2017). For example, 57% of national growth in business establishments and 52% of job growth from 2011 to 2015 were in prosperous zip codes.

The 2000s saw a new crop of environmental justice researchers, scholars, policy experts, and journalists begin to unpack various forms of inequality—including racial, economic, health, environmental, and spatial inequality. The 2007 *Toxic Wastes and Race at Twenty: 1987–2007* report was one of those studies that used improved GIS methodology to map the environmental injustice of hazardous waste facility siting. An EPA report found that people of color are also overrepresented in populations who live within a 1-mile radius (44%) and a 3-mile radius (46%) of the nation's 1,388 Superfund sites. At the time of the study, people of color made up 37% of the U.S. population (U.S. Environmental Protection Agency, 2013).

In ranking the 75 worst-polluting coal-fired power plants in the United States, a 2012 NAACP study, *Coal Blooded: Putting Profits Before People*, found that 4 million people live within 3 miles of these plants (National Association for the Advancement of Colored People & Clean Air Task Force, 2012). Two million people live within 3 miles of one of the top 12 "dirtiest" coal-fired power plants. Approximately 76% of these residents are people of color, and the average per capita income is $14,626, compared with the national average of $21,587. People of color are severely overrepresented in communities that host the "dirty dozen" coal power plants, since they made up only 37% of the U.S. population in 2012 (U.S. Census Bureau, 2021).

A 2014 Coming Clean report, *Who's in Danger? Race, Poverty, and Chemical Disasters*, found fenceline residents who live closest to the facilities that store large amounts of explosive and flammable chemicals have average home values 33% below the national average and average incomes 22% below the national average; the percentage of Blacks in the fenceline zones is 75% greater than for the United States as a whole, and the percentage of Latinos is 60% greater; the percentage of adults in the fenceline zones with less than a high school diploma is 46% greater than for the United States as a whole, but the percentage with a college or other post–high school degree is 27% lower; and the poverty rate in the fenceline zones is 50% higher than for the United States as a whole (Orum et al., 2014).

Oil trains also pose a special risk to people of color, who often live on the "wrong side of the tracks." The nation's oil trains are more likely to run through communities of color and expose their residents to elevated risks from explosion and derailment "blast zones." The blast zone is everything within a mile of tracks used for the oil trains (ACTION United, Forest Ethics, and PennEnvironment Research and Policy Center, 2016).

The nation's oil refineries emit thousands of tons of hazardous air pollutants, including substances that cause cancer. Half of the people who are at an increased cancer risk from refineries' pollution are people of color (Garcia, 2014). America is still segregated, and so is pollution (Bullard et al., 2011). More than 69.2% of Hispanic children, 61.3% of African American children, and 67.7% of Asian American children live in areas that exceed EPA ozone standards, compared with 50.8% of White children. University of Minnesota researchers found that African Americans and other people of color breathe 38% more polluted air than Whites (Clark et al., 2014). All indicators point to pollution taking a heavy health toll on Black America—especially Black children. Black children have an asthma death rate that is eight times the death rate of White children (Centers for Disease Control and Prevention, 2021).

Much of America still has the "wrong complexion for protection," placing Black Americans, other people of color, and Indigenous people at elevated risks from industrial pollution, natural and human-made disasters, and pandemics (Bullard & Wright, 2012). Black Americans and Latinos bear a disproportionate burden of pollution caused mainly by Whites. Black Americans and Latinos breathe in 56% and 63%, respectively, more pollution than they generate. Whites on the other hand, breathe 17% less air pollution than they cause (Tessum et al., 2019).

Recent studies now show that COVID-19 maps closely with race, class, and environmental disparities. Harvard researchers found that persons living in areas with high levels of fine particulate matter (also known as $PM_{2.5}$) are 15% more likely to die from COVID-19 than someone in a region with 1 unit less of the fine particulate pollution (Wu et al., 2020). Racial redlining is implicated in high COVID-19 dangers in segregated Black and brown communities (Richardson et al., 2020).

The EPA in January 2023 proposed updating the federal air quality standards for fine soot, which were last updated in 2012. The new standards would help advance health equity in Black and brown communities that are disproportionately exposed to particulate matter coming from industrial facilities and highways (American Lung Association, 2023). The biggest opposition to the proposed new standards is coming from the cement, manufacturing, and oil industries. It is estimated that lowering the annual PM2.5 standard to 9 micrograms per cubic meter of air would prevent up to 4,200 premature deaths per year and net $43 billion in health benefits in 2032 (U.S. EPA, 2023b). Stronger standards could save even more lives (Industrial Economics Incorporated, 2022).

Air pollution still causes more than 200,000 early deaths each year. A Harvard University study found African Americans are nearly three times more likely to die from exposure to airborne pollutants than other Americans (Di et al., 2017). Reducing current levels of fine particulate matter by just 1 microgram per cubic meter of air would save about 12,000 lives every year. These findings illustrate the need for tighter regulation of air pollutant levels, including imposing stricter limits on levels of PM2.5.

Moving away from dirty fossil energy for power has positive health benefits. For example, an Allegheny County, Pennsylvania, Health Department study found emergency room visits for asthma dropped the year after a polluting Pittsburgh power plant shut down. After the coal-fired Shenango power plant closed, the rate of physician-diagnosed asthma in elementary school students in the region decreased from 25.3% to 19.1%, and the rate of uncontrolled asthma dropped from 64.9% to 37.9% (Marusic, 2018).

The retirement of dirty coal plants had health benefits related to reducing premature births in California (Casey et al., 2018). The prevalence of preterm births decreased significantly near power plants after they closed, with the largest decrease occurring in women who lived closest to the plants. For women living within 3 miles of the plants, the preterm birthrate was 5.1% after closing, compared with 7.0% before the plants closed.

Air pollution even poisons the most defenseless in our society—babies in their mothers' wombs—and sets them up for health problems later in life. A 2018 Johns Hopkins University study showed air pollution during pregnancy is tied to high blood pressure in children (Zhang et al., 2020). These findings have special implications for African American children, who are overrepresented in cities with polluted air. African Americans develop high blood pressure at younger ages, and African American adults are hit harder than any other group in the nation. By the age of 55, 75.5% of Black men have high blood pressure, as compared to 54.5% of White men(Thomas, et al., 2018).

This systematic overexposure of African Americans to air pollution was apparent in an EPA study that found race was more powerful than poverty in predicting exposure to air pollution (Mikati et al., 2018). EPA researchers found racism—not poverty—as the primary factor associated with overpolluted communities of African Americans and other people of color. In 46 states, people of color live with more air pollution than Whites. African Americans are exposed to 1.54 times more fine particulate matter than Whites. Hispanics are exposed to 1.20 times more. Those with incomes below poverty are exposed to 1.35 times more than others (Mikati et al., 2018).

Pollution maps closely with race and place. A disproportionate share of places where people of color live, work, play, and learn have become racialized with toxic hot spots and dangerous industrial operations that pose elevated health threats—especially to vulnerable children of color. Racialized places allow benefits and amenities to flow to White communities while at the same time driving pollution and health threats to communities of color (Cottman, 2017; Foster, 2004; Kwate, 2016).

Environmental racism has left African Americans three times more likely to die from pollution than Whites (Di et al., 2017). The footprint of discriminatory housing practices and redlining—denying mortgages, home loans, and other financial services to residents in mostly Black and Latino neighborhoods based on their race or ethnicity—practiced in the 1920s and 1930s is showing up in urban heat islands and flooding disparities in the 2020s (Plumer & Popovich, 2020). Black neighborhoods that were redlined are nearly 5 degrees Fahrenheit warmer on average than nonredlined neighborhoods—and in some cities the difference can reach up to 12.8 degrees Fahrenheit (Hoffman et al., 2020). Heat and pollution increase bad pregnancy outcomes. Women exposed to high temperatures or air pollution are more likely to have premature, underweight, or stillborn babies. These environmental factors (heat and ozone or fine particulate matter) disproportionately impact Black women and their babies (Bekkar et al., 2020).

The solution to decades of environmental injustice is equal enforcement of our nation's environmental laws and regulations, and fair treatment of all Americans regardless of race, color, nationality, or income. The right to breathe clean air and the right to drink clean water are basic civil rights and human rights. Also, the guiding principle that people and communities most affected by pollution "must speak for themselves" was largely absent from the first Earth Day on April 22, 1970, when the modern environmental movement was born. It took leaders of color and frontline communities to move environmental justice from a footnote in the late 1970s to a headline in the 2020s.

Frontline communities are making their voices heard and are demanding that the Biden administration design and implement the right kinds of programs with transparent application processes as well as screening and tracking tools to ensure that environmental and climate justice investments go to disadvantaged communities—including funds from the $1.2 trillion Bipartisan Infrastructure Law and the $369 billion in climate change provisions in the Inflation Reduction Act, of which $60 billion is tagged for environmental justice (The White House, 2022).

The historic federal funds available for environmental, climate, and energy justice, if used properly, can begin closing the racial income, wealth, and health gaps. The $27 billion Greenhouse Gas Reduction Fund, a provision within the Inflation Reduction Act, is an opportunity to leverage private capital for clean energy and clean air investments to reduce pollution, improve public health, lower energy costs, increase energy security, create good-paying jobs, and boost economic prosperity in underserved communities. It will also support transitioning to renewables and clean energy, and away from the fossil fuels that have disproportionately harmed people of color and poor fenceline communities, as will be detailed in Chapter 3, with special emphasis on the U.S. Gulf Coast region.

Chapter 3: Fossil Fuel Industries' Pollution Impacts in Louisiana and Texas

The previous chapter described how communities in the U.S. South organized against environmental racism; it also identified the need for decision-makers to use the environmental justice framework to correct past practices and prevent future harm. In this chapter, we trace how the petrochemical industry has affected the environmental and climate health of people and places in the Gulf Coast states, with an emphasis on Louisiana and Texas. We also describe the permitting and build-out of liquefied natural gas (LNG) facilities as they largely occur in the Gulf Coast region—Louisiana and Texas in particular—and how the Federal Energy Regulatory Commission's (FERC's) authority has allowed this exponential expansion to occur with little regard for environmental and climate justice concerns.

Historical Perspective

The fossil fuel industry remains one of the largest generators of environmental and climate injustices. The report *Dirty Discrimination: Big Oil's History of Environmental Racism* offers a systematic analysis of atrocities committed by the fossil fuel industry against communities of color both domestically and abroad (Accountable.US, 2022). While the first American oil well, located in northwestern Pennsylvania in 1859, brought industrial interest to the petroleum industry, the 1901 discoveries at the Spindletop gusher in Texas and in Jennings, Louisiana, both launched the 20th-century modern American petrochemical empires. The Gulf Coast states quickly became ground zero for oil exploration, extraction, and production—and still remain the largest expanse of U.S. production.

In post–World War II America, two states, Louisiana and Texas, attracted industries with low wages, tax concessions, and an abundance of resources to extract (Glaeser & Tobio, 2007; Jaworski, 2017; Petzinger & Getschow, 1984). State and local governments offered land adjacent to poorer neighborhoods and neighborhoods of people of color. Jim Crow laws and local and state public officials courted big industry and found a willing partner to build out petrochemical plants and refineries following the "path of least resistance"—this occurring at a time when Black citizens had limited or no access to the vote or a platform to raise their voices without fear of intimidation, threats, and violence (Bullard, 1993c; Roberts et al., 2022).

The 21st century ushered in a shift from U.S. dominance in oil due to rising oil prices. The industry now focuses on unconventional fossil fuel sources, with natural gas at the forefront in extraction and exportation (Manfreda, 2019; Priest, 2012). Unconventional gas originates from smaller, scattered pockets and is more difficult to extract than conventional gas found in large accessible reservoirs. Technology such as hydraulic fracturing, or fracking, allows drilling in these tight, unconventional sources. Fracking has intensified exposure and brought oil and gas activities closer to more populations (Kroepsch et al., 2019).

Unconventional shale production now accounts for 65% of oil and 78% of gas production in the United States. Approximately 83% originates from three oil and gas basins: the Permian (located in Texas and New Mexico), Eagle Ford (Texas), and Bakken (North Dakota and Montana). Half a million people reside within 3 miles of flaring from these three basins, and 39% live close to more than 100 flares (Donaghy & Jiang, 2021, pp. 16–17).

The Beginnings of "Sacrifice Zones" in the Gulf Coast Region

Sacrifice zones are often "fenceline communities" of low-income populations and people of color or "hot spots" of chemical pollution where residents live immediately adjacent to heavily polluting industries or military bases (Bullard, 2011; Lerner, 2011). Quite often, this pattern of unequal protection constitutes environmental racism. Environmental sacrifice zones result from public officials granting permits in communities with populations already disempowered and disenfranchised (Mohai & Saha, 2007). Fossil fuel industrial growth has created such sacrifice zones in which residents closest to the petrochemical industries pay the steepest costs, including loss of health, property values, and wealth, while the economic gains from the petrochemical industry are experienced largely in other places (Bullard, 2011; Lerner, 2011). Both commercial and political networks hold culpability as they advanced more fossil fuel industries into the same sacrificed neighborhoods for more than a century (Randolph, 2021).

Historical discrimination through housing and federal policies, including redlining, which promoted segregation based on race and ethnicity, has made neighborhoods of color primary targets of "dirty industries." While racial redlining was outlawed in 1968 by the federal Fair Housing Act, the practice still impacts communities today (Madrigano et al., 2022). A recent study found that redlined neighborhoods have nearly twice the density of active and inactive oil and gas wells as nonredlined neighborhoods (Gonzalez et al., 2022). Similarly, natural gas leaks are more prevalent in neighborhoods whose residents are low income or majority people of color. Researchers found the density of leaks increase in populations that have an increasing percentage of people of color and also in populations with a decreasing median household income (Weller et al., 2022).

The fossil fuel industry has permanently altered the landscape with pipelines and wells—exposing new generations in fenceline communities to harmful emissions (Johnston & Cushing, 2020). More than 18 million Americans live within a mile of an oil or gas wells (Proville et al., 2022). Pipeline placement also occurs predominantly in places ranked high on the Centers for Disease Control and Prevention's Social Vulnerability Index, a composite of demographic and health factors (Emanuel et al., 2021).

Living in a sacrifice zone created by petrochemical plants has real health consequences. Louisiana's "Cancer Alley" is one of the most widely publicized sacrifice zones that consists of an 85-mile stretch along the Mississippi River from Baton Rouge to New Orleans where more than 100 petrochemical facilities spew their pollution into the air, water, and ground. The area is also home to high concentrations of Black residents with elevated incidences of cancer and other diseases (Blodgett, 2007; Terrell & St. Julien, 2022). In March 2023, Black residents in St. James Parish, led by Rise St. James, Inclusive Louisiana, and Mt. Triumph Baptist Church, filed a civil rights lawsuit in federal court charging the parish government with "racial cleansing" in the way its land use and zoning policies illegally concentrate industrial plants in their communities (Bruggers, 2023).

Mossville, Louisiana, located on the outskirts of Lake Charles, is a Black community founded in 1790 by a former enslaved person, Jack Moss. This Black community survived slavery, the Civil War, Reconstruction, and Jim Crow segregation but could not survive the toxic onslaught of the petrochemical industry. As more than a dozen chemical plants moved into the area after World War II, residents began to experience the impacts of pollution from the plants and organized to resist the encroachment. In 2012, the South African–owned company Sasol, whose U.S. headquarters is located in Houston, gained the first "gas-to-liquid" processing plant in Lake Charles. The government allowed the company to organize a resident buyout that literally wiped Mossville off the map (R. Johnson, 2019; Murphy, 2014; Rogers, 2015).

Across state lines at the confluence of the Sabine and Neches Rivers, Port Arthur, Texas, represents yet another sacrifice zone. Federal housing grants allowed city officials to build public housing directly at the fence line of refineries. Today, the Port Arthur refineries are the largest in the United States. The population of the town is 82.4% people of color (U.S. Census Bureau, 2020). Toxics Release Inventory reports indicate that Jefferson County, which includes Port Arthur, has exceedingly high amounts of toxic air pollution (Accountable.US, 2022, p. 31; Genoways, 2014).

In Corpus Christi, Texas, residents in the historically Black Hillcrest neighborhood have faced years of benzene exposure from the Citgo refinery. The port has offered to buy Hillcrest properties in order to expand and bring more fossil fuel industries into the region. There are already 12 petrochemical plants within a 3-mile radius of each other in Corpus Christi that report under the Environmental Protection Agency's (EPA's) Toxics Release Inventory program (Azhar, 2021). The Manchester/Harrisburg neighborhood in Houston, Texas, which is 98% Latino, also qualifies as a sacrifice zone because of the concentration of 21 Toxics Release Inventory facilities and several hazardous waste disposal sites. Residents in this community, which is located near the Houston Ship Channel, are also exposed to mobile sources of air pollution from the Highway 610 Loop, a major highway that transports both commuters and commercial goods from the Houston Ship Channel (Lam et al., 2021).

Once a fossil fuel industry moves into a region, its presence invites further development. Liquefying gas plants have moved into communities that already have a fossil fuel presence (Rozansky, 2022). The presence of an expanding fossil fuel industry has grave impacts on the environment, public health, the economy, displacement of people, and quality of education. The next section will provide an overview of these impacts.

LNG Facilities' Addition to the Dirty Fossil Fuel Mix

The extraction of shale gas exploded during the Bush and Obama administrations (Huynh, 2012; Kransdorf, 2005; Reeves & Obey, 2013). With the increased volume of natural gas extraction, a demand to transport natural gas led to an increased demand to liquefy the gas. Transporting gas globally in its natural state is both costly and time consuming. In 2005, the United States had four import terminals for LNG: Cove Point, Maryland; Elba Island, Georgia; Lake Charles, Louisiana; and Everett, Massachusetts (Stosser & Andrea, 2005). By 2022, the number of terminals had tripled and primarily line the Gulf Coast states, signaling the growing global demand for LNG. In 2015, the United States exported only 6.5% of the methane gas it produced, but the following year, the first tanker of LNG left Sabine Pass. By 2022, the United States exported more than 19% of its methane gas production (Ross & Zibel, 2023).

Under the authority of FERC, existing LNG import terminals were permitted to retrofit and begin exporting LNG, even to nontrade countries (Stosser & Andrea, 2005). This explosive growth occurred without a meaningful review of the environmental consequences (Michel, 2018). Environmental justice concerns and advanced analytic methods were not considered or applied in LNG licensing decisions. FERC recently amended its review process to include environmental justice impacts on pending and future permits (Willson, 2022a).

Community groups and local officials argue against many issues created by LNG plants near their homes. Many believe the safety exclusion zones FERC established when approving a site may be too small of an area to protect nearby residents in the case of a catastrophic event (Parfomak & Flynn, 2004). Others have cited previous LNG explosions in their protest of the siting of LNG terminals (Stosser & Andrea, 2005). The loudest argument from opposition to the siting of LNG terminals is the opinion that FERC releases subpar assessments of the cumulative and indirect environmental impacts of these respective LNG terminals (Rhodes, 2017; Rozansky, 2022).

In January 2023, as acting chairperson of FERC, Willie Phillips promised environmental justice as a priority in his position. Commissioner Allison Clements stated the need to "commit to prioritizing the 'public' in public interest" (Clements, 2023, para. 9). This inspired the commission to host an environmental justice roundtable on March 29, 2023, which fell short of addressing environmental justice concerns. Only two participants from environmental justice communities were invited: John Beard Jr. from Port Arthur, Texas, and Roishetta Ozane from Lake Charles, Louisiana. Ozane mentioned in her introduction that less inclusion of frontline communities and their respective coalitions was problematic with the setup of the FERC-sponsored roundtable (Federal Energy Regulatory Commission, 2023). Also invited, the senior vice president of an LNG company did not establish trust from those located in environmental justice communities harmed by LNG buildouts. More significantly, the panel did not conclude with the commission's commitment to deny permits based on environmental justice impacts. Only a month later, FERC would approve the Texas LNG project in Brownsville and the Rio Grande LNG project, despite the strong opposition from nearby environmental justice communities (Mallen et al., 2023). As described further in Chapter 6, Driftwood would receive approval for its Line 200 and Line 300 pipelines despite the problems it faced in its permitting process (Reuters, 2023a). Even though FERC commissioners speak of revisioning their roles to incorporate environmental justice concerns in the permitting process, this has not translated to decision-making that considers those concerns. The exponential build-out of LNG plants does not show signs of slowing.

Table 3.1 Number of Liquefaction Trains and Daily Capacity of LNG Facilities, Operational and Under Construction—June 2023*

Name	State	Status	No. of trains	Volume of each train (Bcf/d)	Expansion notes
Calcasieu Pass	LA	Operational	9	0.66	Trains 10–18 have been commissioned by FERC, waiting on authorization for commercial operation.
Cameron	LA	Operational	3	0.59	Approved: 4th train (0.89 Bcf/d)*
Corpus Christi	TX	Operational	3	0.6	Under construction: 14 midscale trains (0.11 Bcf/d each)
Cove Point	MD	Operational	1	0.69	
Elba Island	GA	Operational	10	0.16	
Freeport	TX	Operational	3	0.66	Approved: 4th Train (0.67 Bcf/d)*
Golden Pass	TX	Under Construction	3	0.68	
Plaquemines	LA	Under Construction	36	1.30	
Port Arthur	TX	Under Construction	2	1.58	
Sabine Pass	TX	Operational	6	0.59	
Total			**76**	**7.51**	

Source: Data from U.S. Energy Information Administration (2023b).

Note: Bcf/d = billion cubic feet per day.

* Table includes more recently available information from the U.S. Energy Information Administration.

As of the second quarter of 2023, the United States had seven LNG export facilities in operation, two of which have expansion proposals not yet approved and one that has an expansion approved and already under construction. One has completed construction on an expansion and is waiting for authorization from FERC to initiate commercial operations. Three are new export facilities currently under construction. Table 3.1 shows the different facilities that are either operational or under construction. The table lists the number of liquefaction trains for each facility. Trains are large pieces of equipment that compress and chill natural gas to convert it from a gas to a liquid state. LNG facilities expand by adding new trains. Table 3.1 also shows the capacity of each train by volume, measured in billion cubic feet per day (Bcf/d). Currently in operation, Corpus Christi LNG is also expanding to add 14 additional midscale trains that will produce a volume of 0.11 Bcf/d. All together, these facilities include 76 trains with a combined daily capacity of 7.51 Bcf/d. Freeport LNG suspended operations due to an explosion at the facility on June 8, 2022, and did not reopen until March 2023. Cameron LNG and Freeport LNG have received approval from FERC to add an additional fourth train to their current operations.

Table 3.2 Number of Liquefaction Trains and Daily Capacity of Approved LNG facilities, Not Under Construction—June 2023*

Name	State	No. of trains	Proposed volume of each train (Bcf/d)	Total proposed volume (Bcf/d)
Alaska LNG	AK	3	0.85	2.55
Delfin FLNG	Offshore/Floating	4	0.40	1.6
Driftwood LNG*	LA	5	0.73	3.65
Gulf LNG	MS	2	0.71	1.42
Lake Charles LNG	LA	3	0.70	2.1
Magnolia LNG	LA	n/a	n/a	n/a
Rio Grande LNG	TX	5	0.72	3.6
Texas LNG	TX	2	0.28	0.56
Totals		**22**		**15.48**

Source: Data from U.S. Energy Information Administration (2023b).

Notes: Bcf/d = billion cubic feet per day; n/a = not available.

* Table includes more recently available information from the U.S. Energy Information Administration.

** Construction of Driftwood LNG began in 2022 (American Energy, 2022)

As shown in Table 3.2, an additional eight LNG facilities have FERC's approval but as of the second quarter of 2023 reportedly have not started construction. All but one of these facilities will be located on the Gulf Coast, where the majority of existing facilities are operating. Collectively, these approved-for-construction facilities would include 22 new liquefaction trains and add 15.5 Bcf/d of capacity, more than double the capacity of operating and under-construction facilities. As discussed earlier, residential neighbors of such facilities have already endured decades of pollution from refineries and petrochemicals, and roughly 38% of the people living near these proposed facilities are communities of color and those with low household incomes (Shaykevich & Otto, 2020).

This is a significant risk for a small geographic footprint to produce a product with the potential for methane leaks and other polluting hazards, as the Louisiana and Texas LNG facilities all lie within a stretch of 700 miles. Once up and running, these new facilities collectively could release upwards of 27.3 million tons of greenhouse gases annually (Berry, 2022). Five additional facilities, all located in either Texas or Louisiana, have submitted proposals to FERC for approval. All the gas facilities proposed over the next decade would force the United States to export nearly 60% to support this new infrastructure. A recent market study has forecasted the LNG market to increase by $15.81 billion from 2022 to 2027 (Technavio, 2023).

As the LNG carbon footprint expands exponentially along the Gulf Coast, it signals the commitment to fossil fuels through a minimum of 30 years. All of the existing terminals have either been built or expanded within the last decade, a brief time span to thoroughly understand all the environmental damage they potentially will create. Construction on these sites typically takes years, and it is not unthinkable for it to take almost 10 years for the approval and construction phases (PricewaterhouseCoopers, 2014). Geopolitical tensions from Russia's invasion of Ukraine have the United States scrambling to meet Europe's natural gas needs. LNG shipments to Europe increased from approximately 380 in 2021 to almost 850 in 2022 (Palmer, 2023). However, the export facilities are already operating at capacity and additional LNG facilities under construction will not be operational until 2024 at the earliest (Natural Resources Defense Council, 2022). Even so, financial analysis of the LNG industry has found that the United States has enough supply for Europe through 2030 and does not need new construction (Ross & Zibel, 2023).

The capital required to bring LNG facilities online forces a commitment to use the liquefied natural gas for at least 30 years (Natural Resources Defense Council, 2022). This represents a "permanent 'solution' for the short-term problem of the European gas market volatility" (Ross & Zibel, 2023, p. 3). LNG projects range from $0.5 billion to $30 billion in cost, with an average cost of $0.8 billion per million tons per annum of capacity (Rozansky, 2022, p. 13). As inflation hits all economic sectors, the LNG construction projects are not immune, and this will impact the timeline and cost for them to become operational (Persily, 2022). In 2022, LNG companies secured 45 long-term contracts for both initial facilities and expanding ones, which doubled the amount secured from the previous two years combined. These contracts would add an additional 58.1 million metric tons of methane or 351 million metric tons of carbon dioxide emissions annually, equal to 94 coal plants (Ross & Zibel, 2023, pp. 3–4).

Currently, America and Europe are on the precipice of another international event over natural gas as Russia seizes increased pipeline access in former satellite states as a result of the invasion of Ukraine. The U.S. LNG industry has used this tension to secure more contracts than in previous years, but more than 75% of contracts secured do not help Europe but will go to Asia or commodity trade firms (Ross & Zibel, 2023). Under President Biden's leadership, federal policy has taken important strides to finally protect vulnerable populations from both environmental and climate issues after centuries of systemic racism. However, these policy shifts are compromised by the renewed commitment to protecting fossil fuel interests, such as LNG's expansive growth. Residents living in states such as Louisiana and Texas face aggressive local and state officials who openly advocate for policies that continue to allow fossil fuel industries to operate virtually unchecked, endangering communities and damaging the environment and climate.

Environmental and Climate Impacts

LNG facilities will cause further environmental degradation in already overburdened and underserved communities. In addition to emitting hazardous air pollutants, LNG production, transportation, and consumption emit substantial amounts of greenhouse gases that contribute to global climate change. Estimates show that the LNG industry is between 50% and 200% more carbon intensive than operations for gas in its natural state. This is due to the increased production and transportation that LNG adds to the process (Pickrell, 2022). The combined life cycle emissions of 19 proposed U.S. LNG terminals are estimated to be approximately 1 metric gigaton (1.1 U.S. gigatons) of carbon dioxide annually, which is equivalent to 250 coal plants (Rozansky, 2022, p. 7). Already, more than $500 million worth of gas is wasted by oil and gas operations annually (R. Brown, 2023).

Air pollution emitted from fossil fuels affects the populations surrounding the infrastructure, creating a major environmental justice issue. Particulate matter exposure is a particular concern. People of color are disproportionately exposed to more health-threatening fine particulate pollution than Whites, regardless of location and income. And Black Americans are exposed to higher-than-average levels of this deadly pollution than White Americans regardless of source (Tessum et al., 2019).

Black Americans and those in poverty are exposed to 1.54 and 1.35 times more particulate matter, respectively, than the general population (Mikati et al., 2018). Black populations are exposed to 56% more pollution than caused by their consumption. Latino populations are exposed to 63% more pollution than they cause. On the other hand, White populations enjoy a "pollution advantage," meaning they breathe 17% less air pollution than they cause (Tessum et al., 2019). In the Permian Basin, where a majority of fracking occurs, Hispanics are exposed to flaring more than non-Hispanic White populations (Johnston et al., 2020). The fossil fuel industry uses the practice of flaring to dispose of natural gas, and the process wastes gas and increases air pollution. Sometimes flaring occurs as a safety precaution to avoid an explosion from an increase in pressure (World Bank, 2023). However, Louisiana and Texas safety regulations are lax on flaring (Bradstock, 2021).

Louisiana and Texas have favored big oil and gas interests over community concerns about pollution and public health. Louisiana's state legislature passed House Bill 72 in 2021, which allows environmental self-audits in certain pollution accidents that are not mandatory for state and federal reporting ordinarily. The reports can be withheld from the public for up to two years. The law also allows the Louisiana Department of Environmental Quality to forgo public hearings in the pollution-permitting process for facilities (Muller, 2021).

The Texas Commission on Environmental Quality (TCEQ) also favors leniency to frequent polluters. TCEQ does not hold repeat polluters accountable. A report from the Environmental Integrity Project (2023) discovered 21,000 unexpected pollution releases in Texas that emitted 400,000 tons of air pollution over a 6-year period, but only 1% of the releases prompted action by the TCEQ. In 2022, the agency faced a sunset review, constitutionally required every 12 years for each state agency. While the legislature renewed TCEQ's authority, the sunset review committee did report TCEQ's need to hold polluters accountable rather than allowing industries to police their own pollution activities (Sunset Advisory Commission, 2022). More than 17,000 deaths in Texas can be attributed to outdoor air pollution each year (Vohra et al., 2021). In fact, Texas leads the nation in terms of deaths attributed to oil and gas pollution, and that pollution costs Texans approximately $77 billion in health care in 2016 alone, with a high number of uninsured residents (Drane, 2023b).

Scientists have largely blamed the fossil fuel industry for causing detrimental harm to our climate. Computer models prove that burning fossil fuels accelerates climate change and demonstrate the need for policies to reverse the course our climate is headed (Wuebbles & Jain, 2001). The latest Intergovernmental Panel on Climate Change report (IPCC, 2023) states how critical it is to reduce methane emissions in order to save our climate and provides a narrow window to do so. Replacing dirty coal with methane is a false solution (Zalik, 2008). Methane wells, pipelines, and LNG operations result in massive amounts of leaking methane, which is up to 85 times more harmful than carbon dioxide in trapping heat in the atmosphere (Rozansky, 2022; Taraska & Banks, 2014). Annually, the fossil fuel industry releases 135 million tons of methane and toxic pollutants into the atmosphere, and the release of methane has steadily increased since the mid-2000s (International Energy Agency, 2022). When considering cumulative impacts, it is critical to consider the fossil fuel's life cycle, that is, the potential for emissions at each stage from extracting, processing, transporting, and eventual combustion (Donaghy & Jiang, 2021).

Gulf South residents have experienced the impact of extreme weather brought on by climate change. Climate change is making storms stronger and wetter (Berardelli, 2019). Climate change fueled the powerful Hurricane Harvey, with storm-induced flooding significantly greater in Houston neighborhoods with a higher proportion of non-Hispanic Black and socioeconomically deprived residents (Chakraborty et al., 2019). Climate change fueled Hurricane Katrina—resulting in massive devastation and flooding—with Black households in the low-lying areas of the city hit the hardest (Castellon, 2021).

Petrochemical releases from the shutdown and start-up of refineries and chemical plants in response to Hurricane Harvey disproportionately affected socially vulnerable fenceline populations (A. B. Flores et al., 2021). Similarly, toxic air releases also occurred during Winter Storm Uri in 2021, an estimated 3.5 million pounds in excess of what would normally have been emitted, due to the Texas grid failure. The same facilities that reported toxic chemical releases during Harvey also reported them during Uri (Craft, 2021). Hurricane Laura in 2020 resulted in unplanned releases at the Sabine Pass LNG facility—releases included 51.5 tons of methane, 7.5 tons of nitrogen oxide, and 64.4 tons of carbon monoxide (Jones, 2023a).

Populations along the Gulf Coast have valid fears of displacement from their homes and communities by the oil and gas industry, petrochemical plants, and climate change. While less quantifiable, displacement can cause collective trauma, disrupt social relationships, and cause a loss of knowledge regarding traditional land management (Edelstein, 2004; Healy et al., 2019, p. 226). In some unfortunate cases, displacement has already occurred due to fossil fuel development, encroachment, and buyouts in Louisiana's Cancer Alley, including the destruction of the historically Black communities of Morrisonville, Revielletown, Sunrise, and the Diamond community of Norco, all communities founded by former enslaved people (Wright, 2005).

The United Nations reports that an annual average of 21.5 million people have been forcibly displaced by weather-related events—such as floods, storms, wildfires, and extreme temperatures—since 2008 (United Nations High Commissioner for Refugees, 2016). The Biloxi-Chitimacha-Choctaw in Isle de Jean Charles, Louisiana, became the first "climate refugees" in the United States to be relocated because of climate change (Davenport & Robertson, 2016). Those forced to relocate are uprooted from their ancestral lands and social support systems. For Indigenous people, relocation can curtail traditional cultural practices and harm identities that are tied to place. Relocation can also cause grief, despair, and anger over the destruction of land that tribes consider sacred or trigger historical trauma from past forced relocations (Avalos, 2021; Treisman, 2021).

Health Impacts

Fossil fuels present risks to health in many forms, such as accidents, explosions, and short- and long-term exposures. The network of pipelines has only increased with unconventional oil and gas development. The watchdog group Pipeline Safety Trust used federal data to analyze pipeline failure rates and found that those constructed after 2010 have the same failure rate as those installed before the 1940s. This suggests the new demand has caused industries to cut corners in building them (2015, p. 6). A study of traffic accidents near the Eagle Ford Shale energy corridor in southern Texas reveals a significant pattern of traffic crashes near production sites of oil and gas (Majumdar & Chun, 2022).

Primarily, health concerns occur from breathing in the toxic releases. Louisiana highlights this issue. At the Cameron LNG facility, emissions levels gradually increased each year from 2018 to 2020, with carbon monoxide increasing from 20 tons to 4,153 tons. Nitrogen oxides increased from 7 tons to 1,785 tons (Jones, 2023a). Explosions also pose a public health risk for nearby workers and community members. The rush to export LNG overseas has prompted many regulators and industry officials to downplay or overlook the potential for vapor cloud explosions. Many engineers have argued since 2016 against this complacency to risk (Englund, 2021). On June 8, 2022, Freeport LNG experienced an explosion that the company has downplayed, though the explosion's force knocked a lifeguard off her chair on a beach nearby and caused injury to a toddler (Drane, 2022a). Explosion incidents have occurred from the storage of LNG—for example, at the Buncefield oil storage and transfer depot in December 2005 (Aneziris et al., 2021; Animah & Shafiee, 2020).

Researchers have documented 61 hazardous air pollutants near drilling operations and 64 hazardous air pollutant emissions occurring from drilling activities, leaks, the refining process, and consumer end use (Donaghy & Jiang, 2021, p. 10). Flaring causes higher emissions of particulate matter, carbon monoxide, and nitrogen oxides, resulting in elevated hospital admission rates (Blundell & Kokoza, 2022).

The fossil fuel industry's pollution can also affect reproductive health. Particulate matter exposure from the oil and gas industry is associated with increases in rates of preterm birth, low birth weights, and stillbirths (Bekkar et al., 2020; Gonzalez et al., 2022). Texas women have the highest maternal mortality rate, with Black women dying at twice the rate of their White counterparts (Johansen et al., 2019). Black mothers are especially vulnerable to combined exposure to air pollution and extreme heat, which places them at a higher risk of unfavorable pregnancy outcomes (Bekkar et al., 2020).

Fossil fuel industries can also be detrimental to a person's mental health. A mixed-methods study found that living near oil and gas contributed to chronic stress and negatively affected residents' mental health due to feeling powerless and uncertain while they do not have transparency regarding environmental impacts and public health from the industry (Malin, 2020). This has been voiced by residents of Freeport, Texas, as they wait for information from Freeport LNG and the federal and state government regarding the explosion that occurred on June 8, 2022 (Oldham, 2022).

Pollution from fossil fuel plants poses a special risk to young children. Poor academic achievement occurs due to poor health conditions as much as it does due to inadequate spending. The location of schools in geographies with poor air quality negatively affects the health and academic achievement of students. On average, students in kindergarten through 12th grade spend an average of 6.87 hours per day in school, with a total of 178.71 days or 1,227 hours of attendance annually; however, this varies widely depending on which state or district a student resides in due to the decentralized structure of education standards (Wong, 2022).

Due to their size and metabolism, children breathe in more air per unit of body weight and have higher exposures to airborne pollutants. They also tend to spend more time outdoors than adults, and their developing organ systems are more susceptible to harm from toxic exposures, such as ozone and particulate matter and the potent neurotoxins lead and mercury. Children from less-well-off families are likely to be food insecure and have poor diets and nutrition. This makes children, especially those living in poverty and living in sacrifice zones, vulnerable to environmental health risks that result in disproportionately high rates of asthma, lead poisoning, and obesity (Bussewitz & Irvine, 2021; Landrigan et al., 2010).

When looking at the top 100 polluters of chemicals known to cause neurological damage and developmental disorders in the United States, researchers studied schools located within 2 miles and found that those students disproportionately exposed to criteria and hazardous air pollutants came from poor backgrounds with a higher percentage being non-White populations (Legot et al., 2010). Many other localized studies corroborate those findings. One study found that El Paso, Texas, schools located closer to recorded hazardous air pollutants had students with lower academic performance (Grineski et al., 2016). Mohai et al. (2011) found that Michigan schools located in geographies with the highest air pollution toxicity levels also held the record for lowest attendance, indicating poor health. These schools also had higher percentages of students performing poorly on state exams. Los Angeles Unified School District students, particularly Hispanics, have higher chances of attending schools exposing them to greater outdoor cancer risks and toxins that impact respiratory health (Pastor et al., 2006).

Overall, schools in Louisiana and Texas have greater air toxics health risks than the national average, with Louisiana at 3.87 times greater than the national average, and Texas at 2.61 times the national average (Political Economy Research Initiative, 2023). Most of the schools located near LNG facilities are exposed to high levels of toxic air pollution that poses dangerous health risks to students. Table 3.3 shows percentile ranking of exposures to toxic air pollution at schools in communities with LNG facilities in operation or in the construction phase. EPA's EJScreen was used to identify schools closest to each LNG facility. The air toxics exposure data for the schools were extracted from the University of Massachusetts Amherst's Political Economy Research Institute's (PERI's) Air Toxics at School tool. The data originated from the U.S. Department of Education's 2019–2021 data on schools, EPA's Toxics Release Inventory, and EPA's Risk Screening Environmental Indicators database.

In Table 3.3, the national percentile column indicates the school's ranking among all U.S. schools, including K–12 public, private schools, and higher education institutions. Thus, the 100th percentile would represent the school with the maximum level of air toxics exposure, or the maximum toxic air pollution health risk, in the nation; therefore, the higher the percentile, the greater the exposure or risk. Note that PERI reports rankings in the reverse, such that lower percentiles represent higher levels of exposure.

As seen in Table 3.3, four of the seven schools are at or above the 95th percentile and another is above the 80th percentile for exposure to air toxics in comparison to national averages, with four schools serving predominantly students of color. Five of the seven schools are in the 75th percentile or higher than their respective states. These data show that children going to school near LNG facilities are overburdened with toxic air pollution while at school, even without the added environmental health risks of LNG facilities.

Economic Impacts and Tax Breaks for Big Polluters

Communities in sacrifice zones do not enjoy financial benefits from the surrounding petrochemical industries. This section further explores the distribution of economic benefits of fossil fuel development and the economic impact.

The legacy of switching from enslaved agricultural workers to a sharecropping economy set a low bar for wage earners in the Gulf Coast South. Post–World War II industrial growth advertised a workforce less inclined to unionize and more apt to accept lower wages than other regions of the country. Income disparity in the South has played a central role in petrochemical industrial expansion (Roberts et al., 2022; Rodd, 2015).

Table 3.3 School Air Toxics Exposures Levels in LNG Communities

LNG Facility	Location	School Closest to LNG	National (percentile)	State (percentile)	Students of color %
Cameron, LA	Hackberry, LA	Hackberry High	95th	77th	5%
Driftwood LNG	Calcasieu Parish, LA	Vincent Settlement Elementary	98th	96th	6%
Plaquemines Parish, LA	Plaquemines Parish, LA	Phoenix High	42nd	29th	98%
Corpus Christi LNG	Corpus Christi, TX	East Cliff Elementary	82nd	76th	52%
Freeport LNG	Freeport TX	Freeport Elementary	98th	97th	87%
Freeport Pre-Treatment	Freeport, TX	Velasco Elementary	99th	99th	87%
Rio Grande LNG	Brownsville, TX	Port Isabel Junior High	6th	8th	94%

Source: PERI (2023).

Note: The United States has a total of 125,594 schools. Louisiana has a total of 1,793 schools. Texas has a total of 11,253 schools.

While advocates for "petrocapitalism" defend its ability to bring an economic boom to the region, studies indicate that the incurred cost of pollution is more than the economic value of employment growth that is often promised. One study found a fossil fuel employment gain of $21 billion less than the cost of air quality impairment and climate change, with employment calculated as three jobs per life lost annually (Mayfield et al., 2019). In Texas, tax incentives offered to industry cost $211,600 per job created, yet many companies fail to create the jobs associated with the incentive and are not penalized by the state (Morris et al., 2021). Louisiana, which is heavily peppered by oil and gas operations, ranks low among the United States for education attainment, and instead offers cheap labor and economic losses due to pollution and wetlands loss (Austin, 2006; Priest & Botson, 2012).

During the oil and gas boom of the last decade, Black Americans never made up more than a tenth of the workforce and were paid 23% less than Whites (Tomaskovic-Devey, 2023). Within the fracking industry, Black Americans have held less than 4% of the total jobs (Farber, 2022). Venture Global, a major LNG company, offers little job opportunities to locals in Plaquemines. One local resident stated that several neighbors were hired for construction jobs but were required to be at work at 5:00 a.m. Unfortunately, they would have had to take a ferry from the east to the west bank, and the ferry does not operate that early. Others were unable to take the job because training occurred in New Orleans, nearly 55 miles away, and they had no reliable transportation to go to that training daily for several weeks. A study from the Center for Economic and Policy

Research found that eliminating the fossil fuel industry over the course of 20 years would cause a loss of 53,600 jobs annually, and of those, 32,700 positions have skills nontransferable to another industry and would require retraining. These numbers represent less than the loss of manufacturing jobs from 2000 to 2010. However, clean energy jobs will offer new jobs to those who experience a job loss from the fossil fuel industry (Baker & Lee, 2021).

Economic hardships abound due to climate change. When factoring in the costs for agriculture, crime, coastal storms, energy, human mortality, and labor, a 1-degree Celsius rise in temperature results in a 1.2% loss of gross domestic product (Hsiang et al., 2017). In 2020, the National Oceanic and Atmospheric Administration reported 22 events induced by climate change that each cost more than $1 billion in damages. A total of 262 people died from these combined events that collectively cost $95 billion (Donaghy & Jiang, 2021).

Despite Louisiana and Texas being major U.S. sources of gas production for electricity, the costs to power individual homes remain high in these two states. Exporting the gas will only increase domestic costs. Louisiana regulates electricity providers, so individuals have no choice in the price they pay. The state has only one watchdog group, the Alliance for Affordable Energy, to combat any unfair costs passed on to individual consumers by Entergy, Louisiana's electric supplier. Americans are facing higher electric bills due to the increased demand for LNG by Europe since Russia invaded Ukraine (Leber, 2022). As pricing internationally is almost 600% higher than in the United States, foreign demand can drive up the price domestically (Climate Nexus, 2022).

The year before Russia invaded Ukraine, 20% of Americans struggled to pay their energy bills, and inflation had increased the cost of living (Reinicke, 2021). The domestic residential price for natural gas rose 21% from 2016 to 2021. Electric rates increased by 14% in 2022 at twice the rate of inflation (Mahoney, 2023). This and the inflated cost of gasoline is causing people to make tough decisions about whether to heat or cool their homes to healthy temperatures. The prohibitive cost of energy can contribute to increased mental stress, hospital visits, and food insecurity (Louisiana Public Health Institute, 2016).

In the first 10 months of 2022, approximately 4.2 million household disconnections of either electricity or gas occurred across the United States. The rate of electric disconnections rose by 29% and that of natural gas disconnections by 76% from 2021 to 2022 (Goodson Bell et al., 2023). Goldstein et al. (2022) found that households in predominantly White neighborhoods consume more power than those in predominantly Black neighborhoods, despite Whites typically having more energy-efficient homes. Yet Black households have a 43% higher energy cost and Hispanic households have a 20% higher energy costs than White non-Hispanic households based on income percentages. Low-income homes spend three times more of their income on energy costs compared to the median spending of non-low-income households (Drehobl et al., 2020, p. iii).

The federal government has spurred petrochemical industrial growth with little regard for working people's wages by offering subsidies to fossil fuel businesses. In the Revenue Act of

1926, the federal government allowed companies to deduct 27.5% of their oil and gas revenue from their taxes so companies could recover their capital costs as a reserve was depleted and reinvest in new wells. This encouraged the industry to find and exploit oil and gas resources quickly, though at grave social costs (Barthold, 1994; Beveridge, 1938). The "percentage depletion allowance" decreased to 15% in 1984. In recent years, these federal subsidies that contribute to the federal deficit are no longer needed to prop up fossil fuel companies that are now yielding record-high profits (Coleman & Dietz, 2019; Axelrod, 2023).

From a conservative estimate, the fossil fuel industry saves approximately $20 billion in direct tax subsidies each year, and the amount subsidized increases globally each year (Coleman & Dietz, 2019, pp. 1–2). The Energy Policy Act of 2005 offered tax breaks for renewable energy, but it also continued to offer incentives for fossil fuel industries, including exempting fracked oil and gas from various environmental laws (Metcalf, 2007). Whereas the passage of the Inflation Reduction Act of 2022 promises sweeping changes to promote clean energy, it also offers incentives for oil and gas by allowing the leasing of public lands and areas off the coast (M. Brown, 2022). LNG companies benefit from both the federal percentage depletion part of the tax code and the foreign tax credit, which allows them to deduct any foreign royalty payments as fully deductible foreign income tax (Coleman & Dietz, 2019).

Gulf Coast states and local policymakers have embraced the presence of oil and gas in their communities as it generates revenue and jobs from petrochemical industrial growth. In this particular region, the laissez-faire culture protects industry over community members. Promoting tax breaks and subsidies is a fundamental part of petrocapitalism that incentivizes corruption in both government and industry alike (R. Johnson, 2019; Zalik, 2008). The Louisiana Industrial Tax Exemption Program (ITEP) exempts major industrial sites from most property taxes for up to a decade, which costs local taxing bodies $1.9 billion in revenue in 2017 alone (Sneath, 2019). From 1997 until 2016, ITEP rejected only eight of 16,931 applications (Sneath, 2020). In Texas, until December 31, 2022, companies could apply for a tax break under Chapter 313 of the tax code to lower their property value on the local school district's tax rolls. Gas companies in Texas collectively receive about $380 million in these tax credits. The costs of the Chapter 313 program have risen by 350% since 2012, and the state has denied less than 2.5% of applicants (Morris et al., 2021). Companies typically enjoy a 10-year break under the Chapter 313 incentives.

Residents acknowledge the environmental hazards local industries impose on them, but many feel powerless to enact change given their socioeconomic circumstances and inadequate regulation and enforcement from the government (Singer, 2011). In fact, in states like Louisiana, protesting environmental hazards can be considered an illegal activity. Louisiana passed a law in 2004 making it a felony to trespass near critical oil and gas infrastructure. In 2018, Louisiana legislators updated that legislation to qualify oil and gas pipelines as critical (Sneath, 2020). Lack of transparency from business and government is cited as another barrier to resisting the advance of industrial culprits of pollution (Danta, 2010; Zalik, 2008). There is also the issue that many of these residents are employed by the industry that ruins their natural environment (Hochschild, 2016; Liddell & Kington, 2021).

Public Schools—Children Lose Out

Funding for public education relies on the collection of taxes. Underfunding of schools as well as the poor environmental conditions that students and their families endure contribute to underperforming schools. As the oil and gas industry wins local tax exemptions, public schools become poorer while the industry becomes richer and richer. This blatant transfer of wealth is clearly an environmental, economic, education, and racial justice issue—given the demographic makeup of the Gulf Coast region's public school districts where the oil and gas industry is concentrated.

The defeat of the corporate subsidy in Texas known as Chapter 313 was a big blow to the multibillion-dollar oil and gas industry. Chapter 313 officially expired on December 31, 2022. However, lawmakers are facing intense pressure from the oil and gas industry to produce a replacement for Chapter 313. Texas lawmakers filed House Bill 5 (the Texas Jobs and Security Act) on February 28, 2023, which would allow large businesses to pay lower school district property taxes when they relocate to Texas. The bill excludes incentives for renewable energy companies (Norton, 2023). In May 2023, the Texas House voted to approve corporate tax breaks in House Bill 5, which will give even more incentives to most companies (Scherer & Morris, 2023).

The old Chapter 313 program allowed corporations building new facilities to apply to local school boards for a property tax waiver. Clearly, the biggest winners include the oil, gas, and petrochemical industries. For example, two LNG companies—Corpus Christi Liquefaction, a subsidiary of Cheniere, and Freeport LNG—were the biggest winners, with each garnering more than $55 million in subsidies annually. The biggest losers are urban school districts—where the enrollment is majority students of color (Texas Education Agency, 2022). The Houston and Dallas school districts each have lost more than $20 million annually from the tax exemptions. A study commissioned by Better Brazoria found that Brazoria County, where Freeport LNG is located, loses approximately $2 million in tax revenue per job created by Freeport LNG (Drane, 2023a).

While Freeport LNG, Sempra Energy in Port Arthur, and Cheniere's Corpus Christi LNG received some of the highest tax breaks under Texas's Chapter 313, in South Texas, two proposed LNG projects did not receive sufficient votes from the Port Isabel school board (Morris et al., 2021). Freeport LNG received a 100% tax abatement from Brazoria County for its fourth train, and that concession will last for a period of 10 years (Callahan, 2016). The company also received a Chapter 313 tax abatement from the State of Texas worth $178 million for a period of 10 years that will absolve it from paying property taxes allocated to the local school district (Mann, 2021). Freeport LNG has received these tax abatements since it began operations first as an import facility.

Venture Global has also received tax rebates. In 2016, it received a break worth $83.5 million in its first year of operation. It also received a $29.8 million payroll rebate over 10 years in exchange for 413 direct jobs as well as 6,000 construction jobs (Steward, 2023). Table 3.4 shows the tax breaks awarded for different LNG projects.

Table 3.4 Tax Abatements Awarded by Local Governments to LNG Projects

State	Company/LNG(s)	Amount
Louisiana	Cameron LNG	$3 billion
Louisiana	Cheniere Energy	$3 billion
Louisiana	Venture Global	$1.86 billion
Louisiana	Sabine Pass LNG	$126.5 billion
Texas	Corpus Christi LNG	$147 million
Texas	Freeport LNG	$178 million

Sources: Environmental Integrity Project (2022b); Mann (2021); Steward (2023).

These tax breaks come at a cost to the local schools located near the LNG facilities. Educational rankings for both Texas and Louisiana fall short in part due to tax breaks to industry. Comparing the quality of education received across U.S. states, Texas ranks 38th and Louisiana 49th. In school safety, Louisiana ranks 45th out of 50 (World Populations Review, 2024). In 2023, the national average of spending per student was $12,612, and both Louisiana and Texas spent less per student at $11,917 and $9,871, respectively (World Populations Review, 2024).

One way this hurts the quality of education is through the teacher and staff shortages experienced. In a School Superintendents Association survey, 85% of superintendents responded that they did not have enough applicants for open positions (Kingson, 2022). Such shortages hurt bilingual students the most. In Houston, bilingual teachers are moved between schools, creating instability for students (Ortiz, 2023). Texas has one of the worst rankings for teacher retirement benefits, and retired teachers have not received a cost-of-living increase since 2004 (Lopez, 2022). Among U.S. states, Louisiana has the fifth-highest percentage of uncertified teachers (9%, with the national average at 3%). Louisiana also ranks fourth highest in percentage of beginning teachers, with 16% of its teachers being in their first or second year, above the national average of 12% (Sentall, 2022).

The tax breaks can also affect students' academic achievement. Looking at the districts where LNG facilities are currently sited or in the construction phase, many of the districts underperform in math or reading, or both. Table 3.5 shows student performance in both math and reading in school districts with existing or proposed LNG export facilities. Since individual states determine the criteria that determine proficiency, these numbers cannot be compared across state lines or at a definitive national level. For the 2022–2023 school year, in Louisiana 29% of students were proficient in math and 40% were proficient in reading. In Texas, 37% of students were proficient in math and 42% were proficient in reading. We reviewed proficiency levels for the school districts and compared them to their respective state proficiency levels.

Table 3.5 Local School Performance in Math and Reading by School District

Location	School District	Local math performance	Local reading performance
Cameron LNG	Cameron Parish ISD	35th	51st
Driftwood LNG	Calcasieu Parish ISD	30th	44th
Plaquemines LNG	Plaquemines Parish ISD	39th	48th
Corpus Christi LNG	Gregory-Portland ISD	40th	42nd
Freeport LNG	Brazosport ISD	43rd	41st
Rio Grande LNG	Port Isabel ISD	14th	31st

Source: Public School Review (2024).

Note: In comparison to the national average, Louisiana state performance is 29th in math and 40th in reading, while Texas state performance is 37th in math and 42nd in reading. This percentile indicates the total school district population is at or above proficiency in math and reading.

Mixed-Message Government Response

The United Nations' IPCC provided a "now or never" call for action to remedy the catastrophic course of climate change (IPCC, 2023). Upon taking office, the Biden administration signed a series of executive orders that prioritize climate health, one of which banned new oil and natural gas leases on public land (Newburger, 2022). The Biden administration has committed the United States to answering the IPCC's climate change call and has also called for environmental and climate justice considerations as the country transitions to a clean energy economy. One such policy is the Justice40 Initiative, which promises federal investment of 40% of all benefits to "disadvantaged" communities (The White House, 2022). Congress also passed the $1.2 trillion Bipartisan Infrastructure Law and the $550 billion Inflation Reduction Act—with some $369 billion dedicated to addressing climate change. The infrastructure law has an unprecedented $60 billion for environmental justice and another $60 billion for clean energy. These new federal investments and funding sources have the potential to bring about transformative change and improvements in the lives of residents in sacrifice zones and other frontline communities, who have for far too long been left out and left behind (Mock & Lowenkron, 2021).

Federal agencies such as the Department of Energy, the Department of Justice, the EPA, and the Department of Health and Human Services have also moved to add environmental justice committees and programs within their agencies. More crucial to LNG siting decisions is the declaration from FERC that environmental justice concerns be analyzed in any project that emits greenhouse gases (Willson, 2022b).

With these environmental justice advancements, it would appear that the federal government is moving forward to upend the systematic environmental racism that federal policies have created generationally among populations. However, other developments indicate that federal policymakers have backtracked on potential environmental and climate justice achievements. In regard to allocating money in the Justice40 Initiative, the White House announced it was omitting race as a qualifier in its screening tool for funds, which disregards the importance race played in generations of environmental racism (Joselow, 2022). Facing the pressures of inflation and higher fuel prices, the Department of the Interior announced plans to hold bids on onshore oil and gas leases to reverse executive orders President Biden put in place the previous year (Phillips, 2022). FERC also backtracked by stating environmental and climate justice concerns would not affect new gas projects (Phillips & Pager, 2022). Federal policies aimed at protecting the environment and remedying the climate received another defeat with the 2022 Supreme Court ruling in *West Virginia v. EPA*, which prevents the EPA from regulating carbon emissions in the power sector and prompting a shift away from coal power (Meyer, 2022).

The passage of the Inflation Reduction Act, with the last-minute oil and gas initiatives thrown in, is a bitter pill for some to swallow. However, it does represent a seminal start of cleaner air in frontline communities (Keveny, 2022). The fossil fuel industry has increased exports and garnered large profit margins at the expense of American citizens. With little regulation of export volume, the cost to the planet presents a grim future. In the first half of 2022, the fossil fuel industry exported more than 20% of domestic production (Zibel, 2022).

When Russia invaded Ukraine in February 2022, the fossil fuel industry readied itself for the windfall of demand. The aggression also created a new excuse for the Biden administration to ignore the damaging climate implications of LNG exports. The geopolitical tension has resulted in pressure on the Biden administration to double down on commitments to supply international markets with gas. Prior to the invasion, Russia supplied the European Union with 40% of its gas. In order to impose sanctions, Europe has looked to other sources for its gas, and while its energy use may not increase, the demand will entice new projects outside of Europe to fulfill its demand and create more emissions (Schonhardt, 2022). Despite the Europe–United States partnership to curb Russian expansion of LNG dominance, Russian LNG exports to Europe are increasing. Although Russian pipeline deliveries have decreased, LNG exports were 13.2 million tons through October 2022, whereas they were only 10.9 million tons the previous year (Robinson, 2022). Russia has also purposely reduced the amount of gas to Europe in 2022 (Press Trust of India, 2022).

In July and through August of 2022, satellite images detected Russia burning an estimated $10 million worth of natural gas daily at a Gazprom plant near the Nord Stream 1 pipeline. As diplomatic relations grew tense, Americans and Europeans were uncertain if those were routine operations or a message to Europe that Russia has an excess amount to burn. Regardless, the excess flaring is estimated to have emitted approximately 9,000 tons of carbon dioxide daily and created soot that speeds the melting Arctic ice (Cooban, 2022).

Russia has the world's largest gas reserves (Tachev, 2022). Ukraine climate activists have voiced concerns about how the war may entice countries besides Russia to exploit natural gas: "We'll either fight over the resources themselves—remember the Iraq War?—or fight bad guys (like Vladimir Putin) using fossil fuel dollars to kill. Peace feels impossible in a world dominated by the greed fossil fuels breed" (Funes, 2022, p. 1).

Many environmental justice communities fear that the war in Ukraine will cause the United States to rush and lock in long-term expensive investments in more LNG export terminals, which would make climate goals less attainable. Not only will more export terminals be built, but more fracking will occur, and more pipelines will be built, causing more widespread damage to the communities that host the facilities (Kane, 2022).

Chapter 4: Review of FERC Environmental Justice Analyses

Introduction

This chapter reviews the Federal Energy Regulatory Commission's (FERC's) environmental justice (EJ) analyses for six liquefied natural gas (LNG) facilities in the Gulf South that are examined in this report: Cameron LNG, Driftwood LNG, Plaquemines LNG, Corpus Christi LNG, Freeport LNG, and Rio Grande LNG. These facilities include gas purification and liquefaction plants, power plants, export terminals, docks, compressor stations, pipelines, and other infrastructure. This review focuses on EJ analyses of the locations where the primary infrastructure is located, not the associated network pipelines. We refer to the primary LNG facilities as "LNG export terminals, "LNG terminals," or "LNG site locations," which typically cover about a square mile or more. However, their impacts and the risks they pose to the surrounding communities extend beyond site boundaries.

FERC's EJ analyses are part of environmental reviews done to comply with the National Environmental Policy Act (NEPA). The analyses are included in the "socioeconomics" sections of FERC's environmental impact statements (EISs) for each of the facilities (see Appendix A). EJ analyses are also included in shorter, less comprehensive environmental assessments (EAs) for LNG facility expansion plans, which typically involve adding more methane liquefaction capacity and equipment known as "trains."

FERC conducts EJ analyses in accordance with Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," issued in 1994 (Exec. Order No. 12898, 1994). As discussed below, FERC does not have a standardized approach to conducting EJ analyses. Regardless, FERC tends to follow, to varying degrees, federal guidance and purported best practices. Those are found in the following documents:

- *Environmental Justice Guidance under the National Environmental Policy Act* (White House Council on Environmental Quality, 1997)
- *Final Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses* (U.S. EPA, 1998)
- *Promising Practices for EJ Methodologies in NEPA Reviews* (U.S. EPA, 2016)

In general, FERC EJ analyses seek to determine if an EJ community exists in the project areas and assess the potential for disproportionately high and adverse impacts on people of color and low-income populations. Ostensibly, such analyses serve to inform the public and decision-makers to consider alternatives, and mitigation or compensatory measures.

In its resource document *Promising Practices for EJ Methodologies in NEPA Reviews*, the Environmental Protection Agency (EPA) recommends (1) identifying an affected area or potentially affected areas, that is, places where the impacts of a project are expected to occur; (2) identifying minority (people of color) and low-income populations in the affected area; and (3) comparing those population characteristics of the affected area to a reference community, or a comparison area. The EPA suggests using "thresholds of difference" to determine whether a disproportionately high percentage of people of color or low-income populations could be impacted by the project. As explained below, to apply thresholds of difference, the EPA recommends using "50% analysis" and the "meaningfully greater analyses" to make the determination (U.S. EPA, 2016, p. 24).

Figure 4.1. Corpus Christi LNG Site Location and Its Host Census Block Group and Host Census Tract (inset)

Map source: EJScreen.

As such, FERC's approach to identifying affected areas and characterizing the populations therein is one of convenience. It involves using one or more preexisting geographic units for which census data are reported, such as census tracts and block groups, that most closely correspond with the LNG facility boundary or that are at least partially within a certain distance of the facility where impacts are expected to occur. The problem is that the census units rarely, if ever, correspond with the facility boundary or the surrounding affected areas, such that when census data are compiled, the data may not have a meaningful spatial connection with the actual population living in the affected area.

This point is illustrated in Figure 4.1, which shows the Corpus Christi LNG site and the larger census block group that contains it in green shading, and in the inset map, the even larger census tract. One can see that large areas of the block group extend considerable distances to the east and west of the terminal site boundaries, such that reporting the population characteristics of Block Group 2 of Census Tract 107 would not accurately describe the affected population living in closer proximity to the facility. Figure 4.1 also shows that areas to the north and northwest immediately adjacent to the site location, which are not part of Tract 107, Block Group 2, could reasonably be affected by the facility but might not be counted as part of the affected area.

These problems are in part due to census tracts and block groups being drawn to have roughly equivalent populations, with census tracts typically averaging about 4,000 people and containing on average about four block groups. This means that their geographic extent varies, depending on population density, such that units in rural areas tend to be much larger than those in urban areas. In densely populated areas, a single tract or block group may not be large enough to encompass the affected areas. In those cases, in building-block fashion, demographic data can be compiled for multiple census units that most closely correspond to the affected area. As covered below, how those census units are selected and the data are compiled can make a difference in the accuracy and meaningfulness of the resulting EJ analysis. In cases with large census units, such as with Corpus Christi LNG, the population in nearby affected areas can be estimated using the areal apportionment method, which we describe below (Mohai and Saha, 2006, 2007). However, FERC instead applies less accurate, crude methods that can produce misleading results.

Consider the hypothetical data in Table 4.1. The light-shaded area shows part of what a typical FERC EJ analysis would present, including people of color percentages for "affected" block groups (or tracts) and for one or two larger comparison areas. Table 4.1 shows people of color in one of three block groups exceeding the percentages of the reference communities. FERC tends to interpret these as mixed or inconclusive results. It typically does not report the average of the people of color percentages for the affected block groups, though in this case that average of 30% is also not disproportionately high in comparison to the county. Regardless, the average percentage is not an accurate depiction of the racial/ethnic composition of the affected area, because it weighs the block groups equally even though there is one block group with a much larger population that also has a relatively high percentage of people of color. A better approach that FERC does not employ, shown in dark shading in Table 4.1, is to compute aggregate or population-weighted percentages of people of color. That involves summing the number of people of color in the three block groups (500 + 2,400 + 250 = 3,150) and dividing by the sum of the total population of the block groups (2,500 + 4,000 + 2,500 = 9,000). This yields a people of color percentage for the entire affected area of 35%, which exceeds the percentage for both comparison areas (25% and 30%), that is, a percentage that is disproportionately high.

Table 4.1. Hypothetical Demographic Data for an EJ Analysis Using Raw Block Group Data (light shading) and Population-Weighted Data (dark shading)

Area	Total population	People of color population	People of color percentages
State comparison or reference area	2,000,000	500,000	25%
County comparison or reference area	300,000	90,000	30%
Affected area			
BG no. 40	2,500	500	20%
BG no. 42	4,000	2,400	60%
BG no. 43	2,500	250	10%
Affected area people of color percentages, using BG averages			30%
Affected area, using population-weighted BGs	9,000	3,150	35%

Note: BG = block group.

These and other flaws with FERC's EJ analyses are described below in our review of the EJ analysis of each of the LNG facility locations and their expansion plans. An overview of the methods and comparison areas used in FERC's EJ analyses, and of the census data sources used, are provided in Appendices A and B, respectively. Additional documentation of FERC sources used for this review is in Appendix C.

Note that discussions of tribal consultations, public participation, and cumulative impacts in NEPA documents, while relevant to environmental justice, are generally not covered in the EJ analyses, and thus are not reviewed here. This chapter concludes with recommendations for improving EJ analysis in FERC's NEPA reviews.

Cameron LNG

The 2014 Cameron EIS does not have an EJ analysis and does not report race or ethnicity data. Although the socioeconomics section of the EIS includes poverty and employment data for host parishes (which are county-equivalents) and the state of Louisiana, demographic data are not provided for areas in close proximity to the terminal location (FERC, 2014a). The 2016 EA for the Cameron LNG expansion plan includes a half-page EJ section. It states that the expansion "would have positive socioeconomic effects on minority and economically disadvantaged populations as well as the general population in the Expansion Project area through job creation, economic activity, and continuing tax payments" (FERC, 2016, p. 29). FERC's EA also asserts that there would not be any significant impact to the health and welfare of nearby residents, including children, from air pollution and noise and that "the minor impacts that would occur would be temporary or similar to the existing noise conditions" (FERC, 2016, p. 29). These are both questionable assertions. First, there is very little evidence that polluting industrial facilities provide job benefits to surrounding areas (Ash & Boyce, 2018; Jones, 2023b). Second, LNG facilities are major sources of what the Clean Air Act refers to as criteria air pollutants and hazardous air pollutants, and LNG facility construction is associated with levels of noise pollution that are harmful to wildlife (see the sections "Air Quality Impacts" and "Noise and Vibration" in Chapter 5 of this report). The EA concludes that the expansion project would not "disproportionately affect any population group, and no EJ or protection of children issues would occur as a result of construction or operation" (FERC, 2016, p. 29). However, the EA does not consider the cumulative air pollution and noise impacts of the expansion with that of the existing LNG facility. Although the area is sparsely populated and has low percentages of people of color and persons living below the poverty line, the EJ analysis nevertheless does not provide localized data to allow the reader to weigh the veracity of its claims.

Driftwood LNG

Driftwood LNG is under construction in Calcasieu Parish, Louisiana, several miles north of Cameron LNG. It has a larger nearby population than Cameron LNG, though the surrounding area is also sparsely populated. Its EIS was published in 2019, and the EJ analysis, like all the others, is included in the section on socioeconomics of the environmental impacts chapter (Appendix A) and is stated to be based on the EPA's *Promising Practices for EJ Methodologies in NEPA Reviews* (U.S. EPA, 2016).

FERC's first analysis compares racial/ethnic and socioeconomics characteristics of the parishes where the terminal is located, and pipelines feeding into it, to those of state. While socioeconomic impacts of LNG development, such as effects on housing demand and public services from LNG workers, may extend to the parish level, environmental impacts—for example, air pollution, noise, and risks from accidents—are likely to be confined to areas nearby the terminals and pipelines. This analysis failed to identify a reasonably plausible area of impact where EJ populations may be located, and for which demographic characteristics can be meaningfully compared to a larger, unimpacted comparison area, or reference area. Although FERC's analysis includes the larger reference area—that is, the state of Louisiana—its approach is not suited to determining whether there is a likelihood of people of color and low-income populations being disproportionately impacted. To explain further, this is because the analysis failed to define an impacted or affected area as called for in *Promising Practices for EJ Methodologies in NEPA Reviews*, that is, for determining whether EJ concerns exist.

Although FERC does not follow the EPA's (2016) recommendation to first identify impacted or likely impacted areas for that analysis, the EIS provides criteria for when a minority or low-income population exists. For example, minority populations are said to exist when

> the total racial minorities in a U.S. Census Bureau-defined census tract . . . are more than 50 percent of the tract's population; the percentage of a racial minority in a census tract

> is "meaningfully greater" than in the comparison group; the total ethnic minorities in a census tract are more than 50 percent of the tract's population; or the percentage of ethnic minorities in a census tract is meaningfully greater than in the comparison group high percentages of people of color or low-income populations. (FERC, 2019b, p. 4-139)

The second analysis used what is often referred to as the boundary intersection method[4] to identify census block groups that the "project would intersect" and compared minority percentage and poverty rates of each block group, and the average values of the block groups, to the values for parishes where the facility and its pipelines were proposed, but not to state or national values. FERC does not report population-weighted (aggregate) values of the intersecting block groups (FERC, 2019b, p. 4-140). Because none of the intersecting block groups has a people of color percentage greater than 50% and only one has a percentage greater than its respective parish, FERC concludes that no EJ community exists, also citing that "Louisiana currently has no defined state-specific criteria for an environmental justice community" (FERC, 2019b, p. 4-141). Additionally, FERC states that the project "would have a positive economic effect on the general community, as well as minority and economically disadvantaged populations through job creation, economic activity, and tax payments" (FERC, 2019b, p. 4-141).

Although the use of relatively small units of analysis—census block groups instead of an entire county or parish—is a step in the right direction in terms of identifying potentially impacted areas, there are flaws with FERC's second analysis. First, it uses the crude boundary intersection method (Mohai and Saha, 2006, 2007). Because the area where Driftwood LNG is located has a low population density, even block groups (again, which the Census Bureau draws to have roughly equivalent populations) are large and include populations residing far from the terminal boundaries.

Figure 4.2 illustrates this, showing the eight block groups intersecting a 3-mile buffer around the Driftwood LNG terminal. One can see that a majority of the area of these block groups falls outside of the site boundary and the buffer. The block groups average nearly 34 square miles, with the largest consisting of more than 100 square miles.[5] The percentage of area of the block groups within the 3-mile buffer ranges from 0.07% to 22.9% and averages 7.73%. Thus, FERC's analysis fails to characterize the population living in proximity to the terminal location, where impacts can be expected to occur. As such, the analysis does not provide a meaningful comparison between the population in close enough proximity to the terminal to be affected by it and unaffected reference populations.

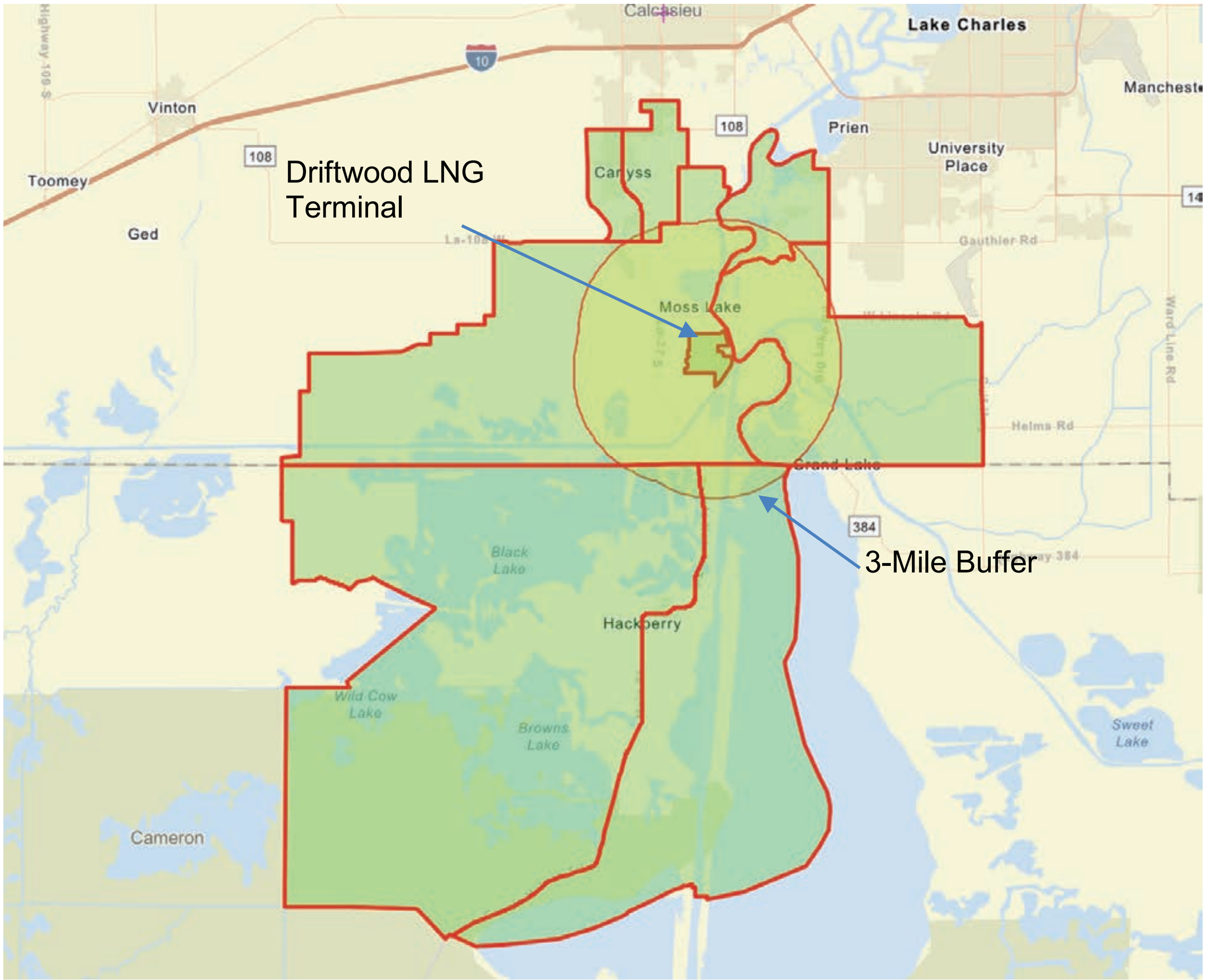
Moreover, FERC's analysis is also potentially misleading by averaging rather than using population-weighted race, ethnicity, and poverty data for the intersected block groups. As such, the analysis does not account for potential differences in the total population of those block groups in comparing their racial and socioeconomic characteristics with those of relevant reference areas. Averages of block group values leave open the possibility of block groups with large populations and percentages of people of color and create the potential for

[4] The boundary intersection method selects Census tracts or block groups that intersect the project site, and in some cases units that are partially or wholly within a certain distance within the site, regardless of what portion of the unit is within the site or a buffer around it. For further explanation, see Mohai and Saha (2006, 2007, 2015a).

[5] Square miles pertain to block group land areas only.

dilution by averaging their people of color percentages with those of other block groups with relatively small populations (see Table 4.1). In addition, state and national comparisons are not made, reducing the potential for revealing racial and socioeconomic disparities. Lastly, FERC does not identify which block groups are associated with the pipeline route and the terminal location, or provide separate EJ analyses for each, leaving open the possibility that there could be EJ concerns associated with one but not the other that could be obscured by combining the two locations into one analysis.

Figure 4.2. Selected Census Block Groups Using Boundary Intersection Method and 3-Mile Buffer Around Driftwood LNG Terminal Location, Calcasieu Parish, Louisiana



Source: EJScreen.

This attempt to conduct an EJ analysis for Driftwood LNG contrasts with the lack of any coverage of environmental justice for the Cameron LNG EIS. In the case of Driftwood LNG, the methodological shortcomings did not result in missing a major EJ concern, as shown in our application of more rigorous distance-based methods in Chapter 5 that show no racial or socioeconomic disparities associated with the terminal location (Mohai and Saha, 2006, 2007). FERC's flawed approach in the case of Driftwood nevertheless exemplifies concerns raised in federal court about the adequacy and rigor of FERC's EJ analyses more generally (Farah, 2021).

Plaquemines LNG

The Plaquemines LNG EIS was completed in May 2019 and includes a five-and-a-half-page EJ analysis. The analysis used the boundary intersection method and census block groups primarily, with Plaquemines Parish as the reference area, though data for the state of Louisiana are reported.[6] Unlike the EJ analysis for Driftwood LNG, this analysis identified an "affected area," defined as census block groups "occupied by the Project facilities" (FERC, 2019c, p. 4-150). The analysis does not conclusively identify whether an EJ community exists in the "affected area." It uses race, ethnicity, and poverty data to determine whether a "potential environmental justice community" exists, first using a "meaningfully greater" threshold to determine whether there was a disproportionately high percentage of minorities in the affected area compared with the reference area, which assumed that "a difference of 10 percentage points indicated a meaningful difference" (FERC, 2019c, p. 4-150). The analysis also examines whether poverty rates in the "affected" area are "greater than the percentage in Plaquemines Parish" as a second criterion for determining whether a "potential environmental justice community" exists. Based on the demographic data for a single large census block group that encompasses the proposed LNG site location and extensive areas to the north-northwest and south, the analysis finds that the "primary affected area is a *potential* environmental justice community based on the criteria" (FERC, 2019c, p. 4-151, emphasis added).

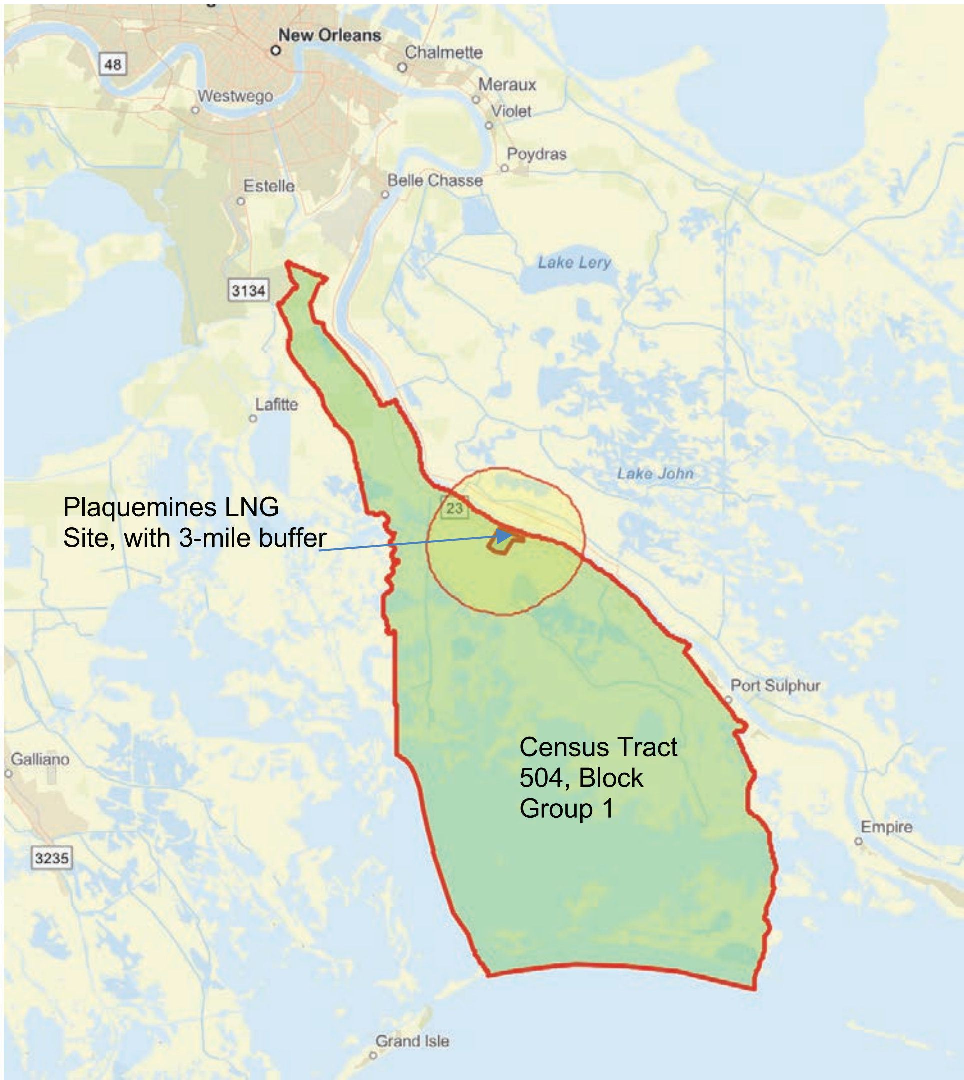
As Figure 4.3 shows, only a small part of the 363-square-mile block group defined as the "affected area" is within close proximity to the LNG terminal boundaries. In fact, the LNG site and areas within 3 miles of it encompass only 2.0% of the block group's land area, and there are areas more than 20 miles from the LNG site in the block group that are not likely to be affected by the facility that are defined as part of the "affected area." Moreover, the analysis does not examine the demographics of the nearby block group to the northeast, on the other side of the Mississippi River, and thus does not account for residents immediately across the river that are within a mile of the terminal. It also does not use other comparison areas such as the state of Louisiana or the nation as a whole, which is commonly done, for example, in the EPA's Environmental Justice Screening and Mapping Tool, EJScreen.

Although the analysis is problematic in terms of accurately identifying the affected area, it does highlight the disproportionately high percentages of people of color (minorities) and persons living below the poverty line in the block group in comparison to Plaquemines Parish (71.8% vs. 33.8%, and 24.5% vs. 17.2%, respectively). Despite finding percentages of people of color in the host block group to be 112% greater than percentages for Plaquemines Parish (and percentages

[6] Four census tracts in southernmost Plaquemines Parish were also used to account for nearby residents whose access into and out of their communities via State Highway 23 could be cut off "during a rare, unexpected event" (FERC, 2019c, p. 4-150).

of Black and Native American populations nearly 100% greater) and poverty rates to be 42% greater, FERC concludes that the "affected areas" constitute a *potential* environmental justice community. Given the magnitude of these disparities, one might ask what criteria FERC would use to identify an *actual* EJ community!

Figure 4.3. Selected Census Block Group Using Boundary Intersection Method and 3-Mile Buffer Around Plaquemines LNG Terminal Location, Plaquemines Parish, Louisiana



Source: EJScreen.

The EJ analysis discusses the potential for air quality impacts, but FERC asserts that those will not violate the Clean Air Act. FERC recommends that the project owner, Venture Global, survey noise and report levels within 60 days after commissioning. It also acknowledges the potential for a catastrophic emergency; the U.S. Coast Guard's responsibility to develop an evacuation plan; and the requirement, under Section 311 of the Energy Policy Act of 2005, for FERC "to review and approve an emergency response plan and associated cost sharing plan prior to final approval to begin any construction" (FERC, 2019c, p. 4-155). While being the most detailed EJ analysis of those reviewed here, it suffers from methodological flaws described above, and it lacks discussion of existing environmental burdens or health vulnerabilities of affected populations, which is also recommended in EPA's *Promising Practices for EJ Methodologies in NEPA Reviews* (2016).

Corpus Christi LNG

The 2014 EIS for Corpus Christi LNG includes a three-page EJ analysis that incorrectly states that census tracts are the smallest geographic area for which race, ethnicity, and poverty data are reported.[7] For the terminal location, the analysis reports demographic data for the very large census tract in which the terminal is located and two other census tracts within a half mile, as compared to San Patricio County. FERC reports percentages of non-Hispanic Whites, Hispanics, Blacks, Asians, Native Americans, other races, and two or more races; however, it does not report people of color or minority percentages as a whole.

Like the EJ analyses discussed above, the Corpus Christi analysis compares demographic data for a very large Census tract (No. 107)—which has a land area of 249.4 square miles, most of which is not in close proximity to the facility and its pipelines—with the demographics of the host county. Again, FERC fails to identify an appropriate affected area. The comparison is also faulty because Census Tract 107 is so large in comparison to the county, which has a land area of 693 square miles, such that it encompasses 36.0% of the county. If the entire tract could reasonably be considered an "affected area," it would be necessary to compare its population with that of the remainder of the county to make a valid comparison. What FERC has done is compare the population characteristics of the host tract with that of a county that includes some of the same population. Although FERC concludes that there are "no disproportionate impacts on low-income or minority populations as a result of the Project" (FERC, 2019a, p. 4-84), our analysis in Chapter 5 using distance-based methods and the areal apportionment method (see Mohai and Saha, 2006, 2007) finds that percentages of Hispanics and people of color as a whole within proximity of the terminal location exceed those of the state, and that Hispanic percentages greatly exceed those of the nation.

In 2019, FERC also released an EA for the facility's expansion plan that includes a four-page EJ analysis. It refers to a 2011 EPA guidance document, and although it does not name or reference the document, the analysis is a marked improvement from the analysis in its 2014 EIS. It uses the boundary intersection method and the EPA's EJScreen to draw a 3-mile buffer around the expansion site. It examines the racial and ethnic composition and poverty rates of 14 block groups intersected by the buffer and used EPA thresholds of analysis to compare the demographics of those block groups with those of two counties, the reference communities. However, the EA perplexedly states that only the block group where the expansion is located would be affected by the project.

To determine whether an EJ concern exists, FERC refers to the EPA's advice stating that "minority population issues must be addressed when they comprise over 50 percent of an affected area or

[7] Census blocks, smaller units that make up block groups, are for race and ethnicity, and Census block groups are for poverty data.

when the minority population percentage of the affected area is substantially greater than the minority percentage in the larger area of the general population" (FERC, 2019a, p. 101). FERC uses the first criterion and not the "substantially greater" threshold and citing United State Code § 689(3) states that

> low-income populations are defined as a geographic area represented by a census tract or equivalent county division where the poverty rate is 20 percent or greater. Therefore, low-income populations for this analysis were determined to be those with 20 percent or greater of the population living below the poverty threshold or when the percent of the population in the affected area living below the poverty threshold is substantially greater than the percent of the population living below the poverty threshold in the larger area of the general population (e.g., county). (2019a, p. 110)

Data for the 14 block groups are not population-weighted to determine the population characteristics of the block groups as a whole—that is, to account for total population differences among them. Instead, FERC notes that "minority" (people of color) percentages exceed the 50% threshold for eight block groups and that poverty rates exceed the 20% threshold for three block groups. FERC dismisses the high people of color percentages by noting that only three block groups exceed percentages for Nueces and San Patricio counties, yet both counties have much greater percentages of people of color than the state of Texas. Based on 2016 estimates, FERC data show percentages of persons of Hispanic or Latino origin of 62.6% and 56.1% for Nueces and San Patricio counties, respectively, compared with 38.6% for Texas. Thus, by using the counties as the reference communities, FERC portrays a much lower level of disproportionate environmental burden on Hispanics than it would have by using the state or nation as a reference area.

FERC concludes that there would be no "disproportionate adverse impact on minority and low-income residents in the area." In boiler plate language FERC asserts that air or water quality impacts from construction and operation "would be temporary and minor" (FERC, 2019a, p. 105). Although FERC acknowledges that there are EJ communities proximal to the expansion, it is not required to take into account the impacts of the existing LNG facility, other cumulative environmental burdens, or health vulnerabilities of the population. That it does not is yet another failure of FERC's EJ analysis of Corpus Christi LNG and the other LNG facilities.

Freeport LNG and Pretreatment Facility

FERC's 2014 EIS for Freeport LNG includes a four-page EJ analysis. It also uses the boundary intersection method to examine minority percentages and poverty rates for three rather large census block groups located within a half mile of the LNG terminal and a pretreatment facility located 3.5 miles north of the terminal. Overall minority percentages and poverty rates are reported for the town of Quintana located immediately next to the LNG terminal, the city of Freeport where the pretreatment facility is located, and Brazoria County. However, percentages of Hispanics or Latinos, Blacks, and other racial groups are not reported for the three Census block groups to allow comparisons to be made for individual racial and ethnic groups. As such, the approach has the potential to overlook EJ concerns related to specific racial or ethnic groups.

In the Freeport LNG EJ analysis, no federal guidance, advisory documents, standards, or criteria are used to define what constitutes an EJ community or what threshold is used to determine whether disproportionately high percentages of people of color or persons living in poverty might be impacted. Minority percentages for the three block groups were reported to vary between 10.8% and 63.4%, and as is the case with other FERC EJ analyses, population-weighted data for the "affected" block groups were not reported (FERC, 2014c). The approach is so streamlined that it can hardly be viewed as an EJ analysis.

The highest minority percentage (63.4%) is reported to be in the block group where the terminal is located. Although the percentage for that block group is much higher than that of the Town of Quintana (33.9%) and Brazoria County (46.8%), in defiance of logic, FERC states that

> other block groups affected by the Projects have a much lower percentage of minorities affected than the county . . . [and the] same is true for percent of persons living below the poverty line: this percentage ranged from 3.5 to 16.2 percent in the block groups affected versus a poverty rate in Brazoria County of 10.6 percent. Accordingly, we find the Liquefaction Project does not disproportionately affect minority populations or low-income populations. (FERC, 2014c, p. 4-135)[8]

FERC's 2018 EJ analysis for the Freeport LNG Train 4 expansion plan uses better but still flawed methods. Since Texas did not have defined state-specific criteria for an EJ community, FERC applied the EPA's thresholds for identifying EJ communities (see discussion of Corpus Christi LNG and Driftwood LNG above). As with the EIS, the analysis relies on the boundary intersection method and a one-half-mile buffer around the project, identifies the same three block groups as did the EIS, and identifies one that has disproportionately high percentages of minorities and two others with relatively high percentages of persons living in poverty. It acknowledges all three block groups as being EJ communities but astonishingly asserts that the block group with a very high percentage of minorities (63.4%), Tract 6444, Block Group 2 (as compared to 25.1% for Brazoria County), will not be affected by the project. Regarding the other two "affected" block groups with poverty rates that exceed those of the county, FERC shifts the focus by stating that "it is anticipated that the Project will generate income in the region and will create on-going sales- and property-tax income for the affected area as well as employment opportunities, ultimately benefiting low-income populations, outweighing any potential adverse effects" (FERC, 2018, p. 123).

FERC provides no evidence to back up that assertion, and its narrative is tantamount to economic blackmail—that is, the premise that low-income communities of color should accept risky, polluting industrial facilities to be economically uplifted—and is consistent with the idea that EJ communities are unavoidable sacrifice zones (Bullard and Wright, 1987; Lerner, 2011). As discussed in Chapter 6, residents of the city of Freeport and Quintana Island—where Freeport LNG's liquefaction plant, terminal, and pretreatment facility are located—do not see LNG

[8] The statement was inclusive of the 10-mile pipeline associated with the project. Poverty rates for block groups proximal to the terminal (and liquefaction plant) and the pretreatment plant range from 5.8% to 16.2%.

providing community benefits and have contrasting views from FERC's analysts of what are acceptable trade-offs for their communities. FERC cannot and should not speak for them.

Both analyses—that is, in the EIS and the EA—in addition to being tone deaf to EJ community concerns, appear to go through contortions to avoid finding an EJ concern. The analyses further highlight the need to report percentages for individual racial and ethnic groups in addition to people of color as a whole. These highly flawed analyses also demonstrate the importance of calculating aggregate or population-weighted population characteristics for multiple census units affected, or likely to be affected, by LNG construction and operations to circumvent the difficulty of interpretation when demographics of census units of interest range widely and to reach sound conclusions.

Rio Grande LNG

The Rio Grande LNG EIS, published in April 2019, has a four-page EJ analysis, which is stated to follow the Council on Environmental Quality's 1997 and the EPA's 2016 guidelines (FERC, 2019d). The analysis uses the boundary intersection method and a 2-mile buffer around the proposed terminal location and thereby selects four census block groups. It does a cursory comparison of the percentages of persons of various racial and ethnic groups and of poverty rates for the four block groups with those of the respective county and the state of Texas. It does not report a population-weighted percentage of people of color or minorities. Three of the four "affected" block groups exceeded the EPA threshold of having a 50% or greater racial or ethnic minority population, Hispanics in this case, including one block group reported to be 99% Hispanic, which also had higher poverty rates than Brazoria County. Two other block groups had higher poverty rates than the state of Texas.

The analysis suffers from many of the flaws associated with the other EJ analyses reviewed above. First, it does not report population-weighted block group data to determine overall population characteristics of the "affected area." It also does not explicitly compare people of color percentages or percentages of persons below the poverty line for the block groups with those of Cameron County, where the LNG facility would be located, or with the percentages for the state of Texas or the nation, to determine whether the project might pose a disproportionate environmental burden. It nevertheless asserts that no such burden would occur in part because the nearest residents live 2.2 miles from the LNG terminal and because traffic delays from construction and disruption to subsistence fishing would be minor or temporary. The analysis states that the terminal site would not cause harmful air pollution because criteria air pollution standards would not be exceeded. However, hazardous air pollutants are not discussed. The Rio Grande LNG EJ analysis is also silent about the risks of a severe hurricane or an unexpected or catastrophic failure of the liquefaction facility to the overwhelmingly Hispanic community in the area. These shortcomings are why FERC was ordered by the D.C. Circuit Court of Appeals to redo its EJ analysis (Farah, 2021; *Harvard Law Review,* 2022).

Conclusions and Recommendations

To summarize, FERC's EJ analyses suffer from a lack of consistency and numerous methodological weaknesses. The predominant approach used, the outdated and inaccurate boundary intersection method (see Appendix A), fails to adequately or consistently identify areas affected by or potentially affected by LNG facility construction and operations. This results in the fundamental problem of not accurately identifying the demographic composition of affected populations. The problem is further compounded by not reporting population-weighted data. Reporting race, ethnicity, and poverty data for multiple census units (e.g., tracts and block groups) captured by the boundary intersection method creates an interpretation challenge, when people of color percentages and poverty rates exceed those of comparison areas for some units but not others. In such cases, there is a tendency in FERC's NEPA documents to dismiss the importance of census units with disproportionately high percentages of people of color or poverty rates.

Another way that is done in effect is to compare affected units near the LNG terminals with the counties or parishes in which they are located. This has the potential to conflate the affected population with the reference population and to render comparisons of disproportionality questionable if not meaningless. This is the case when one or more "affected" census units constitute a large part of the comparison community. Additionally, by using LNG host counties and parishes without also using the host state and/or the nation as a whole as comparisons (see Appendix A), FERC risks overlooking broader-level racial and socioeconomic disparities and thus meaningful EJ concerns.

The State of New Jersey recently developed a methodology that "does not dilute the standard comparison by including other areas in the State or county values that are already impacted" (New Jersey Department of Environmental Protection [NJDEP], 2022, p. 11). NJDEP uses the most protective comparison, whether it is the county or state comparison, and areas with non-overburdened communities. In contrast, FERC tends to use the least protective comparison, counties and parishes, thereby increasing the potential for dilution and decreasing the likelihood of detecting EJ concerns.

Lastly, FERC's EJ analyses systematically ignore cumulative environmental burdens and social and health vulnerabilities of populations of affected areas, even though the EPA suggests conducting such assessments in *Promising Practices for EJ Methodologies in NEPA Reviews* (2016, pp. 16, 34–37). Since 2015, the EPA has provided data on multiple environmental indicators through its EJScreen tool. Although FERC's NEPA review documents published before 2015 would not have had easy access to such data, those published since then could have made use of these data. Because LNG facilities are major sources of criteria and hazardous air pollution regulated under the Clean Air Act, residents living with heart disease, asthma, and other respiratory conditions are particularly susceptible, as are children. Although the Cameron LNG EJ analysis invokes Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks," neither it nor any of the other EJ analyses examines the environmental health risks of LNG to children. In addition, FERC's environmental reviews do not consider preexisting health disparities, but the Centers for Disease Control and Prevention (CDC) has recently begun to provide health data that FERC should employ to assess the health vulnerabilities of affected populations, as we do in the next chapter.

To begin to address the myriad shortcomings of FERC's EJ analyses, we recommend that FERC adopt the following policies and practices:

1. Take advantage of the widespread accessibility of geographic information systems and advancements in EJ analytic methods that represent marked improvements on the boundary intersection method, such as the areal apportionment method, which is used in Chapter 5 of this report (also see Chakraborty et al., 2011; Mohai and Saha, 2006, 2007, 2015a; U.S. EPA, 2015).

2. Use multiple reference communities or comparison areas, including the state and the nation, and adopt a "most protective" standard of comparison like New Jersey's (New Jersey Department of Environmental Protection, 2022).

3. Report total population-weighted percentages of people of color and percentages for specific racial and ethnic groups.

4. Consistently employ readily available, federal EJ screening and mapping tools such as the EPA's EJScreen, the Agency for Toxic Substances and Disease Registry's (ATSDR's) Environmental Justice Index, the White House Council on Environmental Quality's Climate and Economic Justice Screening Tool, the CDC's PLACES maps and underlying database, and CDC/ATSDR's Social Vulnerability Index, and use them to assess existing pollution burdens and health and climate vulnerabilities.

5. Update FERC's *Guidance Manual for Environmental Report Preparation* (FERC, 2017) and NEPA implementing regulations to ensure rigorous, accurate, and complete environmental justice analyses are performed in NEPA reviews that are demonstrably consistent with the public interest under the Natural Gas Act.

6. Work with and train third-party contractors to conduct consistently rigorous, accurate, and complete EJ analyses that take into account existing community environmental, health, and safety burdens, and social vulnerabilities, including risk to children.

7. Provide evidence of job and economic benefits to areas most impacted by the pollution and health and safety risks from LNG facilities and recognize that evidence has been found lacking with regard to polluting industrial facilities more generally (Ash and Boyce, 2018).

8. Support real community benefit agreements negotiated by EJ leaders in affected communities.

9. Do not speak for or on behalf of the EJ community about what is deemed acceptable (Bullard and Alston, 1990).

10. Confer with the White House's Environmental Justice Advisory Council in formulating new EJ analysis policies and guidelines.

To its credit, FERC has begun to listen to EJ stakeholders and has acknowledged the need to give greater attention to equity and justice concerns by adopting an Equity Action Plan in January 2022 and hiring a senior counsel for environmental justice and equity. The Department of Energy has likewise begun to directly engage with communities affected by fossil fuel development (Parker, 2023). In addition to promising better public participation and communication with Indigenous tribes, FERC has identified the need to hire more staff and provide training for conducting EJ analyses, and the Department of Energy has done so (FERC, 2022a; Howell, 2023). This review of FERC's recent EJ analyses and strident calls from grassroots community leaders and environmental justice advocacy organizations indicate that a great deal of work is yet to be done (Sierra Club et al., 2023).

Appendix A: Summary of FERC Environmental Justice Analyses

NEPA review document	Inclusion of EJ analysis	Method	Demographics reported and smallest census area	Reference or comparison area(s)
Cameron LNG EIS (2014)	No EJ section	n/a	n/a	n/a
Cameron LNG EA (2016)*	Half-page subsection of the socioeconomics section	n/a	None	n/a
Driftwood EIS (2019)	~3-page subsection of the socioeconomics section	Boundary intersection method	1. Percentages by race/ethnicity & total minority, per capita income, and poverty rate for Calcasieu Parish 2. Total population, no. of households, % minority, % families below poverty for census block groups	1. State of Louisiana 2. Calcasieu, Jefferson Davis, Acadia, and Evangeline parishes
Plaquemines EIS (2019)	5-page subsection of the socioeconomics section	Boundary intersection method	Percentages by race/ethnicity & total minority, and poverty rate, for one large census block group	Plaquemines Parish
Corpus Christi EIS (2014)	3-page subsection of the socioeconomics section	Boundary intersection method using a ½-mile radius	Percentages by race/ethnicity & total minority, and poverty rate, for large host tract and tracts within ½ mile of LNG terminal	San Patricio County
Corpus Christi EA (2019)*	4-page subsection of the socioeconomics section	Boundary intersection method using a 3-mile radius	Percentages by race/ethnicity & total minority, and poverty rate, for block groups within 3 miles of the expansion site	Nueces and San Patricio counties
Freeport EIS (2014)	4-page subsection of the socioeconomics section	Boundary intersection method using a ½-mile radius	Total minority percentages and poverty rates for block groups within ½ mile of LNG terminal and pretreatment plant	Town of Quintana, City of Freeport, and Brazoria Co.
Freeport EA (2018)*	4-page subsection of the socioeconomics section	Boundary intersection method using a ½-mile radius	Total minority percentages and poverty rates for block groups within ½ mile of LNG terminal and pretreatment plant	Town of Quintana, City of Freeport, and Brazoria Co.
Rio Grande EIS (2019)	4-page subsection of the socioeconomics section	Boundary intersection method using a 2-mile radius	Percentages by race/ethnicity & total minority, and poverty rate, for block groups within 2 miles of the LNG terminal	None made, though data presented for Cameron Co. & Texas

Sources: See Appendix C.

Note: NEPA = National Environmental Policy Act; EJ = environmental justice; n/a = not applicable.

* Expansion plan.

Appendix B: Census Data Sources Used for FERC Environmental Justice Analyses

LNG facility	Census data used
Cameron LNG*	Not applicable
Cameron Expansion	None
Driftwood LNG	American Community Survey, 5-Year Estimates, 2011–2015
Plaquemines LNG	American Community Survey, 5-Year Estimates, 2012–2016
Corpus Christi LGN	2010 American FactFinder
Corpus Christi Expansion	For race/ethnicity: U.S. Decennial Census, 2010 For poverty rate: American Community Survey, 5-Year Estimates, 2008–2012
Freeport LNG	For race/ethnicity: U.S. Decennial Census, 2010 For poverty rate: American Community Survey, 5-Year Estimates, 2008–2012
Freeport Expansion	For race/ethnicity: U.S. Decennial Census, 2010 For poverty: American Community Survey, 5-Year Estimates, 2011–2015
Rio Grande LNG	American Community Survey, 5-Year Estimates, 2011–2015

* Did not have an EJ analysis, but socioeconomic section used 2000 and 2010 American FactFinder data.

Appendix C: Sources for Appendix A ("Summary of FERC Environmental Justice Analyses")

LNG facility	Sources
Cameron LNG*	Not applicable
Cameron Expansion	FERC (2016), pp. 28, 29
Driftwood LNG	FERC (2019b), pp. 4-128 to 4-131, 4-134, 4-138 to 4-141
Plaquemines LNG	FERC (2019c), pp. 4-149 to 4-155
Corpus Christi LNG	FERC (2014a), pp. 4-82 to 4-85
Corpus Christi Expansion	FERC (2019a), pp. 101–108
Freeport LNG	FERC (2014c), pp. 4-132 to 4-136
Freeport Expansion	FERC (2018), pp. 120–124
Rio Grande LNG	FERC (2019d), pp. 4-233 to 4-237

* As noted, although the Cameron LNG EIS does not cover environmental justice, the socioeconomic section includes demographic data for affected parishes and the state of Louisiana (FERC, 2014a, pp. 4-100 to 4-115).

Chapter 5: Cumulative Impact Assessment of LNG Export Terminals

Introduction

The expression "death by a thousand cuts" aptly describes liquefied natural gas (LNG) export terminals. LNG facilities are complex, major industrial facilities and have a large footprint and wide range of environmental, social, and health impacts. Some might shrug off the impacts of one particular type of LNG-related activity, such as flaring or dredging, as minor or insignificant, yet when examining the totality of impacts of either a single LNG terminal or multiple LNG terminals, a different picture emerges. Unfortunately, however, environmental decision-making is typically made in piecemeal fashion, one permit or facility at a time, without much consideration of existing environmental burdens and community social vulnerabilities. Also ignored are the ways that racial and socioeconomic inequalities interact with, and often compound, environmental and health inequalities. This narrow approach results in government and industry decisions that pile environmental stressors on vulnerable communities, one after another. That is why environmental justice (EJ) leaders, grassroots organizations, advocates, and others have, for decades, called for consideration of the cumulative impacts of polluting industrial facilities so it can be understood when enough is enough (Bullard, 2005; Lee, 2020).

According to the U.S. Environmental Protection Agency (EPA), cumulative impact "refers to the total burden—positive, neutral, or negative—from chemical and non-chemical stressors and their interactions that affect the health, well-being, and quality of life of an individual, community, or population at a given point in time or over a period of time" (U.S. EPA, 2022a, p. 1). Cumulative impact assessment (CIA) is a way of taking stock of the range and magnitude of impacts. The EPA (2022a, p.1) describes CIA as an examination of "how stressors from the built, natural, and social environments affect people, potentially causing or exacerbating adverse outcomes." CIA can be distinguished from cumulative risk assessment, which focuses on the health impacts of multiple chemical stressors (U.S. EPA, 2003).

Although there is no widely accepted way to conduct CIAs, there have been some promising efforts, including the development of EJ screening tools that combine environmental quality, health, and social vulnerability indicators (see, e.g., Bhandari et al., 2020; Pastor et al., 2010; Petroni et al., 2021; Williams et al., 2022). Though these efforts are informative and useful, they are quantitative and distill impacts and vulnerabilities down to numeric scores, and thus they do not fully convey the environmental, social, and human consequences of industrial development.

Though the approach we take is mostly qualitative, we also use quantitative environmental, health, and demographic data to identify and characterize vulnerable populations in fenceline communities that are affected by LNG facilities and existing environmental burdens—

communities that are located on the fence line of oil and gas industries, refineries, and petrochemical plants. We also conduct an in-depth assessment of environmental impacts of LNG development along the Gulf Coast, one of the most ecologically diverse and productive parts of the United States. The human communities, economies, and local cultures of the Gulf Coast rely heavily on healthy, functioning natural systems. Thus, environmental degradation and pollution necessarily have profound impacts on people, on some more than others.

Because it was necessary to have a manageable scope, we conducted our CIA for six LNG facilities, selected to be representative of facilities that are operating, under construction, or proposed in Louisiana and Texas, as shown in Table 5.1. Operating facilities include Cameron LNG (Louisiana), Corpus Christi LNG (Texas), and Freeport LNG[9] (Texas), all of which are currently expanding or are seeking to expand by adding new trains, which are energy-intensive equipment used to cool and compress methane gas into a liquid. These three facilities accounted for nearly half of the LNG exports in 2022 from the Gulf South (Louisiana and Texas). Sabine Pass LNG and Venture Global Calcasieu Pass LNG are two operating LNGs in the Gulf South that were not included in our analysis. Both are in Louisiana. Two under-construction facilities, (Driftwood LNG and Plaquemines LNG, in Louisiana and Texas, respectively) and one proposed and approved facility were examined (Rio Grande LNG).

Table 5.1. LNG Facilities for Cumulative Impact Assessment

Facility	Location	Status
Cameron LNG*	Hackberry, LA	Operating, proposed to expand
Driftwood LNG	Calcasieu Parish, LA	Under construction
Plaquemines LNG	Plaquemines Parish, LA	Under construction
Corpus Christi LNG	Corpus Christi, TX	Operating, expanding
Freeport LNG	Freeport, TX	Operating, expanding
Rio Grande LNG	Brownsville, TX	Proposed and approved

* Located in Cameron and Calcasieu parishes.

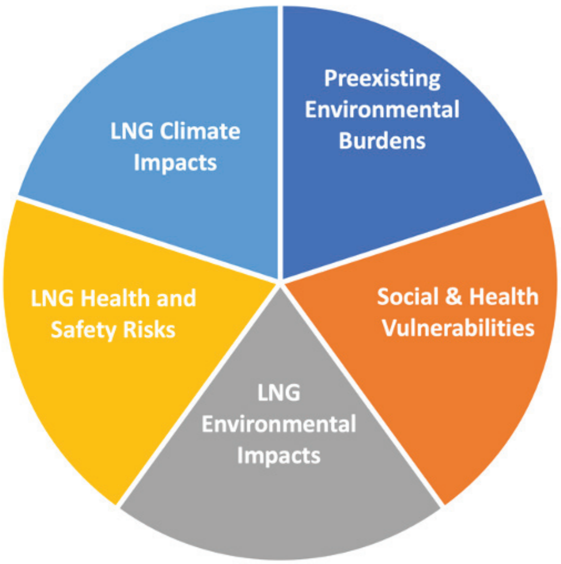
Approach

As Figure 5.1 depicts, the CIA framework we employ entails examining (1) existing environmental burdens; (2) existing social and health vulnerabilities; (3) environmental impacts of LNG facilities from their construction and operation; (4) LNG health and safety risks, including those associated with climate change and extreme weather events; and (5) LNG climate impacts. To examine existing environmental burdens, we first discuss the legacy of environmental damage along the Gulf Coast from oil and gas development and the growth of the petrochemical industry. Second, we examine the existing pollution burdens and toxic hazards within 3 miles of the LNG export terminals; and in the case of Freeport LNG, we examine similar areas around its pretreatment facility, which is not contiguous with the terminal site and poses risks of its own

[9] Note that Freeport LNG has a pretreatment facility located 3 miles north of the LNG export terminal. The pretreatment facility is highly polluting, and thus its location is also examined in various analyses in the chapter.

to the surrounding community. Specifically, we examine environmental indicators included in the EPA's EJ screening tool, EJScreen, by applying a new "matrix method" to assess cumulative environmental pollution burdens. We make comparisons across facilities and characterize environmental stressors for the six LNG facilities as a whole.

Figure 5.1. Cumulative Impact Assessment Framework



To assess social and health vulnerabilities, first, we use the U.S. Census Bureau's American Community Survey 2017–2021 to examine the demographic composition of areas within 3 miles of the LNG terminal sites, including percentages of people of color and low-income populations in comparison to state percentages. After identifying racial and socioeconomic disparities in LNG locations, we use the Centers for Disease Control and Prevention's (CDC's) PLACES data to assess health disparities in LNG host communities. For areas around the LNG facilities, health outcomes and prevention measures (e.g., asthma prevalence, cancer rates, and lack of insurance) are compared with state and national measures.

For our assessment of the environmental impacts of LNG facilities, we used various types of sources, including Federal Energy Regulatory Commission (FERC) and other government documents, peer-reviewed literature, nongovernmental organization (NGO) reports, news stories, and more. We sought to review a wide range of environmental impacts, recognizing that environmental and natural resources protection has always been fundamental to advancing environmental justice (*Principles of Environmental Justice,* 1991; Taylor, 2000). LNG facility construction and operations pollute the air, water, and land. They are being built in environmentally destructive ways in ecologically rich and environmentally sensitive shoreline locations. LNG facilities and the vessel fleets and pipelines that serve them have impacts on a wide variety of natural resources that provide valuable ecological services (e.g., producing food and water), support local economies, and give meaning to and define the identities of human communities (Tidwell, 2007). Although we discuss impacts from vessel traffic as an ancillary part of the operations of LNG facilities, a full treatment of the vast pipeline networks extending from the Permian Basin is beyond the scope of this report. We do nevertheless call attention to a 26-mile proposed pipeline called the "Gator Express" that would supply Plaquemines LNG if it were built.

Our assessment of LNG health and safety hazards, the fourth element of our CIA framework, considers LNG technological failures, leaks, and spills and the associated impacts on the health, safety, and welfare of fenceline communities. A recent explosion and fire at Freeport LNG highlight the salience of this aspect of LNG facilities. For this element, we examine Natech (natural hazards triggering technological accidents), that is, how natural hazards can cause technological failures, and specifically how sea level rise, storm surges, and flooding interact and magnify LNG facility health and safety risks (Flores et al., 2021b).

Our assessment of LNG climate impacts, our fifth element, uses primary and secondary sources to consider the cumulative impact of LNG development, which is heavily concentrated in the Gulf South. We discuss how the amount of greenhouse gas emissions from LNG development would contribute to pushing global warming past the threshold and boundaries for a safe, habitable planet as well as call attention to FERC's abject failure to consider climate impacts in its National Environmental Policy Act (NEPA) reviews.

In applying our cumulative impact framework, we do not suppose that our account of LNG facility impacts is entirely comprehensive or complete. Instead, we view it is as an expansive attempt to complement other reviews of the problems with methane gas, and with liquefied natural gas more specifically (Climate Action Tracker, 2022; CSO Equity Review, 2021; Environmental Integrity Project, 2022a; Kieninger & Robb, 2022; Rozansky, 2022; Rozansky & Langenbrunner, 2022; Shaykevich & Otto, 2020; Shaykevich et al., 2022; Shukla, & Samuel, 2022; Slocum, 2023a; Swanson and Levin, 2020; Union of Concerned Scientists, 2013; van Heerden, 2022; Martos et al., 2023). Based on our CIA, and conservatively speaking, one can conclude that the totality of environmental and social impacts of LNG facilities is vast, particularly when you consider those facilities' contributions to climate change. The carbon footprint of LNG facilities—including the massive amount of methane leaks from the thousands of wells and thousands of miles of pipelines, and the carbon emissions on the consumer end of LNG—is an important part of the cumulative impact of LNG facilities that must be recognized and confronted (Shukla & Samuel, 2022; Swanson & Levin, 2020). Our CIA follows next.

Existing Environmental Burdens in LNG Facility Fenceline Communities

The Gulf Coast is a patchwork of natural wonders and industrial development, home to national seashores and wildlife refuges . . . and "Cancer Alley," the petrochemical corridor that stretches from New Orleans to Baton Rouge and beyond. For more than 60 years, oil and gas development has degraded the coastline and offshore areas of Louisiana and Texas. Industry carved a network of pipelines into fragile coastal wetlands to carry offshore oil and gas inland to a voracious petrochemical industry. The widening of the Gulf Coast rivers and bayous and the channelization of the Mississippi River to accommodate shipping and port building enabled economic growth, urbanization, agricultural development, and with it, tremendous amounts of chemical and nutrient runoff into the Gulf from other water bodies draining into it. These activities spread contamination, caused land subsidence, contributed to massive coastal erosion, imperiled the ecologically rich Gulf Coast, and continue to threaten the fisheries that support the tourism, recreation, and sport- and subsistence-fishing economies (Theriot, 2014; Barron et al., 2020). It is a type of toxic trade-off, whereby once-vibrant coastal ecosystems that sustained local communities have become natural resource "sacrifice zones" (Lerner, 2011). The ecological strain was significantly worsened by the 2010 BP *Deepwater Horizon* oil spill, which had devastating consequences for coastal resource–dependent communities (Hodges et al., 2021; Murawski et al., 2021). The effects of sea level rise and climate change discussed below and in other parts of this report also threaten the lives and lifeways of coastal residents, including Native American and African American communities. Those are among the environmental burdens of Gulf Coast communities who rely on the Gulf for sustenance and who value and care for its ecological richness, many of whom are now confronting the added threats of LNG development.

It is well established that environmental pollution burdens in the Gulf Coast region are disproportionately borne by African Americans and are the result of the nation's largest concentrations of petrochemical industries having located in established African American communities along the industrial shipping channels and ports of Louisiana and Texas (see, e.g., Bullard, 1987, 1994b; Bullard and Wright, 2009; Lerner, 2011; Louisiana Advisory Committee to the U.S. Commission on Civil Rights, 2000; Roberts and Toffolon-Weiss, 2001). Our guiding question here is this*: What are the existing environmental pollution burdens in communities where LNG facilities are being located?*

We used the EPA's EJScreen (version 2.1) to answer that question. EJScreen is a web-based mapping tool first released to the public in 2015 (U.S. EPA, 2022c). EJScreen allows users to examine pollution burdens for user-defined geographic locations using 12 environmental indicators. Drawing on multiple national databases, the environmental indicators cover exposure pathways and hazards associated with various environmental media, including air, water, waste, and dust. They include (1) measures of potential toxic air exposures (based on pollution levels); (2) risk and hazard measures, for example, lifetime cancer risks from inhalation of air toxics; and (3) proximity measures (proxies for exposures to risks), for example, proximity to Superfund sites and hazardous waste facilities. EJScreen does not include some important indicators of environmental hazards and risks (e.g., use of and exposure to pesticides and drinking water contamination) and thus is not as comprehensive as some state EJ screening tools. Nevertheless, EJScreen is a useful tool for identifying areas where environmental and EJ concerns exist or are likely to exist and the related types of exposures and risks as well as affected populations. It also helps in the task of informing affected communities and other concerned parties. As such, EJScreen serves our purpose here.

EJScreen provides numeric results for each of the environmental indicators in relation to user-selected areas—in this assessment, areas within 3 miles of the boundaries of the LNG terminal sites. In selecting 3-mile zones, we are not trying to assert that LNG facilities have impacts on or pose risks to those areas.

Rather we are defining consistent areas or communities around the LNG facility locations so that we can assess the broader landscape of environmental risk in areas where LNG facilities are sited.

EJScreen raw numeric scores are scaled and expressed as percentiles, from 0 to 100. The scaled scores represent the ranking of a given environmental indicator score for a user-defined area in relation to the scores of all census block groups in the state and the nation as a whole. Thus, a score greater than 50 (i.e., greater than the 50th percentile) indicates a higher environmental pollution burden than the median score for the state or country, that is, a higher score than for half of the block groups in a state or national comparison area. Scores of 75 (i.e., in the 75th percentile) and 90 (in the 90th percentile) in comparison to, for example, the state indicate that 25% and 10%, respectively, of block groups in the state have a higher indicator score or pollution burden than the area around the LNG facility.

Our purposes in this stage of the CIA are to determine which LNG host communities are environmentally overburdened, in what ways, to what degree, and how much so in comparison to each other. We use the 50th, 75th, and 90th percentiles as our thresholds. Table 5.2 shows those results for the 3-mile areas around each of the six LNG facilities, that is, environmental indicator scores for those areas in comparison to the state in which each LNG facility is located (Louisiana or Texas), and in comparison to the nation. Values less than 50 are not shown or are signified with an "x." See Appendix A for a detailed description of EJScreen environmental indicators (also see U.S. EPA, 2022c).

Table 5.2 shows elevated scores (> 50th percentile), or what can be considered relatively high environmental burdens, for three or more LNG sites for all of the environmental indicators except ground-level ozone and traffic proximity and volume. Five of the six LNG facilities have elevated scores for fine particulate matter, Risk Management Plan (RMP) facility proximity, and wastewater discharge; and four have elevated scores for lifetime air toxics cancer risk and Superfund proximity.

The 50th percentile is a rather low bar to exceed despite representing values greater than those of half of a state's or half of the nation's census block groups. To better reveal the patterns of Table 5.2, we tallied up and examined the total number of scores for the 12 environmental indicators for each LNG facility that are above the 50th, 75th, and 90th percentiles. This approach helps reveal the cumulative environmental burdens for each LNG facility host community and allows for comparison among such communities. It does not fully overcome the shortcoming of not having a single measure of environmental pollution burdens that combines the various scores (Kuruppuarachchi et al., 2017). However, combining multiple scores to create a single measure has its own challenges and potential drawbacks, such as, for example, in deciding whether and how to weight scores (Mohai et al., 2022).

To streamline the presentation, we took the average of the environmental indicator scores that use the state and the national scores for the rankings. Louisiana and Texas generally have higher environmental indicator scores than the United States as a whole, and thus, scores for LNG facility host communities tend to be lower when ranked with state scores than with national scores. By averaging the two we take into account the relatively high pollution burdens of Louisiana and Texas as compared to the rest of the country.

Table 5.2. EJScreen Environmental Indicator Score Percentiles for Gulf Coast LNG Facilities in Comparison to State and National Scores (State/National)

Indicator	Louisiana LNG facilities			Texas LNG facilities		
	Cameron	Driftwood	Plaquemines	Corpus Christi	Freeport	Rio Grande
Particulate matter ($PM_{2.5}$)	62/73	79/79		x/78	x/62	77/86
Ground-level ozone			75/x			
Diesel PM	x/< 50	x/< 50			64/50–60	
Air toxics cancer risk	70/90–95	90/95–100	52/80–90		95/95–100	
Air toxics respiratory hazard index	x/70–80	93/95–100			99/95–100	
Traffic proximity and volume				60/x		70/66
Lead paint				57/x	82/64	52/x
Superfund proximity	54/x	62/x		71/60	89/81	
RMP proximity*	56/61	75/82		73/78	98/98	85/87
Hazardous waste proximity	54/53	59/59		75/x	97/83	
Underground and leaky storage tanks				57/58	80/73	67/64
Wastewater discharge indicator	85/78	90/85	75/68	57/55	99/96	

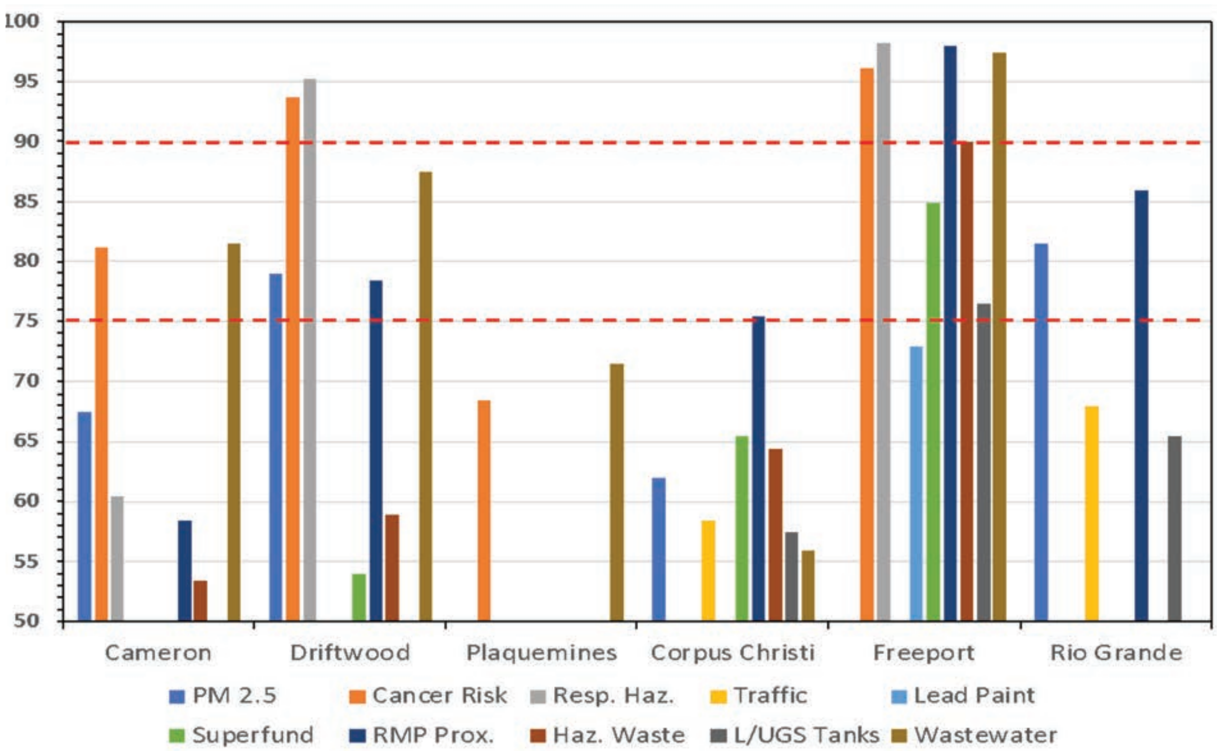
Note: Values less than the 50th percentile are blank or shown as "x."

* Risk Management Plan facility.

Figure 5.2 summarizes the results for each facility by presenting those averages of environmental indicator scores that are higher than the 50th percentile, and it highlights scores at or higher than the 75th and 90th percentiles.[10] Driftwood LNG and Freeport LNG stand out by having multiple environmental indicator scores at or exceeding the 90th percentile, including for lifetime air toxics cancer risk and air toxics respiratory hazards. Freeport LNG also has very high scores (≥ 90th percentile) for proximity to RMP facilities, which store and use large amounts of extremely hazardous substances that may be prone to dangerous chemical accidents, as well as for hazardous waste proximity and wastewater discharges. Driftwood LNG, Freeport LNG, and Rio Grande LNG have two scores between the 75th and 90th percentiles, and Cameron LNG and Corpus Christi LNG have one environmental indicator score in that range as well.

[10] In averaging percentiles, for percentiles reported in a range—e.g., 70th–80th percentile—the midpoint was used; in this example, that would be the 75th percentile. The 25th percentile was used for < 50th percentile.

Figure 5.2. Summary of Elevated EJScreen Environmental Indicator Scores (Percentiles) by Facility



Note: Ground-level ozone and diesel particulate matter omitted (see Table 5.2 for those scores).

Overall, these results show high environmental pollution burdens (≥ 75th percentile) for five of the six LNG sites: Cameron and Driftwood, which are not in areas with dense populations, and Corpus Christi, Freeport, and Rio Grande, which are in or near medium-sized cities in Texas.[11] Freeport LNG clearly stands out as the most environmentally overburdened with scores for four environmental indicators above the 90th percentile, two scores between the 75th and 90th percentiles, and two others between the 50th and 75th percentiles. Plaquemines LNG is the least environmentally burdened LNG facility of the six. It is slated to be built in a largely undeveloped area along the Mississippi River and has elevated environmental indicator scores (> 65th percentile) for lifetime air cancer risk and wastewater discharges.

In conclusion, it is clear from this analysis that, as a whole, host communities where LNG companies are located are environmentally overburdened. As discussed further below, LNG facilities, in addition to damaging the physical environment where they are built, add to the local environmental pollution burdens and contribute significantly to climate change. They also impose risks of accidents, explosions, and fires that could damage property and endanger nearby residents, who are already overburdened by pollution and proximity to other hazardous facilities.

[11] Results for the Freeport LNG Pretreatment Facility can be requested from the authors.

Social and Health Vulnerabilities of LNG Facility Fenceline Communities

Decades of EJ research have shown that people of color and low-income communities are socially and politically vulnerable to the siting of polluting industrial facilities and are often targeted because they are seen as paths of least resistance. They often lack the social and political capital needed to participate in environmental permitting and stave off locally undesirable land uses (Mohai and Saha, 2015b). Race is also a factor in social vulnerability because of legacies of historical racism discussed in this report, present-day discrimination (e.g., in environmental decision-making, housing, banking, education, transportation, employment, health care, and other domains), and structural disadvantage more generally.

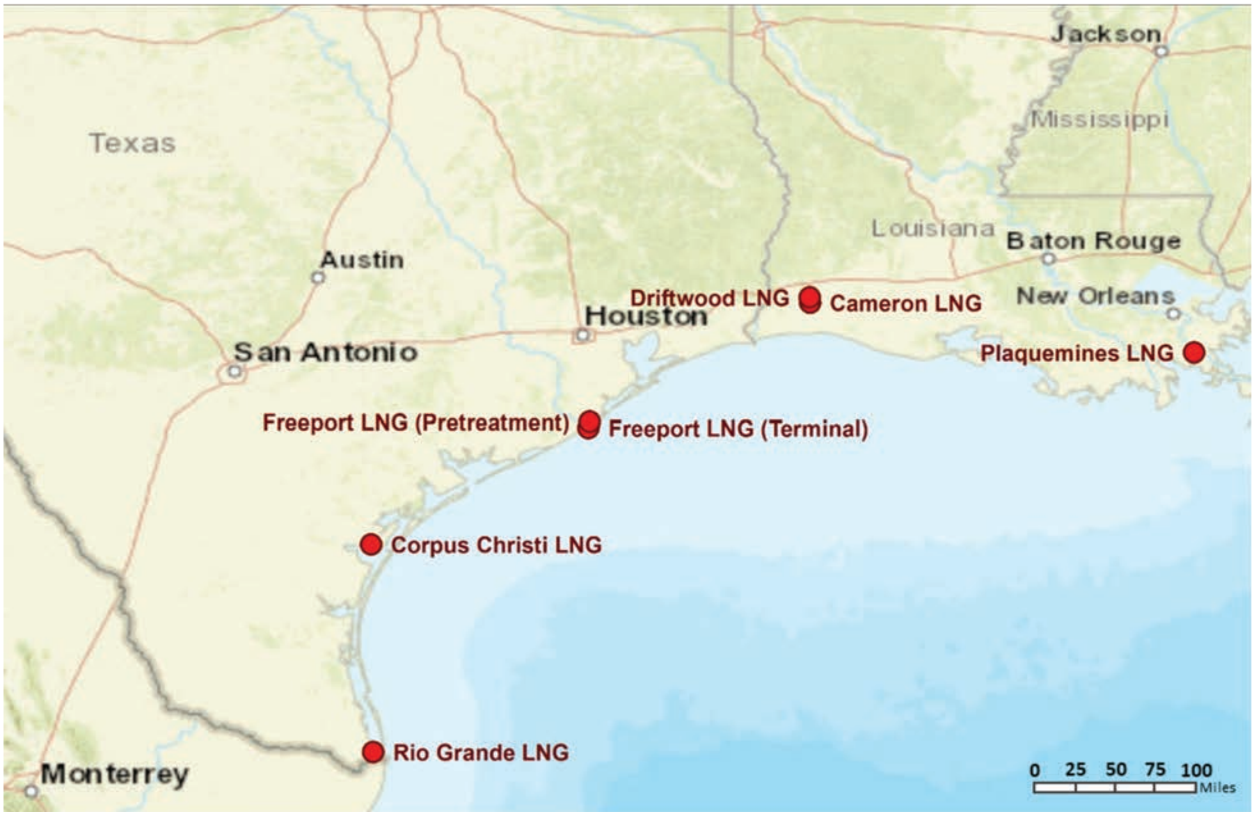
As Hurricane Katrina has shown and as noted by the CDC, socially vulnerable populations are especially at risk during natural disasters and public health emergencies "because of factors like socioeconomic status, household characteristics, racial and ethnic minority status, or housing type and transportation" (Agency for Toxic Substances and Disease Registry, 2023). Social conditions can influence the ability to cope with, recover from, and adapt to environmental and natural hazards (Cutter et al., 2003). One can think of social factors as risk multipliers that are also related to the degree to which a community receives emergency services and environmental regulatory protection (Bullard and Wright, 2012).

Social conditions, such as poverty, homelessness, food insecurity, and lack of access to health care, are among the social determinants of health, that is, factors that affect health behaviors and outcomes such as disease prevalence (Braveman & Gottlieb, 2014; Morello-Frosch et al., 2011). Existing health conditions, as well as existing environmental stressors, affect a population's susceptibility to additional environmental health risks, in this case those from LNG facilities (e.g., see the "Air Quality Impacts" and the "Climate Change Hazards, Technological Failures, Explosions, Leaks, and Spills" sections below).

We take a two-pronged approach to assessing social and health vulnerabilities. First, we conducted a spatial, demographic analysis of areas around each of the six LNG terminal locations and the Freeport LNG Pretreatment Facility, which is located about 3 miles north of the terminal. Facility locations are shown in Figure 5.3.

We employed geographic information system (GIS) software and census block group data to estimate the population characteristics of areas within 3 miles of the various LNG site boundaries. For this analysis, we used American Community Survey five-year estimates for 2017–2021, the most recent data available. We used the areal apportionment method, which surmounts many of the methodological problems with the boundary intersection method used by FERC in its EJ analyses and described in Chapter 4 (Mohai & Saha, 2007; U.S. EPA, 2016). The areal apportionment method has the advantage of examining the population characteristics of consistently sized "affected areas," or areas impacted or potentially impacted by LNG facility construction and operations. In applying the method, we used host states and the nation as a whole as comparison areas. Details of the data sources and methods are provided in Appendix B.

Figure 5.3. LNG Export Terminal Locations in Louisiana and Texas



Map by Fernando Sanchez.

Second, we used the CDC's PLACES data (December 9, 2022, release) to examine health vulnerabilities. The PLACES data use national-level Behavioral Risk Factor Surveillance System data from 2019 and 2020 to provide health outcome, prevention, and behavioral risk measures at multiple geographic levels. We examined health indicators and measures for census tracts that are at least partially within 3 miles of the LNG sites in comparison with all the census tracts in the state where the facilities are located (see Appendix B).

Table 5.3 shows estimated racial and ethnic composition of areas within 3 miles of the LNG facilities, in host states, and in the nation. The areas around Plaquemines LNG and the Freeport pretreatment plant, located in Texas, are home to disproportionately high percentages of African Americans. Areas around Plaquemines LNG are 71.7% African American, more than double the percentage for Louisiana (31.9%) and nearly six times greater than that of the nation (12.6%).

Table 5.3. Racial/Ethnic Composition of Areas Around LNG Facilities in Comparison to State and National Percentages

	Percentage African American			Percentage Hispanic			Percentage people of color		
	3-mile area	State (LA & TX)	Nation	3-mile area	State (LA & TX)	Nation	3-mile area	State (LA & TX)	Nation
Cameron	0.00%	31.9% (LA)	12.6%	1.08%	5.34% (LA)	18.4%	2.02%	42.2% (LA)	40.6%
Driftwood	0.00%			0.61%			2.56%		
Plaquemines	71.7%			0.00%			77.7%		
Corpus Christi	2.24%	12.1% (TX)		41.1%	39.8% (TX)		47.1%	59.3% (TX)	
Freeport Pretreatment	23.1%			43.3%			68.3%		
Freeport Terminal	8.20%			62.8%			72.9%		
Rio Grande	0.04%			85.7%			87.6%		

Four of the seven facility locations are home to disproportionately high percentages of Hispanics: Corpus Christi LNG, Freeport Pretreatment, Freeport LNG, and Rio Grande LNG. Areas around Rio Grande LNG, though sparsely populated, are 85.7% Hispanic compared to about 40% for the state of Texas and 18.4% for the nation. Percentages of Asian Americans and Native Americans were around 1% and are not shown. Overall, these results show that people of color are disproportionately located near LNG facilities and therefore are likely to be disproportionately impacted.

We also determined the socioeconomic composition of areas with LNG facilities. Table 5.4 shows that areas around Freeport Pretreatment, Freeport LNG, and Rio Grande LNG have much higher family poverty rates than their respective states, and, along with Plaquemines LNG, they also have much higher rates than the nation as a whole. For example, family poverty rates around Rio Grande LNG, Freeport LNG, and Plaquemines LNG are 2.4, 2.1, and 1.7 times greater than the nation's poverty rate of 8.9%, respectively. Neighborhoods with those facilities also have disproportionately high percentages of adults 25 years of age and older who lack high school degrees. More than half of the residents near the Rio Grande LNG location (52.6%) and nearly one-third near Freeport LNG (31.4%) lack high school degrees, compared to 20% nationally. Table 5.4 shows that the neighborhoods around Freeport LNG, Freeport Pretreatment, and Rio Grande LNG have disproportionately high percentages of single-parent families.

Cameron LNG and Driftwood LNG, which are located close to each other, are in sparsely populated areas in Calcasieu and Cameron parishes that have few minorities. Table 5.4 shows these areas to be relatively well-off. Nevertheless, the magnitude of the socioeconomic disparities of the other facility locations, coupled with the racial/ethnic disparities discussed above, indicate that, overall, LNG facilities are being located in socially vulnerable communities.

Table 5.4. Selected Socioeconomic Characteristics of Areas Around LNG Facilities in Comparison to State and National Percentages

	Percentage of families below poverty			Percentage ≥ 25 years old w/o a high school degree			Percentage of single-parent families		
	3-mile area	State (LA & TX)	Nation	3-mile area	State (LA & TX)	Nation	3-mile area	State (LA & TX)	Nation
Cameron	8.42%	14.0% (LA)	8.89%	12.9%	24.7% (LA)	20.2%	3.44%	8.41% (LA)	6.40%
Driftwood	3.56%			7.43%			1.90%		
Plaquemines	13.6%			49.3%			2.65%		
Corpus Christi	6.25%	10.7% (TX)		24.5%	27.6% (TX)		7.27%	7.62% (TX)	
Freeport Pretreatment	15.3%			26.8%			19.1%		
Freeport Terminal	18.7%			31.4%			16.1%		
Rio Grande	21.4%			52.6%			11.3%		

Figure 5.4 shows the health vulnerabilities of the adult populations of census tracts at least partially within 3 miles of LNG facilities in Louisiana. Displayed are the percentile rankings for those tracts in relation to all census tracts in the state, using CDC PLACES values for the following health outcomes:

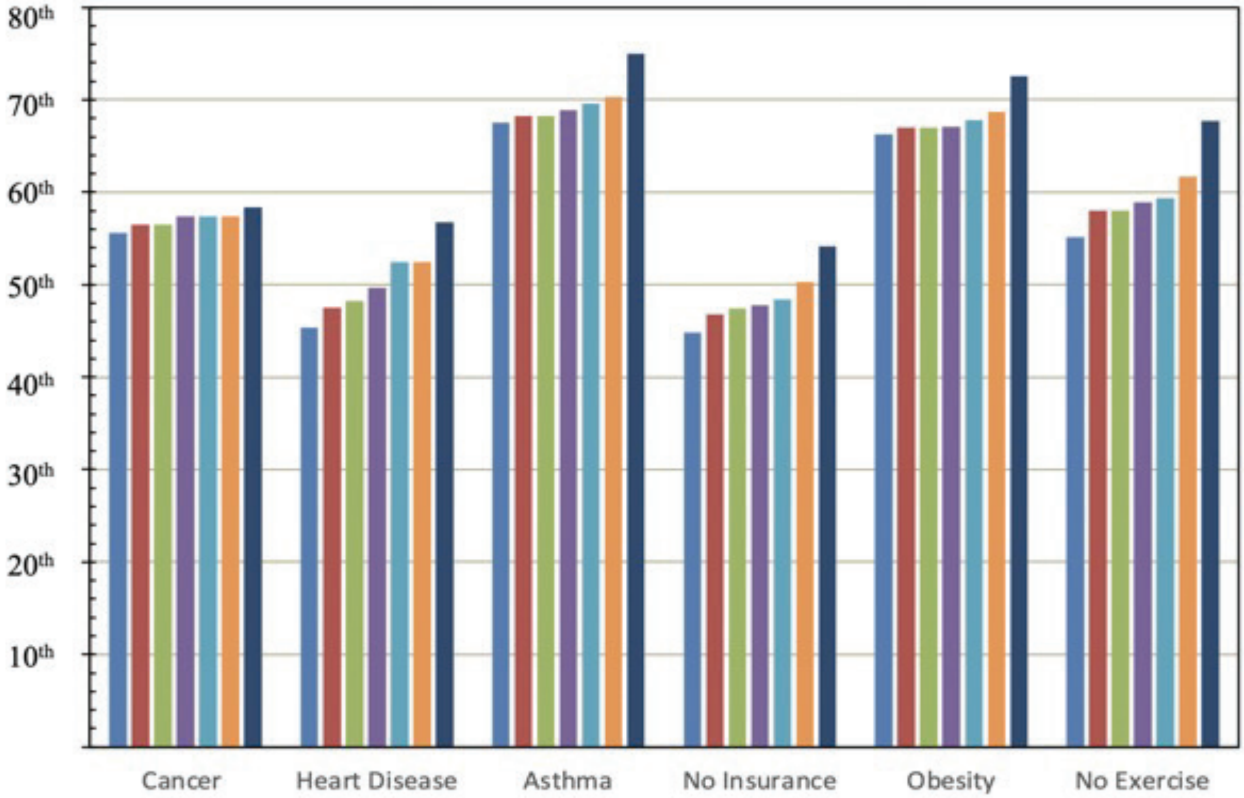
- Cancer (excluding skin cancer) among adults ages ≥ 18 years
- Coronary heart disease among adults ages ≥ 18 years
- Current asthma among adults ages ≥ 18 years
- Obesity among adults ages ≥ 18 years

Figure 5.4 also shows percentile rankings of those tracts for these health prevention and behavioral risk factors:

- Current lack of health insurance among adults ages 18–64 years
- No leisure-time physical activity among adults ages ≥ 18 years

Values above the 50th percentile indicate that a census tract's value for the health indicator is above the median in relation to all census tracts in the state. Census tracts typically have 3,000 to 8,000 people.

Figure 5.4. Percentile Rankings of Health Indicators for Census Tracts Within 3 Miles of Louisiana LNGs



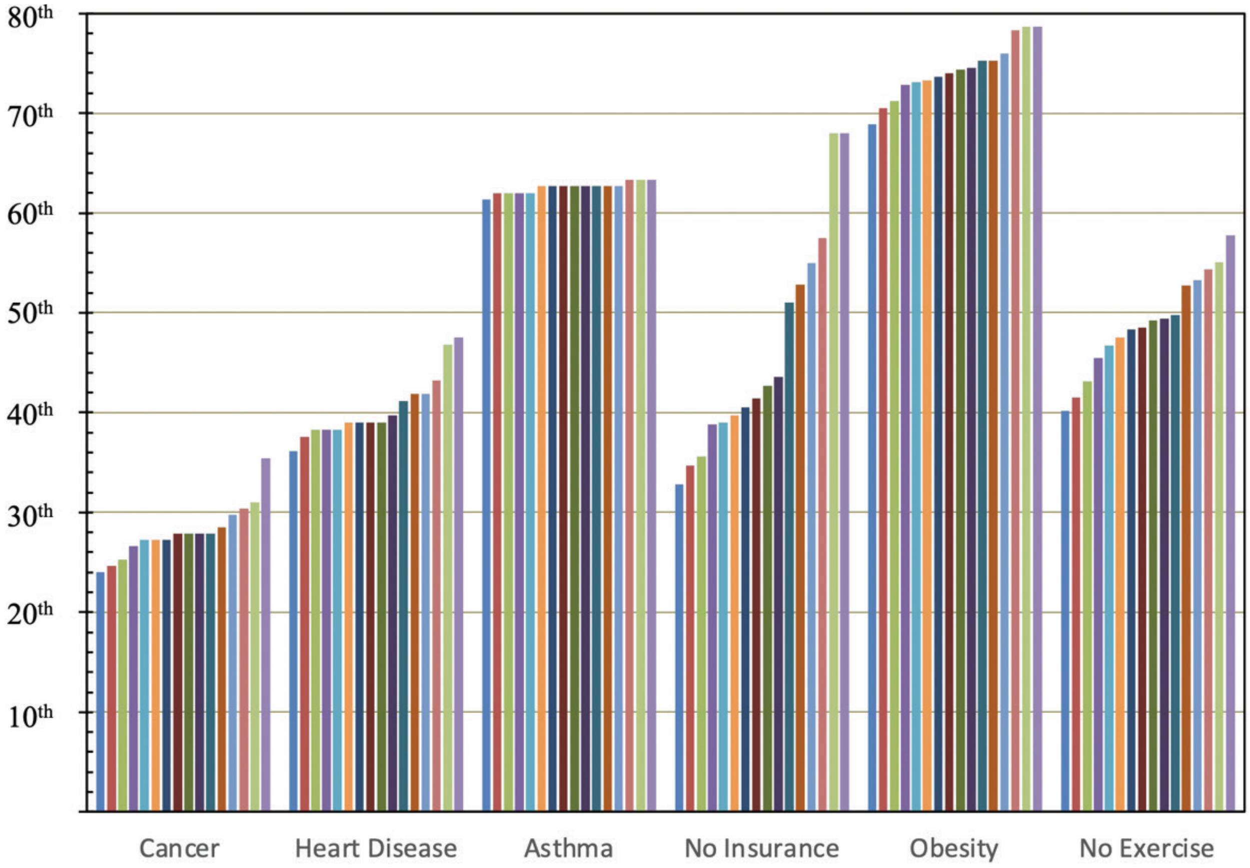
Note: Each bar represents the percentile ranking for a census tract in relation to all tracts in Louisiana.

In relation to all census tracts in Louisiana (*n* = 1,224), the seven tracts near LNG facilities rank higher than the state median (50th percentile) in terms of adult cancer, asthma, and obesity rates and the risk factor lack of leisure-time physical activity (exercise). Heart disease prevalence and lack of health insurance in those census tracts are close to the median for the state.

Figure 5.5 shows percentile rankings for the same health indicators for a larger number of census tracts near LNG facilities in Texas (16), out of a total of 5,222 tracts. Unlike Louisiana, tracts around LNG facilities in Texas do not have elevated cancer rates, though they rank high relative to state median adult asthma and obesity rates. The relatively high ranking for the asthma prevalence is concerning because it indicates susceptibility to LNG-related air pollution and the potential for asthma hospitalizations and deaths.

In sum, it is clear that communities in the vicinity of the LNG facilities we examined are vulnerable to being targeted for LNG siting and may lack the social capital and political clout to advocate effectively for due consideration in siting and permitting decisions and strong regulatory enforcement. The elevated prevalence of asthma and obesity are health risk factors that make fenceline communities in both Louisiana and Texas more susceptible to adverse health outcomes due to pollution and other LNG stressors. Social and health vulnerabilities uncovered here add to the cumulative environmental burden of LNG facilities.

Figure 5.5. Percentile Rankings of Health Indicators for Census Tracts Within 3 Miles of Texas LNG Facilities



Note: Each bar represents the percentile ranking for a census tract in relation to all tracts in Texas.

Environmental Impacts of LNG Facilities

This third section of our CIA examines environmental impacts associated with the six LNG export facilities examined in this study. Excluded from our analysis is a review of environmental impacts of methane wells in the Permian Basin and the network of pipelines crossing hundreds of miles and feeding into LNG export terminals. The impacts of LNG development on global climate change and the risks that LNG facility accidents, spills, and leaks pose for fenceline communities are considered in a separate section below.

Our environmental assessment uses a variety of sources, including FERC documents, peer-reviewed literature, government documents, government databases, permit appeals, NGO reports, websites, news stories, and more. The FERC documents used primarily include environmental impact statements (EISs) prepared under NEPA to assess the impacts of the construction and operation of new liquid natural gas export facilities and to identify mitigation measures. For LNG expansion plans for existing LNG facilities, FERC also prepared environmental assessments (EAs), which are less detailed and rigorous than EISs. In utilizing information from FERC's NEPA documents, we also point out the various ways in which those documents are lacking.

LNG facility EISs are hundreds of pages long, and environmental analysis sections are based on information provided by LNG facility owners further developed with data requests, site surveys, literature reviews, and communication with federal, state, and local agencies, outside organizations, and individual members of the public. Although FERC is responsible for preparing and approving EISs and EAs, other cooperating agencies provide input in accordance with legal requirements and their special expertise (FERC, 2020). The public also provides input on drafts.

LNG project applicants typically employ third-party contractors who work under the direct supervision of FERC staff to assist with document preparation (FERC, 2022b). For LNG projects, impacts are often reviewed under the following headings: geology; soil resources; water resources, including wetlands; vegetation; wildlife and aquatic resources; threatened, endangered, and other special status species; land use; recreation; visual resources; socioeconomics (including environmental justice); cultural resources; reliability and safety; air quality and noise; and cumulative impacts. In a sense, FERC's NEPA reviews are quite comprehensive and provide a lot of good information for the public and concerned organizations.

However, FERC's environmental reviews also have shortcomings. They rarely include monitoring plans and contain a fair amount of boilerplate language; and what is deemed a significant impact requiring mitigation tends to be subjective. As we will show, FERC's LNG EISs give short shrift to climate impacts, climate vulnerabilities, and the safety and reliability of LNG infrastructure. The LNG industry and its consultants have self-serving incentives to understate impacts and dismiss them as "minimal and temporary," and government agencies may be reluctant to impose costly mitigation measures and push for more environmentally friendly alternatives, and, likewise, are unwilling to deny projects. As a result, environmental and EJ organizations, frontline communities, public interest groups, scientist organizations, and tribes have criticized FERC's draft environmental reviews during public comments periods, and some have mounted legal challenges regarding the adequacy of environmental reviews conducted by FERC and other federal agencies, including their reviews of EJ concerns and climate impacts of LNG facilities (Davila, 2020a; *Harvard Law Review,* 2022; Willson, 2022a).

We conducted our review of environmental impacts of LNG export facilities with the shortcomings of official environmental reviews in mind and drew on a wide range of supplementary sources. The presentation that follows examines environmental and human health and safety impacts from the construction and operation of LNG export facilities, including impacts to (1) soil and vegetation resources; (2) water resources; (3) wetlands; (4) wildlife, fisheries, and aquatic resources; (5) special status species; and (6) air quality. We discuss impacts of LNG dredging and shipping in multiple places, because dredging affects soils, water quality, wetlands, and aquatic resources, and shipping affects soils, wildlife, aquatic resources, and air quality. The chapters of this report reviewing FERCs EJ analyses (Chapter 4) and covering fenceline community EJ concerns (Chapter 6) provide a more in-depth account of socioeconomic and cultural impacts, which are typically covered in the environmental analysis sections of FERC's NEPA documents.

LNG Terminal Impacts

LNG terminals are the primary physical infrastructure of LNG export facilities. Although they are supplied by methane wells and pipelines that have their own impacts, in this section we focus on the impacts from terminal construction and operations. Terminals typically include pretreatment facilities, liquefaction plants (trains), large storage tanks, work docks, ship-berthing loading/unloading facilities, power generators, and other ancillary equipment. As discussed below, pile driving and land conversion—including filling wetlands, dredging, and dispersal of legacy contamination—are among the most impactful activities associated with terminal construction and result in permanent destruction of natural resources. Impacts from terminal operations result from noise, air pollution, flaring, light pollution, routine spills, maintenance dredging, and other activities. Operations also pose risks of leaks and explosions due to extreme weather events, technological failures, and human error. These events and activities can result in disturbance, injury, and death to wildlife and broader damage to ecological systems, as well as impacts on human health, safety, and well-being.

FERC's environmental reviews distinguish between temporary disturbances and permanent disturbances or impacts. Temporary disturbances to land, wildlife, and aquatic resources are considered those that generally occur during construction, with the resources presumptively returning to preconstruction conditions afterward. Permanent disturbances occur as a result of activities that modify resources such that they do not return to preconstruction conditions during the life of the project or longer. Permanent impacts typically involve the conversion of a natural area into an industrial site—for example, building on prime agricultural land or filling in a wetland. This can occur by removing vegetation, covering soils with impermeable surfaces, earth moving, compacting or contaminating soil, altering hydrological features, and degrading or destroying upland, wetland, and marsh habitats. Both construction and operation activities can permanently damage natural resources in ways that prevent natural recovery and render restoration efforts impractical.

Table 5.5 summarizes the acres of land (including wetlands) affected by the construction and operations of each of the six LNG facilities examined in this report, including temporary disturbances and permanent impacts, and including the acres of "converted" (i.e., destroyed) wetlands, which are highly valued for the biological diversity, hunting and fishing opportunities, and ecosystem services they provide, such as, for example, in helping to control floods. Information in Table 5.5 was compiled from the facilities' EISs, and from EAs in the case of expansion plans (for Cameron LNG, Corpus Christi LNG, and Freeport LNG).[12]

In Table 5.5, "Total acres" (column h) is the sum of the "Terminal total" and "Expansion construction" acreages (columns f and g); and "Terminal total" (column f) is the sum of "Permanent impacts" and "Temporary impacts" (columns d and e) and only includes impacts to land. "From construction" (column b) includes areas disturbed during construction, including areas slated for postconstruction

[12] Note that Cameron LNG also has an expansion plan, but the expansion is expected to occur entirely within the existing terminal site.

restoration. “During operation” (column c) shows acres of land impacted by the LNG terminal facilities and access roads. Altogether, the six LNG facilities are associated with a total of 5,411 acres of permanently impacted land, including 1,123 acres of wetlands lost (column a).

Table 5.5. Acres of Land Impacted and Disturbed by LNG Facility Construction and Expansions

LNG facility	Permanent wetlands (a)	From construction (b)	During operation (c)	Permanent impacts (d)	Temporary impacts (e)	Terminal total (f)	Expansion construction (g)	Total acres (h)
Cameron*	214	536	502	502	34	536	Within existing site	536
Driftwood**	319	883	718	718	165	883	n/a	883
Plaquemines **	368	648	632	626	22	648	n/a	648
Corpus Christi*	26	870	321	469	623	1,092	13	1,105
Freeport*	14***	688	284	284	404	688	414	1,102
Rio Grande**	182	1,137	819	819	318	1,137	n/a	1,137
TOTAL	1,123	4,762	3,276	3,418	1,566	4,984	427	5,411

Sources: See Appendix C.

Note: n/a = not applicable.

* Existing facility.

** Under construction as of December 2023.

*** Includes permanent wetland losses at the liquefaction plant and the pretreatment plant for the Freeport LNG project.

As Table 5.5 shows, (1) nearly 5,000 acres (7.8 square miles) in toto are impacted by activities at the six LNG terminals (column f), with the existing Corpus Christi LNG and the under-construction Rio Grande LNG having the largest overall footprints of 1,092 and 1,137 acres, respectively; (2) 4,762 acres are impacted by terminal construction, resulting in permanent impacts to 3,418 acres and temporary impacts to 1,566 acres (from, for example, temporary roads and staging areas); (3) the Rio Grande (under construction), Driftwood (under construction), and Plaquemines (under construction) LNG facilities are responsible for the largest permanent impacts, of 819, 718, and 626 acres, respectively; and (4) expansion plans for the Cameron, Corpus Christi, and Freeport LNG sites impact an additional 427 acres, with Freeport LNG accounting for 414 acres of that total. Operational impacts can be permanent if vegetation in the project site is not returned to its preconstruction state—for example, due to soil erosion or compaction.

Acreage affected is not the full measure of impacts, nor does it account for off-site impacts to air and water quality and marine resources from dredging and shipping. We provide more details below on the nature and extent of environmental impacts from LNG export terminal construction and operations.

Soil and Vegetation Resources

LNG terminal construction disturbs soils and vegetation, temporarily or permanently. Temporary disturbance is caused by the use of equipment in on- and off-site construction workspace that damages plants and compacts soils. Permanent disturbances result from road construction, grading, paving, and the placement of permanent structures and facilities, whereby land (including wetlands and agricultural lands) is permanently converted to industrial land uses. Impacts to soils and vegetation can also occur due to contamination by hazardous substances from historical land use and from construction activities.

FERC EISs report a variety of plant communities characteristic of larger ecoregions at the LNG terminal locations. Table 5.6 shows the primary plant communities and examples of dominant plants. Preconstruction vegetation at the Cameron LNG site lacked diversity due to the site being used to deposit dredged material from maintenance of the Calcasieu Ship Channel. Natural plant communities had suffered previous impacts from industrial development at the Corpus Christi site. Although not each site consists of entirely natural, never-disturbed vegetation, it can be conservatively estimated that at least 1,000 acres of vegetation have been or will be destroyed as a result of terminal construction.

Table 5.6. Preconstruction Plant Communities and Dominant Plants at LNG Terminal Sites

LNG facility	Plant communities	Selected dominant plants
Cameron	n/a	n/a
Driftwood	Coastal prairie and longleaf pine savanna; scrub-shrub, wooded/forested, and wetlands	Tall fescue; blunt spikerush; common rush; narrowleaf cattail; salt meadow cordgrass; black willow; salt grass
Plaquemines	Brackish, saline marshes; scrub-shrub upland and herbaceous pastures; isolated stands of coastal live oak/hackberry forest	Bigpod sesbania; Eastern baccharis; alligatorweed; Bermuda grass; common rush; winged sumac; black willow
Corpus Christi	n/a	n/a
Freeport	Upland, herbaceous, and scrub-shrub communities; small areas of estuarine wetland	Bigleaf marsh elder; Eastern baccharis; bushy bluestern; Canada goldenrod and seaside goldenrod
Rio Grande	Herbaceous or scrub-shrub vegetation	Gulf cordgrass; shoregrass; salt wort; prickly pear; Spanish dagger; buffelgrass and other lomas grasslands

Sources: See Appendix D.

Note: n/a = not applicable.

One such plant community includes a patch of coastal live oak/hackberry forest within the Plaquemines LNG terminal site. It is considered critically imperiled/imperiled by the State of Louisiana (FERC, 2019c, p. 4-55). Two vegetation communities of special concern have been identified within 1 mile of the Rio Grande LNG (the Texas ebony-snake-eyes shrubland series and seacoast bluestem-gulfdune paspalum series), and four additional vegetation communities were identified by the U.S. Fish and Wildlife Service (USFWS) as being of concern (FERC, 2019d, pp. 4-82–4-83). There are three lomas (coastal clay dunes) within the proposed terminal site boundary. Although lomas are not protected habitats, USFWS is concerned because of loma habitat value to the ocelot and northern aplomado falcon. Both are federally endangered. A 63.9-acre loma (Loma del Rincon Chiquito) located outside the terminal boundary is composed mainly of South Texas loma grassland and loma evergreen shrubland and would be used for construction activity. This loma is an example of a natural plant assemblage that FERC identifies as a temporary impact area that is not likely to recover to a natural state with preexisting ecological integrity for a very long time if ever. Another loma, Loma de las Yeguas, would be crossed by the LNG pipeline and would suffer serious damage to its natural vegetation and degradation of its habitat value (FERC, 2019d, p. 4-83). The Rio Grande LNG site was surveyed and found to be free of noxious weeds. Finally, FERC indicated that two vegetation communities of special concern may exist within the project area for Driftwood LNG: coastal prairie and longleaf pine savanna (FERC, 2019b, p. 4-75). This raises questions as to whether a survey was conducted, what was found, and whether any mitigation measures were needed and required.

Table 5.7 shows that all six LNG facility locations are susceptible to soil erosion, compaction, and soil contamination from construction. Soil erosion is a natural process caused by the action of water and wind that can be accelerated by human disturbances. Clearing, grading, and equipment movement can accelerate erosion and result in discharge of sediment into water bodies and wetlands, impeding postconstruction revegetation and impairing water quality (FERC, 2019b, p. 4-16). Bank erosion is a concern at several facilities, including Cameron LNG, which is located along the Calcasieu Estuary. Environmental impact assessments for LNG facilities state that projects would minimize runoff with vegetation buffers, stormwater retention ponds, and installation of other erosion controls. Facilities may submit related plans in accordance with FERC guidance plans and procedures. Soil compaction is another unavoidable impact from construction equipment, which can disrupt soil structure, reduce pore space, increase runoff, and cause rutting.[13] Soil contamination from construction is caused from routine and accidental leaks and spills of hazardous materials such as hydraulic fluid, diesel fuel, lubricants, and refrigerants from construction equipment.

Prime farmland is land with soils that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops (U.S. Department of Agriculture, 2015). This designation includes cultivated land, pasture, woodland, or other land that is available and well suited for those uses (FERC, 2019d, p. 4-10). Prime farmland typically contains few or no rocks, drains well, is not excessively erodible or saturated with water for long periods, and is not subject to regular flooding during the growing season. Prime farmland is of concern because it is a finite resource, the loss of which can decrease overall, long-term agricultural productivity regionally and nationally. The Plaquemines LNG terminal site includes

[13] Rutting is known as the accumulation of permanent deformation of subgrade soils.

prime farmland that historically was used for sugarcane production, and more recently has been used for cattle pasture. The project would cover 146 acres of prime farmland soils (silty clay loam) (FERC, 2019c, p. 4-7). Corpus Christi LNG already has been built on 22 acres of prime farmland that had been impacted by prior industrial activity.

Table 5.7. Presence of Soil Impacts Associated with LNG Projects

LNG facility	Construction soil contamination (a)	Soil erosion (b)	Farmland soil (c)	Historical soil contamination (d)	Dredging (e)	Compaction (f)
Cameron*	✓	✓			✓	✓
Driftwood**	✓	✓		✓	✓	✓
Plaquemines**	✓	✓	✓			✓
Corpus Christi*	✓	✓	✓	✓	✓	✓
Freeport*	✓	✓			✓	✓
Rio Grande	✓	✓			✓	✓

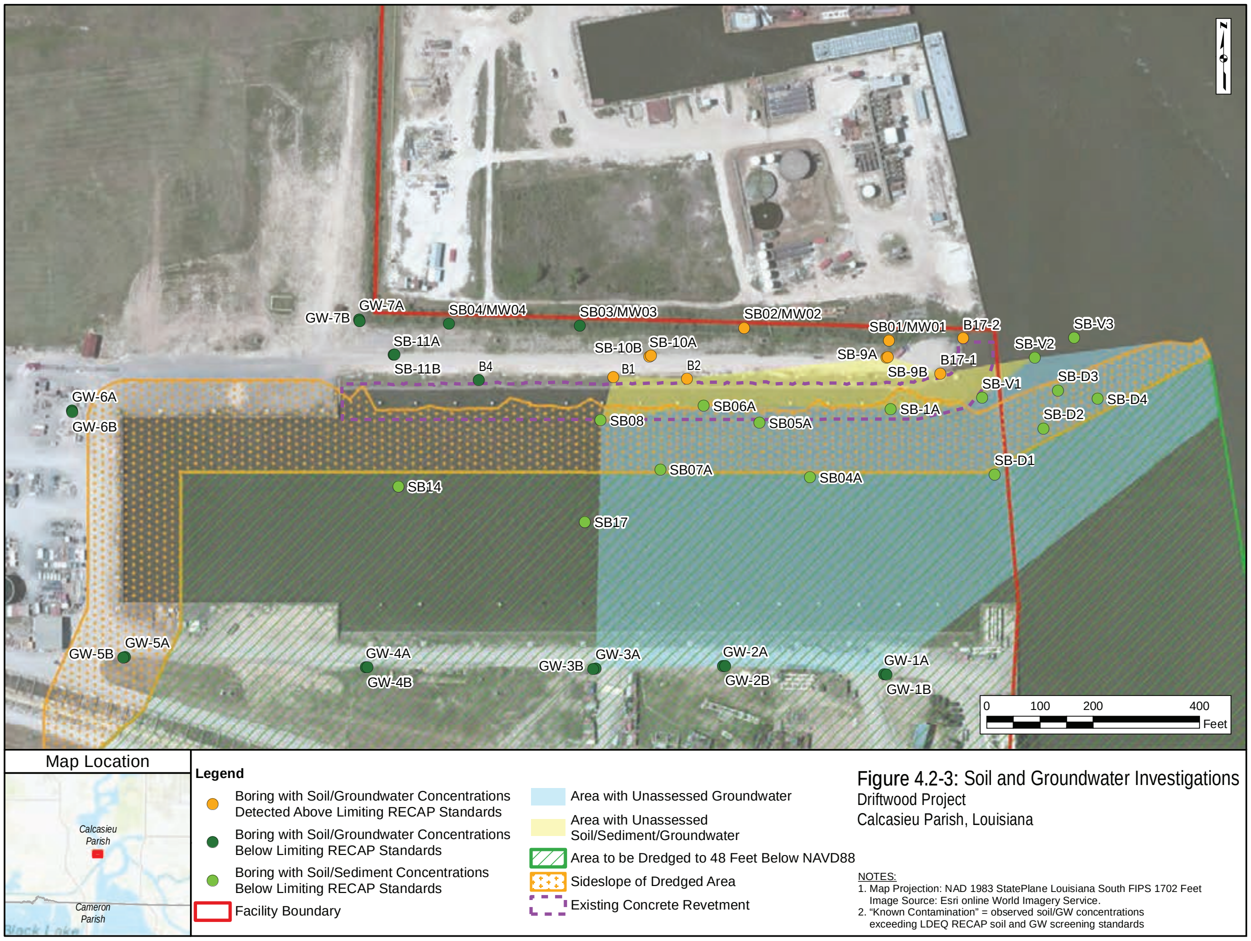
Sources: FERC (2014a, 2014b, 2014c, 2016, 2018, 2019a, 2019b, 2019c, 2019d).

* Existing facility.

** Under construction as of December 2022.

As Table 5.7 shows, historical soil contamination concerns exist for two LNG projects. First, the Bollinger Calcasieu Shipyard, just north of the Driftwood LNG terminal, is a source of soil contamination at the LNG facility site. Although it is no longer operating, the shipyard was the site of shipbuilding, ship repair, and barge-cleaning operations beginning in the 1940s. The historical contamination in the area had been previously discovered, and combined soil, sediment, and groundwater sampling was performed from 2016 to 2018 to further define the limits of the affected soils and groundwater. Testing was done on the shoreline where construction of a loading dock and ship-berthing facility is planned; and testing was done offshore and on some parts of the underwater sideslope where dredging is planned. At locations tested along the shoreline, volatile organic compound (VOC) concentrations exceeded the Louisiana Department of Environmental Quality Risk Evaluation/Corrective Action Program (RECAP) soil screening and groundwater screening standards (FERC, 2019b, p. 4-18). According to FERC, samples at depths over 20 feet contained chlorinated VOC levels above the standard for trichloroethene (also known as trichloroethylene or TCE), vinyl chloride, dichloroethane, tetrachloroethene (also known as PERC), and benzene, which are well known to be highly toxic carcinogens and/or mutagens (FERC, 2019b, p. 4-18). However, as shown in Figure 5.6, samples from the dredging sideslope, where concrete riprap has been placed, and from other immediately adjacent areas already or to be dredged did not exceed the RECAP standards (FERC, 2019b, p. 4-18). The remobilization of the chlorinated VOCs at this LNG site and others and associated environmental impacts are discussed below.

Figure 5.6. Locations and Results of Soil and Groundwater Testing for Driftwood LNG



Source: FERC (2019b, p. 4-19).

Second, the Corpus Christi terminal site was previously used to store bauxite ore beginning in the 1950s, and a metal company deposited alumina processing waste materials on the site (FERC, 2014b, p. 4-13). Not removing contaminated soils during terminal construction risks contaminating more soils and water depending on how the materials are identified and handled. In this case, the EPA determined that the bauxite residue, or red mud, did not exhibit any of the characteristics of hazardous waste, and that the material posed little risk to human health and the environment once capped (FERC, 2014b, p. 4-14). Although we did not determine if it is the case, companies may have Specification for Site Preparation and Earthwork documents with steps to prevent the spread of contaminated soils.

LNG vessel traffic also impacts soil and vegetation resources by causing shoreline erosion in shipping channels. The main mitigation measure is to require large vessels to travel at low speed to minimize wave energy. Even with mitigation measures, increased vessel traffic can still cause damage. For example, wave action has caused the shoreline east and west of the Corpus Christi terminal site to retreat at an average rate of 1 to 3 feet per year (FERC, 2014b, p. 4-12).

Overall, this review indicates that the six LNG facilities are responsible for significant impacts on soil and vegetation resources, including complete loss of wetland vegetation from placement of fill and dredged material at terminal sites, as well as soil compaction, soil contamination, and, in the case of Driftwood, the disturbance of contaminated soils and sediments from construction activities. Disturbance and potential dispersal of contaminated sediments from dredging at other sites is discussed below.

Water Resources

FERC's environmental analyses of water resources examine potential impacts to surface water and groundwater. FERC covers impacts to aquatic and marine resources separately as do we in another section below. Surface water includes freshwater in wetlands, marsh, stream systems, and lakes, whereas groundwater resources mostly exist in underground aquifers. Both types of water resources are susceptible to impacts associated with LNG export terminal construction activities, including excavating, earth moving, dredging, pile driving, and the use of dredged material to create marshlands or fill in wetlands (also discussed in "Wetlands" below). Dredging is a process of excavating materials from a riverbed, lakebed, or the seafloor to improve accessibility for ships (Eikens, 2020). Pile driving entails driving metal pipes and interlocking metal sheets into the ground, ranging from 95 feet to 110 feet deep, to provide structural support for LNG storage tanks and docks and to help slow erosion and ground subsidence (FERC, 2014a, p. 4-18).

Table 5.8 shows common types of construction activities associated with impacts to water resources for the six LNG facilities, according to FERC NEPA documents. All six LNG facilities use piling driving, and five use (or used) dredging to provide LNG vessel access—all but Plaquemines LNG, which can rely on the U.S. Army Corps of Engineers (USACE) to dredge the Mississippi River. Four LNG facilities have shallow groundwater areas that are vulnerable to contamination from spills of hazardous materials during construction and operation. Accidental spills and leaks of hazardous materials associated with equipment trailers, the refueling or maintenance of vehicles, and the storage of fuel, oil, and other fluids pose a significant risk to groundwater resources (FERC, 2019c, p. 4-17). For that reason, facilities may have spill prevention, control, and countermeasure plans. If not detected and cleaned up, contaminants could run off into surface water or infiltrate into groundwater long after a spill has occurred. Although FERC EISs dismiss the possibility, there is evidence that metal piling also can facilitate the movement of contaminants into groundwater (Westcott et al., 2003).

LNG export terminal construction requires large amounts of fresh water for hundreds of workers, mixing concrete, dust mitigation, and other needs. Hydrostatic testing of LNG storage tanks and onsite pipelines is the construction activity that typically requires the largest use of fresh water. In certain places such as Plaquemines Parish, Louisiana, high industrial water demand from LNG development has restricted availability of water for residential and commercial uses (Nolan, 2024). These activities and impacts to water resources are detailed below.

Table 5.8. LNG Project Activities That Have Impacts on Water Resources

LNG facility	Pile driving	Dredging	Leakage of hazardous material
Cameron*	✓	✓	✓
Driftwood**	✓	✓	
Plaquemines**	✓		✓
Corpus Christi*	✓	✓	✓
Freeport*	✓	✓***	✓
Rio Grande**	✓	✓	

Sources: FERC (2014a, 2014b, 2014c, 2016, 2018, 2019a, 2019b, 2019c, 2019d).

* Existing facility.

** Under construction as of December 2023.

*** For original construction, not expansion.

Dredging and Water Quality

LNG terminal projects use two types of dredging: mechanical and cutterhead suction dredging. Mechanical dredging is a broad term that refers to the act of digging or scooping up material from an excavation site before transporting the dredged material elsewhere. Cutterhead suction dredging is a form of hydraulic dredging that uses a rotating cutting tool that is attached to a suction pipe. The cutterhead tool rotates, loosening sediment and breaking up rocks into a slurry that is then suctioned and pumped to an area to be drained and sorted. Three LNG construction sites use a combination of mechanical and hydraulic cutterhead suction dredging: Cameron LNG, Driftwood LNG, and Rio Grande LNG (Table 5.9). The utility of mechanical and cutterhead dredging depends on factors such as substrate composition, hardness and compaction, available places to which to transport dredged materials, and environmental restrictions.

Table 5.9 shows the volume of dredged material reported in the EISs for the five LNG facilities, which totals 19.4 million cubic yards (MCY), enough to fill over four Superdomes, with Rio Grande LNG, Driftwood LNG, and Corpus Christi accounting for the largest amounts, 7.2, 6.3, and 4.4 MCY, respectively. Dredging occurs in harbors and coastal shipping channels (Corpus Christi, Freeport, and Rio Grande LNGs) and a brackish channelized estuary (Cameron and Driftwood LNGs).

Cameron LNG used dredging to deepen the dock and berthing area, removing approximately 205,000 cubic yards of material. Driftwood LNG plans to use 6.3 MCY of dredged material for the Louisiana Beneficial Use of Dredged Material (BUDM) Program and 1.1 MCY for on-site fill. The already-built Corpus Christi LNG planned to and presumably has placed 4.4 MCY of dredged materials in a nearby 385-acre Dredged Material Placement Area (DMPA), former Reynolds Aluminum bauxite waste disposal beds, and in an 85-acre clay borrow pit (FERC, 2014b, p. 2-5). The already-built Freeport LNG project planned to dredge about 1.3 MCY of material from the Freeport Harbor Channel and Gulf Intracoastal Waterway. FERC's project EIS indicates that the majority of dredged materials were to be transported off-site to a designated DMPA (FERC, 2014c, p. 4-19). The remaining dredged materials suitable to be used in construction are said to have minimal environmental impact; however, FERC does not acknowledge risks related to potential historical contamination in the Freeport Harbor Channel, which provides access to one of the largest petrochemical complexes in the world (FERC, 2014c; USACE, 2018a). The Rio Grande LNG project EIS states that 7.2 MCY of dredged materials will be disposed of at specific locations in the nearby South Bay, as well as at two sites on the east side of the adjacent Brownsville Shipping Channel. Much of that dredged sediment is not expected to be suitable for project construction (FERC, 2019d, p. 4-19).

Table 5.9. Water Bodies Dredged, Type of Dredging Used, and Amount of Dredged Materials, by LNG Facility

LNG facility	Water body (name)	Water body type	Type of dredging	Volume of dredged materials
Cameron*	Calcasieu Estuary, Calcasieu River, LA	Brackishwater channelized river/ estuary	Mechanical dredging, hydraulic cutterhead suction dredging	0.21 MCY
Driftwood**	Calcasieu Estuary, Calcasieu River, LA	Brackishwater channelized river/ estuary	Mechanical dredging, hydraulic cutterhead suction dredging	6.3 MCY
Plaquemines**	No dredging planned	n/a	n/a	n/a
Corpus Christi*	La Quinta Shipping Channel, Corpus Christi Bay, TX	Saltwater shipping channel and ocean bay	Hydraulic cutterhead suction dredging	4.4 MCY
Freeport*	Freeport Harbor Channel and Gulf Intracoastal Waterway	Saltwater shipping channel	Hydraulic cutterhead suction dredging	1.3 MCY
Rio Grande**	Brownsville Ship Channel	Saltwater shipping channel	Hydraulic cutterhead suction, mechanical dredging	7.2 MCY

Sources: FERC EISs and EAs (see Appendix E).

Note: MCY = million cubic yards; n/a = not applicable.

* Existing facility.

** Under construction as of December 2023.

Dredging harms water quality by increasing turbidity (suspended sediments) and decreasing dissolved oxygen available to aquatic life (Thompson et al., 2021). The condition of limited oxygen, or hypoxia, is a long-standing environmental quality concern along the Gulf Coast (He and Xu, 2015; Rabalais et al., 2001). It is important to emphasize that dredging can mobilize historical or legacy contamination in sediments beneath bodies of water. Disturbing sediments with existing polyaromatic hydrocarbons, polychlorinated biphenyls, other persistent organic pollutants, and heavy metal contaminants harms fish (Wenger et al., 2017). Furthermore, the use of contaminated dredged sediments to fill wetland areas or create marshes can contaminate wetland ecosystems and groundwater (Johnston, 1981).

Given the industrial history of the Corpus Christi Shipping Channel and Freeport Harbor and Shipping Channel, there is a high likelihood of legacy pollutants spreading in those water bodies as a result of dredging (MacDonald et al., 2011; USACE, 2018a). As discussed above, there is known contamination in the sediment of the Calcasieu River/Estuary, the location of the Cameron and Driftwood LNGs (MacDonald et al., 2011; Mueller et al., 1989). From 2006 through 2009, 139 spills were reported to the Emergency Response Notification System (USACE, 2009). Disposal of dredged materials on land can also harm water quality and aquatic resources from the runoff of decanted water (see, e.g., FERC, 2019b, p. 4-37). As discussed further below, impacts can also occur from disposal of dredged materials in open water and from use of them to fill in wetlands and for so-called "beneficial use" to create marshland.

According to the Driftwood LNG EIS, the company will not disturb contaminated soil, and if contaminated soils or sediments are "encountered" during dredging, measures in its unanticipated discoveries plan (UDP) and its risk management plan (RMP) would be followed, which include stopping dredging immediately, containing material within the excavation/dredging areas, and notifying appropriate agencies. However, it is not clear from the EIS how contamination would be identified or detected in the first place, other than the obvious presence of a visible sheen or possibly a chemical smell. Soil and sediment testing should be required by the Driftwood UDP or RMP as approved by the Louisiana Department of Environmental Quality, which oversees final monitoring and mitigation requirements for mobilization of contaminated sediments as part of Driftwood LNG's Section 404/10 Clean Water Act permit.

It is perplexing why then the EIS states that contaminated excavated or dredged materials that exceed the RECAP standard nevertheless "could be" transported with the dredge slurry and "would be distributed across the marsh restoration area and could potentially affect sediment quality, water quality, fisheries, wildlife, and other resources within the BUDM sites and downstream of these areas" (FERC, 2019b, p. 4-20). Several of these concerns (i.e., about the need to test dredged sediments, identify BUDM sites for the public, and monitor them) were recently raised by several conservation groups with the Louisiana Department of Natural Resources in relation to a coastal use permit extension application by Driftwood LNG LLC and Driftwood Pipeline LLC (Sierra Club et al., 2022). Comments expressing similar concerns were submitted in November 2022 regarding a Clean Water Act Section 404 permit for another proposed LNG project, on the east side of Calcasieu Lake, in an area with six existing or approved LNG facilities (Sierra Club and Healthy Gulf, 2022). This suggests that there is a systemic lack of environmental protection oversight.

Ballast Water

Release of ballast water in coastal estuaries to maintain an acceptable draft during loading of LNG on shipping vessels also impacts water quality. Ballast water discharge changes the salinity and pH of water within the vicinity of the loading docks (FERC, 2014b, p. 4-18). A temporary increase in salinity level will result from ballast water discharge at the Plaquemines LNG berthing dock, on the shore of the Mississippi River, because seawater has a narrow pH range of 8.1 to 8.5, whereas the Mississippi River ranges from 0.2 to 7.9 (FERC, 2019c, p. 4-29). Ballast water discharge can also temporarily decrease dissolved oxygen levels in the immediate vicinity, and also poses risks to aquatic resources. See "Wildlife, Fisheries, and Aquatic Resources" below for further discussion of ballast water.

Water Supply

LNG export terminal construction and operations require large amounts of fresh water that is typically obtained from local water utilities, surface waters, and groundwater sources. For example, Plaquemines LNG had planned to use 17.2 million gallons of water from the parish water district during construction, and an additional 26.2 million gallons of surface water for hydrostatic testing of LNG storage tanks. According to FERC's EIS, Plaquemines LNG would also drill one or more wells to supply 600 gallons per minute for operation of the facility (FERC, 2019c, p. 4-17). The possible use of groundwater raises concerns about accelerating land subsidence, yet FERC's EIS addresses only the potential for such use to affect other wells.

In the latter part of 2023, heavy water demand from the construction of Plaquemines LNG far exceeded the planned and approved use and contributed to serious water shortages in lower Plaquemines Parish (Nolan, 2024). The predominantly Black American residents in the area who rely on the public water system saw water pressures drop to nearly nothing, and a local high school was forced to close. Meanwhile, as Parish officials urged residents to conserve water. and many reportedly lacked water to meet their basic needs, the facility owner, Venture Global, increased its share of water district use from 14% to 24% (Nolan, 2024). The blatant disregard of local officials for Black Americans is a textbook example of environmental racism and a continuation of a historic pattern of discrimination in the parish (Roberts & Toffolon-Weiss, 2001). During these water shortages, FERC approved an expedited construction schedule, including an on-site workforce of up to 6,000 (LNG Prime staff, 2023).

It is no wonder residents feel neglected and abused. Many are still living in temporary trailers after being flooded out of their homes by multiple hurricanes. The area lacks federal levee protection and residents still await adequate disaster relief, as have so many other Black American residents in the Gulf South (Bullard & Wright, 2012). See the Plaquemines case study in Chapter 6 for further details about institutional neglect and residents' vulnerabilities to LNG siting processes, and their concerns and experiences with the siting process.

Wetlands

USACE defines wetlands as areas inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support vegetation typically adapted for life in saturated soil conditions. Wetlands might also become converted from one type (e.g., fresh marsh) to another (e.g., salt marsh) from dredge-and-fill operations and altering the hydrological regime of a wetland. Wetlands generally include swamps, marshes, bogs, and similar areas (USACE, 1987). LNG terminal construction impacts wetlands primarily through permanent conversion of such areas to industrial land use, pavement, or open water. Construction can also result in temporary wetland disturbances, which can be reversed, for example, by restoring preconstruction landscape contours, replanting damaged vegetation, and encouraging natural revegetation.

Table 5.10 shows, by type of wetland, the wetlands having the largest acreages permanently affected by terminal and pipeline construction for each facility, a total of 1,632 acres.

Table 5.10. Wetland Types with Largest Numbers of Acres Destroyed by LNG Terminal and Pipeline Construction, by Facility

	Louisiana LNGs				Texas LNGs		
	Cameron	Driftwood	Plaquemines	Corpus Christi	Freeport	Rio Grande	Total
PEM	119.4	144.4	368.1	—	13.4	42	687.3
PSS	69.8	41.2	—	—	—	3.5	114.5
PFO	24.5	454.3	2.8	—	—	9.9	491.5
EEI	—	126.2	—	6.19	—	—	132.4
EEM	—	—	0.4	—	7.7	198.4	206.5

Sources: FERC (2014a, 2014b, 2014c, 2016, 2018, 2019a, 2019b, 2019c, 2019d).

Note: PEM = palustrine emergent, PSS = palustrine scrub-shrub, PFO = palustrine forested, EEI = estuarine emergent intertidal, EEM = estuarine emergent.

Types not shown, all totaling less than 100 acres, include estuarine submerged aquatic bed; estuarine intertidal flat; estuarine intertidal scrub-shrub; estuarine scrub-shrub; lacustrine, littoral unconsolidated bottom; and estuarine unconsolidated shore.

The Plaquemines and Rio Grande LNGs have permanent impacts on the largest number of acres of wetlands (also see Table 5.5). Palustrine emergent (PEM) and palustrine forested (PFO) wetlands are the types most impacted (687 and 491.5 acres, respectively), followed by estuarine emergent (EEM), estuarine emergent intertidal (EEI), and palustrine scrub-shrub (PSS) types (206.5, 132.4, and 114.5 acres, respectively). Palustrine wetlands, both emergent and forested, are important for the normal function of their surrounding ecosystem (Louisiana Natural Heritage Program, 2009).

PEM wetlands ("inland" or "freshwater" marshes) include all nontidal wetlands dominated by persistent, emergent, vascular plants and emergent moss or lichens and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salt is less than 0.5% (FERC, 2019c, p. 4-39). They contain the greatest plant diversity and highest soil organic matter content of any marsh type (Louisiana Natural Heritage Program, 2009). PFO wetlands include all nontidal wetlands dominated by woody vegetation greater than 6 meters (~20 feet) tall, in which salinity from mixing with ocean water is below 0.5% (FERC, 2019c, p. 4-39). PFO wetlands provide a diverse assemblage of vegetation and an abundance of food and water for wildlife (Bureau of Land Management, 2010). PFO wetlands are important nutrient and sediment sinks, assimilating nutrients from detritus back into the ecosystem and improving local water quality (Louisiana Natural Heritage Program, 2009). These forested swamps also provide habitat for reptile and amphibian species, as well as detritivores such as crawfish, amphipods, and aquatic larvae, and provide important nursery habitat for estuarine-dependent species (Louisiana Natural Heritage Program, 2009). These freshwater swamplands and marshlands play a vital role cycling nutrients, providing critical habitat and nurseries, and improving water quality.

Estuarine wetlands (EEM and EEI) are brackish ecosystems partially enclosed by land, with a mixture of salt and fresh water (Louisiana Natural Heritage Program, 2009). PSS wetlands include areas dominated by shrubs and saplings less than 20 feet tall (FERC, 2019d, p. 4-57). Wildlife frequently use these areas for nesting and feeding, particularly during migration (Bureau of Land Management, 2010).

The Gator Express Pipeline—The Latest Iteration of a Legacy of Environmental Injustice

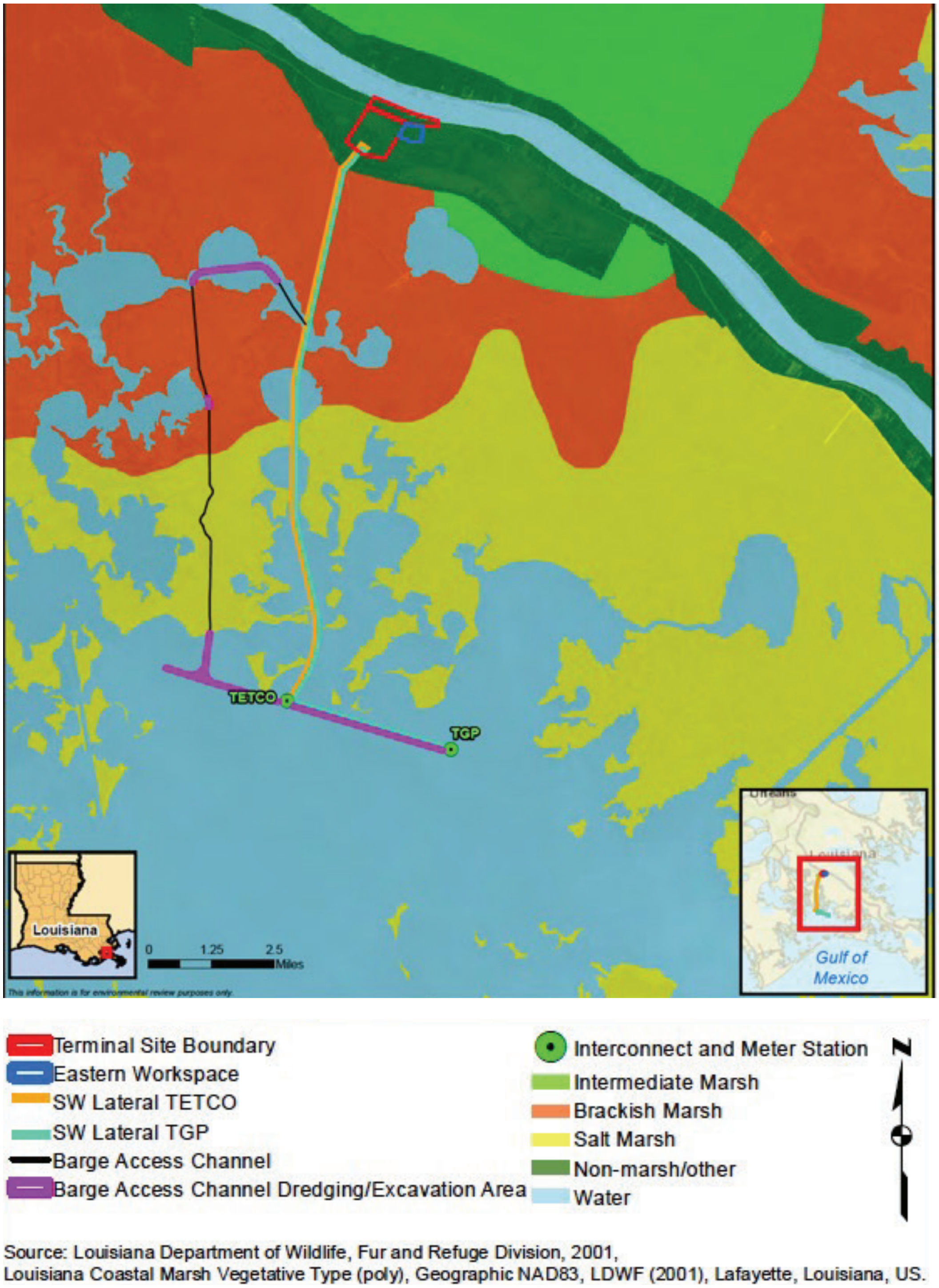
The Venture Global Gator Express Gas Pipeline is part of the proposed Plaquemines LNG project. It would transport natural gas from existing pipelines in the Barataria Basin estuarine system just off the coast of Louisiana to the LNG export terminal along the Mississippi River (Figure 5.7). The project would lay more than 26 miles of new 42-inch-diameter pipeline through open waters, marshland, and vegetated land with a 300-foot-wide construction right-of-way, disturbing 75 acres of wetlands (FERC, 2019c, pp. 4-50, 4-109). Most of the pipeline would be laid in backfilled trenches through open water and saltwater and brackish marshes. In addition to Barataria Bay, the pipeline would cut through the Wilkinson Canal and Wilkinson Bayou, Bay Sanbois, Lake Judge Perez, and Bay de la Cheniere (Figure 5.7). Work, including dredging, grading, and deepening barge channels, would be done from bulk carrier vessels, rake-haul-and-lay barges, and tugs that FERC claims would not interfere with recreational and commercial fishing (FERC, 2019c, p. 4-131).

FERC is rolling the dice and the stakes are high in this highly productive fishery. The Barataria Basin is a large network of water bodies, marshlands, and bays spanning an area of 1,565,000 acres, south and west of New Orleans, and is significant both ecologically and economically. According to the Plaquemines LNG EIS, "A total of 237 species of fishes have been recorded from the deltaic plain estuaries in Louisiana, with the Barataria Basin being the most diverse of any estuary in Louisiana" (FERC, 2019b, 4-70).

FERC notes that "the commercial fishing fleet in Plaquemines Parish is one of the largest in the lower 48 states . . . [and the] parish's highest grossing species are shrimp, menhaden, and oysters; combined, their gross farm earnings valued $117 million in 2014" (FERC, 2019c, p. 4-131). Venture Global plans to compensate private holders of oyster leases, and FERC recommends the company file documentation with the secretary of energy that it consulted with the Louisiana Department of Natural Resources' Oyster Lease Damage Evaluation Board and/or the affected leaseholders.

Recreational fishing is also a major part of Plaquemines Parish's local economy and identity, promoted as "world-class" by the Louisiana Tourism Coastal Coalition and the Plaquemines Parish Tourism Commission, which lists 68 fishing guides and charter outfits in the parish. FERC states that Plaquemines Parish accounts for "a substantial" portion of the state's economic benefits from the sector (FERC, 2019c, pp. 4-131–4-132).

Figure 5.7. Marshlands Crossed by Plaquemines LNG Gator Express Gas Pipeline



Source: FERC (2019c, p. 4-62).

The pipeline is also adjacent to areas used by Native American tribes of Louisiana, who have already been heavily affected by climate change and the BP *Deepwater Horizon* oil spill (Liddell et al. 2021). For example, sea level rise and coastal erosion has led to the planned resettlement of the Isle de Jean Charles Band of Biloxi-Chitimacha-Choctaw (Yawn, 2020). The Atakapa-Ishak/Chawasha Tribe has an ancestral village near Port Sulphur, just 15 miles away from the Plaquemines LNG facility site. The Atakapa-Ishak/Chawasha, a mix of Native American, Black, and Cajun peoples, is not officially recognized by the federal government or the State of Louisiana (Burnett, 2017). This marginalized tribe continues to fish, forage, trap, and hunt out of Grand Bayou Village, located just east of the Barataria Basin (Yeoman, 2020). A legacy of canal digging to support oil infrastructure has fragmented and degraded the once whole marshlands, with some 10,000 miles cut throughout the Mississippi Delta since the 1930s (Yeoman, 2020). With 50% of Louisiana's life-sustaining and protective coastal wetlands already lost, the construction of the Gator Express Pipeline is the latest iteration of the legacy of ecological and environmental injustices inflicted on the area.

FERC consulted the National Marine Fisheries Service and acknowledges that pipeline construction will harm essential fish habitat[14] for postlarval and juvenile life stages of white shrimp, brown shrimp, and lane snapper, and all life stages of red drum and adult gray snapper (FERC, 2019c, p. 4-85). FERC also acknowledges the potential for re-oiling, that is, remobilization of weathered oil from pipeline construction (FERC, 2019c, p. 4-80); likely impacts to the West Indian manatee (p. 4-94); unavoidable destruction of imperiled coastal live oak/hackberry forest, not all mitigated by planned horizontal directional drilling estimated to use 9 million gallons of water (FERC, 2019c, pp. 4-55, 4-80); and impacts on migratory bird species, including songbirds, waterbirds, and raptors, including numerous bald eagles in the area and an island used for nesting by colonial waterbirds within 600 to 1,800 feet of the pipeline, claiming that most impacts can be prevented by Venture Global's project-specific plan and procedures (FERC, 2019c, pp. 4-60–4-65). However, the company has gotten approvals to have no seasonal restriction on pipeline construction, which is expected to take a year (FERC, 2019c, p. 4-80). In short, the Gator Express is an environmentally risky proposition.

Ecosystem Services

Emergent estuarine and estuarine intertidal wetlands serve a similarly vital role in the aquatic ecosystem. Emergent estuarine wetlands act as important nurseries for many larval forms of species important to the local fishing industry, including shrimp, crab, redfish, seatrout, and menhaden, and are critical to enhancing the production of marine organisms in adjacent bodies of water (Louisiana Natural Heritage Program, 2009). Estuarine marshlands also play a significant role in reducing storm-related flooding through floodwater storage (Louisiana Natural Heritage Program, 2009). Estuarine salt marshes function as nitrogen and phosphorus sinks seasonally, improving water quality as it passes through the wetlands (Louisiana Natural Heritage Program, 2009).

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[14] Essential fish habitats are waters and substrate established under the Magnuson-Stevens Fishery Conservation and Management Act that are necessary to fish for spawning, breeding, feeding, or growth to maturity.

These wetlands perform many important functions for the environment and people (i.e., provide ecosystem services). The abundance of water and diversity of vegetation offer protective habitat for fish, birds, reptiles and amphibians, and upland mammals seeking food and shelter (National Oceanic and Atmospheric Administration [NOAA], 2022). Coastal wetlands in the Gulf of Mexico also serve as an important stopover habitat for numerous migratory birds, which rely on the abundance of food sources available (see "Wildlife, Fisheries, and Aquatic Resources"). Other ecosystem services include providing flood control, water filtration, and wildlife habitat (Shepard et al., 2011). Wetlands attenuate floodwaters as well as distribute sediments slowly throughout the floodplain (NOAA, 2022). As waters pass slowly through wetlands, suspended sediment and pollutants settle into the soil and may be taken up by vegetation, thereby improving local water quality (NOAA, 2022). Coastal wetlands also absorb energy from storm surges and help prevent coastal flooding (Costanza et al., 2008). The ecosystem services that the Gulf of Mexico provides have been estimated to be between $300 billion and $1.3 trillion per year in economic value; and to protect these assets, the State of Louisiana's Comprehensive Master Plan for a Sustainable Coast calls for $50 billion in projects (State of Louisiana, 2017).

Cumulative Losses

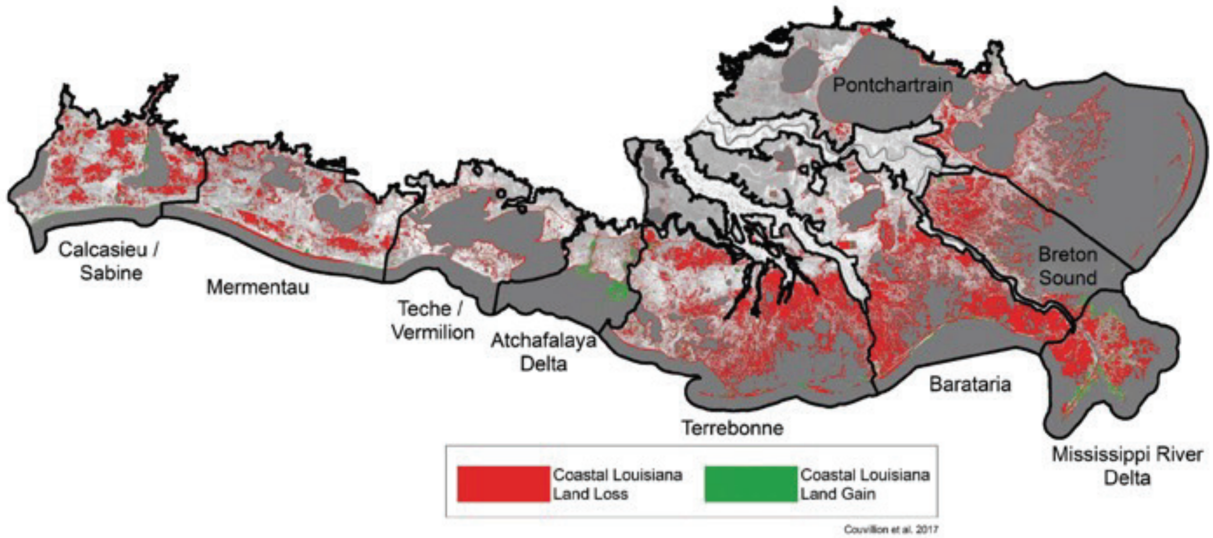
LNG development puts these ecological values, economic benefits, and investments at risk during a time when coastal wetlands continue to be lost to storms, coastal erosion, sea level rise, saltwater intrusion, human alterations of floodplains, oil and gas production and transport, and land subsidence. The U.S. Interagency Coastal Wetlands Workgroup reports that "between 1998 and 2004, an estimated 59,000 acres [92.2 mi^2] of coastal freshwater and saltwater wetlands in watersheds of the Atlantic and Gulf of Mexico were lost on average each year . . . [and] from 2004 to 2009, this rate increased to 80,000 acres [125 mi2] lost on average each year" (Interagency Coastal Wetlands Workgroup, 2022, p. 1). During the latter period, the majority of the nation's freshwater wetland loss and nearly all of the saltwater wetland loss occurred along the Gulf Coast, where losses amounted to more than 160,000 acres and nearly 100,000 acres, respectively (Dahl and Stedman, 2013, cited from Interagency Coastal Wetlands Workgroup, 2022, p. 3).

Indications are that various species of waterfowl are in decline, and their populations are predicted to decline further due to climate change and other threats (Bateman et al., 2020; Meehan et al., 2021). As a result, various federal, state, and local agencies and conservation groups (e.g., Audubon, the National Wildlife Federation, and Ducks Unlimited) work vigorously to restore coastal wetlands. LNG projects work against those efforts.

Louisiana, which accounts for 37% of the coastal marshes and 45% of the intertidal wetlands in the lower 48 states, has lost roughly 2,000 square miles of such areas since the 1930s (Couvillion et al., 2017; Louisiana Coastal Wetlands Conservation and Restoration Task Force, 2021). From 2004 through 2008, more than 300 square miles of marshland were lost from Hurricanes Katrina, Rita, Gustav, and Ike (State of Louisiana, 2017). Observed losses in Barataria Basin (the location of an offshore pipeline for Plaquemines LNG, the so-called Gator Express) and the Sabina-Calcasieu

Basin (the proximal location of the Cameron and Freeport LNGs, as well as the Sabine Pass, Calcasieu Pass, and Golden Pass LNGs) total 450 and 200 square miles, respectively. Those losses are exceeded only by those in the Terrebonne Basin (Figure 5.8).

Figure 5.8. Coastal Louisiana Land Loss



Source: Louisiana Coastal Wetlands Conservation and Restoration Task Force (2021).

As shown earlier in Table 5.5, LNG terminal construction for the six facilities examined in this report is associated with a total permanent loss of 1,123 acres (1.75 square miles) of wetlands. Entirely filling wetlands is tantamount to the localized destruction of an existing ecosystem. The dumping of dredged or other earthen materials into wetlands to convert them to solid land for building on diminishes the size and function of existing wetland ecosystems, thereby reducing or eliminating the ecological benefits they provide (Johnston, 1981). The Plaquemines LNG, Driftwood LNG, and Cameron LNG projects all involve filling extensive acreages of wetlands on-site—368, 319, and 214 acres, respectively (Table 5.5).

Attempts to Mitigate Wetland Loss

Those "unavoidable" impacts to wetlands due to construction are required to be mitigated by federal and state regulations under Section 404 of the Clean Water Act. USACE has regional compensatory mitigation programs, managed cooperatively with states. The "no net loss" goal is to restore, establish, and enhance wetlands, streams, and other aquatic resources to offset unavoidable adverse impacts through various mechanisms. For example, Driftwood plans to purchase mitigation credits, an in-lieu fee (ILF) program, following guidelines established by the Louisiana Wetlands Rapid Assessment Method and prescribed by the USACE New Orleans District Wetlands Mitigation Plan. For Plaquemines LNG, Venture Global intends to create a compensatory mitigation plan (FERC, 2019c, pp. E-4, 4-48). Cameron LNG used permittee-responsible compensatory mitigation to attempt to convert 256 acres of open water adjacent to the terminal into marsh wetlands habitat, using material dredged from the contaminated Calcasieu Estuary

(FERC, 2014a, p. 4-30). The project relies on natural revegetation. As Hough and Harrington (2019) point out, ILF mitigation relies on third-party sponsors to ensure project effectiveness, and, as the name implies, with permittee-responsible mitigation, responsibility rests with the permittee.

There are other reasons why the construction of artificial wetlands to compensate for loss of natural wetlands may not achieve desired results. There is evidence that artificial wetlands are less suitable for wildlife, including waterbirds, than natural wetlands (Ma et al., 2004). Another study found that constructed wetlands fail to replicate the diversity of amphibian species observed in natural wetlands (Drayer & Richter, 2016). An artificial wetland constructed in open water may simply revert to open water over time, a process that severe storms could accelerate. Generally, the "regeneration" time for a wetland to revegetate naturally under the USACE's New Orleans District plan is one year. However, in nature, the process can take years if not decades longer, and the permit requirements to show that revegetation has occurred are rarely, if ever, enforced by USACE or the state (Naomi Yoder, Healthy Gulf, personal communication, January 6, 2023). Given the complex factors that contribute to the proper functioning of wetland ecosystems, and the known deficiencies in artificial wetlands, there is a distinct possibility that attempts to create wetlands out of open-water areas as "mitigation" for wetlands loss will result in a net decrease in functional wetland areas.

USACE and the EPA oversee the permitting, monitoring, and enforcement of compensatory mitigation projects. Permittees typically must monitor sites for five years to determine whether they achieve project-specific performance standards. However, despite established standards and project-specific requirements, several issues have arisen with the compensatory wetlands program. Once the five years of monitoring has taken place, the success of compensatory mitigation sites is often assumed to continue. However, research shows that sites often fail to comply with project standards in the years after monitoring stops and that performance standards can be difficult to verify (Hough and Harrington, 2019). Van den Bosch and Mathews (2017) found that compensatory mitigation sites in Illinois between eight and 20 years old had lower floristic quality compared with nearby natural wetlands, only 65% of project-specific standards were met at the end of the monitoring period, and only 53% were met in a subsequent survey. The study was conducted on projects begun before a new rule promulgated by USACE and the EPA had taken effect. Regardless, there is limited evidence of the long-term effectiveness of compensatory mitigation projects in creating ecologically equivalent wetlands (Hough and Harrington, 2019). Moreover, states play a major role in implementing compensatory mitigation, developing programs, setting standards, and determining monitoring requirements. As a result, successful outcomes vary, and practical and political considerations can take precedence over scientific ones (Peimer et al., 2022).

Overall, one can conclude that LNG facilities contribute to an overall loss of wetlands in quantity and quality. Given the ecological importance of wetlands and the threats to them, including climate change (Shepard et al., 2011), those losses are an important element of the cumulative environmental impacts of Gulf Coast LNG facilities.

Wildlife, Fisheries, and Aquatic Resources

The construction of LNG facilities causes temporary and permanent alterations of wildlife habitat, including disturbance, displacement, direct injury, and death. Wildlife habitat types at project locations include freshwater wetlands, saltwater marshes, open water, open lands, and agricultural lands. "Open lands" are upland wildlife habitats dominated by grasses, forbs, and shrubs. Vegetation clearing for LNG facility construction (discussed above) reduces habitat for some wildlife species; and smaller, less mobile wildlife could be injured or killed by construction equipment. The breeding, nesting, foraging, and sheltering behaviors of wildlife may be disrupted by artificial lighting and noise from construction—for example, from pile driving, heavy machinery use, and a general increase in human activity. Migratory birds in the Gulf Coast are particularly sensitive to an increased presence of humans and noise and vibrations from LNG facilities, which are also harmful to resident birds, colonial waterbirds, and raptors. Many of the same impacts on wildlife and aquatic resources that occur during LNG facility construction persist throughout the facility's operation, due to the presence of physical structures, artificial lighting, noise, and human activity in general. These and other impacts are described below.

Construction activities can also negatively impact aquatic resources, including those in freshwater, saltwater, and brackish marsh habitats. Salt marshes are closest to the beach rim and have low plant diversity, whereas brackish marsh habitats are found more inland and are less influenced by tidal flow. Although brackish marshes have more plant diversity, salt marshes act as a nursery for myriads of larval forms of shrimp, crab, redfish, seatrout, and menhaden and are important for waterfowl habitat (Louisiana Department of Wildlife and Fisheries, n.d.). What are classified as intermediate marshes are often found between brackish and freshwater marshes and have a high degree of ecological diversity. These ecologically rich areas can be locally rare and vulnerable to saltwater intrusion, and they appear to be decreasing (Louisiana Natural Heritage Program, 2009). Plaquemines LNG is located in batture habitat—areas in the Lower Mississippi River between levees and higher banks of the floodplain, areas with a high ecological restoration potential that would be circumvented on-site by LNG development (Biedenharn et al., 2018).

Coastal wetland loss threatens nurseries and juvenile-stage habitats of many species, and in turn the economies and livelihoods of coastal fishing communities. Louisiana tops the country in catches of oysters, shrimp, crab, crawfish, red snapper, wild catfish, sea trout, and mullet (Wilkins, n.d.). In 2021, Louisiana had the second-largest overall commercial catch in the United States, generating more than $367 million.[15] It is estimated that by 2050, the annual loss in commercial fisheries due to coastal erosion will be nearly $550 million (Wilkins, n.d.).

Aquatic habitats such as the Calcasieu River and Lake support both commercial and recreational fishing. Spotted sea trout, southern flounder, and red drum are targeted species for recreational fishers, and brown shrimp, white shrimp, blue crab, and the eastern oyster are the species commonly

[15] Data downloaded on January 5, 2023, from NOAA Fisheries One Stop Shop (FOSS) Landings System: https://www.fisheries.noaa.gov/foss/f?p=215:26:389378147422

sought after commercially (FERC, 2019b, p. 4-46). The fisheries are under stress from decades of industrial pollution, and to prevent further ecological degradation and wetlands loss conservation groups have sued USACE over Driftwood LNG's wetlands permit. James Hiatt, a Southwest Louisiana coordinator for the Louisiana Bucket Brigade, said that LNG development is "destroying hundreds of acres of wetlands and exposing fragile ecosystems that serve as nurseries for fish, shrimp, crabs, and the way of life that makes Louisiana the Sportsman's Paradise" (Naquin, 2022a).

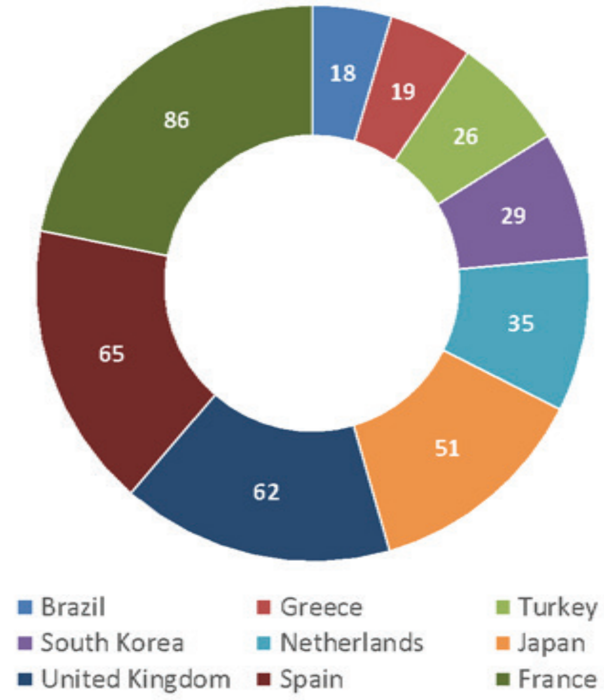
Bays around the Rio Grande LNG terminal are common recreational fishing areas for speckled sea trout, redfish, southern flounder, and sheepshead. The construction and operation of the Rio Grande LNG terminal could affect recreational fishing through restrictions of fishing access and increased noise and vessel traffic (FERC, 2019d, p. 4-219). Commercial fishing in Port Isabel and the Port of Brownsville is dominated by bait fisheries (including shrimp) and black drum. The Port of Brownsville and Port Isabel together were recently ranked as the second-largest fishing port by value along the Gulf of Mexico (FERC, 2019d, p. 4-221).

Aquatic habitats are degraded by soil erosion that occurs due to damage to and removal of vegetation at project sites, thereby exposing soils to the effects of wind, rain, and natural disasters and carrying sediments and contaminants into water bodies. The runoff and infiltration of accidental spills and routine leaks of hazardous substances at LNG sites also adversely affect wildlife and aquatic resources. These types of impacts are a particular concern during construction of LNG facilities in relatively undeveloped areas, such as, for example, the proposed Rio Grande LNG near Brownsville, Texas, where there are significant concerns about impacts to two endangered wildcat species—the jaguarundi and the ocelot (see "Special Status Species" below). Increased vessel traffic during construction and operations also contributes to shoreline erosion, and cooling water intake by LNG vessels results in entrainment, crushing, and suffocation of fish larvae and other small organisms in intake screens (FERC, 2019b, p. 5-5).

Discharge of ballast water in an LNG terminal berthing area is also harmful to aquatic life and provides a pathway for the introduction of exotic aquatic nuisance species into the U.S. coastal waters (FERC, 2014c, p. 4-35). Exporting vessels load ballast water to operate safely. After offloading their cargo, tankers normally ballast with port water, which includes regional biota small enough to pass through grates on intake pipes (Holzer et al. 2017, p. 1470). Although federal regulations exist for ballast water and strategies exist to mitigate invasive species entering the work dock waters, smaller planktonic organisms that survived the transit could be introduced and cause algal blooms and hypoxic conditions, affecting all levels of the food chain (FERC, 2019c, p. 4-77).

In North America, maritime shipping has contributed up to 82% of species introduced to coastal ecosystems via ballast water over the last 30 years (Holzer et al., 2017, p. 1471). Some organisms, such as toxin-generating phytoplankton, which can survive the voyage duration in ballast sediments, can be released during ballast water discharge and tank cleaning (Gollasch et al., 2015, p. 42). Impacts of introduced species vary and can be consequential and long term, disrupting entire ecosystems, damaging fisheries, and causing billions of dollars in infrastructure costs (Davidson and Simkanin, 2012). In the United States, a comprehensive study concluded that the estimated annual damage and control costs from introduced aquatic non-native species amount to $14.2 billion (Gollasch et al., 2015, p. 48). According to Holzer and others (2017), "compared to other vessel types, LNG tankers have a very large ballast water capacity of 58,000 m3 per ship on average . . . which translates to roughly 23 times the volume of a typical Olympic-size swimming pool" (p. 1472). In 2015, LNG vessels were estimated to have discharged 117 million cubic meters of overseas ballast water in U.S. waters (Holzer et al., 2017), and between 2015 and 2021, U.S. LNG exports increased more than 12,000% (more than 120-fold). Given the increases, and projected increases, in U.S. LNG exports, the amounts of ballast discharges that have already taken place are huge and could likely accelerate.

Figure 5.9. Top Destination Countries (by Number of Shipments) for Cameron, Corpus Christi, and Freeport LNGs, January 1 to December 31, 2022



Source: Derived from U.S. Department of Energy (2022).

Figure 5.9 shows the top nine destination countries for LNG in terms of the number of shipments from the Cameron, Corpus Christi, and Freeport LNG terminals in 2022, which include countries in Asia, Europe, and South America. While the destinations may not correspond precisely with places where ballast water is taken on, it is likely that LNG vessel ballast water is originating from across the globe. Although various disinfection processes are used on ballast water as per U.S. Coast Guard regulations (see 33 C.F.R. §151.2026)—for example, UV light, electrolysis, electrodialysis, and chemical injection of chlorine dioxide—systems and operators fail and the broad geographic distribution of LNG export terminals throughout the Gulf Coast further heightens the risk of introducing aquatic invasive species.

Impacts on birds are another major concern. Of the 650 species of birds known to inhabit the United States, nearly 400 inhabit the Gulf Coast, which is considered one of the most important waterfowl areas in North America (Esslinger & Wilson, 2001, cited from FERC, 2019b, p. 4-88). Battaglia and colleagues (2012) state that "gulf coast marshes provide critical habitat for millions of waterfowl, predominantly ducks and geese"; they also note that 90% of all bird species of eastern North America have been observed in the southern coastal marshes along the Gulf of Mexico, which provide habitat for more than 400,000 geese, 4 million ducks, 1.5 million American coots, hundreds of thousands of shorebirds, and other migratory birds (p. 81).

Migratory birds follow broad routes called flyways between breeding grounds in Canada and the United States and wintering grounds in Central and South America and the Caribbean. The Gulf Coast is an important resting and refueling place and key habitat for migratory birds, including large populations of continental waterfowl that use the Mississippi Flyway and the Central Flyway to the west. The Cameron, Plaquemines, and Driftwood LNG projects are within the Mississippi Flyway, and the Corpus Christi and Rio Grande LNGs are in the Central Flyway. LNG facility impacts add to various cumulative impacts on bird species along the Gulf Coast, including decades of shoreline erosion and wetland loss, urbanization, and pollution, such as that caused by the 2010 BP *Deepwater Horizon* oil spill, which had devastating consequences for Gulf Coast shorebirds (Dahl, 2006; Takeshita et al., 2018).

Artificial Light

Artificial light from LNG facilities also has a negative impact on birds by obscuring natural light sources and attracting birds in low light and foggy conditions, causing bird collisions with facility equipment. Nighttime lighting can also disorient birds and other species that rely on sunlight and moonlight to navigate. To mitigate impacts on migratory birds and in accordance with the Migratory Bird Treaty Act and Executive Order 13186, some facilities have committed to measures such as facility lighting plans (Exec. Order No. 13186, 2012). FERC is responsible for ensuring that companies protect bald eagles under the Bald Eagle and Golden Eagle Protection Act, and LNG companies are ostensibly required to document their preconstruction consultations with USFWS regarding their wildlife impact mitigation measures.

In its EISs, FERC repeatedly states that wildlife species within the project areas are expected to acclimate to project disturbances or simply relocate to similar habitats nearby. However, the assertion that displaced wildlife can successfully relocate is based on an assumption that suitable, nearby, unoccupied habitat exists. FERC's environmental reviews downplay impacts on wildlife as "short-term and episodic" and "temporary and localized" (e.g., FERC, 2019b, pp. 4-89–4-90) and therefore not significant, despite the fact that construction can take years and many facilities plan on 24-hour construction work.

FERC's assertions that wildlife will become acclimated to construction noise and lighting and some species will be only temporarily disturbed during construction (i.e., not permanently displaced or harmed) belies the fact that physical structures combined with artificial light and periodic flaring will continually disorient migratory birds and pose collision hazards throughout the lifetime of the facilities. For Plaquemines LNG, FERC acknowledges that resultant injuries and deaths may occur up to 40 times a year. It also should be noted that LNG terminal sites often encompass large land areas. For example, for Rio Grande LNG, a total of about 2,056 acres (3.2 square miles) of current wildlife habitat is within the facility's footprint, including 738 acres (1.15 square miles) that would be permanently converted to developed land at the LNG terminal site (FERC, 2019d, p. ES-7).

Noise and Vibration

Noise and vibration from dredging, pile driving, vessel traffic, flaring, and heavy machinery have significant impacts. Underwater noise can cause behavioral disturbances to aquatic species, which can lead to reduced reproductive success and mortality (FERC, 2019d, p. 4-110). Underwater noise pollution and vibrations can startle and stress fish and turtles and impede their ability to communicate, prompt movement away from feeding and breeding grounds, and increase vulnerability to predators (Peng et al., 2015). Pile driving, used to construct and stabilize docks and other terminal facilities, is especially loud and impactful. Vibratory hammer and hydraulic pile-driving methods are used to install steel pipes and thick metal sheets (piles) deep into the ground. It can cause noise levels in nearby underwater areas that exceed 150 decibels, which can cause behavioral disturbances in fish and other aquatic species and cause injuries (e.g., cochlear damage) at higher levels. Sensory stress to adult birds can disrupt egg laying and result in nest abandonment and mortality of young birds (FERC, 2019b, p. 4-89).

Some facilities use in-water pile driving, which is especially loud; one such facility is Driftwood LNG, for which FERC recommended the development of an in-water pile-driving plan, developed in consultation with the National Marine Fisheries Service (FERC, 2019b, p. 4-52). Noise levels and the distance sound waves carry vary depending on the size of the pilings, depth driven, type of equipment used, composition of the substrate, and physical structure of the water body, such as, for example, whether it is a narrow shipping channel, which may absorb sounds, or an open waterway where sound travels better. In the case of Driftwood LNG, pile driving is expected to occur over a nine-month period (FERC, 2019b, p. 4-51). Citing various studies, the Driftwood EIS states, "Studies have shown that the sound waves from pile driving may result in injury or trauma to fish, sea turtles, and other animals with gas-filled cavities, such as swim bladders, lungs, sinuses, and hearing structures" (FERC, 2019b, p. 4-50). This would include various species of marine mammals.

Dredging and vessel traffic also create underwater sound levels that can impact aquatic resources. Noise pollution levels from LNG operations are considered to be "moderate to loud" within a mile of LNG sites, and for Rio Grande LNG, located in a relatively undeveloped area, such noise pollution would result in disturbances to and displacement of many wildlife species in areas surrounding the LNG site (FERC, 2019d, p. 4-89).

Table 5.11 shows that there were 560 LNG export shipments from January through December 2022 from the three currently operating LNGs examined in this report (with the same number of incoming vessel trips). The lower amount for Freeport LNG is due to the shutdown that resulted from the June 2022 explosion at the facility. Based on this amount of shipping, in a year without interruptions there would be an estimated 1,314 ship trips. Of course, the ship traffic shown in Table 5.11 is only a portion of the current amount, when you consider that there are two other operating facilities (Sabine Pass LNG and Venture Global Calcasieu Pass LNG). The ship traffic could increase by several times what it currently is, with expansion plans of existing facilities (Cameron and Corpus Christi LNG), several LNG facilities under construction (Golden Pass, Driftwood, Plaquemines, and Rio Grande LNGs), and 12 others proposed (22 LNG facilities total). That puts the notion of cumulative impact into sharp relief.

Table 5.11. LNG Export Shipments and Ship Trips—Cameron, Corpus Christi, and Freeport LNGs

LNG facility	Export shipments Jan.–Dec. 2022	Estimated annual ship trips
Cameron LNG	229	458
Corpus Christi LNG	234	468
Freeport LNG	97	388
TOTAL	560	1,314

Source: U.S. Department of Energy (2022).

While FERC acknowledged the sources and environmental impacts of noise, the mitigation measures are limited recommendations and constitute vague assurances that efforts will be taken to keep noise levels below the threshold for behavioral effects, and if noise is above the threshold, FERC asserts that construction will only impact but not injure wildlife (FERC, 2019d, p. 4-111). For Driftwood LNG, located along the largely undeveloped shores of the Calcasieu Estuary, south of Lake Charles, Louisiana, FERC recommends conducting preconstruction land clearing outside of the breeding season, before annual nests are established (FERC, 2019b, p. 4-89).

Vessel Strikes

With the level of shipping currently planned, another concern is the potential for vessel strikes to marine mammals and sea turtles, including ones listed as threatened and endangered under the Endangered Species Act (see "Special Status Species" below). Vessel strikes are well known to result in whale and small cetacean mortality in the Gulf (NOAA, 2018). Whales are especially susceptible to vessel strikes because their habitat and migration routes are close to major ports and overlap with shipping lanes. Whales spend most of their lives within the draft depths of commercial vessels, particularly at night when they rest just beneath the surface. Environmental groups are pushing for vessels to avoid transit through habitats at night, a 10-knot speed limit, and a minimum distance of about 550 yards from observed whales (Birdseye et al., 2021). Sea turtles are also susceptible to vessel strikes as they surface to breathe, bask near the surface, and forage in shallow areas or on prey near the sea surface (NOAA, 2023b).

Whales and sea turtles are often unable to avoid ships because some species move slowly in the water. Blunt trauma occurs when a vessel hull strikes a marine mammal or sea turtle straight on, resulting in bruising, broken bones, or death. Underwater noise generated by an LNG carrier vessel that might alert whales is lowest in the front of a traveling ship (FERC, 2019b, p. 4-55). Propeller strikes cause deep cuts that can sever whales' arteries or spinal cords and can be fatal. Although NOAA documents fatal vessel strikes to cetaceans, the vast majority are likely to go unnoticed or unreported (Save Coastal Wildlife, 2023).

Dredging Impacts

Dredging is destructive to aquatic life (Wenger et al., 2017). Studies show that dredging has negative impacts on the surrounding aquatic environment by stirring sediments, reducing available sunlight, and reducing dissolved oxygen, the lifeblood for aquatic environments. Dredging scours away the benthic zone, which provides important habitat for many small organisms, including invertebrates, that are the foundation of aquatic food webs; estuarine benthic zones also provide habitat for fish, mollusks, crawfish, shrimp, oyster, and crab (Briones, 2004). Hydraulic dredging, which has been or will be used for each facility except Plaquemines, is especially harmful to less-mobile organisms (Wenger et al., 2017). The physical and chemical changes brought about by dredging "can adversely affect fish eggs and juvenile fish survival, benthic community diversity and health, foraging success, and the suitability of spawning habitat" (FERC, 2019b, p. 4-50).

By deepening waterways, dredging changes water circulation patterns, which can alter salinity in estuaries and allow greater volumes of seawater to flow inland during storms, potentially flooding migratory bird nesting habitat and causing more dramatic salinity changes harmful to the shrimping and oyster industries (Defenders of Wildlife, 2020). Dredging by Cameron LNG and Driftwood LNG can safely be assumed to temporarily add to the nutrient load and thereby contribute to eutrophication in the Calcasieu Estuary (He & Xu, 2015). The disposal of dredged material in open waters causes the same type of impacts and is a common practice for LNG facilities that warrants scrutiny.

USACE's Section 404 permits require permittees to provide a plan detailing their disposal or reuse of dredged materials. The Cameron and Driftwood LNG facilities both intend to dispose of their dredged material through Louisiana's BUDM program. Cameron LNG intends to pipe 205,000 cubic yards of dredged slurry to an identified BUDM site located directly across Highway LA-27 from the facility, in a degraded marshland habitat (FERC, 2014a, p. 4-62). Driftwood LNG has identified 10 separate BUDM sites located along the Calcasieu River and Intercoastal Waterway between 1.75 and 8.5 miles away to which it intends to pipe dredge slurry for disposal (FERC, 2019b, p. 2-38). The Corpus Christi LNG plan calls for disposal of 4.4 MCY of dredged materials pumped through an 11,000-foot-long, 30-inch-diameter slurry pipe to fill a clay borrow pit and cap a bauxite disposal bed, with the decanted water outfall to be monitored (FERC, 2014b, pp. 2-5–2-6). Freeport LNG intends to dispose of 1.3 MCY of dredged sludge at an identified DMPA, 2.1

miles northwest of the terminal site, and additional preapproved DMPAs as needed (FERC, 2014c, p. 2-13). Rio Grande LNG intends to dispose of 7.2 MCY of dredged material on-site and across 12 identified disposal areas. Planned areas include eight upland disposal sites located along the south bank of the Brownsville Shipping Channel, two nearshore "beach nourishment sites," and two ocean-dredged-material disposal sites located in the nearby South Bay (FERC, 2019d, p. 2-39). In most cases, FERC identifies preapproved dredged material placement areas in its NEPA documents; however, in the cases of Freeport LNG, Driftwood LNG, and Rio Grande LNG, details about the exact locations are scant and there is little discussion of the impact of dredged material disposal. There also appear to be unanswered questions about whether dredged material is tested for contamination before being used. Some BUDM projects have been hampered by a lack of funds for careful project design. The higher cost and inconvenience of BUDM compared with other disposal methods incentivizes plans to not be carried out.

In addition to the large amount of dredging to construct ship docks, maintenance dredging is typically planned to occur every few years. Although the volumes are lower than during construction, maintenance dredging has negative environmental impacts over the life of each project.

One of the most concerning aspects of FERC's environmental reviews is the tendency to dismiss the impacts of piling driving, dredging, and other activities as "temporary" or "localized" despite the fact that activities like dredging need to be done periodically. Although FERC gives consideration to special status species (covered below), it and state agencies in Louisiana and Texas generally seem to shrug off known, unmitigated, and inadequately mitigated damage to wildlife, fisheries, and aquatic resources that we have described above. It is a tacit sacrifice zone mentality, and the tendency of FERC and state agencies to minimize, dismiss, and ignore impacts as a cost of doing business adds to the cumulative impacts of LNG development.

Special Status Species

LNG projects affect what are referred to as special status species, which include federally listed endangered or threatened species, state-listed endangered or threatened species, and species of concern. Species of concern are those species that federal agencies are concerned may be threatened or could become threatened, but for which insufficient information is available to indicate a need to list the species under the Endangered Species Act (FERC, 2014c, p. 4-86).

Although FERC EISs list at least 12 special status species in each project area, Rio Grande LNG has the most, including 17 federally listed species, 42 state-listed species, and 20 species of concern, followed by Freeport LNG, which has 12 federally list species, 19 state-listed species, and eight species of concern. Collectively, the LNG facilities may impact a total of 114 special status species, including 29 marine mammals, eight land mammals, 14 fish (including sharks and rays), 26 birds, 15 reptiles, six amphibians, seven shellfish, and nine plants (see Appendix F). The large number of special status species LNG terminal construction potentially affects is a reflection of the rich biological diversity of the Gulf Coast, the immediate proximity to coastal waters and waterways abundant with wildlife, and the location of some LNG facilities in relatively undeveloped areas—for example, Rio Grande LNG (Ward and Tunnell, 2017).

Marine mammals are affected by underwater noise, primarily from pile driving and dredging during construction. Underwater noise from construction can injure or harass marine mammals. Other effects include impaired hearing, brain hemorrhaging, and the masking of communication important for survival. In the worst cases, loud noises can cause the gradual or even sudden death of whales and dolphins (Robbins, 2019). For Rio Grande LNG, the bottlenose dolphin has the potential to be impacted by underwater construction noise. The threshold of behavioral effects for dolphins would extend up to 4.6 miles from pile-driving activities. The EIS does not mention mitigation measures to prevent underwater noise damage from pile driving, dredging, or in-water activities (FERC, 2019d, p. 4-175).

As discussed earlier, marine mammals can be harmed by vessel strikes, which are among the top threats to the endangered Rice's whale (*Balaenoptera ricei*), a newly classified species that lives year-round primarily in the eastern Gulf of Mexico (NOAA, 2023a). It also has been observed off the coast of Texas. With less than 100 individuals extant, it is among the most endangered whale species in the world. Other whale species found in LNG carrier shipping lanes include the blue whale, finback whale, humpback whale, sei whale, and sperm whale (Appendix F).

Impacts to special status bird species occur for the same reasons described above regarding migratory, resident, water, and wetland birds—for example, habitat modifications and destruction at and near the terminal site, especially to wetlands, injuries and deaths from striking facility equipment, for which artificial lighting is a contributor, and feeding, breeding, and nesting disruptions due to noise and other human disturbances (see "Wildlife, Fisheries, and Aquatic Resources").

While a review of impacts to the long list of species of concern is beyond the scope of our report, we highlight ways that LNG development is harmful to three species of special significance: the piping plover (*Charadrius melodus*), the Gulf Coast jaguarundi (*Herpailurus yagouaroundi cacomitli*), and the Texas ocelot (*Leopardus pardalis albescens*). Whereas the piping plover is widely distributed, the jaguarundi and the ocelot have limited U.S. ranges and occur only in the vicinity of Rio Grande LNG, located in the lower Rio Grande Valley, which USFWS ranks as one of the most biodiverse areas in the United States (Nature Conservancy, 2022).

The piping plover is a small migratory shorebird that nests and feeds along coastal sand and gravel beaches in North America. There are three populations of piping plover: Northern Great Plains, Great Lakes, and Atlantic Coast. All three populations are federally listed either as endangered or threatened and have extensive recovery plans (USFWS, 2022). Piping plovers migrate north to their breeding habitat in the spring and south in the fall to spend the winter along the Gulf of Mexico and southern Atlantic Coast (Tern and Plover Conservation Partnership, 2022). The Gulf of Mexico is home to about 70% of the wintering population of the threatened piping plover (Brown et al., 2011, p. 10). In 2001, USFWS designated wintering habitat for piping plovers as critical habitat for the species. Critical wintering habitat supports roosting, foraging, and sheltering activities between February and May (FERC, 2019d, p. 4-148).

Wintering piping plovers use a variety of coastal habitats, where they forage for invertebrates in mud flats, ephemeral pools, and seasonally emergent seagrass beds (USFWS, 2022). The main threat to the piping plover is habitat loss—for example, from shoreline development. LNG terminals developed in critical habitat reduce available foraging habitat due to their physical footprint and noise that causes behavioral disturbances. All six LNG EISs list the piping plover as a special status species within the vicinity of each respective LNG terminal (Appendix F), and the immediate vicinity of the Rio Grande LNG terminal is critical habitat for wintering piping plovers (FERC, 2019d, p. 4-149).

The Gulf Coast jaguarundi, a federally endangered feline species, is slightly larger than a domestic cat. They are usually found in the dense forests of Texas's Rio Grande Valley. Jaguarundis have slender, elongated bodies, small flattened heads, and long tails with short legs and short rounded ears. Their typical habitat consists of mixed thorny scrub, interspersed trees, and riparian habitats along rivers or creeks. Jaguarundis hunt primarily during the day for birds, rabbits, reptiles, and small rodents (Texas Parks and Wildlife Department, n.d.). Historical accounts from Mexico suggest that jaguarundis are good swimmers and enter water freely. Because of their sparse populations and lack of recent sightings, little information is available about the jaguarundi in Texas (USFWS, 2013).

The ocelot is a federally endangered solitary feline species about twice the size of a large domestic cat that is distributed from Texas and Arizona into South America. In the United States, ocelots and jaguarundis live in similar habitats, but the ocelot is primarily nocturnal. Ocelots hunt small mammals, birds, and reptiles and rest during the day in trees or sheltered dens (Texas Parks and Wildlife Department, 2022). Fewer than 100 ocelots are known to exist in the entire United States (Nature Conservancy, 2020).

Several wildlife refuges are located in the vicinity of the proposed Rio Grande LNG project, including the Laguna Atascosa National Wildlife Refuge, the Lower Rio Grande Valley National Wildlife Refuge, and The Nature Conservancy's Lennox Foundation Southmost Preserve (Nature Conservancy, 2020). Vital wildlife migration corridors connect these protected areas and the lower Rio Grande Valley with the ocelot's southern range in Mexico. LNG facility development threatens these important habitats. FERC states that "construction and operation of the proposed project could affect ocelots through direct injury/mortality during habitat clearing . . . [and i]ndirect effects could also occur from the habitat disturbance/fragmentation, increased human presence, and increased noise during construction and operation" (FERC, 2019d, p. 4-156).

After LNG facility owner NextDecade received a favorable biological opinion from USFWS, the Sierra Club and Defenders of Wildlife filed a lawsuit claiming that LNG terminal construction would harm the endangered Gulf Coast jaguarundi and the Texas ocelot population in the lower Rio Grande Valley (Davila, 2020b). The conservation groups argued that, if built, the Rio

Grande and another LNG facility in Brownsville (Annova LNG) would fragment and eliminate key habitat by cutting off the ocelot population in the Laguna Atascosa National Wildlife Refuge from the population in Mexico. They also argued that light and noise would disrupt the ocelot's movements, putting the cat at risk of being struck and killed by traffic. This risk will increase significantly due to LNG construction and operation workers (M. Weber, 2020).

Air Quality Impacts

LNG export facilities and vessels emit air pollution that degrades local air quality and contributes to climate change. Emissions of pollutants harmful to human health are a particular concern for LNG facilities in places that already have poor air quality. LNG operations emit what are known as criteria air pollutants, for which the EPA has established National Ambient Air Quality Standards under the Clean Air Act. Criteria pollutants include nitrogen oxides (NO_x), volatile organic compounds (VOCs), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and lead (Pb). Nitrogen oxides and VOCs in the presence of sunlight create ground-level ozone (O_3), which is visible as haze or smog, and also is a regulated criteria pollutant. These pollutants are known to have a broad array of health hazards associated with them (see Table 5.12).

LNG facilities also emit additional pollutants known as hazardous air pollutants, or HAPs. Examples of HAPs associated with LNG sites and their known health hazards are outlined in Table 5.12. LNG facilities are considered Clean Air Act "Major Sources" by the EPA, because they emit large amounts of air pollution (i.e., more than 250 million tons per year for a single criteria air pollutant). LNG facilities and ships also emit large amounts of greenhouse gases—including carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O)—and are required to report those to the EPA. Each of these types of emissions is discussed below.

Table 5.13 shows the annual amounts of criteria air pollutant emissions from normal operations in tons per year (tpy) as reported in FERC EISs.16 Table 5.13 does not include emissions for LNG terminal construction or shipping. FERC EISs indicate that cumulative amounts of criteria air pollution from LNG export terminal construction activities, which take place over several years, typically exceed annual emissions during operations. LNG carriers, tugs, and other escort vessels collectively emit noteworthy amounts of criteria air pollutants while traveling in state waters, while maneuvering in and out of berthing stations, and while moored.

The transition to dual-fuel, diesel/natural gas engines and low-sulfur marine fuel oil could reduce nearshore emissions, but not substantially at export terminals, due to the use of auxiliary marine fuel diesel engines during "hoteling" operations that can last nearly 24 hours, that is, during loading and resupplying when LNG carriers are considered stationary air pollution sources (Afon and Ervin, 2008; FERC, 2014c, p. F-4; Grönholm et al., 2021).[17] Those emissions are part of a facility's air permit, and FERC EISs did not have consistent and complete data to include here.

[16] Allowable emission limits are set in facility air permits.

[17] For example, for Cameron LNG, FERC estimates of emissions from LNG carriers and tugboats include 972 and 38.5 tpy, respectively, of NO*x* and VOC emissions, which are equivalent to 45% and 6.4%, respectively, of the corresponding emissions from the LNG terminal; and HAP emissions from shipping (5.7 tpy) amount to more than 10% of those from terminal operations (calculated from Table 4.11.1-7, FERC 2019d, p. 4-261).

Table 5.12. Air Pollutants Associated with LNG Emissions and Example Health Hazards

Pollutant type		Example health hazards
Criteria air pollutants	Carbon monoxide	Cardiac effects; neurotoxicant
	Lead	Possible carcinogen; neurotoxicant; reproductive/developmental toxicant; cardiac effects
	Ozone	Respiratory toxicant (including asthma)
	NO_x (nitrogen oxides)	Respiratory toxicant (including asthma); immune toxicant
	$PM_{2.5}$ (fine particulate matter)	Carcinogen; cardiac effects; respiratory toxicant (including asthma)
	PM_{10} (particulate matter)	Carcinogen; cardiac effects; respiratory toxicant (including asthma)
	Sulfur dioxide	Respiratory toxicant (including asthma)
Hazardous air pollutants (HAPs)	Acetaldehyde	Possible carcinogen; neurotoxicant; respiratory irritant; toxicant (including asthma)
	Acrolein	Respiratory irritant
	Benzene	Carcinogen; neurotoxicant; organ toxicant (blood); reproductive toxicant
	Ethylbenzene	Carcinogen; organ toxicant (liver, kidney); neurotoxicant
	Formaldehyde	Carcinogen; respiratory toxicant; respiratory irritant
	n-Hexane	Developmental toxicant; neurotoxicant
	Toluene	Developmental toxicant; immune toxicant; neurotoxicant
	Xylene	Respiratory toxicant; neurotoxicant

Sources: U.S. EPA: What Is Carbon Monoxide?; U.S. EPA: Learn About Lead; U.S. EPA: Health Effects of Ozone Pollution; Agency for Toxic Substances and Disease Registry (ATSDR): Nitrogen Oxides, April 2002; U.S. EPA: How Does PM Affect Human Health?; U.S. EPA: Sulfur Dioxide Basics; N.J. Department of Public Health: Hazardous Substance Fact Sheet—Acetaldehyde, May 2016; ATSDR: Public Health Statement for Acrolein, 2011; ATSDR: Public Health Statement for Benzene, March 2015; ATSDR: Public Health Statement for Ethylbenzene, 2015; ATSDR: Public Health Statement for Formaldehyde, May 2021; ATSDR: ToxFAQs for n-Hexane, May 2014; ATSDR: Toluene—ToxFAQs, 2017; ATSDR: Public Health Statement for Xylene, 2014; International Agency for Research on Cancer: List of Classifications; California Office of Environmental Health Hazard Assessment: The Proposition 65 List; Association of Environmental and Occupational Clinics: Exposure Codes (used to identify asthmagens).

Note: VOCs are not included in this table as that category includes a broad array of substances with varying health hazards. Some VOCs are also HAPs. All HAPs noted in this table are also VOCs.

Nevertheless, these emissions levels are deeply concerning given the health effects associated with criteria air pollutants. As Table 5.12 shows, many health hazards are associated with these pollutants. Several are respiratory toxicants, and particulate matter (both $PM_{2.5}$ and PM_{10}), ozone, sulfur dioxide, and NO_x are also all associated with asthma (Guarnieri and Balmes, 2014). Plaquemines LNG and Driftwood LNG are being sited in areas with disproportionately high asthma rates. Also of concern is the carcinogenicity of particulate matter—a known lung carcinogen (International Agency for Research on Cancer, 2015). Emerging evidence also connects $PM_{2.5}$ as well as NO_x to other cancers, such as breast cancer (Amadou et al., 2023; Hvidtfeldt et al., 2023; Poulsen et al., 2023).

Table 5.13. Annual Emissions of Criteria Air Pollutants, Hazardous Air Pollutants, and Greenhouse Gasses, by LNG Facility (short tons per year)

LNG facility	NO_x	VOCs	CO	SO_2	PM_{10}	$PM_{2.5}$	HAPs	GHGs*
Cameron	3,172	226	3,147	27	438		61.0	9.03M
Driftwood	1,704	556	6,039	73.8	356	356	73.4	9.51M
Plaquemines	902	134	1,381	115	372	372	30.0	8.14M
Corpus Christi	2,493	249	2,926	39.3	70.9	70.9	29.4	3.74M
Freeport	51.9	31.8	76.6	25.1	80.1	80.1	15.5	2.04M
Rio Grande**	2,059	604	3,142	30.2	382	382	54.2	8.15M
TOTAL	10,382	1,801	16,712	310	1,699	1,261	264	39.3M

Sources: FERC LNG EISs and EAs (see Appendix G).

Note: NO*x* = nitrous oxides; VOCs = volatile organic compounds; CO = carbon monoxide; SO2 = sulfur dioxide; PM10 = particulate matter; PM2.5 = fine particulate matter; HAPs = hazardous air pollutants; GHGs = greenhouse gases.

* Carbon dioxide equivalents in millions of short tons per year.

** Includes ground flaring during start-up

LNG export facilities use massive turbines that pump refrigerant gases through the methane to cool it and reduce its volume by more than 300 times. All of the turbines for the facilities studied, except for Freeport LNG, are gas fired, combusting even more methane supply gas (Freeport LNG uses electric turbines). During the operations of LNG terminals, natural gas compressor engines used for the liquefaction trains are the primary emissions source and are by far the largest contributors to emissions listed in Table 5.13. Corpus Christi's three liquefaction trains have eighteen 43,013-horsepower compressors (FERC, 2014b, p. 4-112). Although the compressors emit much less fine particulate matter than diesel compressors, they emit large amounts of ozone precursors, NO*x*, and VOCs. In Table 5.13, the variation in the amounts of each pollutant among the facilities may be partially a reflection of different LNG capacities and equipment. For example, the relatively low amount of emissions for Freeport LNG (52 tpy of NO*x*) is due to the use of electric rather than gas compressors.

Freeport LNG air emissions are nevertheless problematic. The EPA establishes Air Quality Control Regions (AQCRs) and designates AQCRs as nonattainment areas for specific criteria air pollutants that exceed national standards. Freeport LNG is in the Houston-Galveston-Brazoria AQCR, which includes eight counties. Brazoria County, where the facility is located, is considered a "moderate" nonattainment area for the EPA's one-hour ozone standard and a "severe" nonattainment area for the eight-hour ozone standard. Thus, unless offset or controlled, emissions from Freeport LNG can contribute to unhealthy air quality, during poor air quality days in particular, and when the wind blows inland. Under the Clean Air Act and by agreement with the EPA, it is the responsibility of the Texas Commission on Environmental Quality (TCEQ) to ensure through its air emissions permitting program that major pollution sources in nonattainment areas do not contribute to deterioration of air quality and are in conformance with the state implementation plan to bring a nonattainment area into compliance. This ideal is patently not the case, however, with respect to regulatory oversight of LNG operations in Texas. Freeport LNG reportedly had about 100 air permit violations that went unenforced, until finally TCEQ fined the company only $9,000 after it emitted 20,000 pounds of carbon monoxide (Ahmed, 2021a). See the Freeport LNG case study in Chapter 6 for further discussion of Freeport.

Corpus Christi LNG, though not in a nonattainment area like Freeport, has also been given nearly free rein. A Reuters investigation revealed that rather than compelling the Corpus Christi LNG owner, Cheniere, to comply with its air permit, regulators looked the other way when the facility repeatedly violated that air permit. Instead of issuing fines, TCEQ reportedly increased Cheniere's allowable emissions (Groom and Volcovici, 2022). The violations were the result of very high amounts of air pollution from gas flaring, which can be extremely loud and bright and radiate intense amounts of heat, in this case near a middle-income Latino neighborhood. Weak permit conditions and lax enforcement do little to ensure that LNG facilities are well operated, use effective pollution controls, and operate according to best practices. The June 2022 fire and explosion at Freeport LNG is the type of result that fenceline communities have come to expect. Numerous shutdown–and–start-up procedures result from poor operations, faulty equipment, and extreme weather events (e.g., see below regarding Cameron LNG) and the result is an extremely high amount of air pollution not accounted for in air permits. These examples in Texas fit into a familiar pattern in which pollution control standards are applied differently in low-income and people of color communities than in affluent white communities (e.g., see the Ocala, Florida, case in Lerner, 2011; and Bullard and Wright, 2012).

As explained next, regulation of HAPs also suffers from systemic failures. Under the Clean Air Act, facilities that emit more than 10 tpy of any single HAP or more than 25 tpy of HAPs in aggregate are considered Major Sources and may be subject to air permit requirements to use emissions control technology. Table 5.13 shows that the Driftwood, Plaquemines, and Rio Grande LNG facilities are Major Sources, assuming that substantially different information on facility HAP emissions was not submitted in air permit applications. Cameron LNG and Corpus Christi LNG fall just below the level to be an HAP Major Source. Given the relatively high LNG capacity of Corpus

Christi, one would expect it to be an HAP Major Source. Collectively, these LNG facilities reportedly emit more than 200 tpy of HAPs. We do not know why the estimated amounts of HAP emissions shown in Table 5.13 vary so much among the facilities, that is, why some facilities are HAP Major Sources and some are not. It was beyond the scope of our study to scrutinize facilities' air permits, which may include different data on HAP emissions than stated in our sources.

It is well established that formaldehyde is the primary HAP emitted by LNG facilities. Formaldehyde is a known carcinogen that causes myeloid leukemia and nasal cancers (International Agency for Research on Cancer, 2018). As shown in Table 5.13, there are additional HAPs released by LNG facilities, which can impart a range of health impacts. Of special note are releases of benzene, also a known carcinogen (International Agency for Research on Cancer, 2018); toluene, which can cause a range of reproductive and developmental harms, including congenital malformations; ethylbenzene, a suspected carcinogen that can cause hearing and kidney damage; xylene (also known as xylol and dimethylbenzene);[18] and *n*-hexane, which is emitted during start-up (Agency for Toxic Substances and Disease Registry, 2007, 2010, 2017; FERC, 2019d, p. 4-261).

Health effects from exposure to HAPs and other air pollutants depend on many factors, such as the level and duration of exposure and interactions among chemicals that are not well understood but that can magnify the health effects of individual chemicals. Such interactions can explain why low levels of exposures may have harmful health outcomes (Lagunas-Rangel et al., 2022). Recently the International Agency for Research on Cancer classified air pollution mixtures—not just individual air pollutants such as benzene or particulate matter—as being carcinogenic (International Agency for Research on Cancer, 2015). There is growing research interest in the health effects of long-term, low-level exposures to a common set of highly toxic substances produced by fossil fuel combustion—what are referred to as BTEX, or benzene, toluene, ethylbenzene, and xylene. Presently the risks of combined exposures cannot be reliably assessed, though the non-cancer effects of each of these chemicals alone are well known and include neurobehavioral health outcomes such as "poor coordination, elevated locomotor activity, measures indicative of anxiety and impulsivity, and compromised learning and memory" (Davidson et al., 2021, p. 11).

The high potential for additive and synergistic effects of LNG emissions, combined with those of other industries (see "Existing Environmental Burdens in LNG Facility Fenceline Communities" above), is illustrative of the type of cumulative impact that EJ communities, activists, and scholars have drawn attention to for decades in calling for use of the precautionary principle (Bullard et al., 2008; Myers, 2002). EJ movement leaders also point out that the current regulatory system fails to adequately address low-level, long-term, and cumulative impacts of environmental exposure to multiple toxic substances. For example, while HAP air concentration levels in fenceline communities may not exceed EPA HAP standards, EPA HAP standards have a weak connection to public health

[18] According to the Agency for Toxic Substances and Disease Registry (2007), "short-term exposure of people to high levels of xylene can cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; impaired function of the lungs; delayed response to a visual stimulus; impaired memory; stomach discomfort; and possible changes in the liver and kidneys" (p. 5).

and have been criticized for being set to match the emissions reductions that current pollution control technology can achieve rather than what would protect people (Ross & Brown, 2012).

Greenhouse gas emissions are another major environmental insult of LNG operations. As Table 5.13 shows, and as FERC reports, carbon-dioxide-equivalent emissions (CO_2e) from the six LNG facilities total 39.3 million short tons per year under normal operating conditions, which observations have shown do not consistently occur. Based on EPA estimates of annual greenhouse gas emissions from a typical passenger car (4.49 metric tons of CO_2e), in aggregate the emissions from those six LNG facilities are the equivalent to adding 8,749,000 vehicles to the road. That amount does not include greenhouse gas emissions from LNG shipping and natural gas pipelines and wells; neither does it include the combustion at the user end. The climate change implications of LNG greenhouse gas emissions are discussed below.

Our assessment of emissions of criteria air pollutants, HAPs, and greenhouse gases indicates that LNG air pollution risks are significant and suggests that the green image that LNG facilities project of themselves is nothing but a mirage.

Climate Change Hazards, Technological Failures, Explosions, Leaks, and Spills

Gulf Coast LNG facilities represent a dangerous cocktail of natural and technological hazards and are a prime example of what are referred to as natural hazards triggering technological accidents, or Natech (Cruz, 2005; Organisation for Economic Co-operation and Development, 2022). Natural hazards such as hurricanes, earthquakes, and floods can initiate events that interfere with the safe operation of facilities, especially those that lack adequate risk management plans for natural hazards (Organisation for Economic Co-operation and Development, 2022). Furthermore, hazards can create a cascade of safety risks, such as if one tank, among multiple tanks of explosive chemicals in close proximity to each other, were to catch fire or leak. Many natural disasters—such as Hurricanes Katrina, Harvey, and Ida—have caused major damage to industrial facilities, releases of hazardous substances, fires, and explosions, resulting in environmental pollution, evacuations, toxic exposures, and economic losses (Bullard and Wright, 2009; Flores et al., 2021a; Schleifstein & Baurick, 2021). We make the case that LNG facilities are subject to failure and to natural hazards due to their location along the Gulf Coast. Importantly, these failures, threats, and risks from natural hazards are predictable and, thus, should be preventable. At the very least, there should be regulations that govern planning for the occurrence of such hazards and the aftermath.

In this section, we describe some of the types of technological failures that LNG facilities can experience and the natural hazards associated with climate change at present and in the coming decades. We also review LNG facilities' preparations for natural disasters, and, in light of their coastal locations, discuss the potential for natural hazards—sea level rise and storm surges in particular—to cause technological failures. We conclude, as have others, that Natech for Gulf Coast LNG facilities have not been adequately assessed by FERC, state, or local officials, or the industry itself, and that further evaluation is needed to understand the risks that Natech pose to fenceline communities over the lifetimes of facilities (e.g., see van Heerden, 2022).

Technological and industrial accidents can result from human factors such as faulty equipment, operational errors, lack of maintenance or monitoring, poor training, and underinvestment (United Nations Economic Commission for Europe, 2020). An explosion at the Freeport LNG on June 8, 2022, is a prime example of a technological failure. A 2020 violation case by TCEQ against Freeport LNG stated that on August 23, 2019, Freeport LNG had another technology failure that resulted in a large release of fugitive emissions (Texas Commission on Environmental Quality, 2021). The 2022 explosion, described as a "450-foot-tall wall of fire," occurred due to inadequate operating and testing procedures, human error, and personnel fatigue (Foxhall & Buckley, 2022). It created a strong shock wave experienced by nearby residents and caused a fire in the LNG terminal's liquefaction delivery system, raising concerns about what else could have gone wrong (Associated Press, 2022). See the Freeport LNG case study in Chapter 6 for further details.

High winds and hurricanes disrupt operations and result in fugitive air emissions due to facilities needing to flare to burn off materials kept under pressure that can explode if not depressurized properly. The quickest way to deal with pressure is to burn off the materials, or flare from a stack. There are also heavily polluting shutdown–and–start-up procedures. In 2020, Cameron LNG lost power for over a month after Hurricane Laura, worrying local residents, who described large flares "that looked like fireballs in the sky." Days after Cameron LNG resumed operations in October 2020, Hurricane Delta hit, forcing it offline again (Juhasz, 2021).

Although raw, and even refined, methane is not explosive, once chilled to become liquefied and form LNG, the liquid must be kept at pressure to retain the cold temperature. Any contact with ambient air forms rapidly expanding LNG vapors, which are highly combustible and explosive. According to the Philadelphia Gas Works' *Safety Data Sheet* for LNG (2015), a release of liquid natural gas and the resulting vapors will flow downward initially due to being heavier than air, and then will form a white vapor cloud that will dissipate into the atmosphere. In most cases, an LNG spill will not contaminate soil; however, it can contaminate water. Because LNG is stored under very high pressure and in large volumes, a liquid spill under pressure (jetting) and vapor clouds may travel "considerable distances," depending on factors such as spill amount, wind conditions, built barriers, and topography. A vapor cloud, once formed, may catch fire, flash back, or explode (Philadelphia Gas Works, 2015, p. 3). Vapor clouds can be extremely cold, and workers are especially at risk of direct of exposures that can cause eye damage, severe frostbite, and freeze burns. Inhalation of large quantities of vapors may cause central nervous system depression, nausea, headache, dizziness, vomiting, and incoordination. LNG vapors are an asphyxiant, and higher levels of exposure may cause rapid breathing, numbness in the extremities, loss of consciousness, serious injury due to lack of oxygen, or death.

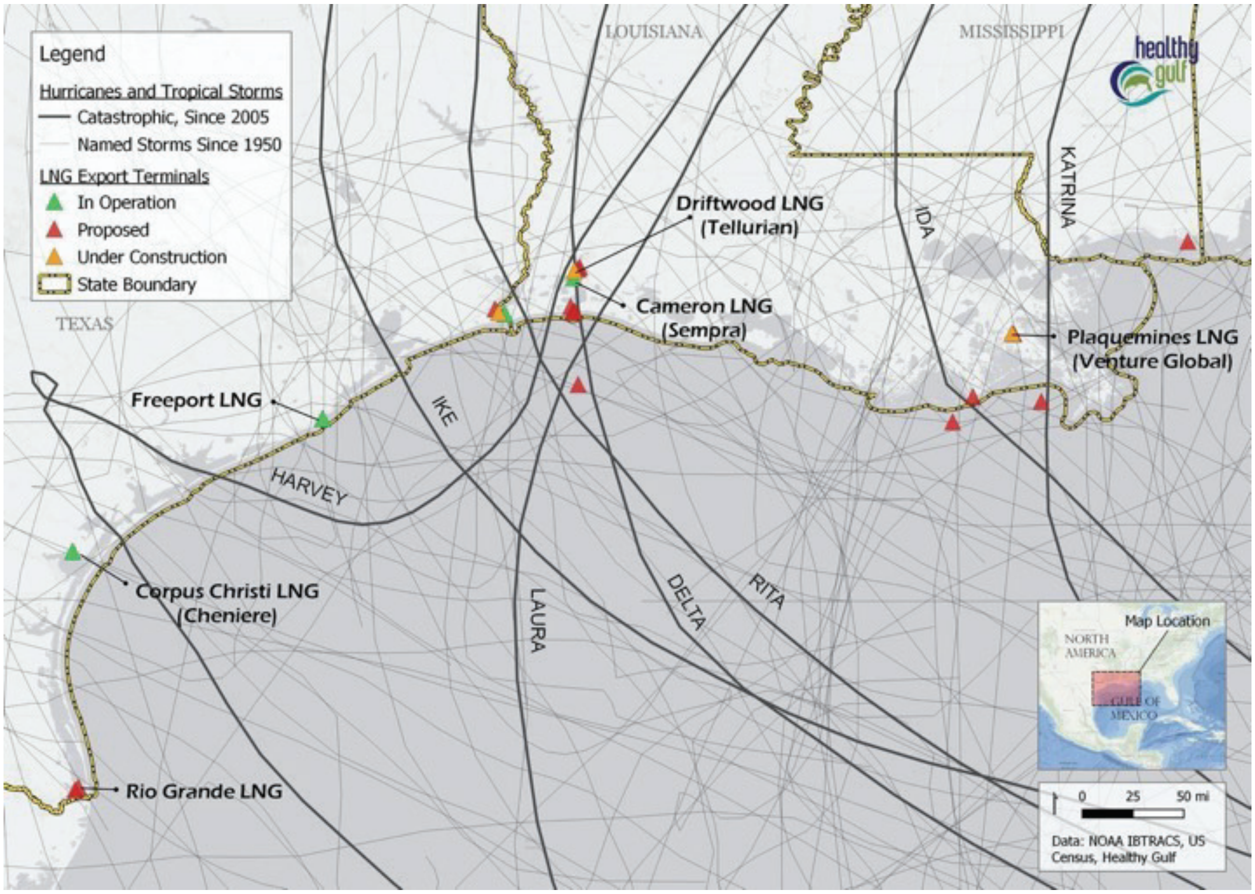
Although LNG liquid is not explosive, LNG vapors are highly combustible and explosive. Vapors can explode at concentrations in the air as low as 4% by volume (Philadelphia Gas Works, 2015,

p. 7). In addition to high levels of heat, fires and explosions pose added risks to nearby residents because of shock waves, flying debris, and potential secondary fires. LNG vapor "can be ignited by heat, sparks, flames, static electricity, and other sources . . . such as pilot lights, mechanical/ electrical equipment, and electronic devices that are not intrinsically safe" (Philadelphia Gas Works, 2015, p. 3). In 1944, a catastrophic series of explosions and fires resulting from an LNG leak in Cleveland, Ohio, killed 128 and injured 200 to 400 people (U.S. Bureau of Mines, 1946). A technical report by the Pipeline and Hazardous Materials Safety Administration (PHMSA, 2017) conducted vapor emissions modeling of jetting and flashing that could result from a release from highly pressurized pipelines within LNG export facilities. The 2017 PHMSA report indicates that combustible vapors from a pipeline leak can disperse up to 9,840 feet, or 1.86 miles, during light winds of 4.5 miles per hour (p. 93). The PHMSA admits that dispersal distances extend beyond the required thermal exclusion zones that LNG operators are expected to safely control. For example, FERC reports an explosion of ethylene and propane storage tanks at Cameron LNG could endanger people and property more than 4,500 feet, or 0.86 miles, from the facility property line (FERC, 2014a, p. 4-190).

As a result of these hazards, LNG facilities may be equipped with leak detection and emergency shutoff systems, special firewater delivery systems, and high-expansion foam systems that quickly blanket liquid LNG in the event of a spill. Under 49 CFR 193, facilities should be required to install high fencing or impoundments to mitigate jetting and flashing of LNG. However, the PHMSA report does not model distances a vapor cloud could travel from a rupture from LNG storage tanks of any size or identify mitigation measures to reduce vapor cloud dispersion. LNG storage tanks and transport vessel tanks under very high pressure contain exponentially more LNG than a pipeline. It stands to reason that material could form catastrophically sized vapor clouds, if released. The PHMSA requires only modest mitigation measures to reduce vapor cloud dispersion—that is, "vapor cloud barriers," walls around 20 feet high. Such barriers would be no match for jetting from a ruptured tank, especially high off the ground, and a subsequent explosion. Large LNG storage tanks and tankers full of LNG transiting almost daily from already-operating facilities potentially endanger people living many miles in every direction. That this safety issue has not been analyzed and the dangers made clear to nearby communities in public NEPA documents is inexcusable. LNG export terminals, as currently regulated in the United States, are a catastrophe waiting to happen.

LNG facilities' siting, safety design, and emergency procedures are regulated by federal agencies, including FERC, the U.S. Coast Guard, PHMSA (an agency within the Department of Transportation), and state utility regulatory agencies. Facilities also must comply with National Fire Protection Association Standard 59A for the Production, Storage, and Handling of Liquefied Natural Gas. However, LNG export facilities are exempt from most PHMSA safety programs (PHMSA, 2023). LNG facilities are not regulated under the EPA Risk Management Program as are other industries that use or store large amounts of hazardous, flammable, or explosive chemicals. Terminals are not mandated to, and do not consistently incorporate risk management planning. Although LNG companies overseen by PHMSA develop and file emergency response plans with FERC, watchdog groups such as Healthy Gulf report that plans are not shared with fenceline communities, leaving them in the dark about the most dangerous risks of LNG. The coastal location of LNG export terminals makes them susceptible to increasingly frequent, extreme weather events and sea level rise associated with climate change (Swanson & Levin, 2020). A NOAA report determined that the likely projected rates and accelerations based on historical tide-gauge observations and model projections show high confidence in relative sea level rise by 2050 (Sweet et al., 2022). That projection means that the relative sea level is expected, on average, to increase over the next 30 years. The report found differences between modeled scenarios and observation-based hypotheses, but nevertheless projected higher relative sea levels and an increase in high-tide flooding frequencies along the coastlines throughout the United States (Sweet et al., 2022).

Figure 5.10. Gulf of Mexico Named Storms Since 1950



Note: Tropical cyclones (tropical storms, hurricanes) that were of great enough intensity to be "named" storms that made landfall on the Gulf Coast from 1950 to 2021. Major storms (Category 3 hurricanes and above) of recent decades are labeled with a darker line and with the storm name. The analysis showed 393 named storms have made landfall on the Gulf Coast since 1950. Map by Naomi Yoder.

Sea levels across the United States are projected to increase across regions, and relative sea level rise along the Gulf Coast is projected to be 10–15 centimeters higher than the U.S. average by midcentury, partly due to land subsidence (Sweet et al., 2022, pp. 13–19, 60). By 2050, if climate change stays on the current trajectory, more than 10 moderate floods and one major high-tide flood are expected annually along the western Gulf Coast; and three to six moderate and 0.2 to 0.3 major high-tide floods (one every 3.3 to 5 years) are expected annually in the eastern Gulf Coast; well above the national average frequency in other coastal regions (Sweet et al., 2022, p. 39).

Along with an increase in sea level rise and flooding, hurricane intensity in the Gulf Coast is a vital concern given future projections. The Intergovernmental Panel on Climate Change, in a recent report, *The Ocean and Cryosphere in a Changing Climate,* discussed an uptick in the frequency and intensity of climate change–driven tropical cyclones on the Gulf Coast over the past 100 years (Intergovernmental Panel on Climate Change, 2022). A recent paper predicted more intense hurricanes along the Gulf Coast, even as it found that the number of hurricanes may decrease (Bruyere et al., 2017). Higher-intensity (stronger) hurricanes suggest the potential for substantial impacts on infrastructure and operations and fenceline communities. Figure 5.10 shows a sampling of recent catastrophic hurricanes and other named storms and serves as a reminder that it is not a matter of if but when.[19]

Sea level rise is a factor that stands to worsen the impacts of hurricanes and other named storms. Sea level rise has been occurring for decades, is accelerating, and is expected to continue to accelerate for the rest of the century and beyond (Sweet et al., 2022). It is a result of warming global temperatures, melting glaciers and ice sheets, and thermal expansion of ocean waters. Land subsidence along the Gulf Coast contributes to what scientists refer to as relative sea level rise, a level that is observed with respect to a land-based reference frame. Relative sea level rise along the Gulf Coast is greater than global mean sea level rise (Sweet et al., 2022). According to SeaLevelRise.org, "sea level around Galveston, Texas, has risen by 18 inches since 1950 . . . and is now rising by nearly 1 inch every year" and "sea level around Grand Isle, Louisiana, has risen by 24 inches since 1950 (SeaLevelRise.org, 2022a, 2022b). Because of sea level rise and subsidence, many coastal areas in the United States, including the Gulf Coast, are experiencing more frequent high-tide floods. What were once rare events are now recurring and disruptive problems (Sweet et al., 2014, p. vi).

As explained in a recent NOAA report titled *Global and Regional Sea Level Rise Scenarios for the United States,* "higher sea levels amplify the impacts of storm surge, high tides, coastal erosion, and wetland loss, even absent any changes in storm frequency and intensity . . . [and] even the relatively small increases in sea level over the last several decades have led to greatly increased frequency of flooding at many places along the U.S. coast" (Sweet et al., 2022, p. 2). SeaLevelRise.org notes that sea level rise alone can "turn what were 100-year storm surges into much more frequent events" and that "in a third of 55 coastal sites studied throughout the US, 100-year storm surges will be 10-year or more frequent events by 2050" (Cybersecurity and Infrastructure Security Agency, 2023).

NOAA provides various sea level rise scenarios for coastal planners and decision-makers to prepare for future flooding recognizing the uncertainties with climate projections. Sea-level-rise

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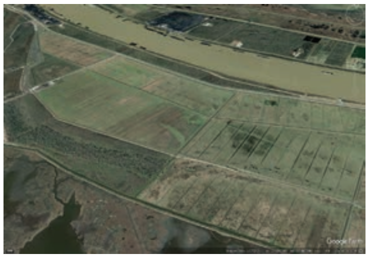
[19] A named storm is one considered to be a tropical cyclone, that is, a tropical storm, tropical depression, or hurricane.

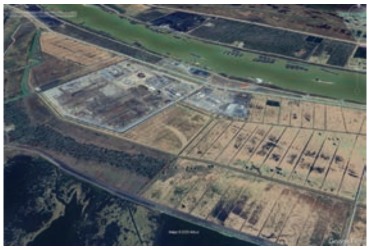
scenarios include "low," "intermediate low," "intermediate high," and "highest." NOAA recommends consideration of a number of factors in applying the scenarios, such as the planning horizon, overall risk tolerance, criticality of assets, and the size and vulnerability of the exposed population. Noting that sea level rise is accelerating and the need to prepare for worst-case scenarios, using the intermediate high scenario can be viewed as a prudent approach (see Sweet et al., 2017, pp. 33–35). NOAA's intermediate high projection of sea level rise in the western Gulf Coast is more than 2 feet from present by 2050, which is within the anticipated operating life of LNG facilities (Sweet et al., 2022, p. 19). This implies that in the future, high-tide floods and storm surges will reach further inland, reach into higher elevations, and inundate areas that are now considered safe.

Figure 5.11. Plaquemines LNG Terminal Site After Hurricane Ida, August 2021

5.11a



5.11b



5.11c

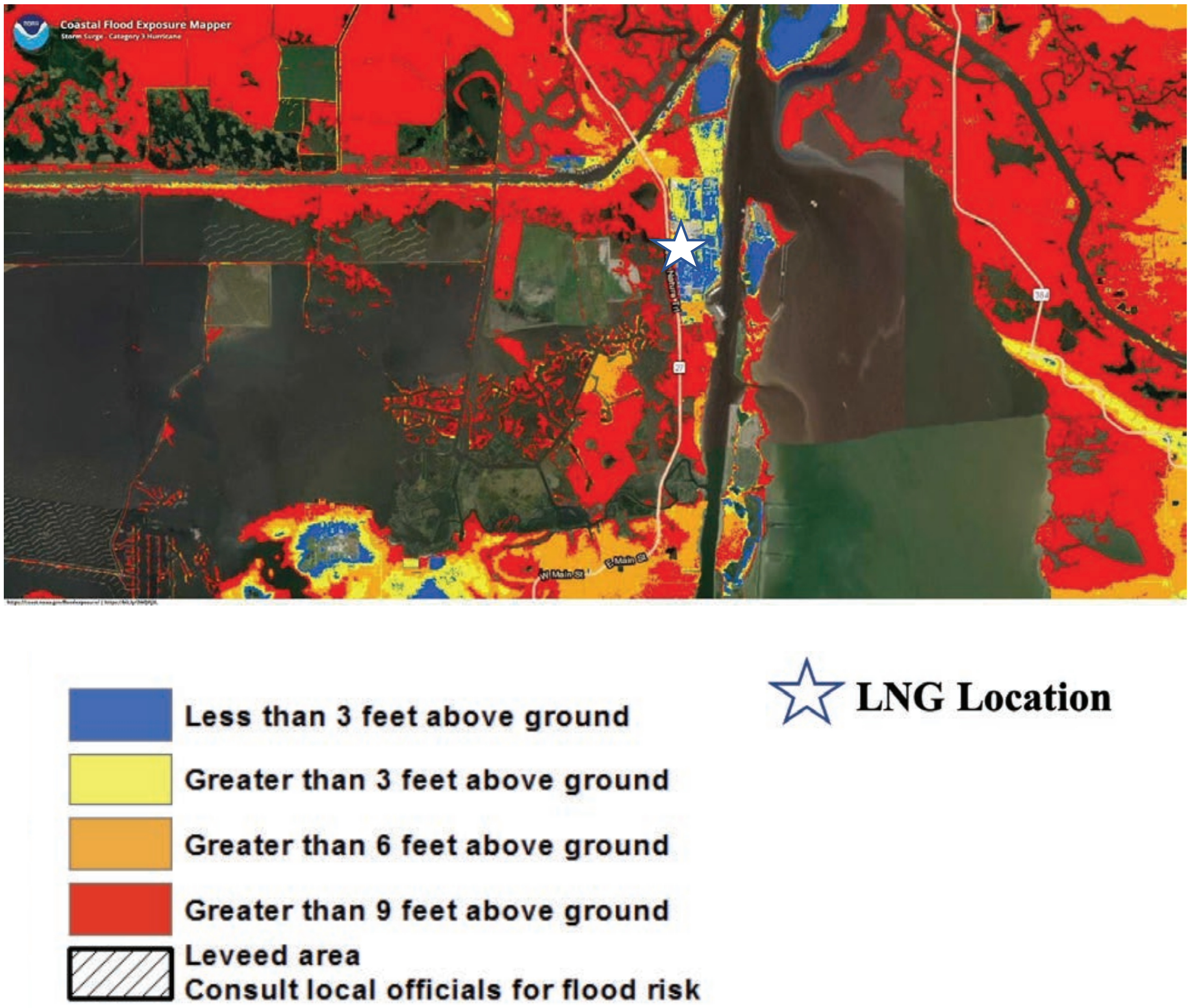
Sources: 5.11a: Healthy Gulf (2021); 511b and 5.11c: Google Earth.

Note: 5.11a—aerial photograph of the site before construction, after Hurricane Ida in September 2021; 5.11b—site of future construction for Plaquemines LNG in January 2021; 5.11c—Plaquemines LNG under construction in January 2023.

Even at current sea levels, hurricane storm surges have inundated some LNG terminal locations, including the Cameron, Driftwood, Freeport, Plaquemines, and Rio Grande LNGs. Figure 5.11a shows the future construction site of Plaquemines LNG 11 days after Hurricane Ida in August 2021, with the Mississippi River in the background. Although the area is protected by levees along the Mississippi River, it is subject to flooding from storm surge. In fact, lower Plaquemines Parish on both sides of the river has mandatory evacuation orders for even smaller tropical cyclones, given the risk from storm surge and how much land has disappeared from the parish from coastal erosion.

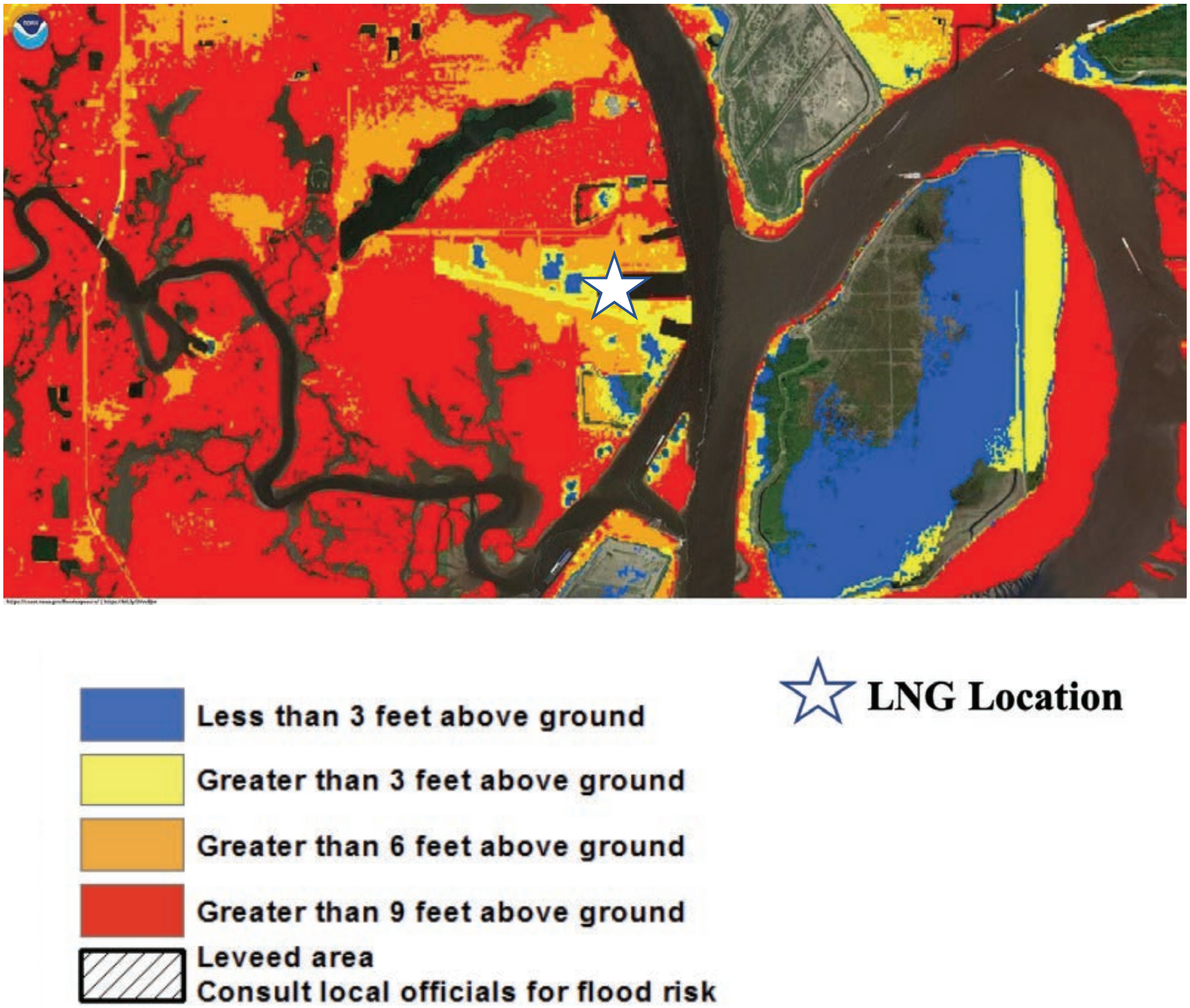
The shaded areas in Figure 5.12 show Category 3 hurricane storm surge levels for the existing Cameron LNG, indicating that parts of the site would be inundated by more than 3 feet of water. Cameron LNG has no retaining wall around the export facility either. Figure 5.13 shows that parts of the Driftwood LNG site (currently under construction) could be under 6 feet of water from a Category 3 hurricane.

Figure 5.12. Category 3 Hurricane Storm Surge Map for Cameron LNG (Cameron Parish, Louisiana)



Source: NOAA Coastal Flood Exposure Mapper.

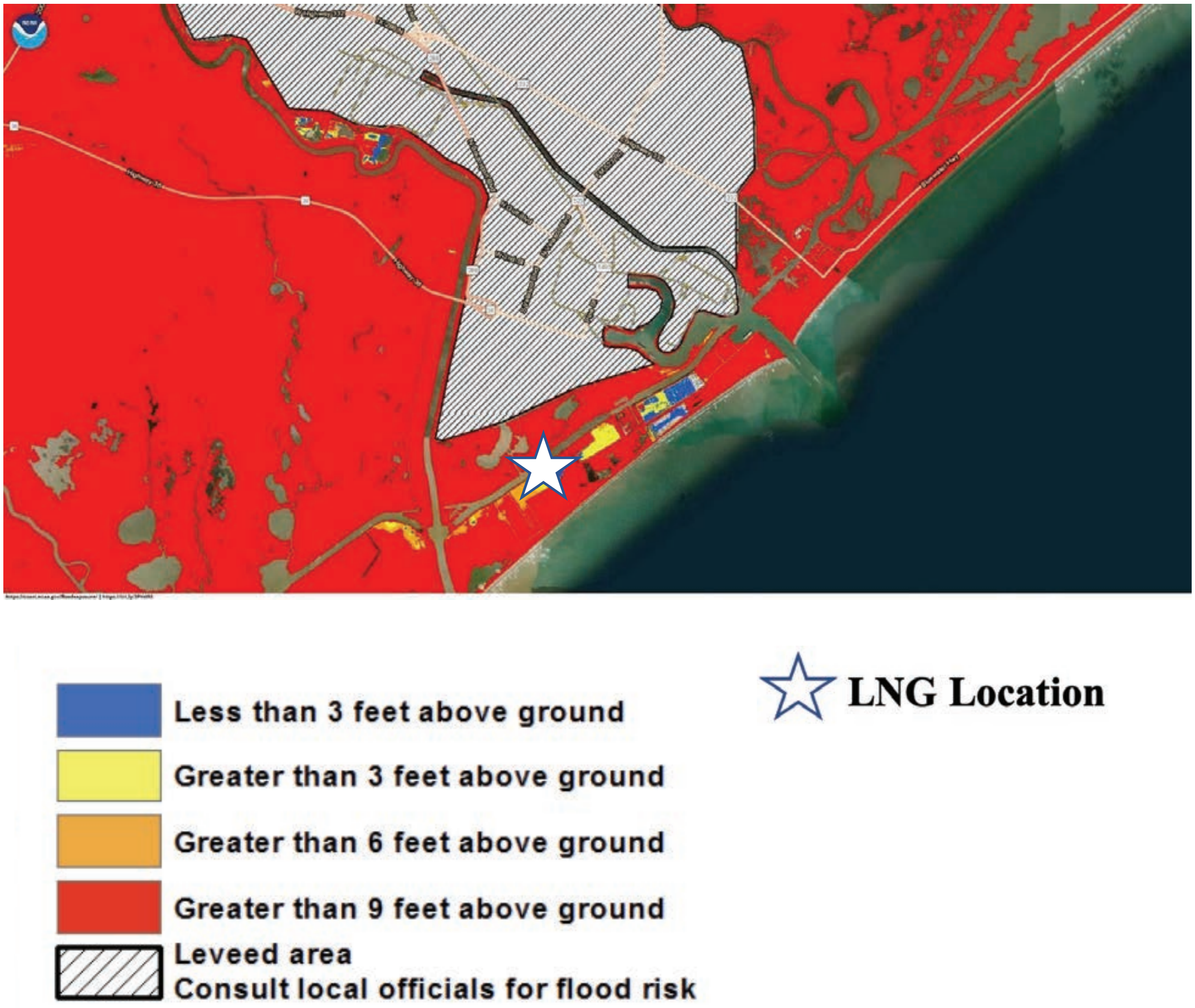
Figure 5.13. Category 3 Hurricane Storm Surge Map for Driftwood LNG (Calcasieu Parish, Louisiana)



Source: NOAA Coastal Flood Exposure Mapper.

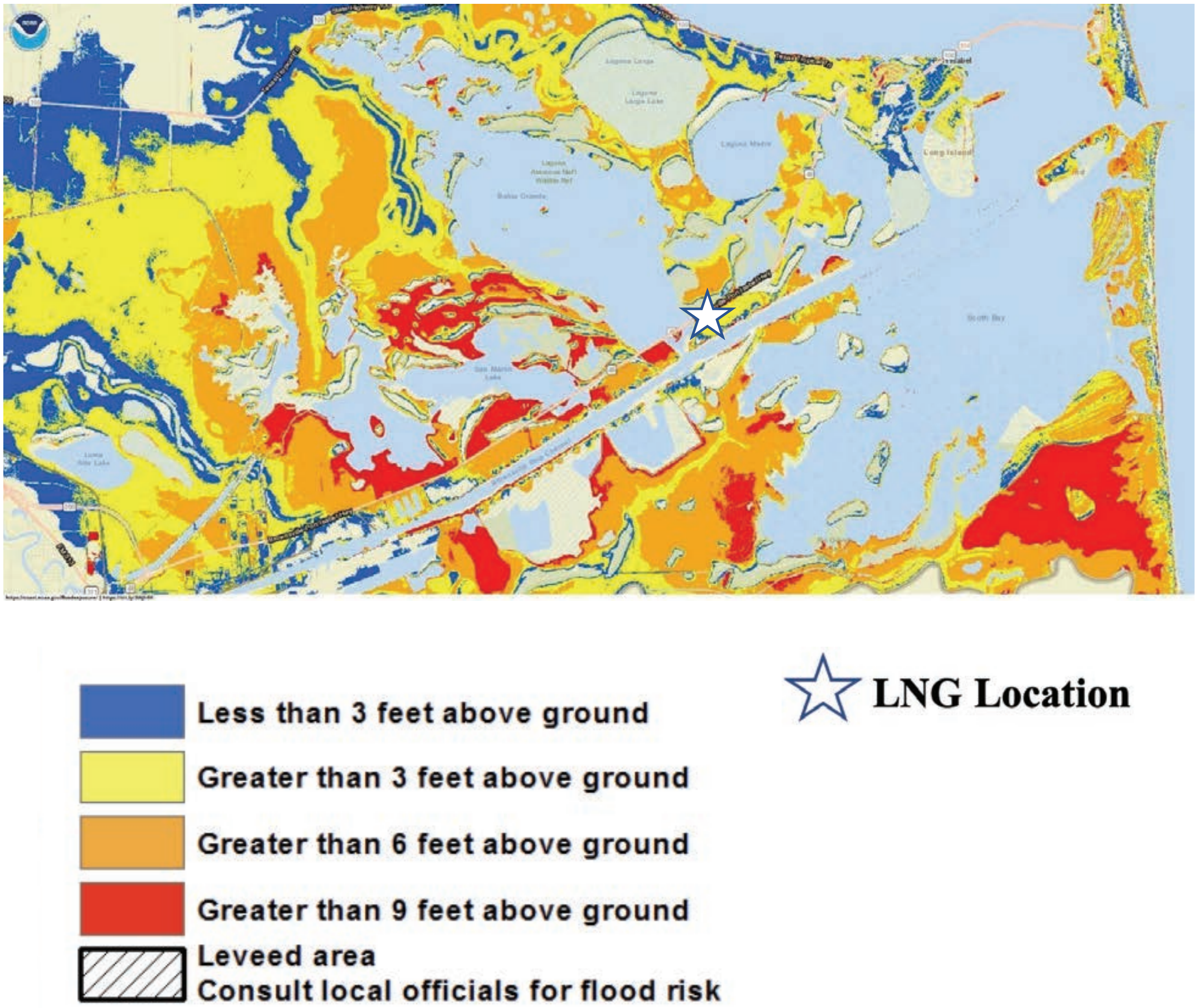
Figure 5.14 shows that most of the existing Freeport LNG site also would be under more than 9 feet of water from a Category 5 hurricane storm surge. The site's location is directly exposed to the ocean. The Freeport LNG EIS states that "even with the increased sea levels due to climate change, and increased storm surge, the non-sacrificial levees elevations of 21-feet above sea level at the Liquefaction Plant would provide a significant barrier to even a 100-year climate-change-enhanced storm surge" (FERC, 2014c, p. 100). However, as noted, higher sea levels and land subsidence result in higher storm surges, which make hurricanes more damaging and can put levees at greater risk, especially if they are not properly built and maintained. Figure 5.14 also indicates that Freeport LNG is outside the Port of Freeport and the municipal levee system.

Figure 5.14. Category 5 Hurricane Storm Surge Map for Freeport LNG (Freeport, Texas)



Source: NOAA Coastal Flood Exposure Mapper.

Figure 5.15. Category 3 Hurricane Storm Surge Map for Rio Grande LNG (Cameron County, Texas)



Source: NOAA Coastal Flood Exposure Mapper.

Figure 5.15 indicates that nearly all of the proposed Rio Grande LNG site would be inundated by more than 3 feet of water by a Category 3 hurricane storm surge. Nearly all of the site would be inundated with more than 9 feet of water by a Category 5 hurricane (not pictured). Corpus Christi LNG is the only facility of those we studied that appears to be on high enough ground to not be substantially flooded by a Category 3 or higher hurricane. Although the Plaquemines LNG site is on low ground next to the Mississippi River, it is in a Federal Emergency Management Agency (FEMA) flood zone, and thus, it is subject to flooding. Specifically, the site is classified as a Zone V according to FEMA, meaning that there is a 1% or greater chance of flooding annually and an additional hazard associated with storm waves. These areas are said to have a 26% chance of flooding over a 30-year period (FEMA, 2022). The parish is building a new "back" levee that is supposed to protect the area from storm surge.

The effects of flooding from storm surges depend on whether protection measures, such as berm and floodwall construction, are employed that could prevent inundation and on whether they are built to the recommended heights. Even still, FERC allows only a 1- or 2-foot margin of error for a hurricane storm surge. FERC does not fully evaluate what risks to facilities and fenceline communities could result from flooding or increased intensity of storms. FERC stated that Category 5 hurricanes are a very low probability at most LNG sites. Only three of the six LNG facilities are designed to withstand a Category 5 hurricane (Corpus Christi, Freeport, and Cameron LNGs). FERC's analyses of potential damage to LNG faculties from hurricane-force winds point to the International Building Code (ASCE 7-05 and ASCE 7-10) and the National Fire Protection Code (Section 59), and in some cases, FERC recommends sign-off by state engineers on safety design. Although FERC does not evaluate risks from tornados, it acknowledges wind-borne projectile hazards to LNG facilities and recommends preconstruction analyses of projectiles be conducted for review and approval prior to construction (FERC, 2019b, 2019c).

One can conclude that Gulf Coast LNG facilities as a whole are in harm's way by virtue of their vulnerable coastal locations and the hazards of extreme weather events and climate change. In fact, many oil and gas operations in the Gulf of Mexico have been disrupted by hurricanes over the years, with the latest largest storm, Hurricane Laura, disrupting the U.S. terminals' exports throughout southwest Louisiana. The hurricane had a 17-foot storm surge and temporarily suspended operations at several LNG facilities, including Cameron LNG. In 2021, Hurricane Nicholas knocked three liquefaction trains offline at Freeport LNG. Hurricane Ida—with a 9-foot storm surge—shut down nine oil refineries in Louisiana, which provide about 1/9th of America's gasoline supply. Further offshore, the Gulf of Mexico is the site of many thousands of drilling rigs and platforms, and during Hurricane Ida there were 3,800 operational and 4,000 non-operating platforms in the wind swath of the hurricane in the Gulf (Yoder and Moore, 2022b)

LNG development adds to the existing cumulative risks of climate change. The Gulf Coast is already a toxic recipe for disaster from ever-expanding petrochemical development. A recent study identified 872 chemical facilities situated in areas vulnerable to hurricane activity along the Gulf Coast, identifying 197 harmful compounds that were released in 166 recorded Natech events (Warmington, 2022). As mentioned earlier, natural disasters such as hurricanes can disrupt facility operations, causing malfunctions and toxic exposures, and thereby harm fenceline communities and damage ecosystems. In compromised facilities and ones that lack preventive measures, the harmful chemicals in above-ground storage units can become dislodged and pollute floodwaters, exposing flammable materials and causing fires and explosions that emit acutely toxic fumes (Warmington, 2022). Severe impacts such as mass flooding, loss of power, or fires lead to petrochemical facilities issuing emergency shutdown procedures to assess impacts and report to designated federal and state agencies. LNG facilities that suffer technological failures caused by natural hazards and that shut down for emergency purposes face significant economic losses from lost production and the necessity to repair damages on-site (Organisation for Economic Co-operation and Development, 2022). A recent report from the U.S. Government Accountability Office (2022a) requested by

Congress concluded that chemical industries need more information, guidance, and federal oversight on how to manage the risks posed by climate change and other natural events.

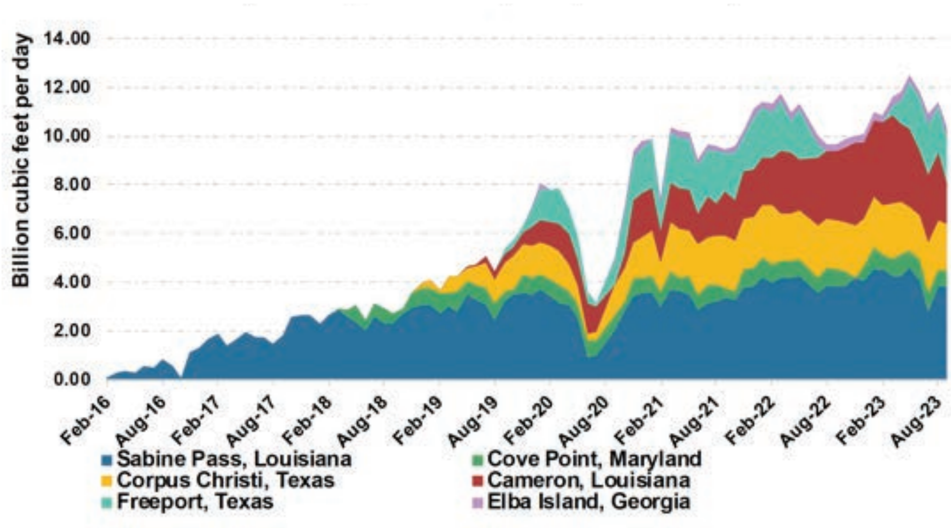
As storm intensity increases, petrochemical industries will likely have to abandon the Gulf Coast altogether given the high costs of moving to higher ground. According to analysts, climate change will result in an increasingly high cost of conducting business in the Gulf Coast region given the macroeconomic changes to demand for oil and gas, making operations in the region unattractive for industry in the future (Nicole, 2021). Over time the pressure of climate change on the petrochemical industry, shutdowns and damage from major storms, and the cost of protecting infrastructure may lead companies to conclude that operating on the Gulf Coast is not worth it. In the short term, and without comprehensive decarbonization, many fenceline communities will continue to face heavy pollution, environmental destruction, health disparities, toxic messes, ongoing recovery from past Natech events, and fear of future disasters.

Climate Impacts of LNG Development

In 2022, the Environmental Integrity Project reported that if the gas industry succeeds in building all of its planned LNG facilities, their operations could emit more greenhouse gasses yearly than "20 new coal-fired power plants," or the equivalent of 18 million cars, not counting the emissions and leaks from drilling and pipeline transportation of fracked gas before exportation, transporting LNG, or the emissions from burning it at its destination (Environmental Integrity Project, 2022a). According to Climate Action Tracker's *Warming Projections Global Update,* the boom in LNG export capacity will compromise meeting the Paris Agreement's 1.5 degrees Celsius global warming threshold (Climate Action Tracker, 2022). The independent research consortium states, "Between 2020 and 2050, cumulative emissions from LNG could be over 40 $GtCO_2$ [gigatons, or billion tons, of CO_2] higher, equal to around 10% of the remaining carbon budget," adding "if all of the LNG capacity currently under construction or planned around the world is actually built, the oversupply of LNG by 2030 could be almost five times the amount that the European Union imported from Russia in 2021" (Climate Action Tracker, 2022). According to the International Energy Agency, to avoid the worst of climate hazards, the world needs to dramatically slash demand for natural gas, bringing it down at least 20% by 2030 and 75% by 2050 (McGhee & Canary staff, 2023). This is a sobering assessment considering that the United States recently became the world's largest exporter of natural gas (Stapczynski, 2023). Aside from the dip due to the global COVID pandemic, Figure 5.16 shows a dramatic upward trend rather than a reduction in U.S. LNG exports in recent years.

For natural gas exports to decline, the Gulf South has to have opportunities to meaningfully participate in the oversight and regulation of LNG development. As Table 5.14 shows, more than 90% of U.S. LNG exports originated from Louisiana and Texas in 2022, even with Freeport LNG being offline for about half of the year. Moreover, several additional LNG terminals have been proposed in Texas and Louisiana.

Figure 5.16. U.S. Monthly LNG Exports by Terminal (February 2016–September 2023) in Billions of Cubic Feet per Day



Source: U.S. Department of Energy (2023).

Note: The Cameron, Louisiana, point of exit includes exports from Cameron LNG and Venture Global Calcasieu Pass LNG.

Table 5.14. Volume of LNG Exports in 2022, by LNG Export Facility

LNG export facility	Volume (in MCF)	Percentage of total exports
Cameron LNG (LA)	660,393,990	17.1%
Sabine Pass LNG (LA)	1,475,028,595	38.2%
Venture Global Calcasieu Pass (LA)	317,842,690	8.23%
Corpus Christi LNG (TX)	753,284,510	19.5%
Freeport LNG (TX)	301,007,640	7.79%
Gulf South subtotal:	3,507,557,425	90.8%
Cove Point (MD)	245,914,431	6.36%
American LNG (FL)	2,036,048	0.05%
Eagle LNG (FL)	67,605	0.00%
JAX Carb Energy LNG (FL)	877	0.00%
Southern LNG (GA)	108,437,294	2.81%
Subtotal all others:	*356,456,255*	*9.23%*
Grand total	**3,864,013,680**	**100.0%**

Source: U.S. Department of Energy (2022).

Note: MCF = thousand cubic feet.

FERC has systematically overlooked the cumulative impacts on climate of existing LNG development and the build-out in its environmental reviews of individual LNG facilities. That was the conclusion of former FERC Commissioner Richard Glick in his dissent from FERC's approval of the Plaquemines LNG and Gator Express Pipeline EIS:

> The commission continues to treat climate change differently than all other environmental impacts. The Commission steadfastly refuses to assess whether the impact of the Project's GHG emissions on climate change is significant, even though it quantifies the GHG emissions directly caused by the Project …The refusal to assess the significance of the Project's contribution to the harm caused by climate change is what allows the Commission to misleadingly state that the Project's environmental impacts will be "less-than-significant" and, as a result, conclude that the Project satisfies the [National Gas Act's] public interest standard. Claiming that a project has no significant environmental impacts while at the same time refusing to assess the significance of the project's impact on the most important environmental issue of our time is not reasoned decisionmaking. (Glick, 2019)

Notable is Commissioner Glick's charge that FERC failed to apply the public interest standard, suggesting that LNG development involves harmful tradeoffs in advancing mostly private interests associated with LNG exports (also see Slocum, 2023b). Nowhere does FERC consider the social and environmental costs of LNG's greenhouse gas emissions. FERC's failure to consider seriously the climate impacts of LNG is one of many that together constitute a failure to grapple with the cumulative impacts and injustices of LNG development.

Summary and Conclusions

This cumulative impact assessment, or CIA, examined five distinct elements to gauge the cumulative impacts of LNG facilities in the Gulf South. This was accomplished through an in-depth assessment of six representative LNG export terminals (three each in Louisiana and Texas, including three operating and expanding facilities, two under construction, and one proposed) and across five dimensions: (1) preexisting environmental burdens; (2) host community social and health vulnerabilities; (3) LNG environmental impacts; (4) LNG health, safety, and Natech risks, present and future; and (5) LNG climate impacts. Our assessment reinforces the conclusion that LNG development is risky business (Rozansky, 2022; Shaykevich et al., 2022; Shukla & Samuel, 2022). It is environmentally destructive and poses significant risk to the health, safety, and well-being of fenceline communities and the long-term habitability of the planet and its capacity to sustain all of us.

LNG development adds significantly to the environmental harm that has already occurred along the Gulf Coast—extensive environmental degradation from decades of canal building, river channelization, oil and gas development, petrochemical industries, other sprawling industrial development, agricultural land use, and urbanization (Murawski et al., 2021; Theriot, 2014). This development has ravaged the Gulf Coast's natural heritage; damaged fisheries; caused land subsidence; polluted land and water; and destroyed 50% of coastal wetlands that protect from storm surges, prevent coastal erosion, and provide life-sustaining ecosystem services on which nationally prominent tourism, fishing, and recreational economies rely. LNG development also adds to the preexisting environmental burdens fenceline communities bear. In those same communities, we find high levels of environmental pollution exposure, respiratory hazards, cancer risks, and proximity to environmental hazards compared with the LNG facilities' host states and compared with the nation as a whole. We find that fenceline communities rank high in measures of asthma and obesity in Texas and Louisiana, indicating susceptibility to LNG air pollution. In fenceline communities in Louisiana, we find evidence of elevated cancer rates, disproportionately high percentages of people of color, and elevated poverty rates. LNG development adds to the climate vulnerability of the Gulf Coast, where nearly 900 chemical facilities are situated in areas vulnerable to hurricanes (Warmington, 2022).

These findings reinforce that LNG development in the Gulf South is an environmental justice issue, and they corroborate the voices and concerns of frontline communities when they say that they are being treated as sacrifice zones. LNG development further overburdens people of color communities, the vast majority of which do not benefit from such development. LNG development adds insult to injury.

We have shown that the scope and magnitude of the environmental impacts of LNG export terminals are significant, despite FERC's assertions to the contrary in its environmental reviews, without which it might be compelled to do the unthinkable—protect the public interest and deny project licenses. In summary, we find that the six LNG facilities we examined

- sacrifice nearly 8 square miles of mostly undeveloped land, including wetlands and prime agricultural lands;
- destroy imperiled plant communities;
- harm numerous types of wildlife, including endangered species, special status species, migratory birds, and marine mammals (e.g., from vessel strikes);
- otherwise disrupt wildlife breeding, nesting, foraging, sheltering, and communication behaviors, from artificial lighting, noise, pile driving, dredging, and so forth;
- risk introducing invasive species from ballast water discharges, which can be exacerbated due to human error and treatment system failures;
- entail routine leaks and spills of hazardous substances that threaten shallow groundwater areas and wash into waterways;
- involve massive amounts of dredging (19.4 MCY) that degrades water quality, damages sea and estuarine bottom ecosystems, and, in the cases of Corpus Christi LNG, Driftwood LNG, and Plaquemines LNG, risks remobilizing contaminated sediments;

- require placement of dredging spoils and disposal of decanted water that degrades water quality and damages commercial, recreational, and subsistence fisheries;
- pose other risks to fisheries, such as from wetland destruction, erosion, ballast water discharge, cooling water intake, and pipeline construction (e.g., the Gator Express Gas Pipeline);
- attempt to mitigate some wetland destruction with artificial wetlands that have lower ecological value and are also poorly monitored;
- due to the enormous amount of energy needed for the liquefaction process, degrade air quality and threaten the public health of fenceline communities as
    - Clean Air Act Major Sources of emissions of ground-level ozone pollutants, with carrier vessels adding 10% more criteria air pollutants on top of those from LNG terminals, and
    - Clean Air Act Major Sources of the hazardous air pollutants formaldehyde, benzene, toluene, ethylbenzene, xylene, and others, known to be carcinogens and respiratory, neuro-, organ, and reproductive toxicants;
- are exempted from federal safety and risk management programs;
- impose added risk to the health, safety, and quality of life of fenceline communities due to leaks, spills, fires, explosions, and excess flaring caused by faulty equipment, poor maintenance, human error, cost-saving incentives, and extreme weather events, exacerbated by climate change and a lack of adequate monitoring and enforcement by state and local agencies, as already evidenced by Cameron LNG and Freeport LNG; and
- contribute significant levels of greenhouse gas emissions throughout the gas chain, from drilling, pipelines, LNG operations, shipping, and end use.

That litany of impacts does not fully account for risks to fenceline communities from natural disasters causing technological disasters, or Natech risks, or take stock of the cumulative impacts of LNG development on global climate change, both of which FERC failed to assess.

In Table 5.15 we summarize our findings regarding the cumulative impacts of construction and operations of the six LNG facilities examined in this report. Those aspects of LNG development represent about half of the development that exists and is proposed in the Gulf South. This summary does not include impacts from methane extraction in the Permian Basin, Haynesville shale, and other geologic formations. Impacts from construction of new pipelines to transport gas to LNG terminals, from shipping LNG overseas, or from end-use emissions are also not covered. Those aspects of LNG development in the Gulf South are also extremely important and impactful to the environment, but they are outside the scope of this report.

Table 5.15. Cumulative Impacts Assessment: Summary Findings for the Six LNGs Sampled

Element	Findings
Preexisting environmental burdens	• Decades of canal building, river channelization, and oil, gas, petrochemical, agricultural, and urban development have ravaged the Gulf Coast, damaging fisheries, causing land subsidence, polluting and destroying extraordinary amounts of coastal wetlands that provide wildlife habitat, fish and shrimp nurseries, filter pollutants, and protect from coastal erosion and storm surges. • As a whole, neighborhoods with LNG terminals have high levels of environmental pollution exposure, respiratory hazards, cancer risks, and proximity to environmental hazards—in comparison with state and national levels (based on EPA EJScreen results).
Social and health vulnerabilities	• People of color are disproportionately located near LNG facilities and therefore are likely to bear harmful impacts disproportionately. • Areas around the majority of LNG facilities have disproportionately high U.S. Census family poverty rates and percentages of residents without a high school degree. • LNG fenceline communities in Louisiana and Texas have elevated asthma and obesity prevalence rates, making them particularly susceptible to air pollution health risks from LNG operations.

Environmental impacts—LNG terminal construction	• The LNG terminals examined (about half of all existing and proposed) impact approximately 5,000 acres (7.8 square miles), destroying vegetation and wetlands and compacting and eroding soils, including approximately 150 acres of prime agricultural land.
	• Routine leaks and spills of hazardous materials lead to contamination of shallow groundwater, aided by pile driving.
	• Runoff pollutes bodies of water during floods.
	• Residents near Freeport LNG face displacement without adequate compensation for loss of property values and relocation (see Chapter 6).
	• Imperiled coastal live oak/hackberry forest (Plaquemines LNG), coastal prairie and longleaf pine savanna (Driftwood LNG), other plant communities of special concern, and rare coastal clay dune habitat for the endangered ocelot and northern aplomado falcon (Rio Grande LNG) all face destruction.
	• Impacts from dredging 19.4 million cubic yards of sediments (enough to fill over four Superdomes) to construct docks and LNG carrier vessel–berthing stations include
	  o temporary water quality impairment and longer-term damage to benthic (bottom-dwelling) organisms and ecosystems;
	  o likely remobilization of contaminated sediments (Corpus Christi LNG) and TCE, PERC, and benzene contamination (Driftwood LNG);
	  o degradation of water quality and impacts to fisheries and wildlife in dredged material placement areas (Driftwood LNG) and the open ocean dumping (Rio Grande LNG and Plaquemines LNG);
	  o water quality impairment from decanted water disposal (Corpus Christi LNG); and

Element	Findings
	o damage to commercial, recreational, and subsistence fisheries ● The ecosystem services of more than 1,100 acres of freshwater, brackish, and saltwater wetlands and marshlands of state and national significance are at risk of permanent destruction and loss, adding to major historical losses at a time when Louisiana is spending billions to build wetlands. ● Attempts to create artificial wetlands through poorly monitored compensatory mitigation programs result in a net reduction of wetland quality and quantity. ● The construction and hydrostatic testing of LNG tanks and pipes require the use and the disposal of tens of millions of gallons of fresh water. ● Plaquemines LNG water use rates in late 2023 caused residential and commercial shortages, even as FERC approved accelerated construction with 6,000 on-site workers. ● The proposed Gator Express Gas Pipeline (Plaquemines LNG) would o damage an additional 75 acres of wetlands and threaten highly productive, “world-class” commercial and recreational fisheries in the Barataria Bay, an area recovering from the 2010 BP Deepwater Horizon oil spill; o resuspend BP Deepwater Horizon oil spill toxins; o damage privately leased oyster beds; o cause coastal erosion due to canal building in existing wetlands; and o cause temporary (up to a year as planned) disturbances to migratory bird species, including a nearby nesting site for colonial waterbirds, and bald eagles and other raptors. ● Land clearing and filling of ecological rich wetlands causes terrestrial habitat loss, habitat that is critical for species important to local fishing industries, worth $367 million in Louisiana in 2021. ● Aquatic habitat is degraded from soil erosion, dredging, contamination, and runoff, worsened by climate-related extreme weather and adding to coastal erosion loss in Louisiana estimated to cost $550 million annually by 2050. ● Wildlife will experience reduced reproductive success and survivability as a result of o disruptions to breeding, nesting, foraging, sheltering and communication behaviors from noise and vibrations of construction, dredging, and pile driving, extending up to 4.6 miles; o injury and trauma from pile driving to fish, sea turtles, marine mammals, and other aquatic species with gas-filled cavities; and o disorientation and collisions of migratory birds with facility equipment due to artificial lighting. ● Construction will potentially affect 114 special status species, including 29 species of marine mammals, eight land mammals, 14

Element	Findings
	fish (including sharks and rays), 26 birds, 15 reptiles, six amphibians, seven shellfish, and nine plants. ● The air pollution from construction equipment over many years typically exceeds annual amounts during operations (see below).
Environmental impacts—LNG terminal operations and shipping	● Operations disrupt wildlife breeding, nesting, foraging, sheltering, and communication behaviors, including in wintering grounds and critical habitat for the piping plover, a special status species (Rio Grande LNG). ● Operations threaten habitat loss for and direct injury/mortality to endangered wildcats, the jaguarundi and ocelot (100 remaining in the United States) (Rio Grande LNG). ● Under normal operations, 30,900 tons/year of "criteria pollutants"—including 12,500 tons of ozone precursors, including in a Clean Air Act "nonattainment area" (Freeport LNG)—will degrade air quality and cause associated health impacts. ● Under normal operations, operations will release hazardous air pollutants (264 tons/year), including formaldehyde, benzene, toluene, ethylbenzene, and xylene (also known as BTEX); recent research indicates that there are adverse, interactive effects from these highly toxic substances at low levels of exposure. ● Impacts on water quality and aquatic species come from periodic "maintenance" dredging, ballast discharge, wastewater and stormwater runoff, and increased vessel traffic ● Impacts from LNG carrier vessels include the following: o Strikes to endangered Rice's whales (100 individuals extant) and blue, finback, humpback, sei, and sperm whales, the West Indian manatee, and endangered species of sea turtles o Water quality impairment, temporary changes in salinity (Plaquemines LNG), damage to aquatic life, and potential introduction of invasive species from large discharges of ballast water—average volume per ship is equivalent to 23 Olympic-size swimming pools o Death of fish, shrimp, and shellfish larvae from entrainment by cooling water intakes while ships are berthed o Air pollution during berthing, mooring, and "hoteling" operations, in amounts estimated to be more than 10% of those from LNG terminal operations o Shoreline erosion, worsened if ship speed guidelines are not followed
Health, safety, and Natech risks	● FERC failed to adequately evaluate the health and safety risks of LNG facilities. ● As complex technologies, LNG facilities are prone to accidents (e.g., leaks, spills, fires, explosions) due to human and natural factors, and the combination of both, that is, natural hazards triggering technological accidents (Natech). ● Risks are elevated in the Gulf South because of low-lying coastal locations, climate change already occurring (e.g., sea level rise),

Element	Findings
	and the growing intensity of named storms and hurricanes originating in the Gulf of Mexico. • Poor maintenance, operations, monitoring, and enforcement have already shown the vulnerability of LNG facilities to human-caused accidents (Cameron and Freeport LNGs). • High-wind events and recent hurricanes contribute to leaks and explosions, revealing the vulnerability of LNGs to natural disasters (Cameron and Freeport LNGs). • Shutdown and start-up operations, caused by extreme weather events, equipment failure, lack of investment in safety equipment, human error, and lax regulation, among other things, release extremely large amounts of air pollution—events that will become more severe and frequent as climate change progresses. • Natech risks to fenceline communities have not been adequately assessed by all levels of government. • LNG companies and FERC indicate that LNG facilities are not designed for Category 5 hurricanes (Rio Grande, Driftwood, and Plaquemines LNGs). • Nearly 900 chemical facilities are situated in areas vulnerable to hurricanes along the Gulf Coast, adding to cumulative risks. • Driftwood LNG and Rio Grande LNG are prone to significant flooding from a Category 3 hurricane storm surge, as is Cameron LNG to a Category 5. • The Plaquemines LNG site experienced inland flooding during the Category 4 Hurricane Ida in 2021 due to heavy rainfall. • LNG Natech risks will increase from future climate change due to the following: o Rising sea levels will result in 10-to-15-centimeter-higher levels in the Gulf Coast than the national average by midcentury. o By 2050, more than 10 moderate and one major high-tide flood are expected annually along the western Gulf Coast. o By 2050, three to six moderate high-tide floods are expected annually in the eastern Gulf Coast. o Sea level rise will continue to magnify the impact of storm surges. o And, in the coming decades, hurricanes, even if not more frequent, are expected to be more intense, produce more rain, and have higher storm surges, increasing chances of severe flooding, accidents, and shutdowns. • FERC and the Pipeline Hazardous Materials Safety Administration (PHMSA) have not analyzed risks of a large LNG storage tank rupture. • In a catastrophic failure (e.g., caused by faulty materials, human error, projectile puncture) involving a mass release of liquefied methane, o methane vapor clouds from a pipeline leak endanger workers and could rapidly disperse nearly 2 miles and catch fire, flash back, explode, and create a supersonic shock wave;

Element	Findings
	o jetting and explosive vapor clouds could disperse significantly greater distances from an LNG storage tank or transport vessel; and o exposure to extremely cold vapor clouds can cause eye damage, severe frostbite, freeze burns, central nervous system depression, nausea, headache, dizziness, vomiting, incoordination, unconsciousness, asphyxiation, related injuries, and death. ● LNG export facilities are exempt from most PHMSA safety programs and are not regulated under the EPA's Risk Management Program. ● Company emergency response plans filed with FERC are not shared with fenceline communities.
Climate impacts	● FERC failed to evaluate the climate change impacts of LNG development. ● FERC failed to consider the public interest trade-offs made in its decisions benefiting the LNG industry, major financial investors, and shareholders. ● The six LNG facilities in our sample could emit 33.8 million tons of CO_2-equivalent greenhouse gasses annually, which equates to adding 7.6 million passenger vehicles to the road. ● Existing and proposed LNG operations in the U.S. (if built) could emit more than 90 million tons of greenhouse gasses annually, equivalent to more than 20 new coal-fired power plants or 18 million cars.[1] ● LNG development is estimated to account for 10% of the remaining emissions budget before the world surpasses the threshold and limits for a habitable planet (i.e., exceeds a 1.5° C increase globally above preindustrial temperatures). ● LNG development is bad and risky business for people and the planet.

[1] Those amounts do not include emissions and leaks from drilling and piping fracked gas, transporting it overseas, or burning it at its destination, which would be several times greater (Shaykevich et al., 2022, p. 3).

Recent LNG export terminal failures and shutdowns during high winds and hurricanes underscore the susceptibility of LNG facilities to accidents (e.g., leaks, spills, fires, and explosions) and demonstrate their vulnerability to natural disasters. Recent accidents raise legitimate questions about operator training, equipment maintenance, inherently faulty equipment, corporate malfeasance, and poor federal oversight. Natech risks from LNG facilities are particularly elevated in the Gulf South because of lax state enforcement, flood-prone locations, and climate change that is already occurring—namely, relative sea level rise (higher in the Gulf than the national average) and the increasing frequency of high-tide flooding, storm surges, and inland floods, which have worsened recently due to more intense, heavy rainstorms. Future climate change will increase those natural hazards and the chances of natural disasters causing more serious accidents.

In some respects, the future risks of LNG are like the present risks, but with some unacceptable unknowns. FERC appears to not know what types of damage could originate at LNG facilities that are not designed to withstand Category 5 hurricanes. By not evaluating such hazards in its EISs, or making them public if they do exist, FERC endangers fenceline communities and abrogates its responsibilities to the public interest. For LNG companies, polluting is cheaper than protecting people and the environment under the current regulatory regime in the Gulf South.

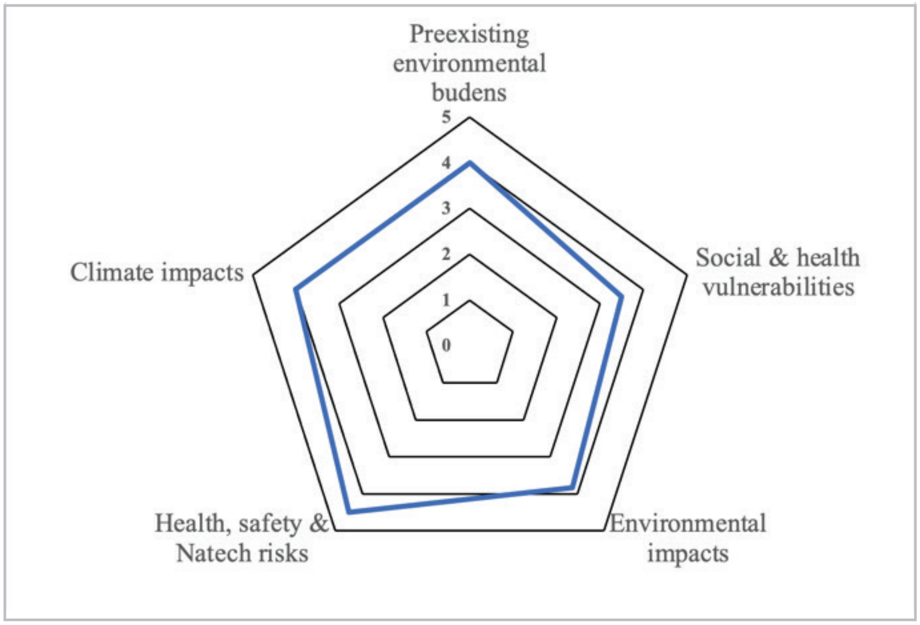
We conclude that FERC understates and disregards the cumulative impacts of LNG export terminals—impacts that we have cataloged (Table 5.15). FERC fails to consider them in their totality. It puts a good deal of faith for the safe and proper operation of LNG facilities in plans for specific facilities, such as underwater noise mitigation plans; spill prevention, control, and countermeasure plans; facility lighting plans; compensatory (wetland) mitigation plans; unanticipated discoveries plans; and project-specific plans and procedures. Although we did not evaluate such plans, the failure of some LNG facilities to get prior government approval before carrying out construction activities, and their failure to comply with their air emissions permits, coupled with their efforts to obtain more permissive ones, raises questions about compliance with facility-specific plans, especially in light of a record of lax enforcement by state regulators.

Table 5.16. Impact Ratings for Six Subcategories of Environmental Impacts

Subcategory	Rating rationale	Rating on 1-to-5 scale (lowest to highest)
1. Soils/vegetation	Areal extent of compaction and prime farmland losses; destruction of imperiled plant communities of special concern; erosion on-site and from carrier vessel wakes	3.5
2. Wetlands	Areal extent, including the Gator Express Pipeline; loss of ecological and ecosystems services, esp. from estuarine wetlands; questions about compensatory mitigation	4
3. Water resources/ water quality	Impacts from runoff of contamination; high-volume dredging; potential for remobilizing contaminants; dredging spoils disposal and decanted water runoff	3.5
4. Wildlife and aquatic resources	Impacts from habitat loss; range of disturbances from noise, artificial lighting, soil erosion, pipeline in the Barataria Bay, dredging and ballast water discharge; larvae entrainment from cooling water intake; vessel strikes	4
5. Special status species	Large number of special status species potentially impacted, including federal- and state-listed endangered species, e.g., Rice's whale, Gulf Coast jaguarundi, Texas ocelot, and piping plover, in critical habitat for Rio Grande LNG	4
6. Air quality impacts	Impacts of criteria air pollutants and hazardous air pollutants emitted by LNG facilities; release of fugitive emissions from accidental leaks and flaring; emissions contributed by carrier and support vessels	4
Average		3.83

To take full stock of the cumulative impacts, we rated the impacts for five elements from extremely low impact to extremely high impact, on a scale of 1 to 5. Because of the wide range of environmental impacts of LNG export terminals, we rated six subcategories thereof. Those are shown in Table 5.16, along with our justifications for the ratings. We then took the unweighted average of scores for each subcategory, 3.83, and created a radar chart with the ratings for the five elements of our CIA framework: preexisting environmental burdens (rated 4 out of 5); social and health vulnerabilities (rating: 4); present and future health, safety, and Natech risks (rating: 4.5); and climate impacts (rating: 4). Those ratings are based on the findings summarized in Table 5.15. The results are shown in Figure 5.17 below. We consider these conservative, reasonable, and justified ratings, though we acknowledge them as somewhat subjective.

Figure 5.17. Radar Chart of Impact Ratings of Cumulative Impact Assessment Elements on a 1-to-5 Scale (extremely low to extremely high impacts)



Note: Natech = natural hazards triggering technological accidents.

Figure 5.17 indicates that each element is associated with relatively high impacts in our assessment. These findings show that LNG export facilities have a wide range of significant impacts that add to and exacerbate existing environmental and social burdens. The purpose of this assessment was not to compare the impacts of LNG facility development to their benefits. We have already made the case (Chapter 3) that the benefits accrue overwhelmingly to producers, owners, financial investors, and overseas buyers, and that LNG development magnifies existing inequalities. LNG companies fail to provide good jobs to fenceline communities, while receiving huge tax breaks and subsidies that starve local governments and school districts. With governmental blessings, they squander American resources for the short-term benefit of owners and shareholders. That is how petrocapitalism works, in this case, aided by the current geopolitical forces favoring LNG development.

Our assessment clearly shows the serious magnitude and scope of the environmental, health-and-safety, and quality-of-life burdens of LNG development in the Gulf South—burdens disproportionately borne by people of color low-income communities. By accelerating climate change, the LNG boom gambles away our nation's future security and our planet's ability to sustain modern societies. It involves perilous trade-offs, providing cheap natural gas overseas while energy costs and inflation stress Americans' pocketbooks. It liquidates a potential valuable resource for future generations of Americans for short-term profits. In these ways, LNG development fails to meet a commonsense public-interest standard and represents a lost opportunity to invest more wisely. LNG build-out is a diversion from the important and crucial work of making a just transition to cleaner, more sustainable energy systems; and it is a diversion that we can ill afford.

Appendix A: Description of EJScreen Environmental Indicators

Key medium	Indicator	Details	Source	Data year
Air	Air toxics respiratory hazard index	Ratio of exposure concentration to health-based reference concentration	EPA Hazardous Air Pollutants	2017
Air	Air toxics cancer risk	Lifetime cancer risk from inhalation of air toxics	EPA Hazardous Air Pollutants	2017
Air	Diesel particulate matter	Diesel particulate matter level in air, µg/m^3	EPA Hazardous Air Pollutants	2017
Air	Ozone	Ozone summer seasonal avg. of daily maximum 8-hour concentration in air in parts per billion	EPA, Office of Air and Radiation (OAR) fusion of model and monitor data	2018
Air	Particulate matter$_{2.5}$	$PM_{2.5}$ levels in air, µg/m^3 annual avg.	EPA, OAR fusion of model and monitor data	2018
Air/other	Traffic proximity and volume	Count of vehicles (avg. annual daily traffic) at major roads within 500 meters, divided by distance in meters (not km)	Calculated from 2019 U.S. Department of Transportation traffic data, retrieved 9/22/2021	2019
Dust/lead paint	Lead paint	Percentage of housing units built pre-1960, as indicator of potential lead paint exposure	Calculated based on Census/American Community Survey data, retrieved 2022	2016–2020
Waste/air/water	Underground storage tanks (USTs) and leaking USTs (LUSTs)	Count of LUSTs (multiplied by a factor of 7.7) and the number of USTs within a 1,500-foot buffered block group	Calculated from EPA UST Finder, retrieved 7/7/2022	2022
Waste/air/water	Hazardous waste proximity	Count of hazardous waste facilities (TSDFs and LQGs)* within 5 km (or nearest beyond 5 km), each divided by distance in kilometers	TSDF data calculated from EPA RCRAInfo database, retrieved 4/26/2022	2022
Waste/air/water	Risk management plan (RMP) facility proximity	Count of RMP (chemical accident management plan) facilities within 5 km (or nearest one beyond 5 km), each divided by distance in kilometers	Calculated from EPA RMP database, retrieved 4/26/2022	2022
Waste/air/water	Superfund proximity	Count of proposed or listed on National Priority List (also known as Superfund) sites within 5 km (or nearest one beyond 5 km), each divided by distance in kilometers	Calculated from EPA CERCLIS database, retrieved 4/26/2022	2022
Water	Wastewater discharge	Risk Screening Environmental Indicators (RSEI)–modeled toxic concentrations at stream segments within 500 meters, divided by distance in kilometers	Calculated from RSEI-modeled toxic concentrations to stream reach segments, created 8/11/2021	2019

Source: U.S. EPA (2023a).

Note. µg/m^3 = micrograms per cubic meter; $PM_{2.5}$ = particulate matter with diameters that are generally 2.5 micrometers and smaller; km = kilometers.

* TSDFs are hazardous waste treatment, storage, and disposal facilities, and LQGs are large quantity generators of hazardous wastes.

Appendix B: Sources and Methods for the Social and Health Vulnerability Assessment

Social vulnerability was assessed by estimating the racial/ethnic and socioeconomic characteristics of populations living in areas within 3 miles of the six liquefied natural gas (LNG) terminal sites and the Freeport LNG Pretreatment Facility (as shown in Tables 5.3 and 5.4 in the body of the report). For that analysis we used ESRI GIS software, census block group data, and the areal apportionment method, which apportions population within a census unit that is within a given distance of a point, or polygon in this case (the LNG site boundary), in proportion to the area of the census unit that is within the same distance (see Mohai and Saha, 2006, 2007).

Our health vulnerability assessment used the CDC's PLACES census tract data and the boundary intersection method to examine the percentile ranking of tracts that are at least partially within 3 miles of each LNG site (i.e., touching a 3-mile buffer) in comparison to all census tracts in the state in which an LNG facility is located (as shown in Figures 5.4 and 5.5). Data sources and methods employed for each assessment are described below.

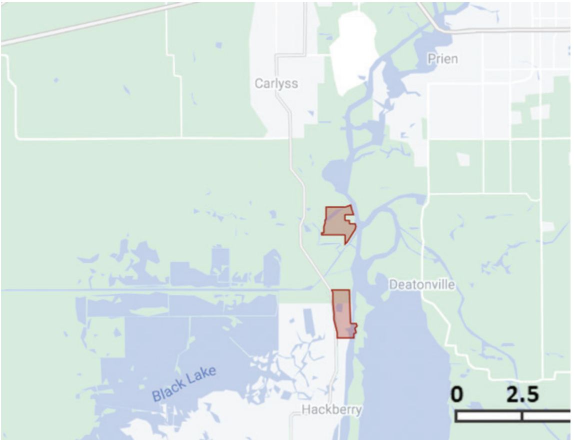
Social Vulnerability Assessment

Using maps published in the Federal Energy Regulation Commission's environmental impact statements (EISs) and environmental assessments (EAs) as a guide, the external perimeters of LNG facility site locations were digitized as KML polygons using 2022 Google Maps/TerraMetrics imagery as shown below.

Next, the KML polygons were exported to polygon features in shapefile format. We used 2022 TIGER/Line shapefiles of U.S. Census block groups in the states of Louisiana and Texas. TIGER/Line polygons include unique geographic identifiers to link them with U.S. Census demographic data to estimate population characteristics of the 3-mile areas around the LNG sites.

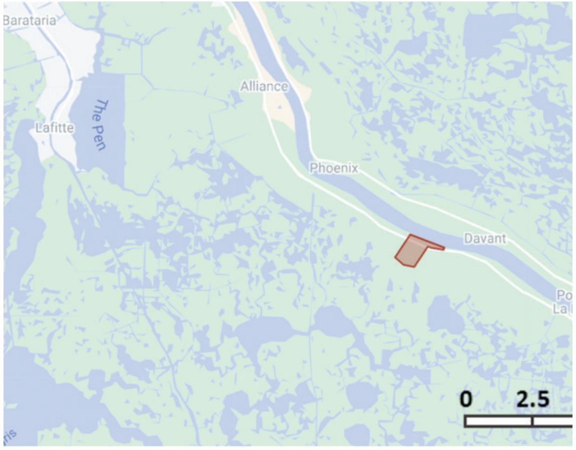
Permanent or seasonal water bodies, wetlands, and other hydrographic features were deemed unsuitable or unavailable space for human settlement, so these areas were subtracted from the census block groups. The hydrographic geography of Louisiana and Texas was based on the U.S. Geological Survey 2022 National Hydrography Dataset (NHD), which is the most up-to-date and comprehensive hydrographic geodatabase for the United States. The NHD Area and NHD Waterbody datasets comprise waterbody features representing the areal extent of natural or human-made physical features such as a stream/river, lake/pond, swamp/marsh, reservoir, playa, estuary, ice mass and other features.

Figure B.1. LNG Facility Site Boundaries (in Red) on Google Maps®

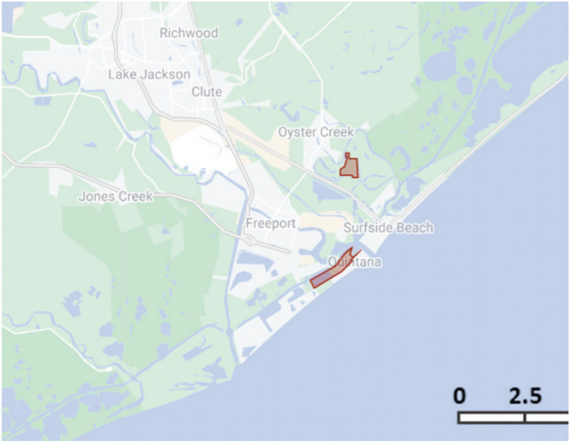


Cameron LNG (south) and Driftwood LNG (north)

Corpus Christi LNG



Plaquemines LNG



Freeport LNG, including pretreatment plant (north) and terminal (south)

Rio Grande LNG

Table B.1. Feature Subtypes in the NHD Area Dataset

Code	Label	Description
307	Area to be Submerged	Known extent of the intended lake that will be created behind a dam under construction
312	BayInlet	Water opening that is an opening of the sea/ocean into the land, or of an estuary, lake, or river into its shore
336	Canal Ditch	Artificial open waterway constructed to transport water, to irrigate or drain land, to connect two or more bodies of water, or to serve as a waterway for watercraft
343	Dam Weir	Barrier constructed to control the flow or raise the level of water
364	Foreshore	Part of a seashore between high-water and low-water marks
398	Lock Chamber	Enclosure on a waterway used to raise/lower vessels as they pass from one level to another
403	Inundation Area	Area of land subject to flooding
445	Sea Ocean	Great body of salt water that covers much of the earth
455	Spillway	Constructed passage for surplus water to run over or around a dam
460	Stream River	Body of flowing water
461	Submerged Stream	Old river course inundated by an impounded water body
485	Water Intake Outflow	Structure through which water enters or exits a conduit
568	Levee	Structure parallel to the course of a river in its floodplain or along low-lying coastline

Table B.2. Feature Subtypes in the NHD Waterbody Dataset

Code	Label	Description
361	Playa	Flat area at the lowest part of an undrained desert basin, generally devoid of vegetation
378	Ice Mass	Field of ice, formed in regions of perennial frost
390	LakePond	Standing body of water with a predominantly natural shoreline surrounded by land
436	Reservoir	Constructed basin formed to contain water or other liquids
466	SwampMarsh	Noncultivated, vegetated area that is inundated or saturated for a significant part of the year. The vegetation is adapted for life in saturated soil conditions.
493	Estuary	Lower end of a river, or a semi-enclosed coastal body of water with access to the open ocean, which is affected by the tides and where fresh and salt water mix

The following workflow was applied to each LNG facility to determine the percentage of each census block group's land area within 3-mile areas around each LNG facility site:

1. Digitize the external perimeters of the LNG facilities in KML format, and export the polygon features to shapefile.
2. Create 3-mile buffers around each LNG polygon feature.
3. For each buffer, spatially subtract the area of the LNG polygon it belongs to.
4. For each census block group and for each buffer, clip the areas that are covered by the buffer.
5. For each clipped block group, estimate its land base by subtracting all the area that represents hydrographic features as described in the NHD Area and NHD Waterbody datasets.
6. For each "water-subtracted" block group generated in Step 5 and associated with a 3-mile buffer tagged with a facility ID, compute the ratio of the remaining area (i.e., its land base area) to the total land area of the block group. This ratio represents the percentage of the land area of a block group within 3 miles of an LNG site.

The workflow was implemented as a Python 2.7 script for ESRI ArcMap® 10 or higher.

Next, we used an online-accessible census data compilation from Geolytics Inc. to download the U.S Census Bureau's American Community Survey 2017–2022 five-year estimates for census block groups in Louisiana and Texas, and for each of those states as a whole, as well as for the United States. These were the most accurate and recent census data available when the analyses were done. The following procedures were followed to estimate the population characteristics within 3 miles of each LNG facility.

1. Merge the data file that includes census block group land area ratios (percentages) and facility labels obtained from running the Python script (see above) with census block group data (American Community Survey five-year estimates, 2017–2021), including raw population tabulations of categories by race, Hispanic origin, family poverty, educational attainment, and household type.
2. For each LNG facility, compute the estimated population characteristics (e.g., percentage African American) within 3 miles, applying the areal apportionment method, that is, for each block group with a percentage of land area (PLA) greater than 0.0000% within a 3-mile buffer, sum the product of the raw number of African Americans and the PLA (to get the apportioned African American population within 3 miles) and divide by sum of the product of the total population of each block group and its PLA, as expressed by the following formula:

$$\frac{\sum AAP_i \text{ x } PA_i}{\sum TP_i \text{ x } PA_i}$$

where AAP is the African American population of the *i*-th block group, PA_i is the percentage of land area within 3 miles of the LNG site polygon of the *i*-th block group, TP is the total population of the *i*-th block group, and *i* represents the count of block groups that intersect the buffer.

SPSS Version 28.0.0.0 (190) statistical software and Microsoft Excel were used to make those calculations for the racial/ethnic and socioeconomic characteristics of 3-mile areas surrounding the LNG facilities shown in Tables 5.3 and 5.4.

Health Vulnerability Assessment

The December 2022 release of the Centers for Disease Control and Prevention's (CDC's) PLACES data was used to assess health vulnerabilities in areas around the LNG facilities. PLACES is a collaboration between the CDC, the Robert Wood Johnson Foundation, and the CDC Foundation. PLACES provides model-based, population-level analysis and community estimates of health measures for small areas across the country, including census tracts. PLACES health data are based on Behavioral Risk Factor Surveillance System data for 2019 and 2020 ascribed to 2010 census tracts.

The EPA's Environmental Justice Screening and Mapping Tool (Version 2.11) was used to identify 2010 census tracts at least partially within 3 miles of each LNG facility boundary, "LNG Facility Tracts" (7 and 16 in Louisiana and Texas, respectively). Using SPPS Version 28, a coded list of those tracts was merged into PLACES datasets for Louisiana and Texas. The data were exported to Microsoft Excel, which was used to compute percentile rankings for the LNG Facility Tracts within each state for the raw values of each of the health indicators shown in Figures 5.4 and 5.5 (cancer rates, excluding skin cancer; prevalence of coronary heart disease; prevalence of asthma; and obesity; all for adults 18 years old and over). Thus, a percentile for an LNG Facility Tract above the 50th percentile (i.e., over the median for the state) represents elevated levels for that health outcome (e.g., coronary heart disease), preventative health indicator (e.g., lack of health insurance), or risk factor (e.g., no leisure-time physical activity).

Appendix C: Sources for Table 5.5 ("Acres of Land Impacted and Disturbed by LNG Facility Construction and Expansions")

LNG facility	Permanent wetlands	Construction	During operation	Permanent	Expansion	Temporary
Cameron	FERC (2014a, p. 4-30)	FERC (2014a, p. 4-14)	FERC (2014a, p. 4-14)	FERC (2014a, p. 4-14)	FERC (2016, p. 23)	FERC (2014a, p. 4-14)
Driftwood	FERC (2019b, Table 4.5-1, p. 4-66)	FERC (2019b, Table 2.2-1, p. 2-18)	FERC (2019b, Table 2.2-1, p. 2-18)	FERC (2019b, Table 2.2-1, p. 2-18)		FERC (2019b, Table 2.2-1, p. 2-18)
Plaquemines	FERC (2019c, Table 4.4-1, p. 4-41)	FERC (2019c, Table 2.2-1, p. 2-18)	FERC (2019c, Table 2.2-1, p. 2-18)	FERC (2019c, Table 2.2-1, p. 2-18)		FERC (2019c, Table 2.2-1, p. 2-18)
Corpus Christi	FERC (2014b, Table 4.4-1, p. 4-27)	FERC (2014b, Table 2.3-1, p. 2-11)	FERC (2014b, Table 2.3-1, p. 2-11)	FERC (2014b, p. ES-3)	FERC (2019a, p. 22)	FERC (2014b, p. ES-3)
Freeport	FERC (2014c, p. 4-46)	FERC (2014c, Table 2.3-1, p. 2-9)	FERC (2014c, Table 2.3-1, p. 2-9)	FERC (2014c, Table 2.3-1, p. 2-9)	FERC (2018, p. 37)	FERC (2014c, Table 2.3-1, p. 2-9)
Rio Grande	FERC (2019d, Table 4.4.2-1, p. 4-60)	FERC (2019d, Table 2.2-1, pp. 2-23–2-24)	FERC (2019d, Table 2.2-1, pp. 2-23–2-24)	FERC (2019d, Table 2.2-1, pp. 2-23–2-24)		FERC (2019d, Table 2.2-1, pp. 2-23–2-24)

Appendix D: Sources for Table 5.6 ("Preconstruction Plant Communities and Dominant Plants at LNG Terminal Sites")

LNG facility	Sources
Driftwood	FERC (2019b, pp. 4-71– 4-72)
Plaquemines	FERC (2019c, pp. 4-49–4-51)
Freeport	FERC (2014c, pp. 4-51–4-52)
Rio Grande	FERC (2019d, Table 4.5-1, pp. 4-70–4-71)

Appendix E: Sources for Table 5.9 ("Water Bodies Dredged, Type of Dredging Used, and Amount of Dredged Materials, by LNG Facility")

LNG facility	Sources
Cameron	FERC (2014a, p. 4-23)
Driftwood	FERC (2019b, pp. 2-36–2-37)
Corpus Christi	FERC (2014b, pp. ES-4, 2-5)
Freeport	FERC (2014c, pp. ES-5, 2-13)
Rio Grande	FERC (2019d, pp. ES-5, 4-19)

Appendix F: Special Status Species Potentially Occurring in the Vicinity of Each LNG Project

LNG facility	Federal (federally listed endangered species bolded)	State (state-listed endangered species bolded)	Species of concern
Cameron	Piping plover, red-cockaded woodpecker, West Indian manatee, sea turtles[a]	Bald eagle, brown pelican, alligator snapping turtle, old prairie crawfish, long-sepaled false dragon-head, dotted gayfeather, silveus dropseed	n/a
Driftwood	Sea turtles,[b] West Indian manatee, whales,[c] piping plover, red knot, red-cockaded woodpecker, eastern black rail, Atlantic sturgeon, smalltooth sawfish, American chaffseed	Bald eagle, brown pelican, interior least tern	Crested caracara, Calcasieu painted crawfish, old prairie crawfish, primrose willow, green milkweed, long-sepaled false dragon-head, blue water lily, small-fruited water-willow
Plaquemines	West Indian manatee, piping plover, red knot, gulf sturgeon, pallid sturgeon, sea turtles,[d] oceanic whitetip shark, giant manta ray, whales[e]	Peregrine falcon, brown pelican, bald eagle	Eastern black rail
Corpus Christi	Whales,[f] West Indian manatee, sea turtles,[g] whooping crane, piping plover	Southern yellow bat, reddish egret, white-tailed hawk, wood stork, Texas tortoise, Texas horned lizard, Texas indigo snake, black spotted newt, South Texas sirens, opossum pipefish	n/a
Freeport	Piping plover, whooping crane, sea turtles,[h] whales[i]	Bald eagle, Eskimo curlew, peregrine falcon, reddish egret, sooty tern, white-faced ibis, white tailed hawk, wood stork, smalltooth sawfish, West Indian manatee, red wolf, jaguarundi, ocelot, Louisiana black bear, false spike mussel, Texas fawnsfoot, alligator snapping turtle, timber rattlesnake, Texas horned lizard	Alabama shad, sharks,[j] Key silverside, Nassau grouper, speckled hind, Warsaw grouper, ivory tree coral
Rio Grande	Sea turtles,[k] West Indian manatee, whales,[l] eastern black rail, northern aplomado falcon, piping plover, red knot, red-crowned parrot, whooping crane, ocelot, Gulf Coast jaguarundi, black-spotted newt	American peregrine falcon, cactus ferruginous pygmy-owl, hawks,[m] Eskimo curlew, interior least tern, northern beardless-tyrannulet, peregrine falcon, reddish egret, rose-throated becard, sooty tern, Texas Botteri's sparrow, tropical parula, white faced ibis, wood stork, Coues' rice rat, jaguar, southern yellow bat, white-nosed coati, frogs,[n] South Texas siren, snakes,[o] reticulate collared lizard, speckled racer, Texas horned lizard, Texas tortoise, mollusks,[p] Mexican goby, opossum pipefish, Rio Grande silvery minnow, River goby, smalltooth sawfish	Dolphins,[q] whales[r]

Sources: FERC (2014a, 2014b, 2014c, 2016, 2018, 2019a, 2019b, 2019c, 2019d; USFWS Species Reports).

Note: n/a = not applicable. Special status species include federally listed endangered or threatened species, state-listed endangered or threatened species, and species of concern, which are those species that federal agencies are concerned may be threatened or could become threatened, but for which insufficient information is available to indicate a need to list the species under the Endangered Species Act.

[a] Green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle.

[b] Green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle.

[c] Sperm whale, humpback whale, fin whale, sei whale.

[d] Leatherback sea turtle, Kemp's ridley sea turtle, loggerhead sea turtle, green sea turtle, and hawksbill sea turtle.

[e] Blue whale, fin whale, sperm whale, and sei whale.

[f] Blue whale, fin whale, humpback whale, sei whale, sperm whale.

[g] Loggerhead sea turtle, green sea turtle, leatherback sea turtle, Atlantic hawksbill sea turtle, and Kemp's ridley sea turtle.

[h] Green sea turtle, Atlantic hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle.

[i] Blue whale, finback whale, humpback whale, sei whale, sperm whale.

[j] Dusky shark, sand tiger shark.

[k] Green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, and loggerhead sea turtle.

[l] Sperm whale and Bryde's whale.

[m] Common black-hawk, gray hawk, white-tailed hawk, and zone-tailed hawk.

[n] Mexican treefrog, sheep frog, and white-lipped tree frog.

[o] Black-striped snake, northern cat-eyed snake, Texas indigo snake, and Texas scarlet snake, speckled racer.

[p] False spike mussel, Mexican fawnsfoot mussel, Salina mucket, and Texas hornshell.

[q] Atlantic spotted dolphin, bottlenose dolphin, Clymene dolphin, false killer whale, Frasier's dolphin, killer whale, melon-headed whale, pantropical spotted dolphin, pygmy killer whale, Risso's dolphin, rough-toothed dolphin, short-finned pilot whale, spinner dolphin, striped dolphin.

[r] Blainville's beaked whale, Bryde's whale, Cuvier beaked whale, dwarf sperm whale, Gervais's beaked whale, pygmy sperm whale.

Appendix G: Sources for Table 5.13 ("Annual Emissions of Criteria Air Pollutants, Hazardous Air Pollutants, and Greenhouse Gasses by LNG Facility [short tons per year]")

LNG facility	Source
Cameron	FERC (2016, Tables 2.6.3, p. 34); FERC (2016, Table 2.6.4, p. 36)
Driftwood	FERC (2019b, Table 4.12-4, p. 4-161)
Plaquemines	FERC (2019c, Table 4.11-4, p. 4-180)
Corpus Christi	FERC (2014a, Table 4.11-6, p. 4-113); FERC (2019a, Table B.8 1-8, p. 126)
Freeport	FERC (2018, Table 30, p. 198 [criteria and GHG]); FERC (2014c, Table 4.11.1-6, p. 4-213 [HAPs])
Rio Grande	FERC (2019d, Table 4.11.1-7, p. 4-262)

Note: GHG = greenhouse gas; HAPs = hazardous air pollutants.

Chapter 6: Community Concerns, Opposition, and Litigation Regarding LNG Export Terminals: Case Studies from Two Frontline Communities

Overview

The chapter provides a summary of public opposition to liquefied natural gas (LNG) facilities development in the Gulf South. We describe the concerns of fenceline communities, their efforts to participate in Federal Energy Regulatory Commission (FERC) licensing and permitting processes, and their strategies to try to defeat LNG terminal siting proposals, including legal strategies. In addition to covering community opposition to siting proposals, which have had limited success, we also describe residents' experiences of repeated leaks, spills, and excessive flaring from operating facilities, and even a large explosion at one. We summarize their efforts to get companies and regulators to enforce LNG environmental permit conditions, often with the assistance of regional and national organizations.

This overview of community opposition is followed by two in-depth case studies of Freeport LNG and Plaquemines LNG that cover community concerns, opposition, and governmental responses. The two case studies provide detailed accounts of environmental injustices and racism experienced by fenceline communities and the challenges they face. These examples give voice to why those most affected oppose the siting of a new facility, Plaquemines LNG, and expansion plans for a fourth train at an existing LNG facility, Freeport LNG.

Public opposition to both LNG facility siting and operations in the Gulf South has been vigorous, sustained, and growing since LNG exporting proposals began about a decade ago (DiSavino, 2017). LNG opposition uses a playbook that is part of a long tradition of the anti-toxics and environmental justice movement (Bullard, 1993a; Saha and Mohai, 2005). They have lobbied local and state governments, held rallies and protests, enlisted allies, and gone to court. Local groups have formed coalitions with regional and national organizations.

Many low-income and people of color communities in the Gulf South have for decades been saddled with pollution from multiple oil and gas facilities. Roishetta Ozane, a community organizer from Lake Charles, Louisiana, stresses the cumulative impact of existing pollution, wetlands loss, and other environmental damages from four existing and proposed export terminals to the Lakes Charles area—home to a heavy concentration of petrochemical facilities and legacy contamination. She is also concerned about climate change, extreme weather, and coastal flooding, stating, "My mission is to ensure that Southwest Louisiana, specifically Lake Charles and the surrounding areas, aren't made into a climate sacrifice zone" (Juhasz, 2021).

Louisiana and Texas are picture-perfect examples of "industry-friendly" states. Affected communities opposed to LNG development face an uphill battle in gaining support of local and state officials. They still try. Take, for example, the case of Driftwood LNG, where opponents were undeterred by Cameron Parish officials' open support of the project. In November 2022, they organized a flotilla of 17 boats of Gulf shrimpers, commercial oyster harvesters, and local environmental justice advocates who spoke out against LNG development across Louisiana and Texas. The flotilla converged in the Calcasieu River, near the Driftwood site and where industry officials were convened for the Americas LNG and Gas Summit and Exhibition. Community members have also partnered with national organizations to use optical gas imaging cameras that show that pollution from LNG is much greater than estimated in the review process (Sneath, 2023a).

There also has been robust opposition to another greenfield project, NextDecade Corporation's Rio Grande LNG, proposed in an ecologically sensitive area near the fishing and tourism community of Port Isabel, Texas. Opponents are concerned about the impacts of LNG and ancillary development on an endangered cat, the jaguarundi (see "Special Status Species" in Chapter 5); impacts on the local economy, community character, and quality of life; "upstream" impacts of natural gas fracking and pipeline construction; cumulative impacts of two other LNG export terminals proposed nearby; and "greenwashing" plans to use carbon capture technologies aimed at reducing net greenhouse gas emissions (Davila 2020a, 2021). Opposition comes from the Carrizo/Comecrudo Tribe of Texas, the Sierra Club, Defenders of Wildlife, Border Workers United, the South Texas Environmental Justice Network, and Texas Rising, as well as local governments such as the City of Port Isabel (Rainforest Action Network & Sierra Club, 2022; Sierra Club, 2022a).

The Carrizo/Comecrudo Tribe cites its concerns over the destruction of culturally and historically significant sites. The tribe also asserts that neither Rio Grande LNG nor FERC consulted with them during the planning and permitting process, despite federal requirements to do so (Collier, 2019; Sierra Club, 2022a). The nearby City of South Padre Island, the Town of Laguna Vista, Long Island Village, the Laguna Madre Water District, and the South Padre Island Business Owners Association have also registered opposition (Rainforest Action Network & Sierra Club, 2022). They are concerned about air quality impacts, including hazardous air pollutants. They argue LNG shipping traffic will be detrimental to local fishing and tourism industries. They assert their coastal waters are among the last pristine areas of the Texas coastline, critical for local shrimpers, fishing guides, wildlife tours, and abundant aquatic life (Sierra Club, 2022a).

Nationally, successful opposition has occurred to LNG export facilities in affluent, well-connected communities—for example, the New Fortress Energy LNG proposal in Wyalusing, Pennsylvania, and the Pembina Jordan Cove Energy Project in Coos Bay, Oregon (Dick, 2022a; Waterkeeper Alliance, 2021). A recent FERC rejection of a proposed LNG facility next to a people of color neighborhood in Tampa Bay, Florida, resulted from sustained community organizing, investigative reporting, local business opposition, and pressure on and support from local and state officials. Alleged malfeasance by the project owner, Strom Inc., also helped (Allen, 2021). The proposed projects in Pennsylvania and Oregon entailed transporting LNG by truck and rail, a risky proposition and a large factor in their rejection. That, however, is not the case with LNG facilities in the Gulf South.

Once LNG facilities are sited, fenceline communities have found that concerns they voiced, largely ignored during environmental review and licensing processes, were not unfounded. Existing LNG facilities are poorly operated and have persistent leaks and permit violations. That coupled with generally lax state monitoring and enforcement has left fenceline communities to fend for themselves, serve as watchdogs for their communities, and enlist outside support. The big question is, "Who is protecting them?" Sadly, the short answer too often is, "No one."

Community-Based Resistance in the Judicial System

Gulf South communities have used litigation to fight the encroachment of LNG facilities. They have focused legal arguments on specific issues with FERC's decision, such as water or air permits, to stop the trajectory of growth. This strategy has met with little success in the reversal of FERC's decisions. However, the use of the courts has created hesitation from financial investors in LNG projects, successfully slowing the process of some buildouts.

When the D.C. Circuit Court of Appeals unanimously ruled that FERC violated the National Environmental Policy Act (NEPA) with an inadequate analysis of the Texas and Rio Grande LNG terminals, it signaled a change toward community protection near proposed LNG plants. The court ruled FERC must redo the environmental analysis but did not completely stop the projects. The court ruled in favor of the need for FERC to further analyze climate impact and environmental justice issues on proposed projects (Farah, 2021). As mentioned in Chapter 3, FERC stated its intention to incorporate environmental justice reviews in the permitting process but would backtrack on that by stating that environmental and climate justice did not impact gas projects (Phillips & Pager, 2022; Willson, 2022b).

While the ruling did not create a seismic shift, communities in the Rio Grande Valley celebrated the victory and used the momentum to further cripple LNG's opportunities in their region. The local school district in Port Isabel voted against tax abatements to subsidize LNG projects in their community (Juhasz, 2021). In January 2020, the City of Port Isabel filed a lawsuit against the Port of Brownsville, which had welcomed new LNG proposals, Texas LNG and Annova LNG; these have since been withdrawn. Port Isabel cited public and environmental health concerns due to the deterioration of local air quality from LNG operations and shipping, although a state district court subsequently dismissed the lawsuit (Davila, 2020b; Dick, 2022a). It led to Annova LNG's bowing out of its permit process, citing its inability to gain a final financial investment decision (DiSavino, 2021). Recently, community members convinced French Bank Société Générale to withdraw from the Rio Grande LNG gas export project. Organizations on both sides of the Atlantic mobilized to crusade against financial investments in LNG projects (Les Amis de la Terre France, 2023).

However, in April 2023, FERC voted to reauthorize the Texas LNG and Rio Grande LNG projects, stating that the additional environmental analysis conducted over the last 20 months gave satisfactory data to continue (Howland, 2023). While FERC's decision signals yet another defeat for communities in the Rio Grande Valley, for the first time, environmental justice communities were considered. FERC stipulated ongoing air quality monitoring and mitigation during the construction and operation of both Texas LNG and Rio Grande LNG. FERC also required an updated bilingual emergency response plan for nearby communities. Commissioner Allison Clements expressed in her dissent that the permits would leave projects susceptible to further legal suits. She also questioned the cumulative impacts limitation of a 2-mile radius when data suggested the environmental impact of air quality extended to a little over 30 miles (Mallen, et al., 2023). In July, the Sierra Club, the Carrizo/ Comecrudo Tribe, and the City of Port Isabel filed two federal lawsuits challenging FERC's decision (G. Brown, 2023).

Many communities have sought legal rulings against air permits issued to LNG facilities. During the permitting process, federal regulators questioned the installation of gas-fired turbines in Cheniere Energy's LNG terminals in both Louisiana and Texas (Volcovici & Groom, 2022). Since operations began in 2018, the Corpus Christi facility has exceeded permitted limits. The Texas Commission on Environmental Quality (TCEQ) responded by increasing permitted pollution limits (Groom & Volcovici, 2022). In 2021, the Sierra Club, the Environmental Integrity Project, and Portland Citizens United, a local community-based organization, requested a public meeting from TCEQ and then filed a lawsuit against TCEQ for extending Cheniere's air permits (Hinojosa, 2022).

TCEQ has also faced legal recourse from the Port Arthur Community Action Network (PACAN), led by John Beard Jr. The Sempra Energy project was given air emissions permits for its first phase, but the company requested additional capacity from TCEQ. PACAN requested a public meeting to discuss the ramifications to their community. In a two-to-one vote, TCEQ decided that PACAN could pursue the matter at the State Office of Administrative Hearings (Dick, 2021). Judges with Texas's State Office of Administrative Hearings concluded that Sempra did not provide reasonable assurance that its technology was the best available to control air emissions. They ruled that TCEQ should revise the permit to adjust emissions controls and limits, potentially reducing emissions by 25% (Dick, 2022b). This ruling required Sempra to use additional pollution controls on its refrigeration turbines (Ayala, 2022). However, TCEQ deemed that the changes would be too expensive for Sempra and ignored the Proposal for Decision. In October 2022, PACAN filed an appeal in the Fifth Circuit Federal Court (Ahmed, 2022b; Goldberg, 2023). PACAN successfully won that appeal when judges overturned the air pollution permit, stating that TCEQ allowed Port Arthur LNG to avoid emission control requirements (Baddour, 2023).

In Calcasieu Parish, Louisiana, community members partnered with the Sierra Club and Healthy Gulf to sue the Army Corps of Engineers, arguing that the Clean Water Act (Section 404) "dredge and fill" permit did not adequately protect wetlands as federal law requires (see Table 5.2 in

Chapter 5 of this report). This will impact more than 718 acres of land and permanently destroy 319 acres of sensitive wetlands (Naquin, 2022a). The group proposed an alternative site that would impact far fewer acres of wetland. This reveals not only a great deal at stake for local residents but, in a rush to build, an unwillingness by Driftwood LNG and FERC to minimize harm. The Fifth Circuit Court did not agree and ruled in September 2023 that the Corps of Engineers had satisfied the Clean Water Act stipulations (Associated Press, 2023).

Although the community lost that battle, it continues to resist the build-out. In November 2022, Tellurian released a video describing its ongoing construction, including site prep and piling (Tellurian Inc., 2022). The Sierra Club filed a formal complaint with FERC after the company divulged construction violations. FERC had authorized only 26 test piles, but the video showed 4,000 feet (Naquin, 2022b). Despite these concerns, FERC approved Line 200 and Line 300 of the $1.4 billion project (Reuters, 2023a).

Port St. Joseph, Florida, residents faced a legal fight that could alter FERC's authority on future LNG projects. Miami-based Nopetro successfully petitioned for exemption from FERC review of its LNG facility because the plant would sit 1,329 feet away from the loading docks. Nopetro planned to use trucks to deliver the gas from the facility to the docks. This setup allowed them to bypass environmental review. The proposed facility would have sat next to a historical African American neighborhood. Community members envisioned using the existing abandoned paper mill as a tourist waterfront. Residents partnered with Public Citizen to sue FERC for not requiring the environmental assessment (Davis, 2022). FERC responded by refusing to claim jurisdiction over the facility due to the design of a separate plant from the loading area (Weitzel, 2023). While waiting for the D.C. Circuit Court of Appeals to hear the case, community members received victorious news when Nopetro announced it would no longer pursue the project due to local pushback (Public Citizen, 2023).

While recent decisions from FERC indicate a commission still protecting the interests of LNG companies, it did deny Lake Charles LNG a second extension of time for its first export date of 2022 to 2028 (Stewart, 2023). The Department of Energy issued a new policy statement on April 21, 2023, that the agency will not consider extension applications for LNG export facilities that want more time than the allotted seven years from receiving a permit without extenuating circumstances. This affects 10 projects, eight of them located in Louisiana and Texas (Shaykevich, 2023).

Litigation against LNG development offers small reprieve for community residents as state agencies continue to issue permits that further compromise the air and water as well as public health. Using legal avenues to prevent the expanse of LNG along the Gulf South is an uphill battle with little gains. However, community members have their views against the build-out chronicled in the public record. This tactic does influence financial investors. The next section of this chapter will describe legal strategies taken by Freeport, Texas, and Plaquemines Parish, Louisiana, along with other strategies to confront LNG threats to their respective communities.

To understand the burdens communities around LNG plants face, we sought to connect with those vocal in the permitting process and shadow them to evaluate their experience. Both communities have already faced a host of pollution challenges from industries near them. Both communities have experienced displacement. In Freeport, people have experienced land grabs from the port as more industry moves into their community. Plaquemines Parish residents have experienced climate displacement from sinking land.

The levels of involvement between the two communities represent the phase of the LNG infrastructure in their respective geography. The Freeport community members have spent years dedicated to learning about the LNG industry to vocalize their concerns in the permitting process. The LNG terminal has been a part of their industrial network since its import operations began in 2008. As a result, Freeport community members have built joint partnerships with other communities that face threats from LNG activity across the Gulf Coast, from Port Arthur, Texas, to Lake Charles, Louisiana.

The community in Plaquemines has just begun the process of learning about LNG's impact on their community. One organization has dedicated its mission to aiding community members in recovery from the numerous storms and industrial accidents like the BP *Deepwater Horizon* oil spill in 2010. They have begun attending meetings to learn about the Plaquemines LNG facility, in its initial construction.

The following two case studies explore the biggest concerns vocalized by community members in Freeport and Plaquemines. Each case study describes the community, its problems with LNG, and the key players in the resistance to LNG buildouts. Each describes strategies used by community organizers and highlights the challenges they face.

Freeport, Texas

In 2019, the Department of Energy announced approval for Freeport LNG to expand "clean energy," calling this expansion "critical to spreading freedom gas throughout the world" (U.S. Department of Energy, 2019). The port of Freeport, which leases land to the LNG facility, is described as a "strategic national asset," in part due to the LNG facility (Port Freeport: The coast is clear, 2012, p. 61). Historically, the industrial presence in Freeport, Texas, has served as a symbol of preserving democracy in the name of wealth while fighting international aggression. The company town, founded by Freeport Sulphur in 1912, promoted settlement there to bolster American dominance on a geopolitical scale. This narrative is problematic as it excludes the exploitation of local people and the environment to achieve global dominance.

Freeport LNG was one of the first to receive FERC approval to import. Shortly after accepting its first import shipment, the facility received approval to export. The liquefying facility has experienced several problems due to its quick growth. The facility has been investigated multiple times. Throughout operations, the facility has reported more feedgas issues than any other LNG facility in the United States (Soraghan et al., 2022).

Background

On June 8, 2022, Freeport LNG experienced an explosion in a pipe rack near storage tanks. Approximately 120,000 cubic feet of liquefied gas was released (Weber, 2022). The blast created a 450-foot-high fireball along a 700-foot section of pipe (Chapa, 2022). Freeport LNG released a statement saying no injuries occurred, the fire lasted only 10 seconds, and it was contained with no impact to the community. It also argued that the release of chemicals in the air was inconsequential due to the short duration (Browne, 2022).

Figure 6.1. Storage Tanks at Freeport LNG

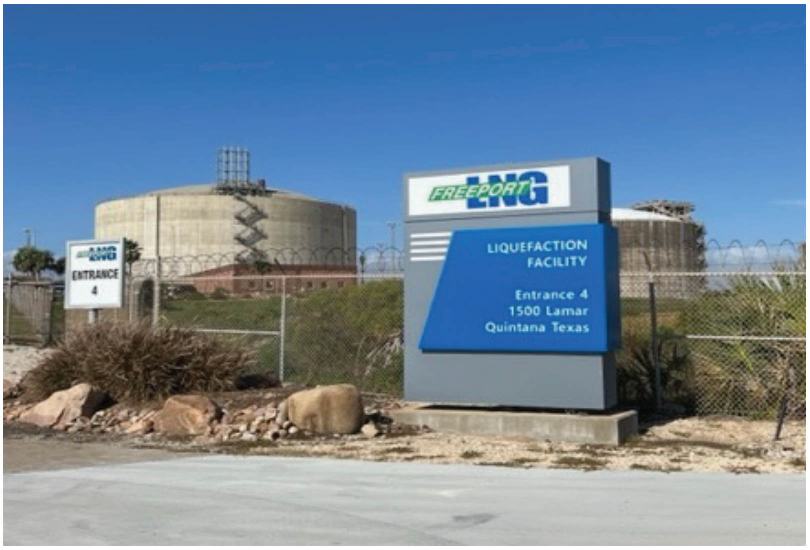


Photo by Liza T. Powers[20]

The community confirmed injuries on nearby Surfside beach. The ground shook and knocked a lifeguard from her chair. A toddler fell on rocks, cutting his forehead. The Pipeline and Hazardous Materials Safety Administration (PHMSA) required Freeport LNG to take corrective measures before reopening in addition to repairing and replacing infrastructure damaged from the explosion (Biggar, 2022). Freeport LNG initially declared the explosion as force majeure, or no fault of the company, for exemption from contractual obligations of supply. By August, Freeport LNG retracted this and was facing a liability of up to $8 billion (Payne & Rashad, 2022).

The explosion caused a ripple effect in the global community. Prices had already soared due to Russia's invasion and pandemic-induced inflation. Immediately after the explosion, Freeport LNG announced reopening would take at least three weeks, but it would not reopen until March 2023 due to supply chain issues and PHMSA's investigation (Schneider, 2022a). The explosion prompted a wildly volatile ride on the market. Natural gas prices dropped 12% at the benefit of domestic consumers. With further delays announced, the prices plummeted even more and experienced

[20] Note that all photos in this chapter were taken by Liza T. Powers during site visits and interviews with community members and local leaders.

highs and lows as news of the reopening changed (Ross & Zibel, 2023). The domestic price dropped by almost one-third (Symons, 2024). Discourse about the explosion, including preventative measures, root causes, and reopening measures, has largely excluded community input or participation. Meanwhile, Freeport LNG continues expansion plans for a fourth liquefaction train.

Key Actors

Better Brazoria: Clean Air & Clean Water (BB). This organization was founded in 2008 by physical therapist Melanie Oldham. The organization primarily focuses on community awareness of health-threatening hazards and attending public meetings. BB has advocated for its community since Freeport LNG's early days through both public meetings and comments. As the facility moved to retrofit to an export facility, BB continued opposition through public participation. The organization has also led efforts to demand more transparency and public participation in the aftermath of the explosion.

Pipeline Hazardous Materials Safety Administration. PHMSA is a federal agency, under the Department of Transportation. The agency regulates safe and reliable transportation of energy and other hazardous materials through pipelines throughout the United States. After the explosion at Freeport LNG, PHMSA investigated and had the final say on the facility's ability to reopen and resume operations.

Federal Energy Regulatory Commission. An independent agency, FERC holds the authority for LNG siting and expansion. The commission also issues certificates for LNG facilities that transport gas across state lines.

Freeport LNG. Freeport LNG is the second-largest export facility in the United States and is expanding to add a fourth train. Freeport LNG began exporting LNG in 2019.

Port Freeport. Freeport LNG leases land from Port Freeport. The port ranks as the sixth largest in the United States for transporting chemicals. The port also manages container shipments and liquefied petroleum gas. In 2014, Congress voted to widen and deepen the port at a federally shared cost of $295 million. This will result in Freeport being the deepest port in Texas. By 2025, the port will have depths between 51 and 56 feet.

Community

Situated at the mouth of the Brazos River on the Gulf of Mexico, Freeport, Texas, is approximately 60 miles south of Houston, and part of Brazoria County. As discussed in Chapter 5, Freeport residents have a high environmental justice risk and Social Vulnerability Index score. (See Tables 5.3 and 5.4 in Chapter 5).

Displacement of residents from the historically Black East End community in Freeport has occurred due to port expansion. Established in 1930 as a racially segregated community, municipal law decreed it as the only neighborhood in which Black people could legally buy property (Ahmed, 2020). Industries such as Dow Chemical located directly across the Brazos River from the East End and public health deteriorated. Municipal services to the East End were limited, and streets remained unpaved and poorly maintained (Ahmed, 2020; Hagerty, 2022). Residents describe seeing yellow dust from sulfur mining in the air and on their clothes, cars, and homes.

Despite the oppression and pollution, residents recall a vibrant community with established churches and thriving businesses. In 1999, the port of Freeport began buying residential lots (Wuebker, 2022b). By 2002, the city refused to issue permits for home repairs located in the East End. Houses, businesses, and public facilities slowly made their exit. Racist redlining killed the East End Black community.

Figure 6.2. One of the Few Remaining Homes in the East End

Port Freeport concentrated its efforts on buyouts of East End residents. The port will repurpose the land for warehouses deemed necessary in its expansion (Hagerty, 2022).

Brazoria County's total population of 71,049 live within a half-mile radius of active oil and gas infrastructure (Earthworks, 2022). Residents experience asthma and other respiratory issues from the presence of the petrochemical industry. Reports of eye and nose irritation on windy days are common (Griffey, 2021). TCEQ has found Freeport LNG to be in violation with respect to emissions of carbon monoxide, hydrogen sulfide, nitrogen oxides, sulfur dioxide, and volatile organic compounds in recorded events (Omar, 2021). Freeport's air quality fails to meet federal standards (Ahmed, 2021b). Freeport LNG committed approximately 100 air permit violations before TCEQ fined them only $9,000 (Ahmed, 2021a).

Figure 6.3. The East End Neighborhood Today: Once a Vibrant Community of Homes and Businesses

Strategies

The Freeport LNG explosion highlights problematic safety regulations for LNG facilities. The explosion became the central argument of community members in opposing the fourth train expansion. FERC and PHMSA met with Freeport LNG behind closed doors.

In response, BB met with environmental organizations and concerned community members to draft a letter to President Biden and all department chiefs and cabinet members. In the letter, they asked that the expansion stop until PHMSA completed inspections. They requested that authorities allow community members to discuss the explosion's impact on the health and safety of the community (Citizens for Clean Air and Water in Brazoria County, 2022).

Later, BB would submit a letter to PHMSA requesting a public meeting, an updated emergency response plan for Freeport, and more current regulations (Oldham, 2022). This was not the first fire to occur at the facility, as one occurred in October 2020 (H. Weber, 2020). During that electrical fire, the call by LNG employees went to Houston rather than local Freeport fire stations. When the emergency personnel arrived at the facility, they experienced delays in entering the facility that prolonged extinguishing the fire (Soraghan et al., 2022). Quintana Island resident Harold Doty stated that he often hears fire alarms from the plant at his home nearby that are not reported to the public (J. Johnson, 2022).

Figure 6.4. Bridge Pictured Is the Only Evacuation from Quintana Island to Freeport

Earlier in 2022, Freeport reduced its promised cargo shipments due to intermittent issues with feedgas impurities. Other LNG facilities have not experienced frequent and quick shutdowns and restarts like Freeport LNG has experienced and reported to TCEQ (Schneider, 2022a). Existing federal regulations for governing gas export infrastructure date back to 1980. Over the course of 40 years, many environmental problems and potential mishaps have occurred (Soraghan & Lee, 2022).

On March 31, 2014, a blast on a vessel sprayed shrapnel, weighing as heavy as 250 pounds, to LNG tanks that began to leak at an LNG storage facility in Plymouth, Washington (Schneyer et al., 2014).

Approximately 200 residents, in a 2-mile radius, were evacuated from their homes. Five workers were injured, and there was approximately $69 million worth of damage. The state of Washington found the company did not adequately train employees and did not have an adequate emergency response plan (Powell, 2016b). PHMSA found the primary issue to be procedural errors (PHMSA, 2016). Only one of the five workers was hospitalized, so his is the only injury reported in the report. Despite residents and emergency responders stating they became sick and nauseous due to the air quality, these harms were not recorded as none of them died or were hospitalized. The incident also did not count as a spill since the LNG evaporated (Powell, 2016a).

Following the Plymouth blast, Dr. Jerry Havens and James Venart, leading LNG safety experts, submitted public comments on the Jordan Cove LNG terminal to warn of explosions and that regulators did not adequately consider the risks (Mandel, 2016). In 2016, PHMSA attempted to update the LNG industry's guidelines but did not garner appropriate support to do so (Soraghan & Lee, 2022). Days before the Freeport LNG explosion, Dr. Havens requested PHMSA change their LNG safety regulations and also implored them to lift the Risk Management Plan exemption given to LNG facilities. The petition also stated the need to address a worst-case scenario explosion and make emergency response plans available to the public (Havens, 2022). Experts believe the risks have grown as these export facilities are using heavier hydrocarbons such as propane, ethylene, butane, and propane (Englund, 2021; Herwick, 2016, Soraghan & Lee, 2022).

Leaders of BB immediately took steps to advocate for their community and demand transparency and answers in response to the Freeport LNG explosion. They traveled to Washington, D.C., in November 2022, where they met with then–FERC chairperson, Richard Glick. At a press conference held before the meeting, several community members explained the need for a public forum to discuss the explosion and its environmental impact (Act.TV, 2022). They also launched a digital campaign, Enough Is Enough, to educate the public on LNG risks and to urge interested parties to demand updated regulations by contacting federal authorities (Enough Is Enough LNG, 2022).

As incidents occur in its community, BB sends letters to agencies that have authority over the problems. The residents attend public hearings for sitings and expansions and post public comments to express opposition. BB leadership has traveled to Washington, D.C., and Austin, Texas, to attend key events. The community members also offer support to other communities facing the threat of LNG sitings in their communities.

More than 40 organizations submitted a letter in March 2022 to President Biden, Secretary Granholm, Administrator Regan, Secretary Buttigieg, and Chairperson Glick asking them to incorporate environmental justice into FERC decisions. The letter also urged more engagement from the U.S. Environmental Protection Agency (EPA) in the review processes. The letter requested a halt of gas exports and a policy shift to renewable energy (We Act, 2022). BB continues to lobby while still educating its neighbors. The organization holds monthly meetings where members prepare to speak at meetings and enter public comments.

Challenges and Recommendations

Environmental justice and community groups have had little success from litigation to stop Freeport LNG expansion. In *Sierra Club and Galveston Baykeeper v. FERC*, the D.C. Circuit Court of Appeals rejected the argument that FERC did not properly follow NEPA guidelines. The decision meant that indirect effects and cumulative impacts would not be required in applications to convert the facility from imports to exports (Morrison, 2016). Residents get limited public hearings and suffer through technical errors that stifle comments shared in the public meetings. Community members express frustration that their voice does not matter. Still, they follow the opposition process, even though they believe that projects already have an unofficial greenlight (Holle, 2022).

In the aftermath of the explosion, community members asked why an emergency activation to alert the community— Community Awareness and Emergency Response (CAER)— did not occur. Though it took 40 minutes to extinguish, officials determined the explosion had no impact on the community and did not activate CAER (Wuebker, 2022a). Five months after the incident, Freeport LNG released results from an independent third-party study that determined a pipe without adequate overpressure protection caused the explosion. The report released to the public was heavily redacted and added another layer of distrust (Smith, 2022).

The community surrounding Freeport LNG faces an uphill battle. As the facility expands, auxiliary facilities will only exacerbate health and climate risks. Freeport LNG has announced a partnership with Talos Energy to develop a carbon capture facility adjacent to the LNG facility, whereby Freeport LNG would dispose of its greenhouse gas waste (i.e., carbon emissions) in an underground storage cavern via injection well. It anticipates the first injection could occur as early as 2024. Residents and experts are concerned about the environmental impact and safety of carbon capture and storage, and the contribution of more pipelines and wells to the area already overburdened with pollution, wetlands destruction and climate disasters (Center for International Environmental Law, 2021; Talos Energy, 2021).

LNG expansion and further port developments have attracted other industries to settle in the area. Kisuma Americas Inc. intends to build a magnesium plant (Clarke, 2022). BB has devoted time arguing against the Deepwater Sea Port Oil Terminal (SPOT). The project will consist of five pipelines running crude oil from Harris County into Brazoria County for loading on tankers. These pipes will run through the Brazos River, impacting 149 wetlands. Other plans for an oil tank farm are also being considered (Wuebker, 2022c).

Approval of SPOT is yet another example of how federal policy promises to lead in carbon emissions reductions yet steadfastly moves in the opposite direction. The U.S. Maritime Administration has reported in its impact statement that SPOT will create 233 million tons of carbon dioxide annually (Baddour, 2022). Many residents find their energy spread thin, balancing addressing the constant threats of petrochemical and gas encroachments with family and work life.

BB scored a huge success when it learned that PHMSA, FERC, and the U.S. Coast Guard would host a public meeting to explain findings from investigating the Freeport LNG explosion; however, the announcement came a week before the meeting, and not all interested community members could attend. The meeting lasted for two hours, and 30 minutes before the end time, a community member raised her hand to ask when the public could ask questions and voice concerns. The first 90 minutes consisted of presentations in which PHMSA, FERC, and Coast Guard representatives discussed the explosion forensics and their findings. They noted a plant operator had reported observing a pipe out of place, but supervisors did not investigate. PHMSA also indicated that Freeport LNG operated with a skeleton staff, resulting in many workers with overtime, and that it promised to fully staff operations once it reopened (Ferman, 2023). The lack of staff provided a source of frustration since Freeport LNG receives tax breaks for the *job opportunities* provided to the community.

Figure 6.5. Trains at Freeport LNG

Many questions and comments from residents provided new information to the agencies. Melanie Oldham expressed gratitude for so few injuries. PHMSA was unaware of any injuries. Both PHMSA and FERC representatives admitted they had little knowledge of human health and that they needed to remedy this. PHMSA also admitted that holding this meeting represented a change from standard practice, as they typically did not hold community meetings to discuss an investigation (Baddour & Erdenesanaa, 2023).

No representative from Freeport LNG attended; however, members of the Port Commission attended. The agencies announced that Freeport would resume operations soon, despite not making all the necessary changes requested by PHMSA. The meeting was held on a Saturday, and the following Monday, Freeport LNG announced that it had asked FERC for permission to reopen Train 1 immediately (Baddour & Erdenesanaa, 2023). Freeport BB partnered with the Sierra Club to sue FERC for extending the expansion deadline on Train 4 for Freeport LNG. The organization will continue to use its legal right to stop the expansion (Sierra Club, 2023).

During the meeting, Melanie Oldham asked whether something systemic could be occurring at Freeport LNG, citing the facility's many violations and feedgas problems. Both agencies agreed to the presence of systemic issues. PHMSA also promised opportunities for community engagement as it updates its safety guidelines for LNG plants. However, PHMSA does not have a streamlined process for public comments. The public has to email the general inbox to comment on regulatory guidelines. PHMSA has also drafted a regulation to require quarterly methane leakage surveys on nontank equipment and components within LNG facilities. Operations will also be required to repair any detected leaks (PHMSA, 2023). This comes in response to the bipartisan Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act of 2016, giving more safety authority to PHMSA (Onsat, 2023).

Since reopening after the explosion, at least one train has experienced a trip or shut down. In January 2024, Freeport LNG announced that one of its trains would be out of service for approximately a month. During Winter Storm Heather, the train experienced a technical issue that caused the unexpected shut down (Childs, 2024; Vakil and Disavino, 2024). In January 2024 alone, each of the three trains experienced issues at least five times, causing emission events (Vakil and Disavino, 2024).

Federal investments and tax concessions have sanctioned Freeport's pollution problem. Transparency with respect to community members of the dangers from both pollution and explosions does not exist. Freeport has also benefited from federal investment and leasing land to Freeport LNG. The port exploited East End members to gain their land for pennies while it repurposed the land to make millions.

While Freeport's residents face many environmental, social, and health-related issues, the dedication of BB allowed a public forum to ask tough questions. Local environmental justice leaders have traveled to Washington, D.C., to meet with FERC, offered testimony at public meetings, and helped push for safer guidelines that will stop the planned expansion of Train 4. They also held a press conference on the one-year anniversary of the explosion.

Plaquemines LNG

On the 16th anniversary of Hurricane Katrina's landfall, Louisiana experienced another deadly and destructive storm, Category 4 Hurricane Ida. The storm became the second-most- damaging storm for Louisiana (Earth Science Applied Sciences, 2021). Recovery from this catastrophic event has been slow and difficult for the rural population of Plaquemines Parish. Many residents celebrated a third Christmas in small Federal Emergency Management Agency (FEMA) trailers as they worry about how to elevate homes before the next storm. FEMA wants the residents to vacate the trailers, and residents would love to return to their homes, but they remain uninhabitable (O'Connor, 2023). Across the highway, their new neighbor Venture Global receives tax breaks and incentives from the federal government to build. The Venture Global LNG facility will contribute to additional loss of wetlands and a new risk of carrying pollution and chemicals into these residents' homes once they do have the money to rebuild (van Heerden, 2022).

Background

Plaquemines Parish residents have witnessed the loss of wetlands and coastal erosion with each generation. They have endured pollution from industrial neighbors such as the *Deepwater Horizon* oil spill (Berlin, 2020). With each passing year, their quiet ways of living and working by the Mississippi River are threatened by the onslaught of more industry that pollutes and plunders their land. Black American populations live in unincorporated towns along the Mississippi River, where they passed down the land generation after generation since their emancipation.

The populations have remained vulnerable to the governance of parish councils. These governing bodies rezone political geographies on a whim. Residents are offered an inadequate voice when industry moves into their communities (Castellon, 2021). Moreover, Louisiana state policies have been far too accommodating in attracting the fossil fuel industry, as described previously in Chapter 3 (Colten, 2014).

A second facility slated for Plaquemines Parish, Delta LNG, is on the horizon in prefiling stages for FERC (Venture Global, 2022). Also, two offshore LNG facilities with onshore components, West Delta LNG and Gulfstream LNG, could come to the parish. Residents question how potentially these LNG facilities in their parish will further damage public health and threaten their ability to remain on their ancestral lands. They are fiercely fighting to protect their land from the next great flood or climate disappearance.

Land loss has occurred primarily as a result of levee protection as well as fossil fuel extraction and production. The Mississippi Delta has naturally altered landscapes and built land by depositing its sediment rich in nutrients and minerals when it overtops its banks. As the built environment has grown alongside the river, levee construction occurred to protect from flooding. This prevents needed deposits to restore land loss. Fossil fuel industries have contributed to climate change by emissions of greenhouse gases, while simultaneously destroying natural mitigation measures by carving up the wetlands to install more pipelines, channels, wells, and other infrastructure to extract and process oil and gas. Louisiana ranks second in the nation for the highest greenhouse gas emissions from large facilities (U.S. EPA, 2021).

Residents have attributed land loss, one of their main concerns, to Plaquemines LNG. One resident described how a helicopter tour of the parish revealed how much land had been swallowed up in her lifetime. She grieves how much will change for her now one- and two-year-old children. She believes that by their adult years, much of the land now will have disappeared (L. Turner, personal communication, December 20, 2022). During testimony to the Senate, Thomas Dardar, principal chief of the United Houma Nation, recounted hunting on lands that are now underwater, and he laments that he cannot hunt those lands with his grandchildren (Senate Committee on Energy and Natural Resources, 2012).

The increased flooding experienced in Plaquemines Parish signals that residents are on the front line to the changes of climate. Without direct intervention, experts predict daily life in the parish will be impossible within the next 50 years (Clipp et al., 2016). Plaquemines Parish faces the second-highest percentage of land loss in Louisiana, with neighboring St. Bernard Parish ranking first (Yoder & Moore, 2022a). One 2023 study ranks Louisiana as the state least prepared for extreme weather (Cohn, 2023).

Key Actors

Plaquemines Parish Council. Politically, the parish is divided into nine districts and has one elected member for each district. The nine people make up the Plaquemines Parish Council, a legislative body for the parish. Each council member serves a four-year term with the option to run for a maximum of two terms. Council members annually vote on the chairperson and vice chairpersons. The council serves as the local governing body for Plaquemines Port (Plaquemines Parish, 2022). Over the years, people have proposed reshaping the council and districts. Most recently, they have discussed rezoning from a total of nine to five districts. Under this proposed plan, there would be a council member for each of the five districts and two additional council members elected at large. This would curb Black districts and lessen their voice.

Houma Nation. The Houma Nation lacks federal recognition, despite being one of the largest tribes to apply. It does appreciate state recognition. Its initial application, submitted in 1979, occurred only a year after the federal government opened up the process. The nation has submitted documentation required as the federal government requests it over the years (House Natural Resources Subcommittee on Insular Affairs, 2010).

Venture Global. Venture Global, headquartered in Houston, Texas, currently has four projects. Two of them will be located in Cameron Parish, Louisiana. The other two will be located in Plaquemines Parish (Venture Global, 2022). Venture Global has named construction of this case study's facility as Plaquemines LNG, and it will cost approximately $8.5 billion to build (Yoder, 2021). Construction began in the spring of 2022 (Schneider, 2022b).

As one of the largest LNG terminals in the United States, the facility plans to produce up to 24 metric tons annually (Yoder, 2021). The anticipated operational start date is 2024 (LNG Prime staff, 2022). The Russian invasion of Ukraine allowed Venture Global to finally reach a final investment decision (Schneider, 2022b). The company has planned for two phases of construction. Each phase will include a liquefaction plant of nine integrated single-mixed refrigerant blocks as well as three pretreatment facilities. Once completed, the facility will include four storage tanks and three loading docks.

Figure 6.6. Construction Site of Venture Global in Plaquemines Parish

Zion Travelers Cooperative Center. The Zion Travelers Cooperative Center formed after Hurricane Katrina. Initially, the nonprofit organization served as a distribution center for residents to receive supplies and aid in gutting and rebuilding homes. After the *Deepwater Horizon* oil spill, the organization arranged health assessments for residents to monitor physical and mental health impact (Gray, 2010). The organization has evolved as a technical center that offers Internet access and computers.

Staff help residents apply for a variety of programs such as FEMA emergency relief and food stamps. Adult education classes allow residents to learn how to use computers. The Zion Travelers have broadened their reach to assist the youth of the parish. They hold a summer program that focuses on *green time versus screen time*. Zion Travelers attend parish council meetings and form watch groups on any issues that impact public health and environmental quality. Recently, the group has followed the movements of LNG construction in their community.

Figure 6.7. Another View of Construction at Venture Global LNG's Site

Deep South Center for Environmental Justice (DSCEJ). Located in New Orleans, this organization partners with groups in the Deep South most vulnerable to pollution and climate change. Through these partnerships, community-based organizations receive resources necessary for capacity building to resist further industrial encroachment and mitigate community impact from natural hazards.

Mid-Barataria Sediment Diversion. Located on the west bank of the Mississippi River at Mile 69 near Venture Global's build-out, this structure will engineer a break in the river levee system. The project will divert river flow into the wetlands of Barataria Bay to deliver fresh water, sediment, and nutrients to mitigate land loss. Once operational, engineers estimate that the project will build or sustain approximately 6,260 acres of wetlands in the first 10 years (McCormack, 2022). It is spearheaded by the Louisiana Trustee Implementation Group, in partnership with the Louisiana Coastal Protection and Restoration Authority. That group organized after the 2010 *Deepwater Horizon* oil spill to remediate damages (National Oceanic and Atmospheric Administration, 2023c).

Figure 6.8. Zion Travelers Baptist Church in Phoenix, Louisiana

Figure 6.9. Marina Near Phoenix Community—Commercial Fishing Has Been Impacted by Pollution From Floodwater and the *Deepwater Horizon* Oil Spill

Community

Plaquemines Parish is a roughly 80-mile peninsula and approximately 50 miles from New Orleans. The Mississippi River divides it, and only one-third of the land is dry (Howard, 2008). This geography is unique in that most people do not leave the parish unless work requires it. New people do not move into the parish, and the original inhabitants have tried to remain there (Howard, 2008). One can travel from New Orleans to the parish by use of Highway 23 on the west bank side of the Mississippi or Highway 39 on the east bank side. The port runs two ferry locations to shuttle vehicles from the east and west banks (Plaquemines Port, 2022). This makes evacuation from disasters a difficult and slow process.

Figure 6.10. Ferry That Runs From the East Bank to the West Bank of the Mississippi River

Unincorporated towns nestle along both the east and west banks of the river. The residents speak highly of their community. Strong social networks have built resilience to the various flooding events and pollution disasters they face. Residents speak about the beauty of knowing their neighbors and having a community of people to help in times of need. They also describe the benefits of low crime and a relatively safe environment in which to raise their children. One resident described the parish as one of the few places a child could still have a childhood (L. Turner, personal communication, December 20, 2022).

The people of Plaquemines have a strong place attachment. Residents of the parish view the natural environment as part of their cultural identity. The Houma population has sacred ties to the land

and has argued that the fossil fuel industry uproots the remains of their ancestors (House Natural Resources Subcommittee on Insular Affairs, 2010). Black residents share a similar perspective. As their enslaved ancestors did not have proper burial rights, that industries are allowed to sit on land previously used for plantations is viewed as a desecration of sacred land (Richie, 2022).

In 2005, Hurricane Katrina caused heavy floodwater damage to Plaquemines Parish, and the storm resulted in floodwater carrying pollution. One million gallons of oil broke out of a Chevron storage tank. The people of Plaquemines Parish resolved to remain on their land despite the devastation that came from Katrina (Thornburgh, 2005). After the storm, roughly 2,000 people moved from the parish, which was not a notable change. However, more people did move to Belle Chasse, the most northern town in the Parish (Bates, 2017). Hurricanes Rita in 2005, Ike in 2008, and Gustav in 2008 would cause further destruction to the parish (Holthouse & Holthouse, 2009).

In 2012, Hurricane Isaac highlighted regulatory flaws with the levee system in Plaquemines, which remains outside federal control. State officials had to do a controlled breach days after Isaac caused storm surge damage to the neighborhood protected by the levee (Gray, 2012). Isaac did prompt many to question whether federal levee protection should occur south of New Orleans as approximately 1 million people live without this federal protection. The Army Corps of Engineers remained reluctant to add this protection because it could not guarantee the fortification of St. Bernard Parish and Plaquemines Parish with sturdier levees (Associated Press, 2012). Plaquemines Parish remains outside such federal protection, and the polluting fossil fuel industries are sitting on the highest ground elevations of the parish (Verdin, 2020). This will cause floodwaters to continue to carry pollution into residential homes.

Strategies

The current construction of the LNG facility sits precariously on land that flooded for more than a month after Hurricane Ida in August 2021. DSCEJ, Healthy Gulf, and the Sierra Club filed a petition with the Louisiana Department of Natural Resources (LDNR) requiring a coastal impact study and a coastal use permit (Sierra Club, 2022b). In the months prior to the filed petition, Dr. Ivor van Heerden, a leading expert on levee failure, had published a report, *Safety and Environmental Review of Plaquemines LNG*, that warned Venture Global's proposed 26-foot storm wall to protect the facility would still likely overtop and cause runoff of pollution and chemicals to surrounding wetlands, residences and other businesses (van Heerden, 2022). He also provided an affidavit to the petition that the LDNR should not issue the coastal use permit (Sierra Club, 2022b).

LDNR did not require a coastal use permit. DSCEJ requested that LDNR reconsider, but it denied it in 2019 due to the planned storm protection levee. In 2020, the committee denied it again by arguing that the site would be at least 5 feet above sea level and would not have an impact. Through the use of computer modeling, scientists have shown that the liquefying plant would potentially have flooded during Ida's storm. Storm runoff can carry toxic chemicals into the residential areas surrounding the facility (Parker, 2022).

Venture Global's LNG facility will sit near the Mid-Barataria Sediment Diversion project, which is located in the west bank levee near Myrtle Grove and Ironton. The diversion program will allow sediment-laden water of up to 75,000 cubic feet per second to flow from the Mississippi River into the marshes of Barataria Bay to mitigate land loss and build back wetlands that were damaged from the *Deepwater Horizon* oil spill (U.S. Army Corps of Engineers, 2018b). Previously, Tallgrass Energy LP sought to build a crude oil export terminal next to the Mid-Barataria diversion project, but the Louisiana Coastal Protection and Restoration Authority questioned potential interference with coastal wetland restoration (Schleifstein, 2019). Tallgrass would later cancel its plans after facing stiff opposition from residents (Rubiano, 2021). The Barataria Basin has shrunk 75% more than other wetlands in Louisiana. In 2012, the Louisiana Coastal Protection and Restoration Authority released a comprehensive master plan outlining steps to mitigate sea level rise and other environmental threats; however, Louisiana did not achieve a net gain, but instead lost more wetlands and other natural buffers from climate change (Mooney et al., 2023).

Venture Global requested permission to produce an additional 3.2 million metric tons of LNG per year, and DSCEJ, Healthy Gulf, and the Sierra Club filed comments with FERC urging the agency to deny (Sierra Club, 2022b). The permits allotted for the facility will already make it one of the largest producers of liquefied natural gas. Other organizations have supported these findings that motivated the lawsuit. The nonprofit Institute for Energy Economics and Financial Analysis has questioned Venture Global's request for further expansion, citing that production will occur when projections predict a weakening of the LNG market and will create further risk of methane emissions (Cowan, 2023).

Recent opposition to Venture Global has banded all four Louisiana communities in a collective effort. The company's existing operations at Calcasieu Pass have issues with near-constant flaring. The Louisiana Bucket Brigade, a watchdog group, details the company's underreporting, citing 91 observed days of flaring between January and May 2022. The company reported only five accidental releases (Vasudevan, 2022). When Venture Global's semiannual air-monitoring report was released for Calcasieu Pass, the report revealed more than 2,000 permit violations. Several groups, including Earthjustice, Rise St. James, DSCEJ, the Vessel Project of Louisiana, For a Better Bayou, Healthy Gulf, the Louisiana Bucket Brigade, and the Sierra Club, submitted a letter to the EPA. This collaborative effort requested that the EPA review systemic violations of Clean Air Act permits in Louisiana. The letter also asked the EPA to hold the Louisiana Department of Environmental Quality accountable for allowing Venture Global so many liberties at the expense of Louisianans' health (Columbus, 2023; Renaud, 2023).

Challenges and Recommendations

Zion Travelers expressed frustration about how quietly and quickly Venture Global moved into the parish. Residents did not receive enough information from Venture Global during FERC's permitting process. Organization leaders recently began attending meetings offered by FERC's Office of Public Participation so that they can learn more about the LNG facility and the risks LNG can bring to their community. They are concerned that Venture Global is seeking a permit from

FERC for another LNG facility in their parish. By not connecting with the community, Venture Global has created distrust and concern that the plant will further exacerbate land loss and other climate change–related threats.

Although many residents have advocated for climate reversal action, mitigation policies are slow to happen. The Plaquemines Parish Council deferred a resolution four separate times in 2022 that would acknowledge climate change threats to the local economy, signal the council's support of coastal restoration and hazard mitigation efforts, and prioritize wind and solar projects (Plaquemines Parish, 2022). When FEMA sent updated floodplain maps, the council did adopt them and required homes to elevate at least 26 feet and hold flood insurance. This is not economically feasible for many residents, and they are being forced out of their homes and the parish. Moreover, more than two dozen home insurance companies elected to leave Louisiana after Ida (2021) or have gone out of business. While homeowners find difficulty obtaining insurance, LNG terminals find insurance coverage (T. K. Brown, 2023). Currently, Zion Travelers is advocating on behalf of community members who lack the financial resources to elevate and do not wish to leave their land.

During the approval process, the EPA spoke out against FERC for not factoring climate change impacts into the project. They recommended that FERC use the federal tool that calculates the social cost of carbon. This carbon calculator estimated a $205 million cost to the climate annually from the proposed facility. The Interstate National Gas Association of America (INGAA) argued that the calculator should help design policy rather than review specific projects. FERC sided with the INGAA (Osborne, 2021).

The LNG siting also presents an evacuation danger as the only highway used on the west bank typically floods during storms. After Ida made landfall, residents could not travel on the highway, where the LNG plant will sit, for more than nine days. During Isaac (2012), the highway was underwater for two weeks (Parker, 2021). According to Elliot Sylve, a resident, "I am disgruntled about the whole ordeal, especially as our community is still displaced, a year after Ida made landfall. . . . Resources are coming into Plaquemines Parish to build this plant, but no help is coming in to rebuild our community or strengthen the levee to protect us" (Sierra Club, 2022c).

In November 2022, the Deep South Center hosted FERC's Office of Public Participation on a guided tour of Plaquemines Parish, Louisiana. FERC members were able to meet with community residents and discuss the Venture Global LNG construction project. When touring the levee at West Pointe à la Hache, community members pointed to all the garbage and junk accumulated from runoff of Ida's floodwaters. One resident tearfully recounted struggling to care for her elderly mother while rebuilding a fifth time from flooding. She told FERC representatives of worrying how the LNG facility would make her more vulnerable to flooding. Recently, she received word that she and her neighbors still living in FEMA trailer camps would be required to pay rent for the trailers. She passionately expressed her desire to remain on her land and her belief that she should not have to leave because industries were allowed to come and damage her neighborhood (West Pointe à la Hache resident, personal communication, November 12, 2022).

Figure 6.11. Residents in FEMA Trailer Camps, Near Venture Global LNG

While residents experience slow recovery from climate change, Venture Global races to finish construction. In October 2022, Venture Global requested a shift to 24-hour construction to complete the project sooner (Reuters, 2023b). However, noise and light already disrupt the lives of those neighboring the construction site. They experience increased traffic near the site because there is only one highway or ferry to travel (Younes & Bittle, 2023). In July 2023, Venture Global requested that FERC expedite the round-the-clock schedule request as well as increase the total staffing count from 4,700 to 6,000 people (Reuters, 2023b).

Science has shown that the fossil fuel industry poses grave danger to the climate and that a reversal must be immediate and drastic. Residents of Plaquemines Parish already witness the damaging impacts on their health and way of life. To offer the residents a voice, it is imperative that there be federal government regulation as local and state policies favor industry over people. To do so, FERC must offer a better opportunity for public participation. Technological difficulties may prevent some populations from participating through the public commenting process.

Finally, in-person public meetings should be held in the parish at times when the ferry is operational so more can attend. FERC should offer more transparency regarding the climate and environmental impacts the project will have on the community, but this requires more thorough studies than previously employed. Industry should not come into communities at the cost of people's opportunity for employment and health and the risk of their lands and homes being destroyed. These "trade-offs" are unacceptable and must end. The time for environmental, climate, and energy justice is now.

Chapter 7: Conclusions and Policy Recommendations

The previous chapters described the cumulative impacts of liquefied fossil "natural" gas (LNG) facilities, that is, the harmful effects of LNG export terminals on people and natural environments. This report also documents how the Federal Energy Regulatory Commission (FERC), in licensing LNG facilities, has failed to adequately assess disproportionate impacts on people of color and less-affluent communities. FERC has also not adequately considered the cumulative environmental burdens and impacts of LNG export terminals on coastal communities, which is a primary focus of this report. LNG development includes massive fracking and flaring operations in places like the Permian Basin of West Texas, and LNG requires construction of extensive export terminals and pipeline networks (McDonald & Wilson, 2021; Rozansky & Langenbrunner, 2022).

The history of oil and gas facility permitting, siting, and operations reflects a pattern of environmental injustice in the Gulf Coast region—a region that for decades has been plagued with racism in housing and land use planning and notoriously lax environmental protection and enforcement. These converging policies and practices have created a toxic nightmare for mostly poor, Black, Latino, and other people of color communities, who suffer disproportionately worse health outcomes than the overall population in large part as a result of living on the fence lines of petrochemical plants.

LNG development tends to steer economic benefits (jobs, tax base, and public school funding) away from the communities it harms the most. Generally, having oil and gas and petrochemical plants next door has not brought economic prosperity to fenceline communities in Louisiana's Cancer Alley, along the Houston Ship Channel, and amidst other Gulf Coast industrial fossil fuel complexes (Burnett, 2023; Drane, 2023a). Many fenceline communities have become "sacrifice zones," inhabited by a disproportionate share of people of color and poorer people who face more pollution and health threats than the population at large. The highest-paying industry jobs typically are not awarded to residents living in fenceline communities, but instead go to workers who drive in, work eight hours, and drive out (Jones, 2023b). Residents who live in these environmental sacrifice zones are left with more pollution, poverty, and unemployment—and more sick people.

Consider that Black Americans as a whole have 1.54 times more exposure to particulate matter in the air than the general population, Hispanics have 1.20 times more exposure, and those living below the poverty line have 1.35 times more exposure (Mikati et al., 2018). Exposure to particulate matter has been linked to a greater risk of dying from COVID-19; compromised reproductive, respiratory, and cardiovascular health; and cancer (Zhu et al., 2021). For the most part, the federal government has not offered remedies for these types of civil rights violations (see, e.g., Parker, 2023).

Most Americans have no idea what it's like to live, work, play, or attend school next to petrochemical plants, refineries, or LNG terminals. The people who do know what it's like know in excruciating detail about the extraordinary toll the facilities take on their health and well-being. Oil and gas facilities are not randomly scattered across the American landscape. Instead, fossil fuel facilities are disproportionately located in areas that were redlined as "least desirable" neighborhoods or in lower-income communities with more people of color. This systemic environmental racism persists to this day (Hendricks & Van Zandt, 2021). Residents of these sacrifice zones are forced to endure pollution and economic hardship; they deserve special attention instead of the large petrochemical companies that receive tax breaks, and other special treatment.

Despite the drastic impacts on communities and ecosystems and despite the drawbacks, more LNG facilities are in the queue for approval from FERC. As of February 2023, the output from the nine terminals operating or under active construction at the time on the Gulf Coast, in addition to that of the approved terminals and operational terminals elsewhere in the United States, would equal more than 90% of all the methane gas that the U.S. domestic power sector consumed in 2021 (Ross & Zibel, 2023). The United States became the world's largest LNG exporter as recently as 2022. Exporting LNG and building new terminals at such a rapid pace has created grave risks to our environment and climate. This closing chapter will review our findings and provide recommendations to the Biden administration, the U.S. Department of Energy (DOE), and government agencies responsible for permitting and approval processes and regulating the safety of LNG infrastructure.

Findings

An Unjust Legacy of Environmental Assault on Frontline Communities from Oil and Gas Industries

LNG export facilities in the Gulf South add to the environmental burdens fenceline communities bear from decades of oil and gas development, where the dominating presence of this industry has created sacrifice zones. Louisiana and Texas account for more than a third of the nation's methane production (U.S. Energy Information Administration [EIA], 2024a). Texas is the nation's top oil-producing state, and it and Louisiana have the 10 largest petrochemical complexes in North America (EIA, 2024b; Offshore Technology, 2023). The two states also are home to many communities with large percentages of people of color, especially Black and Hispanic communities that endure compromised health and declining property values and wealth while other areas experience the economic gains from the petrochemical industry (Bullard, 2011; Lerner, 2011). Dozens of communities including Lake Charles, Louisiana; the River Parishes, Louisiana; Port Arthur, Texas; Corpus Christi, Texas; and areas along the Houston Ship Channel are ground zero for the petrochemical industry's assault on people of color communities (Offshore Technology, 2023).

Economically, those most vulnerable to fossil fuel presence and pollution do not reap the gains others often enjoy from the industry. Employment gains from the fossil fuel industry generate $36 billion less than the estimated costs of air pollution and climate damages the industry causes (Mayfield et al., 2019, p. 7). Of those employed in the fossil fuel industry over the last decade, less than 10% were Black Americans, and those folks earned 23% less than White Americans (Tomaskovic-Devey, 2023). Black Americans held less than 4% of jobs in the fracking industry (Farber, 2022).

Exporting LNG has contributed to rising costs for domestic residential methane ("natural") gas. The price rose by 21% from 2016 to 2021. Electricity rates increased 14% alone in 2022 over that of the previous year, twice the rate of inflation. Also in 2022, the United States surpassed Qatar to become the world's biggest exporter of LNG (Kusnetz, 2023; Mahoney, 2023).

The fossil fuel favoritism extended by federal and state agencies is a textbook example of government failures and environmental racism (Tomain, 2011; Willyard, 2019). For example, Louisiana and Texas agencies offer tax incentives to attract the fossil fuel industry to their states; however, many of the tax incentives are offered to companies that would have settled there without the concession. These tax abatements sometimes come in exchange for a number of jobs promised by the industry, but companies face little to no repercussions if they fail to honor a formal or informal job-provision commitment (Morris et al., 2021). In Brazoria County, home to Freeport LNG, tax breaks provided to industries cost Texas taxpayers approximately $2 million per job created at the terminal (Drane, 2023a). Lack of revenue generated from taxes results in underfunded public services and increased residential property taxes. In Texas, education is the primary loser. Despite the vast investments in and exorbitant profits reaped from oil and gas development, Louisiana and Texas schoolchildren have a poorer quality of education than the national average as a result of corporate welfare. In 2023, both states fell below the national average of spending per student of $16,867, with Louisiana spending $12,248 per student and Texas spending $12,825 per student (Public School Review, 2023).

Adding insult to injury are the natural resource damages from decades of oil and gas development, which has spread contamination, caused land subsidence, contributed to massive coastal erosion, imperiled the ecologically rich Gulf Coast, and damaged fisheries that support the tourism, recreational, sport, and subsistence fishing economies (Barron et al., 2020; Theriot, 2014). For example, Louisiana, which accounts for 37% of the coastal marshes and 45% of the intertidal wetlands in the continental United States, has lost roughly 2,000 square miles of these ecologically productive areas since the 1930s, a land area equivalent to the size of the state of Delaware (Couvillion et al., 2017; Louisiana Coastal Wetlands Conservation and Restoration Task Force, 2021). Once-vibrant coastal ecosystems that sustained local communities and Indigenous peoples have become relics of the past. These areas no longer support communities and subsistence in a robust way, and they are more vulnerable to sea level rise and increasingly severe tropical storms brought on by climate change. Thus, LNG development, which contributes to all of the aforementioned issues, in the Gulf South represents both an environmental injustice and a climate injustice, resulting from environmental racism.

Deficiencies With Environmental Justice Analyses Used in Permitting LNG Facilities

FERC systematically fails to effectively use federal resources and follow guidelines for conducting robust environmental justice (EJ) analyses of LNG export terminals and associated infrastructure. As discussed in Chapter 4, FERC sometimes acknowledges but does not apply even the rudimentary best practices already established federally for conducting quantitative EJ analyses in its environmental reviews under the National Environmental Policy Act (NEPA) (U.S. Environmental Protection Agency [U.S. EPA], 1998, 2015, 2016; White House Council on Environmental Quality [CEQ], 1997). Additionally, FERC has not established its own standards.

As a baseline, EJ analyses of LNG facilities should assess the potential for disproportionate impacts by comparing population characteristics of areas likely to be affected by the environmental hazards posed by LNG facilities and activities with unaffected comparison, or control, areas. However, FERC EJ analyses use crude, outdated methods that do not accurately, consistently, or reliably identify affected populations. In too many instances in its environmental review documents, FERC reaches conclusions without evidence or substantiation. In other instances, it selectively dismisses findings of relatively high minority percentages in some census block groups and instead highlights ones with low percentages to insinuate that the area is not of EJ concern. FERC tends to use single counties and parishes as comparison areas rather than also using larger or multiple comparison areas. That approach combines the affected populations with the comparison populations and systematically reduces the likelihood of detecting environmental disparities and renders FERC's assessments meaningless when it comes to detecting disproportionality, especially at the national level. So, too, does reporting average rather than population-weighted percentages of people of color (see Chapter 4). Reporting percentages of people of color as a whole, rather than percentages of specific racial and ethnic groups, is another way that FERC EJ analyses mask disproportionate impacts on people of color (especially for Indigenous peoples). In fact, a federal court has also noted inadequacies with FERC's EJ analyses (Farah, 2021). Even in its most recent EJ analyses, FERC does not effectively follow federal guidelines from the CEQ and the EPA, nor does it make use of federal tools, such as the EPA's Environmental Justice Screening and Mapping Tool (EJScreen), the CEQ's Climate and Economic Justice Screening Tool, or the Centers for Disease Control and Prevention's (CDC's) Environmental Justice Index or PLACES maps. Our reanalysis of LNG export facility locations using more rigorous and reliable methods, summarized below, found racial, ethnic, and socioeconomic disparities that FERC's EJ analyses had not discerned.

Results of Our Environmental Justice Analysis of LNG Facilities

Our EJ analysis found that the populations living near most LNG facilities are characterized by disproportionately high percentages of people of color and higher percentages of families living below the poverty line. Our analysis uses a sample of existing and proposed LNG facilities in Louisiana and Texas consisting of Cameron LNG (Cameron Parish, Louisiana), Driftwood LNG (Calcasieu Parish, Louisiana), Plaquemines LNG (Plaquemines Parish, Louisiana), Cheniere Corpus Christi LNG (Nueces and San Patricio counties, Texas), Freeport LNG (Brazoria County, Texas), Freeport LNG Pretreatment Facility (Brazoria County, Texas), and Rio Grande LNG (Cameron County, Texas). To avoid the various shortcomings of FERC's EJ analyses, we relied on the areal apportionment distance-based method (see Chapter 5) and population-weighted American Community Survey 2016–2021 U.S. Census block group estimates to examine population characteristics in areas within 3 miles of each of the LNG facilities; and we used state and national comparisons for the standard of comparison.

The areas around the Freeport LNG Pretreatment Facility and Plaquemines LNG are notable for disproportionately higher percentages of Black Americans. The population living near the pretreatment plant is composed of 23.1% Black Americans, whereas Black Americans make up 12.1% of the state of Texas's population. For Plaquemines LNG, the percentage of the population living near the plant is 71.7% Black, while Black Americans account for 31.9% of the population statewide. Corpus Christi LNG, Freeport Pretreatment, Freeport LNG, and Rio Grande LNG all have disproportionately higher percentages of Hispanics among the nearby populations. Populations near the Plaquemines, Freeport, and Rio Grande LNG facilities have higher poverty rates than the national average. Family poverty rates as reported by the U.S. Census Bureau around Rio Grande LNG, Freeport LNG, and Plaquemines LNG are, respectively, 2.4, 2.1, and 1.7 times greater than the national rate of 8.9%.

Thus, it can be concluded that LNG facilities in the Gulf South follow a familiar pattern of being disproportionately sited in people of color and less-affluent communities that are often socially and politically vulnerable to the siting of polluting industrial facilities and that are often targeted because they are seen as paths of least resistance (Mohai and Saha, 2015b).

Deficiencies of Cumulative Impact Methodologies Used in Permitting LNG Facilities

FERC takes shortcuts in its cumulative impact assessments (CIAs), resulting in inadequate and incomplete analyses. FERC fails to take stock of the totality of the environmental and social impacts of LNG construction and operations. FERC's environmental reviews also do not account for preexisting environmental burdens or the health status of fenceline communities, that is, conditions that make nearby residents more susceptible to the environmental impacts of LNG development, such as air pollution, and to hazards such as leaks and explosions. This is despite the fact that the CDC provides census tract–level health data and the EPA provides pollution exposure measures at the block group level. FERC does not conduct meaningful analyses of environmental pollution burdens vulnerable populations such as children bear, as required under Executive Order No. 13045 (1997), "Protection of Children from Environmental Health Risks and Safety Risks." FERC tends to dismiss the environmental impacts of LNG development on vegetation, soils, aquatic resources, wetlands, and wildlife as "temporary" or "minimal," while largely ignoring previous decades of environmental harms from petrochemical and oil and gas development (e.g., environmental contamination and wetland loss). Moreover, FERC's environmental reviews fail to adequately assess climate impacts, climate vulnerabilities, and the safety and reliability of LNG infrastructure (*Harvard Law Review,* 2022).

Cumulative Impact Assessment of LNG Facility Siting in Louisiana and Texas

Our assessment clearly shows the serious magnitude and scope of the environmental, health-and-safety, and quality-of-life burdens of LNG development in the Gulf South. LNG export terminals add significant local environmental pollution, damage the natural environment through their construction and operations, and make a significant contribution to climate change. In addition to air and noise pollution generated by LNG facilities, fenceline communities face the risk of accidents, explosions, and fires that can damage property, endanger lives, and release even more pollution. Those risks are magnified by the effects of climate change, including sea level rise and the increasing incidence of hurricanes, coastal flooding, and other extreme weather events. Our CIA methodology consists of five main components: (1) an assessment of existing environmental burdens; (2) an assessment of existing social and health vulnerabilities; (3) a summary of the environmental impacts of the construction and operations of selected LNG facilities; (4) an assessment of LNG health and safety risks; and (5) a review of LNG climate impacts.

Existing Environmental Burdens

To take stock of existing pollution burdens in LNG fenceline communities we used the EPA's Environmental Justice Screening and Mapping Tool, or EJScreen, to assess pollution exposures, cancer risks, and proximity to hazardous facilities in areas within 3 miles of the LNG terminal locations. Based on 12 environmental indicator scores, we find that five of the six LNG facilities have relatively high environmental pollution burdens for several indicators. The levels in these areas are greater than the 75th percentile when compared with either the respective host state or the entire United States. Two facilities—Freeport LNG and Driftwood LNG—have scores above the 90th percentile. Areas around five of the six facilities we surveyed have above-median, or elevated, amounts of harmful fine particulate matter and areas around four have an elevated air toxics cancer risk. As a result, LNG host communities experience compromised air quality, not taking into account pollution from LNG facilities. Five of the six host communities score higher than the state or national medians with regard to proximity to a chemical plant. Four communities have elevated scores for proximity to hazardous waste and Superfund sites. It can be concluded that the host communities in the vicinities of LNG export terminals are environmentally overburdened by other pollution sources.

Existing Social and Health Vulnerabilities

The populations in census tracts surrounding the facilities we studied are characterized by social and health vulnerabilities. Those living in census tracts within 3 miles of the facilities have relatively high rates of asthma and obesity compared with host state rates. Census tracts close to the Louisiana LNG facilities are marked by elevated cancer rates and higher health risk factors due to lack of leisure time physical activity. These are conditions that make fenceline communities more susceptible than other communities to LNG facility pollution.

Children make up a particularly vulnerable population, and they are at an elevated risk from pollution without the added risks of LNG facilities. Using the University of Massachusetts Amherst's Political Economy Research Institute's Air Toxics at School tool (Political Economy Research Institute, 2023), we find that schools in Louisiana and Texas have higher levels of air toxics exposure than schools nationwide: Louisiana's level is 3.87 times greater and Texas's is 2.61 times greater than those for the nation. Five of seven schools near our sample facilities rank in the top decile nationally (i.e., above the 90th percentile) for air toxics exposure and four of those are majority-student-of-color schools.

Environmental Impacts of LNG

The LNG facilities' detrimental environmental impacts are extensive on soil, vegetation, water, wetlands, wildlife, fisheries, special status species, ecosystem services, and air quality. Communities around the four built facilities have experienced a wide range of detrimental impacts to the natural environment during both construction and operations.

Almost 5,500 acres, including wetlands, will be temporarily or permanently disrupted if all of the facilities we examined are constructed. Whereas at some of the LNG terminal locations vegetation communities have already been disturbed from previous industry, at least 1,000 acres of vegetation, along with about 150 acres of prime agricultural land, have been or will be destroyed by LNG facility construction, including a critically imperiled plant community in Louisiana and two plant communities of "special concern" in Texas. A total of 1,123 acres of wetlands, which provide valuable wildlife habitat and natural flood risk mitigation, will be permanently impacted, including wetlands and marshlands of state and national significance. Wetland vegetation and ecosystems provide valuable wildlife habitat and natural flood risk mitigation. An additional 75 acres will be lost from the Plaquemines LNG Gator Express Pipeline—wetlands that support "world-class" fisheries in the Barataria Bay, an area still recovering from the 2010 BP *Deepwater Horizon* oil spill. Artificial wetlands constructed to mitigate some of the losses often do not get established as planned, are likely to be poorly monitored by state agencies, and, when they are established, typically consist of smaller patches of contiguous wetlands with relatively low ecological value. All of these wetland mitigation issues are compounded by the major historical losses of wetlands from other industrial development, agriculture, and urbanization. Wetlands loss also contributes to coastal erosion, which will cost Louisiana alone an estimated $550 million annually by 2050 (Wilkins, n.d.)..

Pile driving, artificial lighting, and noise pollution from LNG construction and operations harm wildlife in numerous ways. The discharge of large amounts of ballast water by LNG carriers—each discharge on average equivalent to 23 Olympic-size swimming pools—risks introducing invasive species and threatens the local fishing industry, an industry that was worth $367 million in Louisiana alone in 2021. LNG vessels pose the added threat of strikes to various imperiled species including the endangered Rice's whale, other marine mammals, and sea turtles. Rio Grande LNG is slated to destroy rare coastal clay dune habitat for the endangered northern aplomado falcon and to disrupt migration corridors for the endangered Texas ocelot. Indeed, the Gulf South is a rich, biodiverse region, one in which the six LNG facilities could have impacts on a total of 113 special status species, such as, for example, the Eastern black rail (*Laterallus jamaicensis jamaicensis*) and the piping plover (*Charadrius melodus*). The Gulf Coast provides critical overwintering habitat for the latter migratory bird listed under the Endangered Species Act.

Material dredged at five of these facilities totals 19.4 million cubic yards, enough to fill more than four New Orleans Superdomes. Dredging degrades water quality and damages fisheries, plus in many cases the dredge spoils (sediment from dredging operations) can contain pollutants or toxins and must be placed in an appropriate disposal site. Four of the six LNG facilities we examined will also increase the release of toxic substances into the environment—for example, in the Calcasieu Ship Channel, dredge sediments are known to be contaminated with trichloroethylene (TCE), tetrachloroethylene (also known as PERC), and benzene (FERC, 2019b, p. 4-18). Furthermore, periodic "maintenance dredging" must also be conducted, generally about once a year, once a shipping lane or dock has been initially dredged, and maintenance dredging poses perpetual risks to the environment by altering the hydrology of the area and re-suspending toxins in settled sediments.

LNG export facilities require a tremendous amount of energy to compress and cool methane to extremely low temperatures. For example, Corpus Christi LNG's three liquefaction trains have eighteen 43,013-horsepower compressors, the equivalent horsepower of nearly 2,700 Ford F-150 trucks! All six LNG facilities are considered "major sources" of criteria air pollutants under the Clean Air Act.

Even under optimal operating conditions and as reported by FERC, the six LNG facilities will emit nearly 30,000 tons of criteria air pollutants, including 12,500 tons of ozone-forming pollutants annually (nitrogen oxides, sulfur dioxide, and volatile organic compounds). This includes 1,382 tons of particulate matter (PM_{10} and $PM_{2.5}$). Particulate matter is associated with asthma and lung cancer (Guarnieri and Balmes, 2014; International Agency for Research on Cancer, 2015) as well as other cancers, such as breast cancer (Poulsen et al., 2023). It is responsible for 50% to 60% of all anthropogenic air pollution–related deaths every year (Lelieveld et al., 2023; McDuffie et al., 2021). LNG shipping vessels, tugboats, and pilot vessels emit additional air pollutants that degrade air quality and harm human health. Poor operations, faulty equipment, extreme weather, and lax enforcement result in emissions exceeding permitted amounts, for example, due to excessive flaring (Groom and Volcovici, 2022).

According to FERC, the six LNG facilities we examined will emit 264 tons of Hazardous Air Pollutants (HAPs) annually. Most HAPs are harmful to human health in even tiny amounts. The HAPs released include formaldehyde (a known carcinogen that causes myeloid leukemia and nasal cancers), benzene (also a known carcinogen), toluene (which can cause a range of reproductive harm including birth defects), ethylbenzene (a suspected carcinogen that can cause hearing and kidney damage), and xylene (which has wide-ranging effects). There is growing research interest in the health effects of long-term, low-level exposures to this common set of highly toxic HAP substances produced by fossil fuel combustion; the latter four are referred to as BTEX (benzene, toluene, ethylbenzene, and xylene). Although the risks of combined exposures currently cannot be reliably assessed, the known non-cancer effects of each of these chemicals include poor coordination, anxiety, impulsivity, and compromised learning and memory (Davidson et al., 2021).

HAPs are a concern because regulatory standards are often not protective of public health and instead are set to match the emissions reductions that current pollution control technology can achieve (Ross & Brown, 2012). The high potential for additive and synergistic effects of LNG emissions, combined with those of other industries, is illustrative of the types of cumulative impact that EJ communities, activists, and scholars have drawn attention to for decades (Bullard et al., 2008). Interactions among chemicals can explain why low levels of exposure may have harmful health outcomes (Lagunas-Rangel et al., 2022). However, the current regulatory system does not adequately address the low-level, long-term, and cumulative impacts of exposures and the impacts of environmental exposure to multiple toxic substances. The regulatory system is not precautionary or preventative.

Climate Change Hazards and Technological Failures of LNG Export Facilities

LNG export terminals create health and safety risks in part because they are subject to technological failures and human error. They are also highly susceptible to natural hazards due to their coastal locations. Natural hazards triggering technological accidents (Natech, or double disasters) are a great concern for communities surrounding Gulf Coast LNG facilities as climate change, including sea level rise and extreme weather events, increasingly affects the region (Swanson & Levin, 2020). Natural hazards such as hurricanes, high-tide flooding, storm surges, freezes, wind, tornadoes, and inland flooding can interfere with the safe operation of facilities, especially those that lack adequate risk management plans (Organisation for Economic Co-operation and Development, 2022).

High winds and hurricanes can disrupt operations and necessitate emergency flaring and also heavily polluting shutdown–and–start-up procedures. There is scant accountability or penalty for excessive emissions, and thus little incentive to prevent them. Furthermore, LNG export terminals' air pollution permits are effectively suspended when there is an emergency declaration. Many other oil and gas operations around the Gulf of Mexico have been interrupted by hurricanes, also releasing massive amounts of pollution (Yoder and Moore, 2022b). In 2020, Hurricane Laura caused a temporary suspension of operations at several LNG facilities (including at Cameron LNG, resulting, among other things, in flaring there for two months), and in 2021, Hurricane Nicholas knocked all three liquefaction trains offline at Freeport LNG.

These examples highlight how vulnerable LNG facilities are to extreme weather events. Using the National Oceanic and Atmospheric Administration's (NOAA's) Coastal Flood Exposure Mapper, we found that hurricane storm surges—depending on hurricane strength—could inundate some LNG terminal locations by more than 3 feet and even more than 9 feet, including Cameron, Driftwood, Freeport, Plaquemines, and Rio Grande LNGs. According to FERC, only three of the six LNG facilities we examined are designed to withstand a Category 5 hurricane (Corpus Christi, Freeport, and Cameron LNGs). In their environmental impact statements, FERC is silent as to what the effects would be of a Category 4 or 5 hurricane on other LNG facilities and the potential for a catastrophic failure.

Combustible and explosive vapors from a methane leak from a pipeline in an LNG export terminal can disperse up to 9,840 feet, or 1.86 miles, during light winds of 4.5 miles per hour (Pipeline and Hazardous Materials Safety Administration [PHMSA], 2017, p. 93). Methane vapor cloud dispersal and explosion hazards from LNG storage tanks have not been publicly evaluated by PHMSA, FERC, or any other agency. This has not been done despite both agencies as well as the EPA having been asked repeatedly for this information from community members and extensive coalitions of concerned people. FERC recommends, but does not require, analyses of projectile hazards from tornadoes spawned by severe hurricanes. LNG terminals are not mandated to, and do not consistently incorporate, risk management planning. Moreover, LNG export facilities are exempt from most PHMSA safety programs (Pipeline and Hazardous Materials Safety Administration, 2023). Yet FERC tends to make optimistic assessments of hurricane hazards. It asserts that Category 5 hurricanes are very low probability at any given location, which would then make a Category 5 hurricane less of a risk. However, low probability does not equate to low risk or impact, and communities near these facilities should be the ones to choose whether or not the risks are acceptable. Laissez-faire policy predominates as LNG export facilities are exempt from most of the safety programs that other facilities storing large quantities of explosive chemicals are subject to.

Adding to the stress of fenceline communities is that federal regulatory agencies do not make emergency response plans public. This creates uncertainty and fear about the potential hazards posed by LNG infrastructure and reinforces a general lack of confidence in federal regulation and oversight of this relatively new and complex technology.

This backdrop raises serious concerns about the preparedness of LNG infrastructure for the coming realities of climate change, especially in light of a projected acceleration of sea level rise in the next 30 years and beyond. Because of sea level rise, many coastal areas in the United States, including the Gulf Coast, are experiencing more frequent high-tide floods. Once-rare events are now common (Sweet et al., 2014). Sea level rise also amplifies the impacts of storm surges. Relative sea level rise along the Gulf Coast is projected to be 10–15 centimeters higher than the U.S. average by midcentury. As a result, more than 10 major high-tide floods are expected annually along the western Gulf Coast; and three to six moderate high-tide floods are expected annually in the eastern Gulf Coast (Sweet et al., 2022). It is a waiting game for when an intense hurricane or flooding event will inflict serious damage on any of the six facilities we studied.

Of course, technological failures can occur without a nudge from nature, such as, for example, with the Freeport LNG explosion, fire, and shutdown on June 8, 2022. A 2020 violation case against Freeport LNG stated that on August 23, 2019, Freeport LNG had a technology failure that resulted in a large release of air pollution (Texas Commission on Environmental Quality, 2021). Yet the corrections were not made to prevent the explosion that occurred in 2022. Technological and industrial accidents can result from human factors such as faulty equipment, operational errors, lack of maintenance, poor training, and underinvestment (United Nations Economic Commission for Europe, 2020).

LNG development adds to the existing cumulative risks from climate change in the Gulf Coast, where there are nearly 900 chemical facilities in areas vulnerable to hurricanes and inland flooding (Warmington, 2022). These types of natural disasters routinely cause malfunctions, fires, explosions, leaks, and forced shutdowns that release toxic substances that harm fenceline communities and surrounding ecosystems (U.S. Government Accountability Office, 2022a). These conditions raise concerns about the breakneck pace of LNG development and the Natech risks of LNG facilities that have not been adequately assessed by FERC or state or local officials, or the industry itself. The addition of LNG plants to already overburdened communities will only create more exposure to the environmental and public health risks around them. The build-first-and-see-what-happens approach results in extraordinary and unnecessary risk to vulnerable communities and ecosystems and necessitates better federal oversight of LNG facilities.

Climate Impacts of LNG Development

If it were to come to fruition, the planned build-out of LNG export facilities in the United States will push our planet's systems past thresholds that can sustain life as we know it—beyond a 1.5 degrees Celsius increase in global mean temperatures from the preindustrial level (Climate Action Tracker, 2022). Planned LNG build-out would increase greenhouse gas emissions the equivalent of adding 20 new coal-fired plants or 18 million cars on the road, just in their operations alone and not the entire gas life cycle chain from drilling, pipelines, and shipping to end use (Environmental Integrity Project, 2022a; Shaykevich et al., 2022). The International Energy Agency states that to avoid the worst effects of climate change, the world needs to dramatically slash demand for natural gas by 2050 (McGhee & Canary staff, 2023). However, FERC has refused to assess the climate impacts of LNG development, including the social and environmental costs of LNG greenhouse gas emissions. In not meaningfully examining the realistic trade-offs of LNG development, FERC has abandoned its responsibility to apply a public-interest standard. Instead, it has sanctioned spending the inheritance of future generations and prioritized the interests of the LNG industry, major financial investors, and other stakeholders. LNG exports account for 10% of U.S. production and provide cheap natural gas overseas, while increasing domestic energy costs strain Americans' pocketbooks. With more than 90% of U.S. LNG exports coming from Louisiana and Texas, communities in the Gulf South have a huge stake in America's energy future. And as described next, frontline communities concerned about their homes, health, and economic security are making sure their voices are heard (Martinez, 2023).

Community Concerns, Public Opposition, and Litigation

Communities across the Gulf South have organized locally and have banded together to oppose LNG export facilities in their communities. This unofficial coalition of community-based organizations communicates regularly and enlists one another for specific permitting concerns they face in their respective communities. Leaders in frontline communities next to LNG infrastructure exhaust all sources to communicate their concerns through drafting, publicizing, and sending letters to agencies in the decision-making process. They also hold rallies and press conferences and participate in public meetings. Several times, they have initiated the call for public meetings. Community and tribal organizations joined forces to launch a new campaign, A Gulf without LNG, to a public audience.

In these forums, they describe their concerns regarding the facilities' environmental and health impacts on their communities. The use of digital campaigns, such as Dangerous Driftwood and LNG Is Not Safe, has offered some measure of success for community members (Dangerous Driftwood, 2022; Enough Is Enough LNG, 2022). For example, Freeport area residents' development of the LNG Is Not Safe campaign alongside a letter submitted to regulatory agencies regarding the explosion at Freeport LNG yielded a public meeting cohosted by PHMSA, FERC, and the Coast Guard, in which PHMSA admitted the meeting was the first of its kind (Baddour & Erdenesanaa, 2023). Currently, community and tribal organizations have joined forces to launch a new campaign soon to be released to a public audience.

Once federal and state agencies issue permits, community members do not acquiesce to the decision but seek assistance from legal organizations and national organizations to use the judicial system to review the permits. They find specific arguments, such as regarding the air or water permits issued, to question how the permits will negatively affect them. Existing Gulf Coast LNG export facilities have given community advocates ample ammunition. Cheniere Corpus Christi LNG and Venture Global Calcasieu Pass LNG have asked for additional air permits or variances after violating ones already granted (Groom & Volcovici, 2022; Vasudevan, 2022).

Although some court decisions have benefited affected communities, these wins have not effectively stalled the spread of Gulf Coast LNG export facilities. A federal appeals court found that FERC did not and should more thoroughly analyze EJ concerns and climate impacts with respect to LNG export terminal sitings. However, FERC later stated that environmental and climate justice would not impact new gas projects (Farah, 2021; Phillips & Pager, 2022). In Port Arthur, the federal Fifth Circuit Court of Appeals sided with community members and vacated an air permit issued to Port Arthur LNG by TCEQ. TCEQ's only recourse now would be to request that the case be heard by the Supreme Court (Goldberg, 2023; Zuvanich, 2023).

Public pressure against LNG owners has disrupted the financing of new LNG projects in the Gulf South. Exelon Corp and other proponents of the Annova LNG project in the Rio Grande Valley pulled out of the permitting process due to lack of financial investments (DiSavino, 2021).

Driftwood LNG also faced financial setbacks as community members fought against its permits. In a recent filing with the Securities and Exchange Commission (SEC), the facility owners, Tellurian, reported very limited cash reserves. As of late 2023, construction has all but halted on Driftwood LNG. In Port St. Joseph (Port St. Joe), Florida, community residents partnered with Public Citizen to mount a successful opposition campaign, resulting in Nopetro Energy bowing out of its proposed LNG export facility that would transport liquefied gas from storage tanks to ships by truck (Davis, 2022; Public Citizen, 2023).

This report also incorporated two community case studies to better understand community concerns about LNG development and the challenges they face in getting effective government responses (Chapter 6). The case studies detail community opposition to LNG export terminals in Plaquemines Parish, Louisiana, and Freeport, Texas. We examined the public participation and opposition strategies of one community that faces initial construction (Plaquemines) and one experiencing expansion of an operational facility (Freeport). Both communities have experienced displacement, but for different reasons.

In Plaquemines Parish, residents closest to the Plaquemines LNG construction have spent the last two years recovering from Hurricane Ida. Plaquemines Parish has lost 50% of its land area since the 1970s, due to subsidence, sea level rise, oil and gas extraction and development, and the starvation of sediment inputs from the Mississippi River. Community residents are more worried about storm surge and the poor protection the back levees offer, which is why they have to evacuate. They also have dealt with a lack of investment in those levees year after year—the back levees in Plaquemines Parish in this area have been proposed for funding for many years and continue to be deprioritized by the parish. For decades the parish has said it would build them back up, but it has not done so. Venture Global is building one but it will not be part of the federal levee system and is inadequate for protecting people (van Heerden, 2022). The LNG export terminal site sits in the lower part of the parish that is outside of federal levee protection and frequently get mandatory evacuation orders due to hurricanes. The site of Plaquemines LNG flooded during Ida and will continue to be susceptible to storm surge flooding and winds. These conditions easily resuspend oil, dispersants, and other chemicals that had settled out after the BP *Deepwater Horizon* oil spill. Flooding in the lower parish readily adds pollution to floodwaters that will reach nearby homes, orchards, ranches, and businesses. In Plaquemines Parish, the Zion Travelers community-based organization implemented health assessments after the *Deepwater Horizon* oil spill (Gray, 2010).

In Freeport, a once-thriving, historic Black American neighborhood, the East End, now consists mostly of vacant lots with few remaining homes. Port Freeport (where Freeport LNG leases space) used eminent domain to displace residents. The buyouts, far from equitable, left most unable to find homes of comparable value. The land grab only conveniently paves the way for further expansion of fossil fuel infrastructure. Brazoria County's entire population already lives within a half-mile radius of active oil and gas infrastructure (Earthworks, 2022).

In our interviews with residents in both Plaquemines Parish and Freeport, they expressed concerns about how new LNG operations could further compromise their physical health. Members of the East End community already have a long list of family members and friends in their social circles that suffer from wide-ranging health issues, including cancer and respiratory and pulmonary problems, that could make it hard to get informed and organized against LNG development. In fact, community concern about the Plaquemines LNG facility has been slow to develop, and many residents only learned about the facility and its potential dangers to their community after construction began. Residents are also concerned about other LNG proposals in the Plaquemines Parish, and they are frustrated that the government is not protecting them from industrial pollution.

In Freeport, Texas, community members have dealt with their polluting neighbor since the LNG facility first began operations as an import facility in 2008. The quick growth of Freeport LNG has come with many problems including air permit violations, feed gas problems, and an explosion that halted operations for nine months (Soraghan et al., 2022). Currently, the community is fighting against an expansion. The residents spend a great deal of their time and resources to travel both domestically and internationally to advocate against more LNG development.

The Plaquemines Parish and Freeport communities believe a lack of transparency and little public involvement—all too common in EJ communities—have allowed LNG development to occur. Both communities have complained about limited public hearings and technical hurdles to participating in the permitting process. Both communities also believed that any public forums, whether meetings or commenting procedures, occurred as a formality only. They believe no matter the public input, the facilities will receive FERC's approval. These findings indicate a broken process that has led to public mistrust. In the next section, we provide our recommendations to address these procedural injustices and the other injustices revealed in the findings of this report.

Recommendations

Biden Administration

Adhere to Global Climate Mitigation Agreements

President Biden pledged support for a robust climate agenda while campaigning for office but has been fast-tracking oil and gas projects in the name of diplomacy (Lefebvre, 2024). In fact, oil and gas exports have grown more during Biden's tenure than they did during the Trump presidency (Williams-Derry, 2023). However, a recent report revealed that voters, by a 2-to-1 margin, want to slow LNG growth (Huffman, 2023). President Biden now must face up to the perils of climate change and to the voters.

The Biden administration's policy on LNG exports needs to comport with the president's commitments under the Paris Agreement, which the United States rejoined in February 2021. In reengaging with the international community to mitigate climate change, President Biden pledged to reduce U.S. greenhouse gas emissions from 1990 levels by 26%–28% by 2025, and by

50%–52% by 2030 (Higgins, et al., 2024). LNG development undermines the Paris pledge and the country's position as a global leader on climate change.

The Biden administration also needs to align its LNG export policies and practices with its international position on methane, in particular the Global Methane Pledge (GMP), a voluntary framework adopted in 2021 at the United Nations Climate Change Conference (COP26) that supports nations agreeing to collectively reduce methane emissions by 30% from 2020 levels by 2030. LNG is composed primarily of methane, a greenhouse gas that is 80 times more potent than carbon dioxide in the short term and 30 times as harmful in the long term. Among the methane gas extraction, pipeline transport, and transfer infrastructure used for LNG development in the Gulf South are "super-emitters"—facilities and infrastructure that emit massive amounts of methane leaks, many times greater than EPA estimates (Robertson et al., 2020; Cusworth et al., 2021; Irakulis-Loitxate et al., 2021). Thus, the authorization of the rapid build-out of LNG exports conflicts with the United States' global position on methane. As the world's number one LNG exporter, the United States, on the global stage, looks like the "number one hypocrite" when it comes to methane.

Community residents do not regard LNG as safe and call out the industry's "greenwashing" of LNG as natural and safe (Beaumont, 2023; Dangerous Driftwood LNG, 2021; Enough Is Enough LNG, 2022). The transition to natural gas is being touted as climate friendly, and under the Biden administration, export facilities have more than doubled. LNG advocates claim that it is better than burning coal, but investment in LNG terminals will further our dependency on fossil fuels (Elbein, 2023).

The Biden administration has worked against its own climate goals, having spent $1.8 billion on overseas fossil fuel plants in 2023, while voting at a World Bank meeting to direct $400 million in new methane gas financing to developing countries (Elbein, 2023). Emissions from exporting natural gas could be 24% to 274% higher than burning coal (Gelles et al., 2023). Current approved and under-construction projects will double export capacity again in four years (Joselow & Puko, 2023). Under the leadership of Senator Ed Markey (Massachusetts), some Democratic senators have called on the Biden administration to discourage investment in the gas industry and end dependence on fossil fuels (Elbein, 2023).

International pressure has also mounted on the Biden administration to do right by the climate. At the 2023 UN Climate Change Conference, more than 300 groups from more than 40 countries petitioned the Biden administration to stop permitting new LNG terminals and to stop supporting overseas LNG projects diplomatically and financially. Biden, not in attendance at the conference, came under fire for the United States being the largest exporter of LNG as well as the largest emitter of greenhouse gases (Corbett, 2023).

The latest project on FERC's agenda to approve is the Calcasieu Pass 2 (CP2) project in Louisiana, which also requires export authorization from the DOE. As pressure mounts and with the decision on CP2 looming, studies indicate that that project will create 20 times the emissions of the Willow project, an Alaskan oil-drilling development approved in March 2023. More than 170 scientists have petitioned the Biden administration to block CP2 (Gelles et al., 2023). To make the true cost of the CP2 project transparent, the Biden administration should issue a supplemental environmental impact statement following Executive Order No. 13990 (2021)—"Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis"—taking into account the social cost of carbon by following the CEQ's "Interim Guidance on Consideration of Greenhouse Gas Emissions and Climate Change."

It is long past time for the Biden administration to come clean and acknowledge how CP2, and LNG development in the United States as a whole, works against the administration's climate goals. The Sierra Club estimates that the combination of all LNG facilities currently operating and the proposed new facilities would contribute the equivalent in emissions of 681 coal plants or 548 million gasoline-powered cars annually (Jealous, 2024). Top-level leadership is needed to require new methodologies that incorporate "full life cycle" impact analysis of methane extraction and transport, export terminal construction and operation, the export of LNG via ships, and end uses (Gelles et al., 2023). Such analyses are necessary for the public to better understand the trade-offs involved in LNG development and whether it serves the public interest.

Finalize the CEQ Guidance on Consideration of Greenhouse Gas Emissions and Climate Change and Require Its Application to LNG Licensing and Environmental Reviews

In January 2023, the CEQ published a notice of interim guidance titled "National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change" and accepted public comment until April 2023. The guidance directs federal agencies to (1) make decisions using the best available science; (2) account for the urgency of the climate crisis; (3) identify reasonable courses of action in the face of climate change; (4) protect national security through reduction of climate change–related threats; (5) demonstrate U.S. leadership in the climate crisis; and (6) assess better courses of action with pollution reduction, cost savings, and decreased litigation (Council on Environmental Quality, 2023).

The CEQ has yet to finalize the guidance but it needs to in order for agencies to adopt it widely. The guidance includes six guideposts that direct agencies on how to consistently consider climate change impacts in the NEPA process. As part of Guidepost 1, "Using GHG Quantification and Contextualization Tools," the CEQ says this should be a "simple and straightforward calculation" to demonstrate how a project is or is not helping meet global and national climate goals. Quantification should include direct and indirect emissions, cumulative emissions, reasonable alternative actions, and the no-action alternative. Quantification should include the social cost of greenhouse gases (SC-GHG), which refers to the short- and long-term harms from emissions—for example, harms resulting from sea level rise and increases in the frequency and severity of extreme weather events, and the associated damages to public health, property, ecosystems, and so on. The federal government's current social cost of carbon emissions is $51 per metric ton, and though use of the metric is under litigation, the EPA has suggested a price of $190 per metric ton may be more accurate and appropriate (Farah & Clark, 2022). The Office of Management and

Budget (OMB) recently estimated "that climate-related disasters could increase annual federal spending by over $100 billion and decrease annual federal revenue by up to $2 trillion by the end of the century" (The White House, 2023).

It is also crucial that LNG projects use other guideposts in the guidance. For example, Guidepost 2 calls on agencies to choose a resilient, reasonable alternative to a proposed NEPA action, identifying the most environmentally friendly alternative, and making decisions that align with climate change commitments and goals. Guidepost 3 asks agencies to use a *substitution analysis* to compare the impacts of different types of energy sources and to provide a full analysis of how a proposed action is likely to affect the energy mix that is available for consumers, incorporating cumulative effects, connected actions, and an upper-bound analysis on emissions. Substitution analysis is an analysis of how renewable energy projects compare in those regards. Having such information clearly outlined allows agencies to make more informed decisions in support of climate goals (Council on Environmental Quality, 2023, pp. 1204–1207).

Direct the OMB and FERC to Conduct a Climate Impact Assessment of FERC's LNG Licensing Program

A September 2023 White House statement on "New Actions to Reduce Greenhouse Gas Emissions and Combat the Climate Crisis," referring to Executive Order No. 13990 (2021), states that the OMB has been directed to work with agencies on programmatic climate impact assessments beginning with measuring "baseline greenhouse gas emissions and [the] use [of] the SC-GHG to calculate the benefits and impacts of federal programs" (The White House, 2023, para. 7). The White House should direct the OMB and FERC to prioritize a climate impact assessment of FERC's LNG licensing program, including all existing, approved, and planned LNG projects in the United States and its territories.

Continue the "Pause" on New LNG Development Until LNG Impacts Are Comprehensively Assessed and Public Interest Determinations Are Made

On January 26, 2024, the Biden administration announced a "pause" on the DOE's issuance of new LNG export licenses. The pause does not affect export terminals currently in operation, under construction, or approved for construction (Lange, 2024). Five under-construction LNG terminals alone will nearly double U.S. export capacity by 2027 (Chang, 2024). Frontline communities and national environmental organizations nevertheless find some measure of success in this announcement, while representatives from the LNG industry argue that it will harm energy security for Europe and other places around the world (Chang, 2024; Williams, 2024b). The White House's national climate adviser, Ali Zaidi, describes the pause as an opportunity to review future projects' economic and environmental impacts more carefully to comply with the global agreement to transition from fossil fuels as well as uphold Biden's climate agenda (Zaidi, 2024). The pause garnered positive responses from several European national parliaments as well as European and Asia-Pacific environmental organizations (Holt & Schmidt, 2024). President Biden stated that young activists and leaders from frontline communities inspired the decision to pause new LNG export licenses (Joselow & Halper, 2024).

Biden's climate actions have long been under the microscope of young voters. Impact Research surveyed 1,000 young people ages 18 to 34 years. They generally held negative views of both political parties and wanted to see more aggressive climate mitigation from the Biden administration (League of Conservation Voters, 2023). Young climate activists recently used their social media platforms to express disappointment with the Biden administration's decision to approve the Willow project, a large oil-drilling development in Alaska (Osaka & Lorenz, 2024).

It is long past time that the Biden administration listens to the concerns of young Americans and frontline communities about the need to take full measure of the implications of an LNG build-out for this and future generations and the planet. Highlighting the stakes, consider that 12 of the 17 yet-to-be-built LNG terminals affected by the pause on new export approvals are estimated to have the potential to emit the greenhouse-gas equivalent of 223 coal plants annually (Mader, 2024).

Many frontline advocates view the pause with raised eyebrows. John Beard, executive director of the Port Arthur Community Action Network, expressed concern about the criteria that will be used to determine whether LNG projects are in the public interest and about whether the Biden administration will continue to approve projects in sacrifice zones when the pause ends (Pedersen, 2024). Roishetta Ozane, in Lake Charles, expressed the need to shift to alternatives to fossil fuels and to "remain vigilant" (The White House, 2024, para. 27). Another Louisiana frontline leader, James Hiatt, conveyed his reservation, stating, "We're not going to take a victory lap here because there's so much more to do." (Lange, 2024, para. 13).

The pause offers an opportunity to examine the climate impacts, including the SC-GHG, of LNG development, give due consideration to cleaner alternatives to meeting global energy needs, assess cumulative impacts on frontline communities, and begin a transparent debate about whether LNG is in the public interest (Chang, 2024).

The current pause on new LNG licensing should remain in effect until a comprehensive climate impact assessment and a public interest determination are completed and the public and members of Congress have had an opportunity to review and comment on those studies. Likewise, FERC's LNG programmatic climate impact assessment should be sure to make provision for a public comment period and meaningful public participation—including outreach to and meetings in EJ fenceline communities—in its planning phase.

Fill FERC Leadership Positions with Environmental Justice Champions

During President Biden's tenure, cracks have appeared in the façade that FERC remains an independent agency. In January 2023, FERC Chair Richard Glick was forced to leave when Senator Joe Manchin stonewalled Glick's renomination. This resulted in a 2–2 split partisan vote. For a year, FERC had operated with one vacant seat. At the end of 2023, Commissioner James Danly faced term limits, and there are now two vacant seats (Rosenthal, 2023). In February 2024, Biden promoted Willie Phillips from acting chairman to the named FERC chair (Gardner, 2024). The same month, the strongest proponent of climate action at FERC, Commissioner Allison Clements, announced she would not pursue another term. With Clements's departure, FERC will not have the necessary quorum if her seat is not replaced (Morehouse, 2024). Her departure could result in decisions more favorable to the fossil fuel industry should her replacement not share her position on protecting the climate. To support his climate and EJ agenda, President Biden should fill FERC seats with candidates who will prioritize environmental justice and take climate change concerns seriously, issues so long ignored and dismissed by the agency (Rosenthal, 2023).

This is essential given the environmental protection challenges fenceline communities in Louisiana and Texas face with state governments that consistently favor fossil fuel industries at the expense of their own constituents' health and wealth. At the federal level, these same residents' voices and experiences are rarely, if ever, seriously considered. Moreover, the vast majority of Gulf Coast residents do not have the financial means to compete against the deep pockets of fossil fuel giants to litigate against them each and every time they encroach further into their communities. The challenge of having their voices heard is also formidable due to FERC's jurisdiction over LNG siting, construction, and operations and its track record of approving nearly all LNG and pipeline projects despite overwhelming evidence that each project will harm its surrounding community (Bullard, 2023).

In 2022, FERC revised its "Certificate Policy Statement" and a "Greenhouse Gas Policy Statement" that would have established guidelines to address climate health and environmental justice, but FERC succumbed to pressure from the natural gas industry and did not implement those statements (Giannetti & Johnson, 2023). The Natural Resources Defense Council commented, "Federal regulators and policymakers failed to finalize initiatives that would ensure gas projects benefit the public and, as a result, 2023 will go down as a lost opportunity to put climate leadership ahead of short-term corporate profit" (Giannetti & Johnson, 2023).

FERC nevertheless has an obligation to protect the public interest, and the makeup of the commission will influence the type of public interest review FERC conducts during the current pause on certain LNG projects, in particular whether environmental and climate justice impacts will get due consideration alongside the standard economic, trade, and national security considerations (Mallen et al., 2024). Although President Biden cannot direct how FERC, an independent agency, considers the public interest, he has indirect influence through his choice of whom to nominate to the commission.

Implement a Rapid and Just Transition to Clean Energy

Currently the world's largest exporter of LNG, the United States plans to greatly increase export capacity. By 2028, projects now under construction will effectively double the 2023 export capacity of operating LNG facilities. A recent increase in demand comes from Europe, driven by a steep decline in imports from Russia and an increase in import capacity. However, energy analysts report that the capacity of currently operating LNG export facilities is more than sufficient to meet Europe's LNG needs (Symons, 2024). A third wave of proposed, yet-to-be-approved construction—facilities affected by the Biden administration's pause—would come online by

2028 or later and would quadruple U.S. LNG export capacity compared with 2023 capacity (Symons, 2024). In its *World Energy Outlook 2023,* the International Energy Agency projects that, due to developed countries' transition policies, methane gas demand will stay at around 2020 levels through 2050 (International Energy Agency, 2023). Given that, why the rush to build out LNG? Overbuilding is setting the booming LNG industry up for a bust.

A concern is the amount of capital that could instead be invested to expedite a global transition to renewable energy. LNG build-out works against a clean energy transition. In response to assertions that LNG is a necessary "transition" fuel on the path to 100% renewables, the chief executive officer of the European Climate Foundation noted that "swapping one source of fossil fuels for another is not a viable strategy for energy or climate security" (Holt & Schmidt, 2024, para. 7). Thus, the Biden administration should make the pause permanent and reduce international funding for fossil fuel development and increase renewable energy funding for developing countries.

Closer to home, implementing clean energy programs in the Bipartisan Infrastructure Law and the Inflation Reduction Act are a top priority for the DOE in 2024 (Dabbs, 2024). At COP28 climate talks in 2023, the United States and other countries agreed to triple renewable energy by 2030; however, some proposed climate solutions will only further dependence on fossil fuels (Dabbs, 2024). Carbon capture plans, such as those for Plaquemines LNG and Cameron LNG, are one way that industry attempts to greenwash its detrimental impacts.

Carbon capture plans, such as those for virtually every new proposed LNG export terminal (and all of the expansions planned), depend on very costly and unproven technologies (Sneath, 2023b). The plans are an attempt by industry to justify more drilling and fracking and more LNG construction with a false promise of carbon mitigation. Carbon capture amounts to denial of the detrimental impacts of LNG development, while simultaneously ignoring LNG's life cycle impacts.

A just transition to clean energy must also incorporate solutions to the many inequities in today's fossil fuel–dependent system, such as residents whose utilities are shut off because they cannot afford their bills. The transition must also address "utility redlining," in which communities of color and lower-income communities are more vulnerable to outages. This transition must also focus on equitable measures so that public dollars for clean energy are not solely beneficial to wealthier and whiter zip codes (Stamas, 2024). Instead, just energy will need to include EJ communities in decision-making processes and mitigate the disproportionate impacts they already experience from the fossil fuel industry. A just transition should include better economic opportunities for EJ communities, access to information and resources for those communities to shape local energy transitions, capacity for community environmental monitoring, and improved health and environmental benefits (Gaskin, 2024).

DOE and FERC

Recognize and Confront Fossil Fuel Racism

The DOE and FERC need to affirmatively address the oil and gas industry's legacy of environmental racism. "Fossil fuel racism" is the process and outcome of systems of power and privilege that continue to protect and promote the production, processing, and distribution of fossil fuels at the expense of communities of color. Throughout the fossil fuel life cycle, from exploration and production to end use, people of color and other historically disadvantaged communities face numerous harms to public health and quality of life. Academic research consistently shows that fossil fuel pollution contributes to respiratory, reproductive, and cardiovascular diseases as well as premature death that disproportionately impact people of color and poor communities (Healy, 2023). Such communities are also disproportionately exposed to climate change hazards caused by fossil fuel combustion. Fossil fuel racism includes fragmented decision-making that fails to account for existing environmental burdens or cumulative impacts and creates sacrifice zones, where the health and way of life of people in EJ communities are increasingly compromised (Donaghy et al., 2023). The DOE and FERC must recognize the historical and systemic nature and present-day manifestations of fossil fuel racism and adopt a policy of no new licensing of facilities that contribute to and reinforce environmentally discriminatory burdens on people of color. The DOE should go a step further and enact policies and programs that mitigate or remedy existing environmental harms of LNG development to historically and socially disadvantaged communities of color.

Prevent New Sacrifice Zones and Additional Environmental Burdens in Existing Ones

LNG facilities present the newest threat to already-established sacrifice zones on the Gulf Coast. Existing and proposed LNG export terminals are concentrated in the U.S. Gulf Coast (Corbett, 2023). LNG licensing policies and practices should not add pollution and environmental burdens to existing environmental sacrifice zones and should not contribute to the creation of new sacrifice zones.

As we report, most LNG export facilities in the Gulf South are located predominantly in communities of color that also have preexisting environmental pollution burdens. As such, LNG export facilities are already exacerbating existing environmental injustices, and additional new and expanded gas export facilities will add insult to injury to communities already overburdened by industrial pollution from the fossil fuel industry—communities that are also increasingly vulnerable to extreme weather events related to climate change (Friends of the Earth, 2023).

Community residents living in sacrifice zones feel forgotten and unheard. They have legitimate concerns about the health impacts of LNG pollution, displacement, and climate change. Time and time again, community residents speak out against projects that they believe will pose health, safety, quality-of-life, and climate impacts. Time and time again they are ignored. FERC and other regulatory bodies should consult communities and investigate concerns that arise from LNG operations, such as over excessive flaring and leaks. Agencies should incorporate direct-from-community information into licensing decisions (Federation of American Scientists, 2024). Communities should be empowered with EJ grants and technical assistance to conduct their own community monitoring, especially in cases where data are self-reported by the industry or not reported at all. FERC and other government agencies should also seek prior, informed consent of the community when renewing permits and proposing mitigation measures.

Incorporate More Thorough Cumulative Impact Assessments

In 2022, the EPA published *Cumulative Impacts Research: Recommendations for EPA's Office of Research and Development,* which provides a federal framework for incorporating nonchemical stressors as well as pollutant exposure to determine a complete portrayal of harm (Julius et al., 2022). Such a framework has been a long time coming for those that have advocated for environmental justice over the past 40 years, and it is a good start toward the type of CIA that should be done for all fossil fuel projects. The assessment herein (Chapter 5) also presented a CIA framework and applied it to a set of LNG export facilities in the Gulf South.

Our CIA shows that the LNG industry poses a multifaceted threat to vulnerable populations that reside near LNG export facilities. In addition, the industry upends ecosystems—for example, fragile coastal wetlands essential to maintaining ecological health by providing biodiverse habitats. Wetlands also provide vast ecosystem services—such as mitigating damage from floods and supporting robust fishing and tourism economies.

We concluded that FERC's environmental impact statements fail to adequately assess cumulative impacts. The commission has treated environmental justice, human health, and climate hazards as less important than other environmental considerations, and this needs to change. Using the CIA framework, NEPA reviews should examine existing environmental burdens and social and health vulnerabilities; NEPA assessments also must carefully examine climate and other natural hazards. Combined with assessment of the environmental impacts of LNG facilities and any health or safety risks from the liquefaction plants, such assessments will provide more accurate and complete depictions of impacts on fenceline communities.

Take Community Input Seriously

FERC and other regulatory bodies should consult the respective community about issues arising from LNG operations that are harming it, and in turn, incorporate that information into decision-making regarding the respective facilities. Direct-from-community data—for example, from community environmental monitoring—should be accepted and prioritized by the respective regulatory bodies. FERC and other government agencies should also consult the community when proposing mitigation measures (Federation of American Scientists, 2024).

Unfortunately, existing public participation processes are formal and inaccessible, such that regulators fail to learn about or acknowledge many harms to a community or engage in meaningful exchanges of knowledge with those living around LNG facilities. Pre-meetings and open houses led by FERC and LNG companies lack "procedural equity," defined by the EPA as allowing for genuine engagement and representation in decision-making processes (Minovi, 2024). Instead of having community-led discussion and meaningful dialogues, the commission sends representatives to "talk at people." Even the Environmental Justice Roundtable held at FERC headquarters in Washington, D.C., had only two representatives from fenceline communities to speak for all the locations across the Gulf States with LNG facilities (FERC, 2022c). These approaches are directly contrary to Executive Order 14096, which required effective measures of public participation in matters affecting people's quality of life and fundamental interests to life and liberty (Executive Order No. 14096, 2023; Minovi, 2024).

Require Environmental Justice Analyses in Permitting

Federal laws—the Natural Gas Act and NEPA—already require FERC to conduct a thorough environmental review of gas infrastructure projects. The commission should already employ rigorous socioeconomic and EJ considerations when reviewing projects. Recent court rulings and our review of FERC's EJ analyses in NEPA environmental reviews reveal numerous shortcomings. FERC EJ analyses are inconsistent and fail to use widely accepted sources and methods to identify EJ communities of concern, and when FERC has determined that projects affect EJ communities, it has taken no remedial action. FERC should develop EJ analysis standards that consistently follow best practices described in the CEQ's *Environmental Justice Guidance Under the National Environmental Policy Act* and the EPA's *Guidance on Considering Environmental Justice During the Development of Regulatory Actions* (White House Council on Environmental Quality, 1997; U.S. Environmental Protection Agency, 2015).

FERC should also use readily available federal screening tools including the EPA's EJScreen, the CEQ's Climate and Economic Justice Screening Tool, and the CDC's Environmental Justice Index and Places maps. On top of those screening tools, FERC should employ a method of considering communities for self-identification for EJ consideration. Doing all of these things would allow FERC to consider preexisting health conditions and assess subpopulation susceptibilities to the added pollution burdens of proposed facilities. Finally, once FERC has made a comprehensive and rigorous analysis of EJ in a facility's proximity, the agency should take appropriate action when there is significant impact to any EJ community by either curtailing the project or collaborating with the community for a solution agreed upon by the affected community members.

Furthermore, FERC's EJ guidelines should incorporate information that describes the environmental and climate justice framework. The commission's *Suggested Best Practices for Industry Outreach Programs to Stakeholders* does not adequately address community concerns or how energy infrastructure should value them when involving a community in the siting and permitting processes (FERC, 2015).

Adopt Rigorous New Standards for Public Interest Determinations for LNG and Provide for Public Input

The DOE needs to finalize its criteria and processes for making *public interest* determinations, and in doing so, seriously take into account the climate change impacts of LNG and environmental and climate justice concerns, that is, the interests and concerns of fenceline communities. Under the Natural Gas Act, the DOE is required to evaluate the public interest of LNG exports to countries with which the United States does not have a free-trade agreement, which amounts to about 76.5% of LNG exports (Slocum, 2023b). The Natural Gas Act does not provide a clear definition of what constitutes the public interest (Mallen et al., 2024). The DOE has an opportunity to expand on its studies of the energy market and energy security and rigorously analyze both global and local climate change impacts of LNG and make use of the CEQ's guidance on the social cost of carbon (Council on Environmental Quality, 2023).

Furthermore, EJ analyses, though not included in the DOE's public interest determinations in the past, must be used moving forward (Williams-Derry, 2023). The DOE defers to FERC's NEPA analyses, but FERC does not consider life cycle greenhouse gas emissions or downstream emissions because the courts have determined that downstream emissions are under the DOE's authority rather than FERC's. Regardless, it is important that the DOE incorporate environmental and climate justice into its new public interest determination standards in a highly rigorous way (Mallen et al., 2024).

Also, the DOE should establish transparent and verifiable standards for determining significant impacts, according to which if the anticipated consequences of a project adversely or disproportionately harm people or ecosystems, the project permit will not be approved. In project approvals and identifying acceptable mitigation measures, FERC must follow the principles of free, prior, and informed consent (Institute for Human Rights and Business, 2022).

FERC's public interest determinations must consider the effect of LNG exports on domestic gas prices. LNG exports contribute to energy poverty for some Americans. Americans have long endured a volatile market for oil and gasoline prices but have enjoyed low natural gas prices. However, despite record levels of domestic projection, natural gas bills have risen by 29% since 2020. Geopolitical conflicts, such as the Russian invasion of Ukraine, caused a spike in wholesale costs, but by 2023 prices had stabilized. With the rise in U.S. exports, domestic gas prices are now tied to volatile overseas demand (Williams-Derry, 2023). In 2022, the U.S. exported 10% of its domestic methane production, an amount that is projected to increase up to 33% by 2035. The U.S. Energy Information Administration predicts that prices are likely to increase by $1.50 per million British thermal units as U.S. exports increase, resulting in a 10% increase in residential, utility, and manufacturing gas bills (Martinez, 2023). Using Energy Information Administration data, Public Citizen estimated that domestic consumers will spend $14.3 billion more in 2050 on gas if the projected growth in LNG export capacity is unabated (Slocum, 2023a). Of course, those with limited financial means will suffer the most.

Households in lower income brackets pay a relatively high percentage of their income to utility companies. To date the DOE does not take that into consideration in LNG export authorizations because the agency does not conduct any distributional analysis (Slocum, 2023b). Likewise, the DOE has not revised its guidelines to incorporate climate change or environmental justice. In response to the DOE's antiquated approach, more than 60 members of Congress recently sent a letter to it urging it to consider the climate, environmental justice, and domestic energy prices when making public interest determinations. Ten years ago, the Sierra Club, the Center for Biological Diversity, the Delaware Riverkeeper Network, Environment America, and Friends of the Earth petitioned the DOE to issue regulations for determining whether gas exports were consistent with the public interest. After no response, the group filed a lawsuit against the DOE in March 2023 (Friends of the Earth, 2023).

PHMSA

Increase Oversight of LNG Operations and Update Safety Regulations

The robust expansion of LNG has followed the laissez-faire tradition of American industrial growth that is characterized by minimal safety regulation and lack of concern for safety. In 2022, PHMSA registered 265 "significant incidents" of pipelines or LNG terminals across the United States catching fire or leaking oil and gas (Osborne, 2024). The Freeport LNG explosion in June 2022 highlighted the problem of lax regulation. LNG terminals and other facilities have operated under PHMSA rules adopted in 1980, well before the LNG import facilities were retrofitted to export and fracking technology was developed (Soraghan & Lee, 2022). In 2015, two leading experts in LNG safety, Jerry Havens and James Venart, submitted public comments on the proposed Jordan Cove LNG terminal warning that regulators did not adequately consider the dangers of explosions (Mandel, 2016).

PHMSA's plans to update its rules and regulations in 2016 failed (Soraghan & Lee, 2022). Discussions on the safety of LNG were explored after a March 2014 explosion at Plymouth, Washington, injured five people and caused $72 million in property damage (Mandel, 2016). The risks have grown as export facilities began using heavier hydrocarbon fuels on-site (propane, ethylene, butane, and pentane) (Englund, 2021; Herwick, 2016; Soraghan & Lee, 2022). Currently, PHMS relies on the industry's safety monitoring (Englund, 2021), but the industry has proven untrustworthy. For example, Sabine Pass LNG was slow to report a leak in one of its tanks in 2018. PHMSA's investigation found that the tank had leaks in four places and a second tank had more than a dozen leaks, and PHMSA reported that the leaks could result in an uncontrollable fire (Mandel & Zou, 2019).

Eight months after the Freeport LNG explosion, PHMSA said that it was in the initial stages of updating rules for the safe design and operations of LNG facilities, although that timeline has now been pushed back to mid-2024 (Somasekhar, 2023). Freeport LNG has resumed partial operations—it was allowed to restart although it did not complete all the requirements of an agreement with PHMSA (Baddour & Erdenesanaa, 2023).

Despite facilities' storing of enormous amounts of supercooled methane, neither PHMSA nor any other agency has released hazard assessments or detailed a worst-case scenario of an explosion of methane at an LNG terminal storage tank. Liquid methane itself is not explosive, but when it is depressurized on release, it forms a vapor cloud that is explosive. In fact, the Physicians for Social Responsibility, in a report about the health effects of fracking for gas, wrote that an LNG storage tank at an export facility typical to those studied in this report has the explosive power of 55 atomic bombs (Lovins & Lovins, 2001, p. 88). The head of the LNG Center of Excellence at McNeese University, Jason French, said during a presentation at an industry conference that one storage tank has the power of 52 atomic bombs (Naomi Yoder, personal communication, November 2022). Either way, that amount of power is staggering and suggests that an utterly catastrophic explosion is one of the risks that has not been delineated to the public and the communities surrounding these facilities. The fact that regulating agencies are turning a blind eye to the risk of catastrophe is indicative of environmental racism and further validates the claims that such agencies regard the most vulnerable people of the Gulf Coast as disposable and that the LNG industry is using their communities as sacrifice zones.

Commission a National Academies Study

We recommend that a highly respected body like the National Academies of Sciences, Engineering, and Medicine (the National Academies) conduct a study on the safety and risk of LNG operations. LNG facilities are exempt from developing EPA risk management plans (RMPs) and do not have to publicly release their safety plans and risk assessments. The industry has long documented instances of problems while downplaying the risks that LNG terminals pose (Englund, 2021; Soraghan & Lee, 2022). Days before the Freeport LNG explosion in 2022, Dr. Jerry Havens petitioned PHMSA to change PHMSA's regulation and lift the RMP exemption to address a worst-case scenario and make the facility's emergency response plan public (Havens, 2022).

The National Academies, an independent, esteemed group of scientists, engineers, and health professionals, has already studied LNG safety. In September 2023, PHMSA and the Federal Railroad Administration announced the suspension of a Trump administration policy of shipping LNG on railroad tank cars, except for existing special permits or ISO (International Organization for Standardization) tanks (Rao, 2023; Stephens, 2023). This decision came after Congress requested, under the Further Consolidated Appropriations Act of 2020, that the Transportation Research Board of the National Academies conduct a study of the safety of LNG shipments by rail (National Academies, 2021).

While the federal government has not asked the National Academies specifically to study LNG export terminals, the organization has published a study that contradicts industry claims that gas is a better alternative than coal for achieving climate goals. By using satellite observations, researchers determined that methane from oil and gas is globally 30% higher than countries report to the UN (Shen et al., 2023). Those data demonstrate that LNG has a much greater impact on our climate than policymakers and the industry acknowledge. That is why 170 scientists recently urged the DOE to study the "full life cycle" impacts of LNG, from methane extraction to building and operating LNG export terminals to shipping LNG and burning it overseas (Gelles et al., 2023). The National Academies has found that emissions, such as leaks from wells and downstream operations, make methane's climate impact comparable to that of coal (Stapczynski et al., 2024). The National Academies also recently released a report concerning pipeline safety and the need to install automatic and remote-control shutoff valves on existing pipelines, as is required on new pipelines (National Academies, 2024). Having the leading scientists and engineers provide a thorough examination of the safety of LNG operations is long overdue. This type of study should be commissioned immediately before any other projects are granted a license.

Concluding Remarks

The Intergovernmental Panel on Climate Change warns that it is now or never if we are to arrest, much less reverse, climate damage. In Plaquemines Parish, a peninsula in Louisiana that stretches 100 miles into the Gulf of Mexico, residents experience daily land loss, while an LNG facility is being built on flood-prone land.

Ignoring those and other critical issues, in October 2023, FERC approved a capacity expansion of Plaquemines LNG and a variance that allows rushed construction to meet the owner's timeline (Plautz & Bright, 2023). That is just one example of an LNG export facility being built in harm's way—in areas prone to tropical storms and flooding—and a fenceline community's concerns for its residents' health and safety being sidelined in the rush to build. A day after UN Secretary-General Antònio Guterres issued his warning that the world was not phasing out fossil fuels fast enough to avoid a climate catastrophe, FERC approved the second phase of the Port Arthur LNG facility, which would double the facility's annual capacity, and it approved an expansion of Calcasieu Pass LNG despite its chronic violation of air permits and operations mismanagement (Joselow, 2023).

As we have shown in previous chapters, the interests of private entities, such as the fossil fuel industry, have historically driven energy and climate policy, resulting in the rubber-stamping of projects despite strong public opposition from fenceline communities. FERC, currently with only three voting members and two vacant seats, continues to approve projects that undercut the United States' climate commitments and the Biden administration's climate goals. This has caused many to question FERC's ability to consider environmental and climate justice concerns (Plautz & Bright, 2023). The Biden administration finds itself in a quagmire as it publicly acknowledges a "climate crisis" while also pushing forward an agenda for the United States to be the world leader in natural gas exports (McKibben, 2023).

The LNG industry and its investors have benefited immensely from this high-level political support, and they even complain that projects take too long for approval. Yet all proposed projects seem to get approved with little objection from decision-makers. FERC Chairman Willie Phillips has announced plans to fast-track the review process for pipelines and LNG terminals. This ignores the need to conduct rigorous CIAs that consider the social cost of carbon and rigorous EJ analyses as well as the need to more fully involve fenceline communities in LNG facility permitting processes. Fast-tracking moves the United States further away from a carbon-neutral economy. Those in support of a quick review argue that LNG facilities provide a clean source of energy; however, given the life cycle impacts, including those resulting from poor oversight of operations and the allowance of the self-reporting of leaks, LNG facilities are as troubling for the climate as coal-powered facilities (Stapczynski et al., 2024). As indicated in *Gas Run Aground*, the 19 proposed facilities in FERC's dockets would, at a minimum, produce emissions equal to those of 250 coal-fired plants (Rozansky, 2022, p. 7), and that is one of the low estimates.

Under mounting political pressure, including from young people, the Biden administration is reviewing its policy on natural gas exports (Lefebvre, 2024). The DOE is studying whether LNG exports are in the public interest, under the watchful eye of members of Congress, environmental organizations, and fenceline communities, who urge the DOE to factor in climate change and EJ considerations.

The exponential growth of the LNG industry has occurred without a comprehensive assessment of the impacts or safety risks. With the overwhelming majority of the United States' LNG export capacity concentrated along the Gulf Coast, the region has become a vast cruel experiment of the ills LNG can inflict. The environmental reviews done in the vetting process of LNG facilities indicate that LNG infrastructure is harmful to human health and the environment. Reports from existing operations indicate that flaring has resulted in poor air quality and a host of health conditions ranging from headaches and dizziness to respiratory issues (Jones, 2023a; Vasudevan, 2022). The LNG export terminal in Corpus Christi has routinely exceeded its air pollutant permitted allowance, and that has significantly contributed to an 83% rise in air pollution in Corpus Christi over the last few years (Ross & Zibel, 2023).

FERC's record regarding LNG permit approval sends the message that despite public concerns and despite negative long-term impacts on the environment and domestic energy prices, as long as a project receives financial investment and has end customers, FERC will approve it and eventually allow its expansion. If the United States continues down the path of LNG capacity growth, Louisiana and Texas will experience dire consequences, specifically in frontline communities and to fragile coastal ecosystems. Such concerns prompted our analysis of the cumulative impacts of LNG facility construction and operation on nearby communities. In turn, our CIA prompted our recommendation to better incorporate EJ and rigorous cumulative impact analyses in the review process.

Ultimately, a shift in thought is imperative to reverse the false narrative of LNG proponents that LNG is clean, safe, and necessary. Frontline communities that live among the facilities, nestled alongside other polluting petrochemical facilities, experience few if any benefits, while the industry receives generous tax incentives and enjoys little regulatory oversight. Residents continue to fight for acknowledgment of the negative impacts of LNG operations, including population displacement and exposure to pollution and the risks of natural hazards causing technological disasters.

Even as renewable energy becomes more advanced and affordable, LNG development locks up astonishing amounts of capital that could be invested more wisely, with grave consequences for our climate. The Bipartisan Infrastructure Law and other Biden-driven initiatives make significant investments in renewable energy programs, modernization of the power grid, electrifying transportation, and provision grants to EJ communities to benefit from the energy transition. However, the federal government continues to fund fossil fuel development overseas and, thus, stimulate demand for exports from the United States. Instead, it should be doing more to support renewables and energy efficiency abroad.

While the federal government aims to heal our environment and climate, it is vital that governing bodies stop rubber-stamping projects, reverse the standing practice of forsaking vulnerable communities, and firmly commit to equitable policies and transparent decision-making processes. In so doing, it is important to formally acknowledge any past failings and commit to thorough environmental reviews that properly involve EJ communities. Is also critical to adopt new safety regulations based on independent assessments of climate-related hazards, provide better oversight of the safety of the LNG industry and its operations, and provide tools to empower communities to serve as their own watchdogs.

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